

DO AGILE METHODS RESULT IN HIGHER QUALITY WEBSITES?

The purpose of this paper is to present a research methodology for measuring the relationship between the factors of agile methods and the quality of U.S. e-commerce websites. Agile methods are a new product development process used for designing websites using factors such as early customer involvement, iterative development, self organizing teams, and flexibility. Website quality refers to customer satisfaction with e-commerce transactions such as information search, website navigation, ordering, customer service, delivery, and satisfaction with the results. Therefore, survey research is recommended to measure the relationships between early customer involvement, iterative development, self organizing teams, flexibility, and final website quality. The overall approach is to collect the addresses of websites produced using agile methods and then assess them using a scholarly model of website quality with proven reliability and validity. As shown in Figure 1, eTailQ will be used to assess website quality based on its four factors: (a) fulfillment and reliability, (b) website design, (c) privacy and security, and (d) customer service.

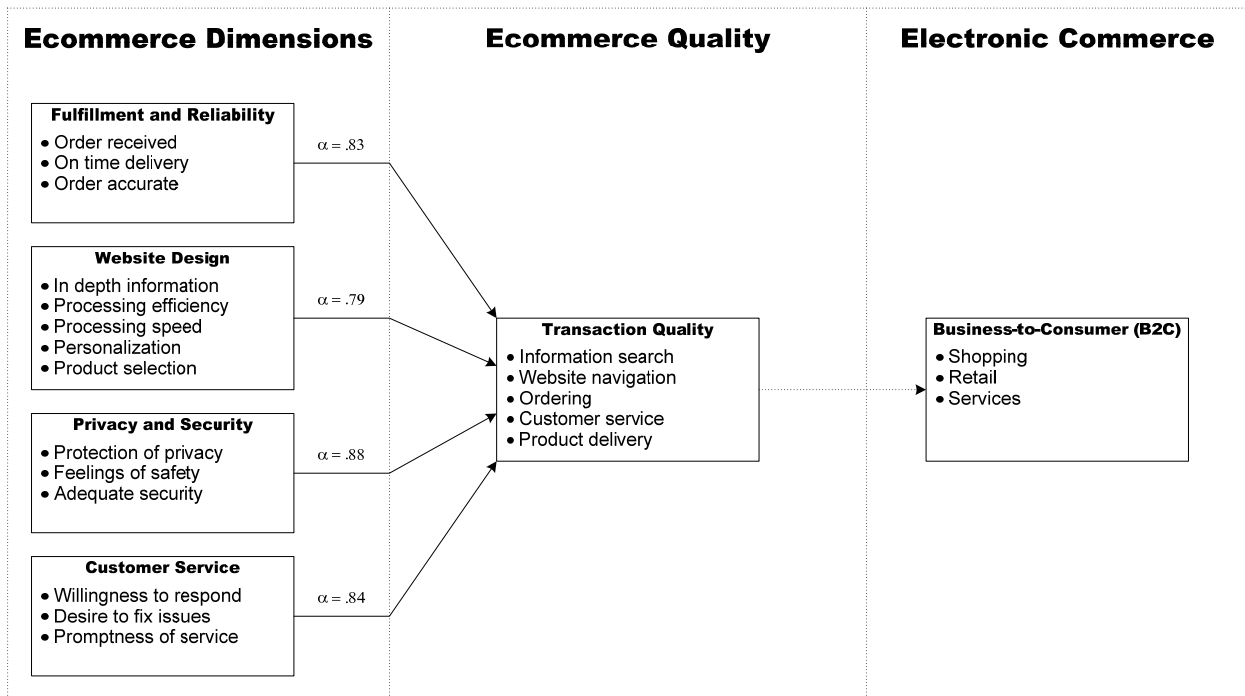


Figure 1. Scholarly model for evaluating quality of e-commerce websites

Research Background

Using agile methods, small teams of programmers gradually incorporate early market feedback into a steady stream of small software releases designed to withstand constant change. The underlying theory is that evolutionary design is better than a sequential process of collecting all requirements, doing all design, coding all software, and then testing the software all at once. The Internet presents new opportunities to apply agile methods, because software may be written in cross-platform languages like Java, which may be released to numerous users on a daily basis. Proponents of agile methods assert that iterative development results in higher quality software, while traditionalists assert that their rapid and informal nature results in lower quality software. Therefore, we propose to assess the quality of e-commerce websites made using agile methods to establish a baseline of empirical data for current and future analysis with regards to this debate.

Research Model

Website quality often refers to user judgments, attitudes, and perceptions of the overall excellence and superiority of the design and operation of websites used for Internet shopping. Early website quality models focused on characteristics of aesthetics, appearance, and usability, while newer models focus on the entire transaction from finding information to product delivery. Over 45 models of website quality have been produced in the last 10 years, and a model known as eTailQ was selected for this study based on a survey of multiple alternatives (see Table 1). The eTailQ instrument is one of the newer models of website quality, encompassing the entire range of e-commerce transactions, and exhibits high reliability and validity using repeated tests. The eTailQ instrument is composed of only four factors and 14 items, and was derived from a combination of data collected from focus groups and scholarly models of website quality. The eTailQ model was then tested and validated using data from over 1,000 respondents.

Table 1. Scholarly Studies of Website Quality

Author	Purpose	Factors	Variables	Items	Definition
Liu, Arnett, & Litecky (2000)	In 2001, three management scholars surveyed 119 webmasters to develop a reliable instrument for measuring the quality of Fortune 500 websites	Attractiveness	Information Quality	12	What they found was that factors of attractiveness, trust, and satisfaction were positively correlated to the dependability, reliability, and trustworthiness of websites
			Learning Capability	5	
			Playfulness	5	
			System Quality	6	
		Trustworthiness	System Use	5	
			Trust	3	
Sullivan & Walstrom (2001)	In 2001, two management scholars surveyed 82 designers to evaluate an instrument for measuring the service quality of websites	Service Quality	Service Quality	4	What they found was that tangibles, reliability, responsiveness, assurance, and empathy were correlated to overall service quality
			Customer Satisfaction	3	
			Tangibles	4	
			Reliability	5	
			Responsiveness	4	
Aladwani & Palvia (2002)	In 2002, two management scholars surveyed 228 web users to develop a reliable instrument for measuring user perceptions of website quality	User View	Assurance	5	What they found was that factors of website quality, content, specific content, and appearance were correlated to the perceived and overall quality of websites
			Empathy	4	
			Adequacy	9	
		Web Quality	Content	6	
			Specific Content	5	
			Appearance	5	
Chae, Kim, Kim, & Ryu (2002)	In 2002, four management scholars surveyed 8,761 web users to determine the relationships between information quality, satisfaction, and loyalty	Information Quality	Perceived	1	What they found was that connection, content, interaction, and contextual quality were correlated to user satisfaction and customer loyalty
			Overall	1	
			Connection	4	
			Content	3	
		Satisfaction	Interaction	6	
Li, Tan, & Xie (2002)	In 2002, three management scholars surveyed 202 web users to test an instrument for measuring the service quality of electronic commerce websites	Data	Contextual	4	What they found was that responsiveness, competence, information, empathy, assistance, and callback systems were correlated to website service quality
			Customer Satisfaction	3	
		Services	Customer Loyalty	2	
			Empathy	4	
			Assistance	2	
McKnight, Choudhury, & Kacmar (2002)	In 2002, three management scholars surveyed 1,420 web users to determine the relationship between website trust and its use	Predisposition	Callback	2	What they found was that disposition, institution, beliefs, and intentions were correlated to trust and website adoption
			Adoption	n/a	
		Trust	Disposition	12	
			Institution	15	
Tsikriktsis (2002)	In 2002, a management scholar surveyed 171 international web users to determine the relationships between website quality and dimensions of international culture	Interface	Belief	11	What he found was that an instrument measuring website quality was correlated to cultural dimensions such as masculinity and uncertainty-avoidance
			Intention	16	
			Information	3	
			Design Appeal	3	
		Function	Visual Appeal	3	
			Emotional Appeal	3	
			Interactivity	3	
			Trust	3	
			Responsiveness	3	
		Culture	Intuitiveness	3	
			Innovativeness	3	
			Business Process	3	
			Viable Substitute	3	
Cai & Jun (2003)	In 2003, two management scholars surveyed 228 web users to test an instrument to measure the overall service quality of websites	Service Quality	Power Distance	4	What they found was that Internet shoppers had higher standards when it came to overall service quality of websites and had different expectations than web surfers
			Individualism	4	
			Masculinity	4	
		Web User	Uncertainty	4	
			Orientation	4	
Wolfbarger & Gilly (2003)	In 2003, two management scholars surveyed 1,013 web users to test an instrument to measure website quality	Etail Quality	Content	6	What they found was that fulfillment, design, privacy, and customer service were correlated to website quality
			Trustworthiness	4	
			Service	4	
			Communication	5	
			Browser	n/a	
			Shopper	n/a	
			Fulfillment/Reliability	3	
			Website Design	5	
			Privacy/Security	3	
			Customer Service	3	

Research Design

The recommended research design is a small-scale survey in order to measure the relationships between the four factors of agile methods and scholarly models of website quality. Survey research is one of the premier approaches for collecting both small and large quantities of data to support scholarly research in the fields of both administrative and management science. Survey research has been successfully used to study the four factors of agile methods: (a) early customer involvement, (b) iterative development, (c) self organizing teams, and (d) flexibility. And, survey research is the preferred research design used by management scientists to collect and analyze attitude data concerning use of the Internet and website quality as shown in Table 1. The goal of this study is to help determine if a link exists between the use of agile methods to produce e-commerce websites and their subsequent quality. Therefore, survey research will help satisfy this goal by gathering data about the quality of websites produced using agile methods.

Research Variables

There are four major factors in the agile methods instrument: (a) early customer involvement, (b) iterative development, (c) self organizing teams, and (d) flexibility. Early customer involvement consists of five variables: (a) feedback solicited, (b) feedback received, (c) feedback frequency, (d) feedback quality, and (e) feedback incorporated. Iterative development consists of five variables: (a) time boxed releases, (b) operational releases, (c) small releases, (d) frequent releases, and (e) numerous releases. Self organizing teams consist of five variables: (a) team leader, (b) vision and strategy, (c) goals and objectives, (d) schedules and timelines, and (e) small team size. And, flexibility consists of five variables: (a) small size, (b) simple design, (c) modular design, (d) portable design, and (e) extensible design. The survey instrument in Table 2 contains definitions and explanations of the 20 variables associated with agile methods.

Table 2. Measurement Instrument for Assessing Agile Methods

Factor	Variable	Item
Early customer involvement	Feedback solicited	We seek early market feedback on every software release
	Feedback received	We receive early market feedback on every software release
	Feedback frequency	We receive early market feedback within a few hours or days
	Feedback quality	We receive in-depth early market feedback on every software release
	Feedback incorporated	We incorporate early market feedback into every software release
Iterative development	Time boxed releases	Our software is delivered in fixed intervals
	Operational releases	Our software is delivered as working products
	Small releases	Our software is delivered in multiple small increments
	Frequent releases	Our software is delivered in daily, weekly, or bi-weekly increments
	Numerous releases	Our software is delivered in more than 12 increments
Self organizing teams	Team leader	Our software teams have clear administrative and technical leaders
	Vision and strategy	Our software teams have clear visions, missions, and strategies
	Goals and objectives	Our software teams have clear goals and objectives
	Schedules and timelines	Our software teams have clear schedules and timelines
	Small team size	Our software teams have a small size with no more than 10 people
Customer service	Small size	Our software is designed to be as small as possible
	Simple design	Our software is designed to be as simple as possible
	Modular design	Our software is designed to use modular and interchangeable parts
	Portable design	Our software is designed to work on multiple operating systems
	Extensible design	Our software is designed to be extensively changed if necessary

There are four major subfactors in the eTailQ instrument: (a) fulfillment and reliability, (b) website design, (c) privacy and security, and (d) customer service. Fulfillment and reliability consists of three variables: (a) order received, (b) on time delivery, and (c) order accurate. Website design has five variables: (a) in-depth information, (b) processing efficiency, (c) processing speed, (d) personalization, and (e) product selection. Privacy and security has three variables: (a) protection of privacy, (b) feelings of safety, and (c) adequate security. And, customer service has three variables: (a) willingness to respond, (b) desire to fix issues, and (c) promptness of service. The survey instrument in Table 3 contains definitions and explanations of the 14 variables associated with eTailQ.

Table 3. Measurement Instrument for Assessing Website Quality

Factor	Variable	Item
Fulfillment and reliability	Order received	You get what you ordered from this site
	On time delivery	The product is delivered by the time promised by the company
	Order accurate	The product that came was represented accurately by the website
Website design	In-depth information	The website provides in-depth information
	Processing efficiency	The site doesn't waste my time
	Processing speed	It is quick and easy to complete a transaction at this website
	Personalization	The level of personalization at site is about right, not too much or too little
	Product selection	This website has good selection
Privacy and security	Protection of privacy	I feel like my privacy is protected at this site
	Feelings of safety	I feel safe in my transactions with this website
	Adequate security	The website has adequate security features
Customer service	Willingness to respond	The company is willing and ready to respond to customer needs
	Desire to fix issues	When you have a problem, the website shows a sincere interest in solving it
	Promptness of service	Inquiries are answered promptly

Research Instrument

The agile methods instrument shown in Table 2 was derived from an analysis of scholarly literature as shown in the research framework (see Figure 2). The agile methods survey instrument is an original contribution of this study and early reactions to it from peer reviews have been positive. As shown in Table 3, only 14 instrument items are associated with the eTailQ instrument: (a) three for fulfillment and reliability, (b) five for website design, (c) three for protection and privacy, and (d) three for customer service. The strengths of eTailQ are: (a) it is one of the newest, most mature, and scholarly models of website quality; (b) it encompasses the entire life cycle associated with electronic commerce transactions; (c) it has a small size maximizing speed and clarity; (d) it was developed and tested using focus groups, confirmatory factor analysis, and a large population of respondents; and (e) each of its factors, variables, and items exhibit high levels of inter-item reliability and validity as shown in Figure 1.

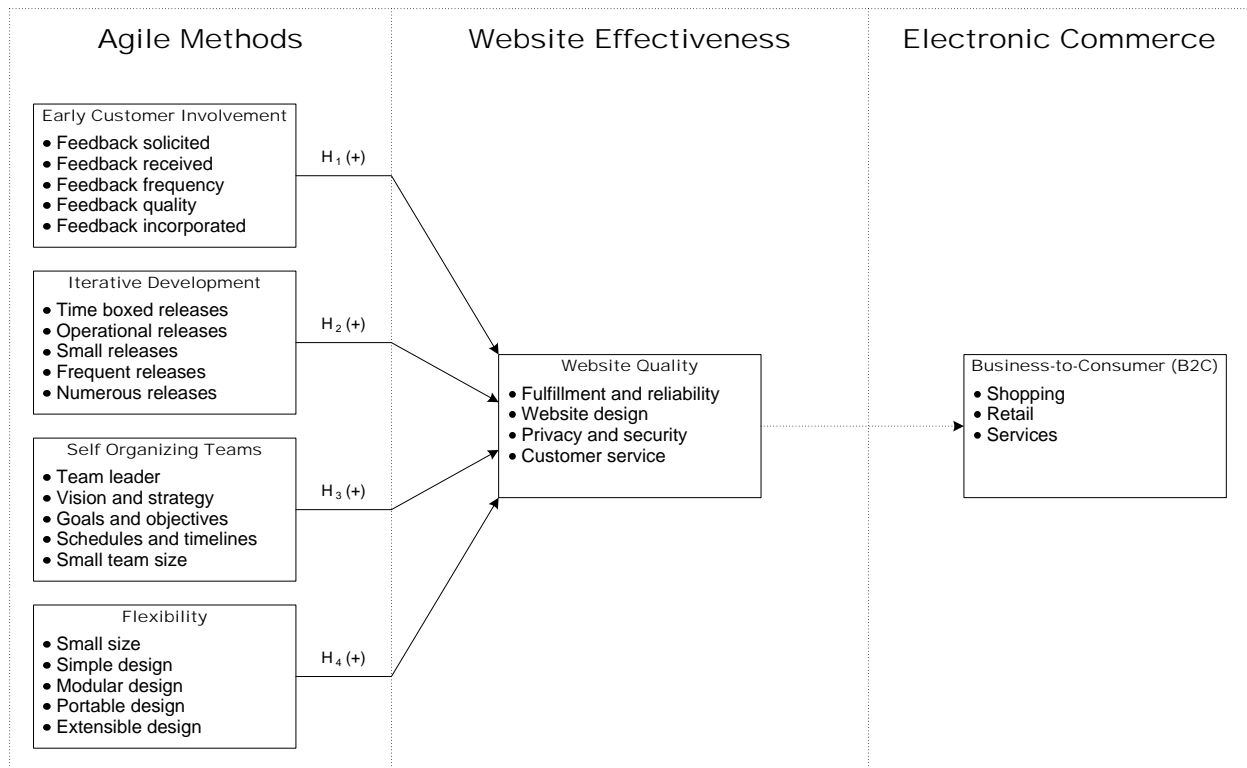


Figure 2. Conceptual model of agile methods, website quality, and e-commerce

Research Scales

All of the instrument items for the survey instruments will consist of a seven point Likert-type scale. They will be rank-ordered from low to high as follows: (a) strongly disagree, (b) disagree, (c) somewhat disagree, (d) neutral, (e) somewhat agree, (f) agree, and (g) strongly agree. A graduated Likert-type scale will maximize the degree of variability in the responses and lend itself to an analysis of continuous variable data. And, rank-ordering the responses from lowest to highest will also reduce the likelihood of misclassifying or incorrectly categorizing the data due to reverse encoding of response data. For instance, the scales will be encoded from one to seven, depending upon the response (e.g., 1 for strongly disagree and 7 for strongly agree). Each of the instrument items were designed to elicit a response corresponding to these scales. That is, items were designed to elicit a graduated response, rather than simply “yes” or “no.”

Data Collection Strategy

The data collection strategy is a key element of the research methodology. The goal of this study is to test for a link between using agile methods and producing high quality websites. We propose to accomplish this goal by assessing the quality of websites produced by computer programmers using agile methods. In order to accomplish the goals of this study, we will first conduct up to six cognitive interviews to further validate the agile methods survey instrument. We will then survey up to 1,800 software developers using the agile methods survey instrument to determine the extent to which they are using agile methods. We will also ask these developers to provide the addresses of websites they've produced using agile methods. From there, we will randomly choose which website addresses to use. We will then survey up to 200 graduate students and ask them to assess the quality of the websites using the eTailQ instrument. With as small as a 10% response rate, we could generate up to 3,900 data points from which to analyze.

Population and Sample

The population of computer programmers in the U.S. is around 2 million and has been in steady decline since 2001. The level of U.S. electronic commerce revenues has grown to more than \$2 trillion, in spite of the decline in both U.S. information technology workers and computer programmers. The sample cannot equal the population for a full-scale academic research study and certainly not for a small-scale graduate study. We propose to use a database of up to 1,800 software developers to which we will administer the agile methods survey instrument. They may not all be using agile methods; however this database consists of a significant number of software developers applying agile methods. Not all of these software developers produce electronic commerce websites. So the boundaries and findings of this study may be constrained by the number of software developers producing e-commerce websites.

Data Analysis Strategy

The first step is to obtain a usable data set from the questionnaires. The next step is to generate a summary of descriptive statistics. We propose to do a simple statistical analysis of the responses from the sample of software developers and graduate students. We will do this by analyzing the response data from the instrument items, variables, and factors from the agile methods and eTailQ survey instruments. Thus, we will determine the degree to which the websites produced by programmers satisfy the four factors of eTailQ: (a) fulfillment and reliability, (b) website design, (c) privacy and security, and (d) customer service. See Figure 3 for the type of analysis we will perform using eTailQ. Then, we will attempt to analyze the relationships between the use of agile methods and the quality of e-commerce websites produced by U.S. programmers. We fully expect all of the websites produced by programmers using agile methods to meet or exceed the minimum thresholds of website quality using eTailQ.

Factor	Item	1	2	3	5	6	7
Fulfillment and reliability	You get what you ordered from this site				█		
	The product is delivered by the time promised by the company				█		
	The product that came was represented accurately by the website				█		
Website design	The website provides in-depth information			█			
	The site doesn't waste my time		█	█			
	It is quick and easy to complete a transaction at this website	█	█	█			
	The level of personalization at site is about right, not too much or too little		█	█			
	This website has good selection			█			
Privacy and security	I feel like my privacy is protected at this site				█		
	I feel safe in my transactions with this website				█		
	The website has adequate security features				█		
Customer service	The company is willing and ready to respond to customer needs				█		
	When you have a problem, the website shows a sincere interest in solving it				█		
	Inquiries are answered promptly			█			

Figure 3. Assessment of the quality of websites produced using agile methods

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