# USER SATISFACTION WITH SEARCH-DRIVEN ENTERPRISE PORTALS

Ingunn Myrtveit
*Norwegian School of Management, Nydalsveien 37, 0484 Oslo, Norway*

Erik Stensrud
*Det Norske Veritas Research & Innovation, Veritasveien 1, 1322 Høvik, Oslo, Norway*

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Abstract: Advances in new information technology have considerably changed the end user computer environment. Therefore, it is appropriate to revalidate existing user satisfaction measurement instruments. Doll and Torkzadeh (1988) developed an instrument that measured end user satisfaction with now 20-year old information systems and which has been widely cited and used. This pilot study revalidates their measurement instrument on a state-of-the-art, search-driven enterprise portal.

## 1 INTRODUCTION

There are huge, and increasing, investments in information systems (IS) every year. However, more than half of the software projects undertaken in the United States fail, according to Standish Group, wasting billions of dollars (Standish Group, 1995), and we may assume that improving the success rate of IS investments is therefore of vital interest to organizations and society. It is not surprising, then, that there is much research on topics like IS success.

However, what makes a software project successful depends on your perspective. An IS has many stakeholders, each with a different perspective on IS success. From the end user's perspective, a successful system may be one that the user perceives makes his job more fun and more efficient. The software manager may feel successful when he delivers the project on time and within budget. From the purchaser's or investor's perspective, a successful IS is one that contributes a positive return on investment (ROI).

Our perspective is the investor's perspective. We would ideally like to measure ROI, that is, evaluate IS based on its contribution to productivity increases, revenue increases, cost reductions, and improved decision making. However, this is generally not feasible, and therefore surrogate measures like end-user satisfaction must be used (Doll and Torkzadeh, 1988).

User satisfaction is generally regarded as one of the most important measures of IS success. There has been considerable research devoted to establishing a standard user satisfaction instrument since the 1980s (e.g. Ives et al., 1983; Bailey and Pearson, 1983; Baroudi et al., 1986; Benson, 1983), when data computing in organizations moved from data processing to end-user computing (EUC) (Doll and Torkzadeh, 1988). Doll and Torkzadeh (1988) developed and validated an End-User Computing Satisfaction (EUCS) instrument. It included five components: content, accuracy, format, ease of use, and timeliness.

Since the development of the EUCS instrument, there have been significant changes in information technology, especially with the soaring growth of the Internet and search technologies like Google®. Internet search applications, exemplified by Google® and Yahoo®, have undisputedly added significant value to users in their quest for information on the web. More recently, in businesses, we see similar significant changes in information technology like the emergence of corporate systems that are enhanced by enterprise search components. Businesses hope that enterprise search will do for the business what web search has



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done for the web community. It is, however, still in its early stages, but, looking to the web, it might become an important technology for businesses, too. In 2007, the search and discovery software market reached more than $1.7 billion, a growth rate of 23.4%, and expecting to reach $3.1 billion in 2012 (IDC, 2008). Therefore, it is of interest to be able to assess the user satisfaction of these new, enhanced-by-search corporate systems by ensuring valid and reliable measuring instruments.

Information is an important business asset and making effective use of it is central to business success (Ball and Harris, 1982; Brancheau et al., 1987 and 1996; Niederman et al., 1991). Much business information is unstructured data (e.g. emails and documents). A widely touted IT factoid states that unstructured data account for 80% of the total information (Kuechler, 2007). The amount of information is large and growing at a fast rate.

Information workers need seamless access to information scattered across corporate systems as well as the Web, and they need access to structured as well as unstructured information. In order for individuals to make the best business decisions, deliver the greatest business impact, and be as productive as possible, they must be able to find, use, and share relevant business information quickly, easily, and securely. Therefore, they do not just need access but also aid in retrieving what is relevant information.

We see a trend that corporate information systems are adapting the best from web information systems and deviating more and more from the traditionally corporate information systems. The differences we observe between traditional corporate systems (TCS) and new corporate systems like search-driven enterprise portals (SDEP) are several. For example:

- TCS access information from one repository; SDEP access information across repositories. Thus, SDEP offers to juxtapose and compare information and could be a better analytics tool rather than just a portal.
- TCS mainly access structured data; SDEP access structured as well as unstructured data. SDEP provide the ability to intelligently and dynamically, access, retrieve and analyze information in real time, regardless of data format, structure or location, e.g. email archives, file servers with documents, and presentations and databases.
- One output of TCS is traditional, static reports; In SDEP, the concept of a report seems to vanish at the expense of more ad hoc queries.
- TCS user interface mostly have static menu structures with predefined categories; SDEP offer dynamic menu structures where the categories are created based on analysis of the information content presented to the user
- The result sets in TCS small and often not ranked; The result sets in SDEP are large and therefore ranked and organized in logic way before presented to the user
- TCS technology gave the users limited possibilities to customize the user interface. SDEA systems have put more and more capabilities and power at the disposal of the user, i.e. the systems opens for customizing of individual user interfaces.
- TCS is isolated to one system; SDEP is enterprise wide and integrated.

Because of these differences between TCS and SDEP, and because the EUCS instrument was developed to measure user satisfaction with TCS, it is not appropriate to adopt the EUCS instrument to measure user satisfaction without first examining the validity and reliability of the instrument in the SDEP context.

The rest of the paper is organized as follows. Section 2 gives an overview of related work. Section 3 presents the data. Section 4 describes the research method. Section 5 presents the results, and Section 6 discusses and proposes areas for further work.

## 2 LITERATURE REVIEW

User satisfaction has received attention in the research literature since the 1980s. Much research has concentrated on finding a valid measure for user satisfaction. Among this research, Bailey and Pearson (1983) developed a semantic differential instrument, with 39 items measuring overall computer user satisfaction. This was later revised by Ives et. al., (1983) to a 13-item instrument. These two instruments measure a combination of satisfaction with the system as well as with the services from the EDP staff. Baroudi et al. (1986) and Benson (1983) also published user satisfaction studies. Based on the instrument of Ives et al., Doll and Torkzadeh (1988) therefore developed a 12-item instrument, designed to measure the end-user satisfaction with a specific application. It consisted of five factors: information content, accuracy, format, ease of use, and timeliness. It was later confirmed to be valid and reliable as a standardized measure of user satisfaction with a specific application (Doll et al., 1994). Xiao and Dasgupta

(2002) studied user satisfaction with web-based IS and validated the instrument of Doll and Torkzadeh. They found that with minor revisions the instrument is still valid. The End User Computer Satisfaction, EUCS, instrument developed by Doll and Torkzadeh is still among the most used and cited instruments.

Doll and Torkzadeh's 12-item EUCS instrument comprised of 5 factors/components: content, accuracy, format, ease of use, and timeliness. Ease of use was not included in previous studies. Two global measures of perceived overall satisfaction and success were added to serve as criterion. The construct was developed with five point Likert-type scale (1=almost never, 2=some of the time, 3= about half of the time, 4= most of the time and 5= almost always). The two global factors were "Is the system successful?" and "Are you satisfied with the system?"

This research is based on the EUCS instrument by Doll and Torkzadeh because it is a widely used instrument, and has been validated through several confirmatory analyses and construct validity tests. After the exploratory study was completed in 1988, two confirmatory studies with different samples were conducted respectively in 1994 and 1997, which suggested the instrument was valid (Doll et al., 1994; Doll and Xia, 1997). A test-retest of reliability of the instrument was conducted in 1991, indicating the instrument was reliable over time (Torkzadeh and Doll, 1991). The instrument is widely accepted and adopted by other researchers. McHaney and Cronan (1998, 2000) adopted it to examining computer simulation success. McHaney et al. (1999) adopted it in decision support systems research. Chen et al. (2000) applied it to measure user satisfaction with data warehouse and Xiao and Dasgupta (2002) applied it to web-based information systems.

# 3 DATA AND DATA COLLECTION

We conducted a pilot study of an SDEP in a multinational consulting company using their employees as subjects and having them evaluate the company's internal enterprise portal which is an SDEP. The questionnaire was the Doll and Torkzadeh 12-item instrument (see Appendix). Data were collected by distributing email with the questionnaire implemented in the online tool Confirmit. The questionnaire was distributed to all the employees in the Norwegian branch (approx. 70). The response rate was approx. 50 %. As we want to validate the Doll and Torkzadeh instrument, we used the original, 12-item version of the questionnaire. However, we introduced one new feature as we gave the respondents the option to answer N/A to each question. Also, we collected data for the age and work category of respondents: sales, administration, infrastructure consulting and development consulting. The reason for making these groups is that we hypothesize that the groups use the portal for different purposes. For example, infrastructure consultants are typically searching for a general term or idea whereas programmers are searching for code snippets or something very specific such as an error code.

We found that development consulting respondents were most likely to answer immediately whereas the other groups seemed to hesitate. After a second appeal, we ended up with equal response from development and infrastructure consultants – but no response from sales, and only two responses from the administration. The average age was 32 years, spanning from 25 to 49.

# 4 METHOD

A literature review was conducted on related topics. We found that the Doll and Torkzadeh instrument is still among the most widely used and cited instruments (with more than 700 citations on Scholar Google). We want to examine whether the Doll and Torkzadeh instrument is still valid for new technologies like SDEP, or if it has to be revised. As a first step, this pilot study replicates their original research methodology with minor adjustments.

We applied the concepts and procedures introduced by Doll and Torkzadeh, and which seem to have been the custom in this stream of research. Doll and Torkzadeh applied exploratory factor analysis both to assess the construct validity of the measure and to determine the underlying factors of end-user satisfaction. However, this has not generally been applied to the pilot studies as factor analysis generally requires four to five times as many observations as there are items to be studied. (There is some disagreement regarding this ratio.) Therefore, in this study, we copied previous studies and mainly examined construct validity with correlations between the total score and each item score. In addition, we performed a factor analysis, but due to the low number of observations the latter results must be treated with caution.

Two global items of end-user satisfaction with the SDEP were included in the survey. Thus, the extent to which each item correlates with the global items is indicative of its criterion-related validity. The two-item global criterion were "Is the enterprise portal successful?" and "Are you satisfied with the enterprise portal?" (see Appendix). Correlation between the overall user satisfaction and individual item scores were calculated using Pearson's correlation coefficient.

Following Doll and Torkzadeh's procedure, we examined the correlation of score of each item with the total score of all items. To avoid the spurious part-whole correlation, we subtracted each item score from the total score before conducting the correlation. Therefore, we conducted correlation of each item with the total of rest 11 items.

# 5 RESULTS

Table 1, column 2, presents the results of the correlation assessment. According to Doll and Torkzadeh, there is no accepted standard of cutoff threshold, therefore they suggested (and it seems to have become the custom in later studies) a cutoff value of 0.5. All items are above the threshold of 0.5, except for the item F1 ("Do you think the output is presented in a useful format?") which is just below.

In conducting the criterion-related validity analysis, we examined the correlation of each item with the score of the global satisfaction criteria G1 and G2 (items 13 and 14). As G1 and G2 were very highly correlated, we only used one measure. As Doll and Torkzadeh, we assume these measures to be valid. Table 1, column 3, shows the results. The cutoff threshold is 0.4 as in Doll and Torkzadeh. All values were above the threshold except E2, which was just below. Therefore all items are valid – except maybe E2 ("Is the enterprise portal easy to use?") which could be reconsidered.

We did a factor analysis despite the low number of observations. Principal Component Analysis was used as the extraction technique and varimax was used as the method of rotation. Without specifying the number of factors, three factors emerged. However, to be in line with Doll and Torkzadeh, we forced the analysis to have five factors (components). We used a threshold of approximately 0.7 for factor loading criterion.

Table 1: Reliability and Criterion-Related Validity of Measures of End-User Satisfaction.

| Item | Corrected Item-Total Correlation | Correlation with Criterion |
|---|---|---|
| C1 | 0.724 | 0.856 |
| C2 | 0.727 | 0.727 |
| C3 | 0.518 | 0.585 |
| C4 | 0.846 | 0.880 |
| A1 | 0.587 | 0.611 |
| A2 | 0.540 | 0.676 |
| F1 | 0.472 | 0.414 |
| F2 | 0.694 | 0.526 |
| E1 | 0.548 | 0.457 |
| E2 | 0.538 | 0.385 |
| T1 | 0.710 | 0.574 |
| T2 | 0.543 | 0.479 |

Table 2: Rotated Component Matrix(a).

| | Component | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| C1 | .709 | | | | |
| C2 | .695* | | | | |
| C3 | | | | | .931 |
| C4 | .690* | | | | |
| A1 | .794 | | | | |
| A2 | .931 | | | | |
| F1 | | .938 | | | |
| F2 | | .708 | | | |
| E1 | | .713 | | | |
| E1 | | | | .890 | |
| T1 | | | .757 | | |
| T2 | | | .917 | | |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

The result is presented in Table 2. We observe that some results are similar to Doll and Torkzadeh, but not all. "Timeliness" and "Format" seem to fit with previous results, but it is hard to distinguish, for example, between "Content" and Accuracy". However, due to the low number of observations in this pilot study, we do not place much confidence in these results.

# 6 DISCUSSION AND FURTHER WORK

As stated in the Introduction, we would ideally like to measure the return on investment (ROI) but resorted to end-user satisfaction as a surrogate

measure. In this pilot study, we have taken a first, small step to investigate whether the End-User Computer Satisfaction (EUCS) instrument developed by Doll and Torkzadeh is still valid for new technologies like search-driven enterprise portals (SDEP). We found that the validity of the instrument cannot be rejected. However, we have become more skeptical regarding its use as a valid surrogate measure of ROI. In addition, the respondents commented that some of the factors were unclear, in particular "Accuracy".

Therefore, we now believe that user satisfaction instruments may add more value when used to gather user feedback for the purpose of improving the IS, rather than as a surrogate measure for ROI. In this case, other, more elaborate instruments must be considered. An IS like an enterprise portal consists of the quality of the system (delivered by the system provider), and of the quality of the information (delivered by the content provider, end-users themselves, etc.). The perceived success depends on both system and information quality. Therefore, to enhance the success of the portal, we need to know whether it is the system or the information that needs to be improved. The EUCS instrument by Doll and Torkzadeh does not make this distinction.

However, others, like DeLone and McLean (1992, 2003) make an explicit distinction between information quality (IQ) and system quality (SQ). They argue that IS success is a multidimensional and interdependent construct, where IQ and SQ are antecedents of user satisfaction and use. A similar separation is very common in marketing where attribute satisfaction and information satisfaction are antecedents of satisfaction. See e.g. Spreng et al., (1996).

While distinguishing between IQ and SQ may not be widespread in empirical IS studies, such a distinction is clearly very relevant for an enterprise portal study as we may separate the content from the content-delivery system. McKinney et al. (2002) did a study of web-customer satisfaction. They combined the perspectives from the user satisfaction literature in IS and the customer satisfaction literature in marketing and identified nine key constructs for analyzing web-customer satisfaction. Based on IS literature, they argue that measuring web-customer satisfaction for information quality and system quality provides insight about a customer's overall satisfaction with a web site. In addition, they synthesize this with the expectation-disconfirmation paradigm from marketing literature. Web-user satisfaction is affected by their prior expectations (formed by their prior experiences and exposure to vendor's marketing efforts), possible discrepancies (e.g. disconfirmation) between such expectations, and the perceived performance of the web site.

Inspired by this work and input from behavioral economics, Cheung and Lee (2005) studied the satisfaction with an e-portal. Behavioral economics claim that negative performance has a greater impact on satisfaction than positive performance. They examine the asymmetrical effects of negative and positive web site attribute performance on satisfaction. Their empirical findings are inconclusive, but we regard the model as relevant for future research.

Regarding future research, we find it relevant to distinguish between SQ and IQ as the feedback from users must be provided to software providers and information providers, respectively. Thus, we want to investigate DeLone and McLean's model in this respect. Furthermore, it will be very relevant to investigate whether negative performance on one or more factors influence user satisfaction dramatically – or vice versa.

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## APPENDIX: THE EUCS MEASUREMENT INSTRUMENT

C1. Does the enterprise portal provide the precise information you need?

C2. Does the information content meet your needs?

C3. Does the enterprise portal provide reports that seem to be just about exactly what you need?

C4. Does the enterprise portal provide sufficient information?

A1. Is the enterprise portal accurate?

A2. Are you satisfied with the accuracy of the enterprise portal?

F1. Do you think the output is presented in a useful format?

F2. Is the information clear?

E1. Is the enterprise portal user friendly?

E2. Is the enterprise portal easy to use?

T1. Do you get the information you need in time?

T2. Does the enterprise portal provide up-to-date information?

G1. Is the enterprise portal successful?

G2. Are you satisfied with the enterprise portal?