
DESIGN OF ELECTRONIC METHOD FOR ASSESSMENT OF IS SERVICES QUALITY

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Abstract

This paper is divided into three major parts. The first part begins by introducing traditional and current methods of survey and assessment. Traditional methods of assessment include phone survey, mail survey, and face-to-face survey. Survey research accounted for 36.3% of research publications by leading institutions in US (Falconer and Hodgett, 1999). With the advent of Internet and the World Wide Web, assessment has gone online. Latest tools and technologies have been utilized to improve accessibility and introduce flexibility to the respondents. Regardless of the method, a set of questions is put forward to the intended respondent. The respondent will provide answers in the form of views, perceptions, or opinions. The response rates obtained from these methods are least encouraging. Researchers have given various reasons for the low response rate and have suggested possible remedies to improve response rates as reported in Falconer and Hodgett, (1999), Ballantyne, (2000). The second part of the paper is concerned on IS services. IS services are defined as activities that facilitate and support customers in exploiting IS in

organization. The various types of IS services can be categorized into three major groups: development service, use service and user support service (Saaksjarvi and Saarinen, 1994). The SERVQUAL instrument is adapted from Parasuraman et. al. (1985) as the content of the questionnaire. The final part proposes a design of online assessment method that takes into account the various stakeholders (respondents, owners, and administrators) views. The proposed online method is examined through the system design, which deals with how the method is developed. This paper shows that the online assessment method is actually part of a larger "information system" which is governed by the interaction among the stakeholders, the processes, environment, and other external factors.

Introduction

This paper is based on a project being conducted under an IRPA grant. The project focuses on information systems service quality assessment. Online assessment is being used in many fields or industry ranging from pizza delivery services to feedback on current issues. This paper looks at a specific part of online method. Online methods are actually electronic means of communication. Online is the condition of being connected to a computer or a telecommunications system. The term is frequently used to describe someone who is currently connected (but not limited) to the Internet. Since Internet-based activities are considered online activities, then Internet-based assessments are also referred to as online assessments in many of the available literature.

Assessment

Assessment means involves estimation of size, value or quality. It is also referred as estimation, measurement, or evaluation. Assessments can be done by activities such as surveys. A survey is done to gather information regarding certain issues. Surveys through the Internet are becoming more and more popular. The World Wide Web (WWW) is now becoming part of daily life for people in developed and developing countries, and the Internet has become an avenue for information gathering for many organizations (Kaye and Johnson, 1999, Dillman and Bowker, 2000, Dillman et. al., 1999). Thus, electronic assessments encompass surveys conducted over computer networks, which may be internal to the organization or external, such as the Internet.

Internet-based Electronic Assessment

The term electronic assessment refers to assessment done using electronic means, usually involving computers or information and communication technology (ICT) based on computers. Computer networks are used as a medium for communication and the biggest network is the Internet. Thus, Internet-based assessments are a type of electronic assessment. The Internet includes all types of electronic networking such as email messages either

between individuals or *en masse* through list servers, newsgroup postings, email conferencing via bulletin boards, and the WWW (Strauss, 1996). Internet has become a favorite ground for gathering data from all types of people. It is more suitable for accessing consumer (general public) rather than corporate users. This is because the security procedures such as firewalls in the firms' computer network may block users from accessing the questionnaire forms (Strauss, 1996). Among the many methods available via Internet, WWW has been topping the list as the most suitable method. Internet-based assessment is implemented using technologies that involve the WWW such as HTML forms or Java applets.

Part I

Traditional Methods

Traditional methods include phone surveys, face-to-face surveys, and mail surveys. It is categorically grouped as manual surveys since more manpower rather than technology is used. Phone surveys typically consist of one or many calls made to a prospective respondent. The questions are read out through the phone and the receiver responds by giving the answer through the phone. Some variation includes mailing the questionnaire beforehand, or asking the respondent to mail the answers. Face-to-face surveys involve interviewers or surveyors going around finding respondents and getting feedback from them. Questions may be presented to the respondent in paper format or read out by the surveyor. The respondents usually mark the answers on the given paper, but in some cases the surveyors take down the answers. Mail surveys, as the name implicate, involve the mailing of questionnaires to suitable respondents, expecting them to reply, and post it back to the surveyors. Usually a self-addressed stamped envelope is provided together with the questionnaire to facilitate the replying process. In all cases, some sort of incentive is provided as to encourage more participation. These incentives can range from lucky draws, free vouchers, to plain cash.

These manual assessments make use of humans to gather information from the sample. Manual assessments employ more manpower and are harder to manage. The surveyor may have bias about the assessment topic. The data entry for manual assessment takes months to complete. This will delay the feedback, and the feedback might not be useable or applicable for the organization, especially those in corporate sector (Goodman and Campbell, 1999). Phone surveys may demand that the respondents remember possible options before choosing the most appropriate option. This can result in repetition of questions and possible options. The cost of conducting the phone assessment is tremendous especially if the sample covers a big area. The data obtained is entered by humans, thus increasing the probability of data entry error. Furthermore, the respondent cannot review their answers and typically bound by time constraints (Pitkow and Recker, 1995).

Current Methods

Current methods employ more technical tools such as the Internet. Email surveys, newsgroup postings and Web-based forms are commonly applied to gather information. Web-based methods are more prominently used compared to the other two methods. Newsgroup postings are limited to the members of the group. Many groups discourage postings that involve questionnaires. Thus, this method is suitable for limited or specific target groups rather than broad population.

Using emails for feedback purposes will at least involve two messages, and more if it involves clarifications or confirmations. A web-based form is more efficient and fast compared to email service in terms of error checking and confirmation (Goodman and Campbell, 1999). The answers format and structure can only be suggested, not enforced on the respondents. For example, question about the age of respondent may result in an integer or fractional value. The answer may be on the same line as the question or the line immediately below it (Pitkow and Recker, 1995). This places more burden on the surveyor as answers need to be streamlined or formatted before fed into statistical analysis packages.

By asking respondents to return completed forms, lower response rates are expected. The respondents are expected to spend time, effort (and maybe money through Internet access) to fill in the questionnaire (Goodman and Campbell, 1999, Pitkow and Recker, 1995).

Traditional email assessments require the respondents to perform text entry (by marking 'X', typing number or text) before sending the reply to the surveyor. Another way of email assessment is by posting the questions in newsgroups, hoping that the subscribers of the newsgroup will follow the given instructions and submit their responses via email.

Advantages of Online Web-Based Assessment Methods

Doing online assessments affords the surveyor many advantages. Access to a large group of potential assessors of diverse population, less use of resources such as paper, postage, telephone, manpower, and time (meaning relative inexpensiveness), flexibility of the assessment in terms of time and place, the faster implementation and data gathering, the easiness of doing follow-up since participants can be contacted electronically, ease of access for respondents, anonymity for respondents, better quality response – since participants answers at his own pace and not under supervision, visual and audio attractiveness, and its electronic format that facilitates better and accurate data collection are among the attractive feature of WWW-based assessment (Witt, 1998, Cheyne and Ritter, 2001, Goodman and Campbell, 1999, Strauss, 1996, Dillman et. al., 1999, Teague and Martin, 1998). Some of the advantages are outlined below. More information can be accessed through the literature listed in the reference.

Response Rates

Response rates for traditional methods and Internet-based assessment differ. This can be attributed to certain factors as discussed earlier. Previous researches have suggested some approaches to improve response rates; offering incentives, diverse publicity methods, and prominent advertisement are some of the possible steps that can be taken. Response rates for traditional method assessments are generally low, usually no more than 25 % (Falconer and Hodgett, 1999). Researchers who modified their methodologies and introduced extra strategies managed to improve the response rates to about 35 %. Falconer and Hodgett's (1999) research on non-response divided the non-respondents into four groups. The first group of reason involved time constraint. Reasons that came under this group are such as (i) lack of time (which was the main reason cited by the respondents), (ii) assessment completion is not a high priority activity for the respondents, and (iii) assessment looked to long and therefore the respondents were not willing to allocate time to answer it. The second group revolved around organizational constraints. Some of the reasons given are (i) organizations were not willing to give out information, and (ii) against organization's policy. The third group involved those who (ii) feel that there's no benefit from responding to the assessment or (ii) do not answer from principle, while the last group involved non-applicability to organization, meaning that the respondent's organization could not contribute to the assessment. In short, the response rate is affected by a number of factors including design parameters and the respondents' propensity to respond. The researchers summarized that between 38 % and 54 % of sample will not reply because of time or organizational constraints. Taking into account those who voluntarily do not respond and those who feel it is not beneficial, response rate of 42 % to 58 % is the best that can be expected from mail assessments.

Reasons for low response rates include:

- i. lack of motivation to complete assessment
- ii. lack of access
- iii. lack of time
- iv. missing respondents
- v. lack of support from management
- vi. nature of sample used for assessment

Internet assessments can procure high number of respondents from diverse global locations, and this is in fact used to offset the sample frame and self-selection bias (GVU and Hermes, 1995). By advertising heavily in many strategic locations, the surveyor can try to reduce any demographic bias, even though that might not be always possible. Some of the methods to attract respondents are advertisement in newsgroups, usage of banner ads in prominent web sites, and including the assessment in web search engines (Cheyne and Ritter (2001), GVU (1998), and GVU and Hermes (1995)).

Part II

IS Services

IS services (ISS) are defined as activities that facilitate and support customers in exploiting IS in organization. The various types of ISS can be categorized into three major groups: development service, use service and user support service (Saaksjarvi and Saarinen, 1994). Like other services, ISS involves interaction between the service provider and the recipients. In the case of ISS, the service provider can be looked at from two different perspectives; the service provider may be the staff that represent the IS department or it may also be the IS products which are in a form of systems application or machines (Rose et. al., 2001). The recipients of the ISS are users who interact direct and indirectly with the service. Figure 1 illustrates ISS. Some common ISS include application system development, software installation, IT education and training, software and hardware selection, outsource evaluation, network connection, hardware maintenance, e-mail provision, consultation and help desk service (Rose et. al., 2001). Although the types of ISS are dynamic, they can still be categorized by three major roles: development service, use service and user support service as outlined by Saaksjarvi and Saarinen (1994).

Service Quality Model

Donnelly et. al. (1995) emphasize that customers are the sole judgment of service quality. This is evident by examining the many service quality models that exist. The most popular model is SERVQUAL model by Parasuraman et. al. (1985). The model revolves around the perception and expectation of recipients of service. Parasuraman et. al. (1985) identified five attributes of service: empathy, responsiveness, reliability, assurance, and tangibles. The model is implemented through the SERVQUAL instrument, which is basically a questionnaire that consists of 22-items encapsulating the 5 dimensions. Parasuraman et. al. (1985) theorized that the five attributes are generic in nature and are applicable to all types of services. It was concluded that effective management of the service attributes would increase the customers' perception of service delivery.

One of the many adaptations done on SERVQUAL involved the area of information systems. Kettinger and Lee (1994) modified the wordings of the items to suit their study on a college's computing services. The number of items for the modified instrument remained same. The instrument was named IS-SERVQUAL. The current project uses the IS-SERVQUAL instrument as the assessment content.

Part III

System Design and Development

A questionnaire is usually divided into few categories. The first category almost always deals with

the particulars of the respondents such as age group, education level, occupation, sex, nationality and other demographic details (Pitkow and Recker, 1995). The second part of the questionnaire will consist of the items that need to be answered by the respondents. The items are almost always grouped according to certain categories that were decided by the assessors. In an online assessment, the questionnaire is set in electronic format, and shown on a web page. The process of designing a web-based questionnaire can be divided into many aspects such as deciding on information that can appear on each screen, deciding on programming tools, planning each screen's element layout and color schemes, anticipating respondents' computer processing capability, limiting the memory and storage used by the assessment system, planning on how to get accurate and complete answers, and motivating or encouraging the respondents. Dillman et. al. (1999) did an extensive study on existing and past assessments done through the Web and also through traditional methods. They also proposed eleven principles that can be immensely helpful in achieving the assessors' objectives. In designing an online system, we go through a scenario of the possible system use, develop a framework to work on, and propose a system architecture.

Scenario of System Use

1. Pre-System Stage (System Setup)

System administrator sets the assessment periods and list of analysis report receivers (key personnel of the agencies).

2. First Stage (Input from Respondents)

The system administrator initiates a new assessment period or the system automatically starts an assessment period based on preset dates. Users are informed of the assessment period through respondent mailing list and web page banner. Potential respondents visit web site, choose a language, and identify themselves via email address (for feedback and incentive) and the organization/branch they would like to assess. The respondents are also asked if they would like to be added to the mailing list for future assessments. If the respondents agree, then the email address is added to the respondent mailing list. The email address and organization/branch information is used to check for duplicate respondents. If duplicate respondent is identified, then error message is displayed. If respondent is valid, then initial questions are selected and displayed. Based on the responses, further questions may be displayed for the respondent to answer. At the end, respondents are required to submit the answers by clicking on the "submit" button. The browser checks for input errors before submitting the response to the server. If errors exist (such as incomplete questionnaire or wrong data type for demographic details), the error is highlighted for respondent to take action. After submission, "thank you" note and other information is displayed.

3. Second Stage (Processing Input)

The data (response) received from is sorted into user information (email address, age, education, occupation etc.) and questionnaire response. The user information is stored in User Information database while the Logged Response database stores the responses. This process continues until the assessment period ends.

4. Third Stage (Data Analysis)

As soon as the assessment period ends, the system closes the web site and displays appropriate message to inform visitor on the next assessment period. Then, the system initiates data collation and analysis. Data from User Information database and Logged Response is sorted according to branches and agencies. Various tests such as reliability tests and validity tests are conducted by the system. The results are formatted and sent to respective personnel as listed in the Key Personnel mailing list for further action. The results will be displayed in a format acceptable throughout the agencies such Microsoft Word. The report includes graphical output such as graphs and pie charts. The system then waits for the next assessment period.

5. Post-System Stage (System Maintenance/Tuning)

The System administrator may change the settings such as Key Personnel mailing list, questions list, assessment periods, or types of reports as requested by the Key Personnel.

Electronic Assessment Framework

Based on the extensive reviews, a framework has been generated in order to optimize the assessment.

The prototype is inserted into a "larger system" that involves other issues as well. Based on the literature reviews of online assessments, it has been deduced that a prototype application itself is insufficient. It needs to be supported by efficient publicity strategy as done in GVU's surveys. The prototype application should also have the necessary clout in terms of support from relevant authorities and organizations. These two factors can affect the implementation of the prototype and eventually a successful assessment, in term of response rates. The types of analysis done and its effectiveness also play an important in deciding the outcome of assessment. The above factors are summarized in Figure 3.

Some of the publicity strategy has been outlined in examples shown earlier. These include aggressive advertising in prominent and relevant websites, announcements in mass media, incentives, promotion in newsgroups and submission in search engines. Support is obtained from relevant authorities or other entities that are perceived to have influence over the public. Examples are the government, non-governmental organizations (NGOs), education institutions, and popular websites such as Yahoo, Cari, MalaysiaKini, Berita Harian, and The Star portals. Support strategy can be intertwined with publicity as

those who support the assessment may also help to publicize and vice versa.

Implementation strategy covers more than the issues discussed in the previous part. Other societal factors such as languages, educational background, and accessibility for disabled people need to be considered together with the system design of the prototype. The analysis that is done on the responses need to be reliable and thorough. All possible constraints must be clearly outlined so that the decision makers can take the results in the correct context. The results, if made available to the respondents, must also outline initiatives that would be taken by the respective agencies to resolve the problems faced by ISS recipients. Otherwise, the public can lose confidence on the agencies.

Prototype Design

A prototype system is designed based on the requirements obtained from literature reviews and feedback from feasibility study. The system's requirements in terms of hardware and software are identified based on the analyzed data.

The design will start by focusing on a conceptual or architectural model of the prototype. The model will be the basis for decomposing the prototype's components and interfaces. The components and interfaces are further refined into functional models. Finally, the algorithms and necessary data structures are designed. Based on the data requirements, the database is designed.

Prototype Architecture

The system architecture (Figure 4) consists of four main components: System Manager, Question Engine, Logging Routines, and Decision Support Agent, and a support component that consists of shared libraries: Library Routines. Three databases are required: questions database, logged responses database, and user information database.

System Manager is the main component that handles functions such as getting the language choice for users, displaying welcome screen and thank you, verifying users to filter duplicate respondents, maintaining the results distribution list (for the decision support agent), maintaining the site for the allowed period of time, and getting user information (demographics) to be stored in user information database. The Question Engine provides the initial set of questions and implements adaptive questioning. It interacts directly with the questions database. The logging routine component logs the interaction between the user and the server. It keeps the results in the logged responses database. The results are analyzed

by decision support agent and then sent to the key personnel of the organizations (based on the distribution list) at the end of the assessment period. The library routines will store common or shared libraries and functions. The HTTP server houses the prototype, the web server (Microsoft's IIS), and firewall.

Hardware and Software

The prototype's front end (user interface) is to be developed using Oracle's Developer 6i and other Oracle tools, while the back end is Oracle 8i database. The prototype's middle tier will be created using programming languages such as PL/SQL or Java. The system is developed on a machine running Microsoft's server operating system (Windows 2000 Server). The analysis package SPSS 10.0 will be used for data analysis. The prototype machine is a server with Intel Pentium 4 processor (1.5GHz), 30GB hard disk space, and 256MB RAM.

Conclusion

The system prototype is still being developed and is in design phase. At the moment, the data flow diagram (DFD) and functional hierarchy is being developed and the data dictionary is being created based on the entity-relationship model. The prototype will be tested at two government agencies. The results and feedback from the testing will be used to improve the system. As it is, even though Internet penetration is not high as we like it to be, the system would provide a useful and interesting alternative for the increasingly urbanized and mobile consumers. It also fits into the e-Government implementation, one of the flagships in Multimedia Super Corridor. The use of ICT will definitely increase the performance of the agencies and reduce many possible human-induced errors and delays.

As shown through the electronic assessment framework, the success of the assessment depends on various strategies and commitment from many parties. Previous assessments have a variety of response rates because of the difference in these components. The online assessment system itself is part of a larger system of assessment as in Figure 5.

Some future plans include assessing the viability of mobile computing as part of the assessment method. Hand – held devices, such as the Pocket PC, are gaining popularity, and is a prospective avenue of alternative data gathering that can fit into the proposed online assessment system.

The authors appreciate any feedback on the design of the system and can be contacted via the addresses given above.

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Appendix

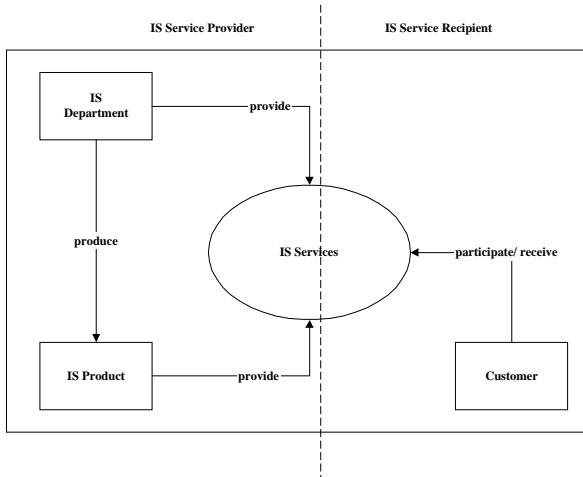


Figure 1: Information System Services (ISS)

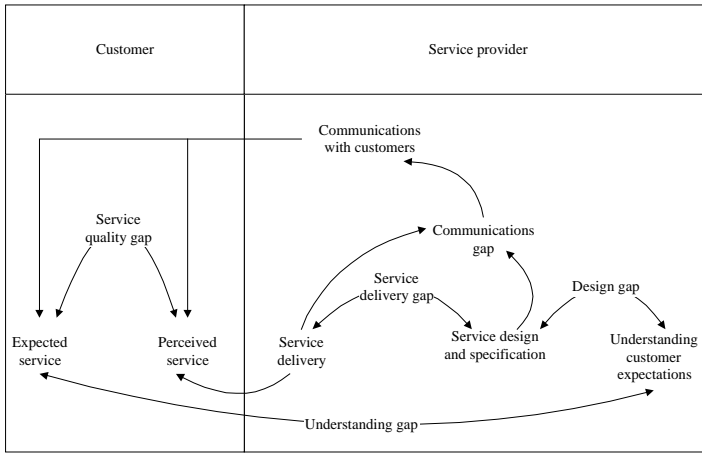


Figure 2: SERVQUAL (Gap) Model (Zeithaml et. al., 1990)

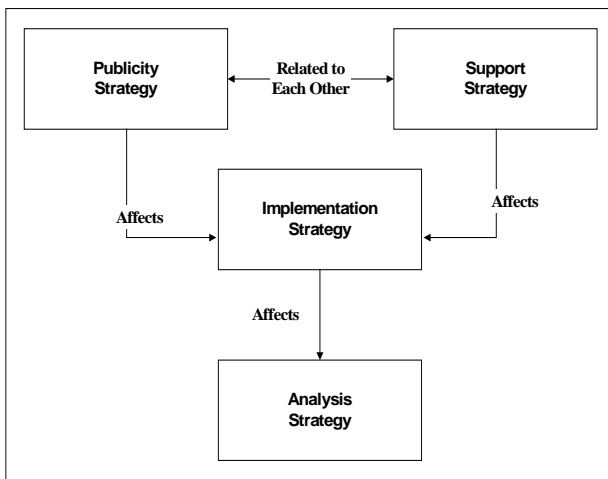


Figure 3: Electronic Assessment Framework

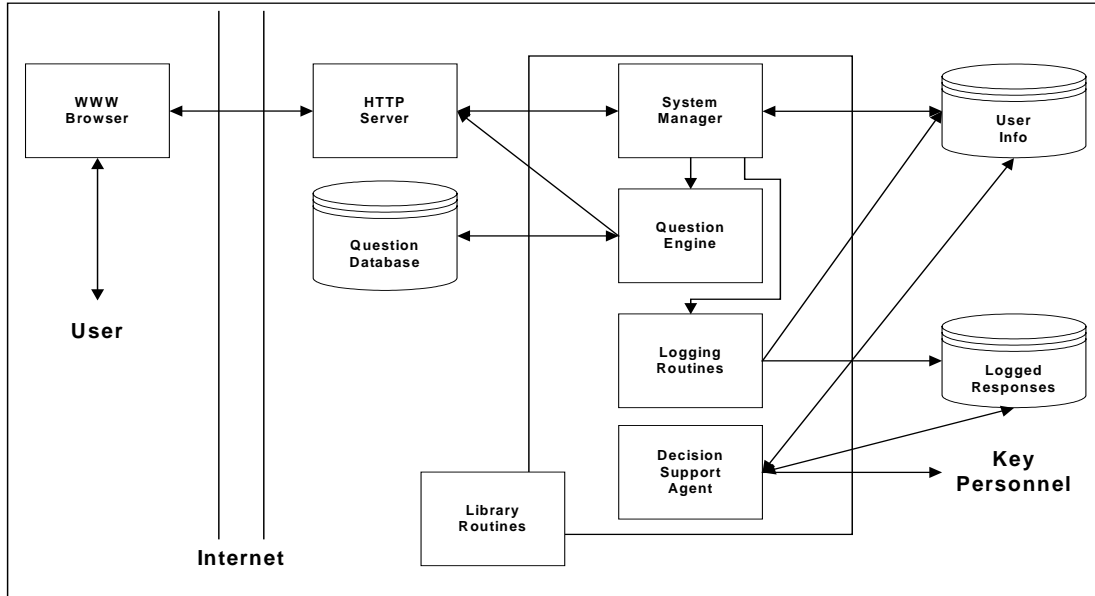


Figure 4: Prototype System Architecture (modified from Pitkow and Recker, 1995).

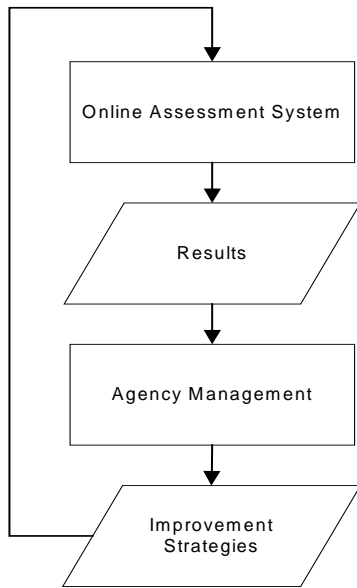


Figure 5: The Assessment System