

**Impact of Organizational Capability in Developing Internet-based Solutions on
Perceived Website Effectiveness**

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Abstract

This study investigates the organizational capability in developing internet-based solutions to deliver online citizen services for its impact on perceived agency website effectiveness. Using a sample of 239 IT managers from state-level primary health and human service agencies, the results show that capability in developing citizen oriented solutions are significantly responsible for perceived effectiveness of the agency website. Supported by MIS literature, user participation and subsequent user-satisfaction is proposed to cause a favorable perception of the agency's IT capability, irrespective of the communication pattern with the external publics. Experience in developing and hosting a public website was positively correlated to its effectiveness. Ordinal Logistic Regression and Multinomial Regression were used to test the validity and reliability of the data thus obtained.

Introduction

Information Technology has had an enduring effect on the way organizations function and has permeated the public sector in order to boost the effectiveness and timeliness of services provided. E-government was the catchphrase used to define the first wave of interactive government. E-government definitions are harder to come by without adequately including all the perceived functions of the government but the definition cited by Zweers and Planque fits our purpose because of its intended exclusion of online democracy and restricts itself to service provided to the citizens,

“Electronic government concerns providing or attainment of information, services or products through electronic means, by and from governmental agencies, at any given moment and place, offering an extra value for all participating parties.”

Government agencies at all levels have made considerable investments in IT infrastructure. Federal, State, and local governments are deploying Internet-based solutions to provide enhanced, integrated services to citizens that provide lower costs, reduced fraud and abuse and increased accountability (Burns, 2000). The Gartner Group¹ has predicted that public spending for e-governance will increase from \$1.5 billion in 2000 to \$6.2 billion by 2005. The above definition works from the perspective of the public but does not speak much for innovative incentives for incorporating the change on part of the public agencies. Moreover, the novelty of e-governance has waned over the years and highly pragmatic and utilitarian net usage prevails (Accenture Institute for Strategic Change). The inundation of technology juxtaposed over traditional public organizations has not proved to be entirely compatible. Reluctance to indulge in innovative change and less technology usage specifically related to computing needs are highlighted as the undermining factors of e-government strategy (Joyce, 2002). Strategic innovation is achieved through the separation of service from the structure of the providing organization (Zweers and Planque, 2001). The strategic innovation entails efficient value-added usage of information technology (IT) for improved services, building external support and promoting organizational capacity and infrastructure (Heymann, 1987; Moore, 1995). The incentives for usage of IT can be reinforced by measures in organizational infrastructure and driven by innovative capability emphasized by the organization culture and protocol. These new strategies are attempting to increase productivity and effectiveness of public sector agencies after the initial investment of computer systems and development of internet-based solutions (Schware, 2000).

E-Governance and Success of Information Systems

The first step of e-governance was the provision of easy and open-access information through governmental websites. Information communication and technology (ICT) has

driven transformation of organizational innovation and development of communication linkages (Joyce, 2002). The outcomes in form of websites are created to cater to different citizen services and are perceived to improve efficiency and timeliness. These perceptions of website effectiveness are perceived to be driven by user satisfaction, which in turn is influenced by strategic innovative capability of the organization, external support and management of information systems (IS) in terms of its communicative capability (Hargie and Tourish, 1996). This paper attempts to identify the influence of end-users in systems development on the perceived effectiveness of the outcomes of the organization i.e. the agency website. The MIS success of organizations in question is related to the perceived effectiveness of their websites for this paper. New and innovative management information technologies have resulted in changed organizational relationships between the end-user and the system developer. This paper studies the nature of relationship between the end-user and the systems developer to analyze the perceptions of the agency's information systems capability. This relationship is hypothesized to affect the perception of agency website effectiveness in delivering services to citizens in an efficient and timely manner. The organization's proclivity for promoting innovation in user-developer relationship can also be a determining factor for agency IS effectiveness. The focus of the paper is not just on studying the perceived capability of the agencies' IS development competency but also on analyzing the aspects that strengthen the influence of the user in the development process. Although the overall goal is to analyze the user's propensity to innovate in IT by participating in the systems development, the results are extrapolated to predict the influence on the perceived effectiveness of the websites, which are the outcomes of the information system of the organization. The focus of the paper is on technology users as determinants of the organization's IT capability. The research question asks "how can the relationship between user-developer explain perceived effectiveness of

organization's computerized information systems (CIS)? Data from the NASP II study is used to formulate this conceptual thought process supported by literature in the MIS sector. The focus of the study was on managers engaged in information management activities, thus greatly reflected the organizational capability in terms of innovation and communication. The work presented here reflects not only the influence of user-developer communication to innovate in IT but also offers a fresh perspective on aspects of system development that has direct implications for a citizen-level outcome i.e. the agency website.

The literature draws several examples to predict the success of IS though primarily empirical measures of user satisfaction, level of systems usage, user decisional performance and organizational performance (Raymond, 1987). User satisfaction and level of system usage however are the most extensively used measures in the literature. But user satisfaction ranks higher in terms of significance and literature review suggests more incidence of attempts at correlation for different levels and types of organizations. However higher participation of the user in the system development process leads to success of information systems (Franz and Robey, 1984) but at the same time, user's appreciation and subsequent satisfaction for the system led to higher utilization of its outputs and perceived effectiveness (Swanson, 1974).

This paper attempts to bridge the gap between user participation and user satisfaction to augment an organization's ability to develop information systems. User participation and user satisfaction are by far, the most influential factors for MIS success (Edstrom, 1977; Boland, 1978; Lucas, 1978; Powers and Dickinson, 1973; Guthrie, 1972)

End User Computing and Systems Development

The user community forms an important link between the middle management and the services offered. End User Computing (EUC) has been the focus of attention in the MIS literature and comprises almost 40-50% of computing resources in an organization

(Rockart & Flannery, 1983). EUC is defined as “the process by which users develop applications whereby they have access to computers, data and support systems” (Rockhart and Flannery, 1983) and “the capability to control their own applications and computing needs directly” (Davis and Olson, 1985). This study includes the middle managers, the base-level developers and the end-level users of the information systems under the banner of this definition. End user satisfaction, for this study, is determined by the level of capability of the agency to develop internet-based solutions influenced by the extent of participation in the development process. The perceived level of capability is directly influenced by the extent of participation and end user satisfaction.

Our study allows us to study the level of participation by extrapolating the perception of capability. Carr (1988) lists the stages of Systems Development Led by end-Users (SDLU) by providing the entire range of system development possibilities from the perspective of the user; development of the system by professionals by inclusion of controls and security measures to avoid tampering and customization to development empowered by the end-user dictating or sometimes indulging in design of the system itself.

SDLU is a process facilitating the specification and development of effective organizational systems (Dodd and Carr, 1994). The agency website, as in our study, though is a form of extended organizational system can be considered so because of its direct outcome measure capability. SDLU is highly influenced by end-user participation and leadership capability promoted by the organizational structure. Inclusion of end-users in the design of systems can overcome the problem of non-implementation or perceived ineffectiveness of the system (Issacs and Olson, 1979). SDLU helps in increasing computer awareness in the organization and let the users determine the needs of their service delivery component (Dodd and Carr, 1994). Understanding of technology and its limitations or capabilities lets the end users handle the problem

solving on their own and a sense of participation gives them a feeling of oneness with the system; leading to heightened sense of satisfaction. SDLU as a movement, though deleterious to the system programmers in general, is highly influential for success of an organization owing to its “integrative and hybrid approach” though efficient use of its internal resources (Dodd and Carr, 1994). However the diversity of the end-users can undermine the efforts at designing an organizational infrastructure that supports end-user participation (Henderson and Treacy, 1986) but the direction of work and responsibility will flow necessarily to the resources or users that can handle it, at least in the initial stages (Dodd and Carr, 1994) until the other users get a chance to improve their computer competency.

User Satisfaction and IS Success

The correlation between user participation and user satisfaction however have conflicting correlations in the literature (Ginzberg, 1984 & Sanders, 1984; Baroudi et.al, 1986) but greater emphasis has been found in the positive relationship between participation and satisfaction. Analyzing user satisfaction has been the prerogative of middle managers in determining the systems usage and effectiveness. It is also believed that utilization is directly connected to the user community’s sense of satisfaction with those services (Bailey & Pearson, 1983). End users get more acclimatized with the systems they use and hence are able to judge its effectiveness and become more comfortable with its usage leading to higher level of satisfaction. At the same time, other personal traits like education, gender and organizational level are found to be insignificantly correlated to user satisfaction but encouragement of innovative management leadership does lead to high user satisfaction (Igbaria & Nachman, 1990). User satisfaction has been cited as the most critical criterion in measuring computer system success or failure (Powers and Dickinson, 1973). End users inherently satisfied with their degree of participation or general system compatibility tend to favor system

outcomes in a favorable light. The literature has measured computer user satisfaction as a measure of the sum of one's feelings or attitudes towards a variety of factors affecting that situation and those measures have been operationalized through a number of measures throughout the literature (Bailey and Pearson, 1983). Among the plethora of measures in the literature, the relevant ones for our study are confidence in systems, technical competence of the development staff and understanding of systems. These three variables mentioned are reflective of the organizational capability in development of internet-based solutions as part of information systems process. These measures seek to establish a tool for end user satisfaction for the scope of this paper; however it is not comprehensive enough to extrapolate for outcomes other than the website.

Guimares and Gupta (1988) have focused on the priority of satisfaction with MIS department by the top management. Rushinek and Rushinek (1986) have added the aspect of "technical support" to analyze the impact on user satisfaction. Gallagher (1974) focused on end product as a measure for user satisfaction rather than the quality of service. This perception of value by Gallagher finds conjunction with this paper's attempt at measuring the agency website's value via satisfying the end users' perceptions of an effective system. The literature emphasizes the role of user expectation, system usage, technical support, power and control, user participation and communication in measuring user satisfaction. The latter two factors are instrumental in drawing theories of participative decision-making and narrowing the familiarity gap between the users and developers. Conrath and Mignen (1990) emphasize the primacy of using user satisfaction as a direct measure of success of information systems but the contention is rooted in primary success of user participation for user satisfaction.

The shortcoming involved in development of an effective system that leads to user satisfaction is rooted in the limited intra and extra organizational resources. Each organization has independent information system needs but this can prove to be an

ineffectual shortcoming as the outcome measured is the website that is easily customizable from a basic template. But the organizations differ in service aspect of their information systems. The higher level of interactivity for some agencies is seen as a complex task and is mainly provided by external rather than internal sources. This prevents an organization from having its own MIS development staff. However, greater participation of end-users by increasing the level of MIS autonomy by encouraging more user-development applications can seek to bridge the competency capability gap (Raymond, 1987). For small organizations, this can be a tedious and significant investment of time and resources but proves to be effective in the long run.

The terms in literature often interchangeably use user satisfaction and success of information systems as the dependent variable while establishing a strong correlation between the two.

User Participation and IS success

Barki and Hartwick (1989) use “user participation” when “referring to the various design related behaviors and activities that the target users perform during a system development process” and user involvement is used as a “subjective psychological state of the individual and defined as the importance and personal relevance that users attach either to a given system”. For the purposes of our study, we will concern ourselves with “user participation” in the development process.

The literature moves back and forth by trying to establish a relationship between user satisfaction and user participation towards the success of an information system. The satisfaction and participation linkages also are directly correlated making possible the use of both factors for predicting effectiveness and success for the outcomes of the agency information system. Boland (1978) and Gallager (1974) show empirical results supporting a positive relationship between user participation and systems quality. User participation is represented by the active involvement of the target or end user in the

development process (Ives and Olson, 1984). Ives and Olson further elucidate on the application of participative decision-making and planned organizational change. Participative decision-making leads to increased job satisfaction and subsequent rise in productivity (Locke and Schweiger, 1979). Several theorists have attributed user participation for improvement of system quality and assessment. The user understanding of the system with which they are involved is greatly enhanced (Lucas, 1974; Robey & Farrow, 1982). Promoting user participation in systems development can decrease user resistance to change and make them more acceptable for technology shift (Lucas, 1974) although the development staff is in control of the final outcomes and assessment of the resulting system is pertinent to the relationship between the developers and the end-user (Ives & Olson, 1984). Outcomes of such collaborative efforts thus, focus on system quality and system acceptance and previous studies have operationalized “successful implementation” through the dependent variables system quality. The most common outcome variable is user information satisfaction, defined as “the extent to which users believe their information systems meet their information requirement” (Ives et.al, 1983). It is important thus to emphasize on the role of the end-user in the development process while examining questions of organization capability for developing internet-based solutions. “In relation to other factors, e.g. top management support, competence of EDP staff, quality of goal setting, user participation seems to be the only one which is consistently related to the quality of final outcomes” (DeBrabander and Edstrom, 1977).

Types of participation

“The form of participation can vary from direct involvement, where all parties right from the developer to the end-user affected by the system are involved to indirect, where employee representatives serve on decision-making committees” (Ives & Olson, 1984). Outcomes of information system like a website require coordinated efforts from the end-

user, who is in direct contact with the citizen and the development staff. This is essential for communicating the anomalies of the system, which can be rectified to avoid loss of service quality. Mumford (1979) classifies the user participation from consultative to consensus to denote the increasing degree of user influence in the design process. One of the strongest forms of user participation, suitable for this study can be by involving the end-user directly in the design team (Gibson, 1977; Hoyer, 1980) or by establishing a qualified “liason” person with the development group to maintain the direct linkage with end-user group (Lucas, 1974; Gibson, 1977)

User-Developer Communication

It is important, even in the presence of minimal participation to have a strong communication link between the target end-user group and the systems development group. Moreover, the effect of user-developer communication derives greatest benefit when the system is in the development stage (Edstrom, 1977) and reducing uncertainty involved with the information requirements at the initial stages greatly affects the information system success (Davis, 1974). User influence and user-developer communication are independently predictive of user satisfaction regardless of user participation (Mckeen, Guimares, and Wetherbe, 1994). This is true especially in case of complex systems wherein effective communication between users and developers are able to provide precise input into systems development decisions. Robey and Farrow (1982) emphasize the importance of communication by highlighting the facilitating role during user participation to identify conflicts and its subsequent resolution. Exchange of information necessary for identifying system requirements plays an important part in successful development effort (Verrijn-Stuart and Anzenhofer, 1988). Bostrom (1989) stresses the “different frames of reference to the situation and ability to integrate these diverse views into a shared accurate and complete model of the desired system for successful projects”

Data and Methodology

The data used for this study was obtained from the National Administrative Studies Project (NASP) survey. This data however is based on the second part of the NASP project² called as NASP-II. NASP-II, funded in part by the *Center for State Health Policy* and the *Forum for Policy Research and Public Service* at Rutgers University, extended³ the principal goal of the project by collecting data for furthering knowledge in the field of public management. NASP-II included questions on six definite headings namely organization culture, communication, organizational rules and procedures, policy environment, public service motivation, decision-making, and information systems and seeks to study the impact of policy/political context on public management. This paper concerns itself with the impact and context of information systems in such public agencies on outcomes that interact directly with the public.

The source for the questions⁴ was primarily based on the context of NASP-I but majority of the questions were extracted from the extant questionnaire items, with appropriate modifications in tune with the context, with “known psychometric properties in order to operationalize study constructs”. This initial draft was subject to extensive peer-review by fifteen experts in public management and survey methodology⁵. The final questionnaire was finalized in tune with the “TDM guidelines (Dillman, 1999), resulting in a 12-page, 41-question survey instrument requiring 220 variables to store the resultant data in a database” (Pandey, 2003).

This questionnaire was mailed out primarily to managers engaged in information management activities, working in state-level primary health and human service agencies⁶. In context of this study, Information management was broadly defined “to include a range of key managerial roles such as the top program administrator, managers of information system applications, managers in-charge of evaluation and research, and managers dealing with public information and communication” (Pandey,

2003). The sampling frame was developed using the APHSA directory which comprises of human service agency managers nationwide and resulted in a sampling frame of 570 managers from 50 states and Washington D.C. The small size of the sampling frame prompted the application of the survey to the entire "population". Attempts were made to boost the response rate by adhering to Dillman's (1999) comprehensive TDM approach⁷. The first step in conducting the research was to mail out pre-notice letters intimating the respondent of the forthcoming questionnaire and the study. This in addition to priming the respondents avoided the regular incidence of bulky surprise questionnaires. The final questionnaires were mailed out after a week and followed up by thank-you/reminder postcards after a period of about a week. A month later, non-respondents were contacted via fax with intimation of forthcoming replacement surveys. The final attempt to enhance the response rate was by personal phone messages and 2-day Airborne Express or Priority Mail delivery of Final replacement survey.

The sampling frame was revised from 570 to 525 managers after exclusion of 45 potential respondents. The manager leaving the organization or retirement was the primary reasons for this exclusion. Though not complete, the first phase of NASP-II documented 239 completed responses for a response rate of almost 46% (Pandey, 2003).

Although this survey was restricted to public health agencies, it is typical to expect these agencies to exhibit generalizable attributes for the public sector. This study purports the findings of the study to be suggestive for public agencies only and though most of the literature is derived from the private sector, it is believed that the user attributes for information systems development are common for public and private agencies. In order to gain common ground, most of the organizational attributes are ignored in the study and analysis is based purely on user responses for specific information system based-behaviors and perceptions. The responses are considered to be real indicators rather

than perceived measures, hence the exclusion of demographic or organizational attributes.

Hypotheses and Measures

As discussed above, there has not been any attempt to unify user satisfaction and user participation in order to measure effectiveness of information systems. Each measure has individually been empirically tested successfully to have a positive relationship with the “success of MIS systems” but success of the system has not been quantified in measurable terms to reflect the agency mission. In our study, we equated success of MIS system with the effectiveness of the website. The website is the direct interface that is communicable to the citizen and hence forms the “front-face” of the agency. The effectiveness of the website is assessed by the end-users within the agency through measures of quality and timeliness. Each of the user attributes – participation & satisfaction – has led to user awareness of the agency’s capability to develop internet-based solutions to make their website more effective.

Our approach is to rely on measures of user’s perceived (measured as real) indicators of agency’s capability to develop internet-based solutions as well as the agency’s experience in dealing with information system. This however does not account for all aspects for predicting the success of website quality and timeliness but draws on the assumptions that user participation and satisfaction with information systems lead to favorable perception of agency IS. Other studies have concentrated on direct implications of user attributes, organizational innovation characteristics, socio-technical perspectives but we feel that success of agency information system is better served by establishing a direct implication of user participation and satisfaction on a common measurable factor of agency capability. Agency capability can be further classified according to different purposes it excels in, firstly skill in developing citizen services or transactions or provision of online information to citizens and secondly skill in developing

solutions for procurement of or contracting for agency services using the internet. The third category of skill level is more complex i.e. developing interactive communication solutions for interacting with citizens to provide real-time service. Thus it is important to note that we are not only emphasizing on quality attributes of agency capability but also on the direction of their information system application that seems to mold their perceptions of effectiveness of the information system i.e. the website.

The measures of website effectiveness were developed by asking the respondents to indicate their perception of their organization's capability in developing internet-based solutions on a 5-point ordinal scale ranking from "far behind" to "far ahead". Each of the measures was considered important for an organization's IT capabilities are explained in Table 1.

INSERT TABLE 1 HERE

As seen in the literature, user awareness and comfort level with the IS tends to increase with growing experience as use breeds familiarity and productivity is enhanced with increasing usage of information system (Lucas, 1974; Robey & Farrow, 1982). A similar measure was used to estimate the amount of time an agency had with a particular information system i.e. the agency website. Respondents were asked to list the year in which the agency developed and posted a public website, variable name WEBSITE.

Since the spectrum of interviews were conducted across different types and functions of health public agencies, it was important to consider their contact with the citizen. It is observed that the agency with more public participation and interaction tends to evaluate its service more critically than one which has minimal contact.

From the above variables, and keeping in mind the constraints of the paper, it was hypothesized that the variables were in tune with user participation and satisfaction.

Hypothesis 1: the higher the technical skill measured in developing direct citizen-based solutions, the higher would be the perceived effectiveness of the agency website,

Hypothesis 2: Higher the technical skill measured in developing business-oriented solutions, higher would be the perceived effectiveness of the agency website,

The hypotheses above measure the direct implications of agency capability and technical skill in developing internet-based solutions. But these measures are implicit measures of greater user participation in the development process and their subsequent satisfaction with the IT systems involved in the agency functions. Since it is recognized in the literature that utilization of information systems is directly connected to the user's community's sense of satisfaction (Bailey & Pearson, 1983) and sense of satisfaction is implied by the participative role that the agency promotes in developing IT solutions. User involvement is proved to be an important factor in explaining IT success (Straub and Tower, 1988)

Hypothesis 3: Longer the agency has had a public website to dispense client services, higher would be the perceived effectiveness of the agency website

This hypothesis deals with the previously mentioned assumption of familiarity with information system makes the user more comfortable with the technical change. A complete and accurate user assessment then can be obtained, which is utilized for system improvement (Robey and Farrow, 1982).

Hypothesis 4: One-way communicative agencies are less likely to rate websites effective than agencies dealing with two-way communication with their clientele.

As indicated earlier, the type of agency's communication pattern is hypothesized to affect the respondent's perception of website effectiveness. To measure the impact, the

variable measuring agency's communication with the external publics was recoded, as explained in Table 1.

Choice of analytical method used

As seen in table 1, all the variables were converted to either a dichotomous or polytomous categorical distribution. Based on statistical literature, the appropriate method suggested was ordinal logistic regression⁸ to plot the dependence of a polytomous ordinal (PLUM) response (3 or more categorical responses) on a set of categorical predictors, modeled as covariates (Ibrahim, 2000). Following the notation of Armstrong and Sloan, the integers 1, ..., k are the labels for the k ordered response categories (here 1, ..., 7 from "not at all effective" to "effective a great deal"; recoded to 0, ..., 2); and x_j , $j = 1, \dots, k$ are the multinomial probability of a response appearing in each category. In an ordinal regression model, the x_j depends on the values of a vector of explanatory variables x through regression parameters (To et al, 1984). The outcome variable Y takes values 0 (not effective), 1 (somewhat effective) and 2 (very effective) and let $p_1 = P(Y=0)$, $p_2 = P(Y=1)$ and $p_3 = P(Y=2)$. The ordinal logistic regression models the relationship between the cumulative logits of Y , that is, $\log(p_1/(1-p_1)) = \log(p_1/(p_2+p_3))$ and $\log((p_1+p_2)/(1-(p_1+p_2))) = \log((p_1+p_2)/p_3)$ in this case, and independent variables. The model assumes a linear relationship for each logit and parallel regression lines,

$$\log(p_1/(1-p_1)) = \text{intercept}_1 + b_1 \cdot X_1 + b_2 \cdot X_2 + \dots + b_k \cdot X_k,$$

$$\log((p_1+p_2)/p_3) = \text{intercept}_2 + b_1 \cdot X_1 + b_2 \cdot X_2 + \dots + b_k \cdot X_k,$$

McCullagh and Nelder (1989) suggest that reducing the number of response categories, as in the case for outcome variable, could affect the parameter estimates and consequently the estimated odds ratios. But that is not always the case, especially for higher significance variables. Since the response categories have a natural ordering, proportional odds model is incorporated directly to signify the way we specify the logits.

“The proportional odds model is based on the assumption that the effects of the covariates...are the same for all categories on the logarithmic scale” (Iau, 2002). For ordinal response, cumulative logits can be modeled with the proportional odds model. “The proportional odds model assumes that the cumulative logits can be represented as parallel linear functions of independent variables, that is, for each cumulative logit the parameters of the models are the same, except for the intercept” (Agresti, 1990). Proportional odds imply that odds ratios for outcome being not effective (0) vs. somewhat effective or very effective (1 or 2) and for the outcome being not effective or somewhat effective (0 or 1) vs. very effective (2), are the same. But this is applicable only after the score test for proportional odds assumptions is deemed insignificant.

Analysis & Findings

This section reports the results for the above-mentioned hypothesis after testing it statistically for empirical standing. Table 2 presents the distribution of all the variables used in the analysis. As observed, the outcome variable has significant variance even after collapsing the categories from 7 to 3. Among the predictor variables, variance can be noticed in the ability of the agency to develop primary internet-based solutions that seek to provide information to citizens or just involve transferring the real-time agency activities to the internet. For higher end activities such as interactive communication and usage of the internet for procurement and contracting for business needs, the tendency for the agency is a bit muted and tends to be less-developed than the citizen services solutions. Two-way communication agency are higher in number than one-way communicative agencies, displaying a strong linkage between the agency and its clients.

INSERT TABLE 2 HERE

This provides a suitable validity for our hypotheses since agencies have significant interaction with their clients. The public agencies studied are relatively new to the online version of service delivery and the agencies have developed and posted their websites

at an average of 4.4 years ago. But the tendency for the public agencies to lag in their technological application as compared to the private sector is known and recent studies have shown that the public agencies have started catching up on the technological applications and service delivery outcomes.

As identified in the paper earlier, attempts to group variables according to a common theme namely - direct citizen solutions, business procedures solutions and complex interactive client communication solutions proved useful. The perceived grouping scale attained Cronbach alpha reliability of more than 0.70, an estimated minimum for reliability test. As seen in table 3, when observations for direct citizen internet-solutions were pooled, alpha was 0.82 and similarly for business procedures internet-solutions, the alpha was 0.77. The combination of the two groups was adjusted by recoding of the variables to adjust for decimal values and to retain the 5-scale ordinal categorical distribution. Further validation can be seen from the correlation matrix observed in table 4. The three variables pertaining to citizen related services are highly correlated (more than 0.60) and significant at the 0.01 level. This can also result in problems of multicollinearity. Combination of the highly correlated variables, as in the case of citizen related services into a single variable, can ameliorate the problem and lend robustness to our model.

INSERT TABLE 3 HERE

Non-parametric correlations for the model give us an idea of individual significant predictor variables. Spearman values are used because of non-normal distribution and ordinal scale of variables. As seen in table 5, website effectiveness is significantly correlated positively with almost all the variables except one-way communication pattern of the agency. Actually, it is negatively correlated but lack of significance does not let us assume that website effectiveness is different for agencies having different communication pattern with their external publics.

INSERT TABLE 4 HERE

INSERT TABLE 5 HERE

The justification for using proportional odds assumption i.e. regression lines for cumulative logits is parallel, is strengthened by the insignificance of score test , chi-square (1,4) = 3.593, $p < .46$. According to table 6, the likelihood test statistic is equal to 204.26, which corresponds to a p-value less than 0.0001, hence it is conclusively proved that the model with the predictor variables is significant as compared to the model with just the intercept. According to Pearson's result only, we can conclude that the model fits the data adequately, because the p-value = 71%, which is not less than 5%. The Deviance p-value of 37.6% further strengthens the assumption.

INSERT TABLE 6 HERE

Factors predicting Website Effectiveness

The results of the ordinal logistic regression⁹ are shown in Table 7. It can be recalled that the higher technical skill of an agency in developing its internet-based solutions for providing services to its clients was expected to increase the perceived effectiveness of its public website. As hypothesized (H1), developing citizen oriented internet-based solutions does have a positive significant relationship with website effectiveness. But the second hypothesis (H2), that development of business oriented solutions that assisted the agency in streamlining its daily operations with external publics other than their clients did not prove to be significantly influential for perceiving website effectiveness. Although the relationship was positively related, it did not conclusively prove that indulging in developing business oriented solutions led to a higher measure of perceived website effectiveness. This finding supports the argument that public agencies are more concerned about developing solutions for their websites that directly concern their citizen services than indirect utilization of internet technology that would boost their skill in other complementary areas. However the experience of having a website did prove to be

significantly related. Agencies having websites for a longer time (H3), tend to rate their public website to be more effective than the agencies which developed and posted their website for a shorter period of time. Considering that the majority of the agencies were bi-direction in their form of communication with their clients, the difference between agencies having uni-direction or bi-direction communication pattern (H4), did not matter significantly. It, thus could not be conclusively proved that agencies having differing forms of client communication in term of direction had any impact on their perception of website effectiveness.

By far the most important factor predicting website effectiveness is the measure of an agency's capability at developing citizen oriented internet-based solutions. The Wald statistic in Table 6 shows that skill at citizen oriented solutions ranges in importance from four to nine times more than the most important factor. However, the relationship of developing internet-based solution like interactive communication between agency and its client is not clear, it is clear that implementation of complex technologies involves a higher level of user participation and requires a greater time commitment to get familiar with a higher degree of complexity. But it may also be the case that such complex tasks are simply not considered part of MIS development staff's functions and the agencies tends to rely on external contracting. The nature and direction of services however induces us to group the interactive communication factor under citizen oriented solutions. An in-depth study of the source of development of such solutions may shed more light on the relationship.

The comparative results¹⁰ for perceived website effectiveness can be interpreted from table 7, which is obtained by running a multinomial logistic regression. The odds ratio for the only significant variable, Citizen oriented solutions thus obtained also proves that development of citizen oriented internet-based solutions is the most significant factor for obtaining a highly effective perception of website effectiveness.

INSERT TABLE 7 HERE

INSERT TABLE 8 HERE

Implications, Limitations and Conclusions

The purpose of this study was to examine end-user perceptive measurement scales for predicting impact on the effectiveness rating of the agency website. The study was successful in distinguishing the impact of developing citizen oriented measures from generic agency online business processes. Specific measures to develop citizen oriented internet-based solutions are more likely to cause a favorable perception of the public agency website than mere indulgence in generic application development. Although business oriented also spurs user participation and satisfaction, its direct applicability to citizen services seems remote and its inability to transfer the skill set so developed to the effectiveness of the website. Complexity can be the deciding factor and “requires information, negotiation and decision making to assist in its reduction” (McKeen, Guimares and Wetherbe, 1994) and the need to involve users can greatly decrease the complexity of the development process.

The relationship between the end-user and the MIS development staff is paramount to the success of the perception of agency capability. The primary source of responses were the IT managers of the Information Systems department of the agencies in question hence it may be a bold conjecture to implicate that they are the only linkages between the end-user and the developers. Several factors were examined to explain the end-user and developer linkages in the literature namely of user satisfaction, system usage, technical support, power and control, user participation and communication. But the primary factors responsible for success of the system were identified as participation and satisfaction, which can be mutually correlated. In the context of this study, it is perceived that user participation leads to a higher level of understanding of the agency’s capability for development of information systems that have a direct measurable

outcome such as a website. User participation also breeds familiarity with the system and increased user satisfaction that leads for favorable responses to system effectiveness.

The outcome of the information system was measured in terms of website effectiveness which may not be a wholesome measure to determine MIS success but in the context of the study, the predictor factors were oriented only in terms of agency capability to develop internet-based solutions. Also, it was understood that perceived agency capability are people's subjective appraisals and do not represent objective reality (Davis, 1989) but in this study, their perceptions are measured independently of the organizational context, social constructs and behavioral determinants and are assumed to be valid reported variables in their own right. This is done in spite of popular trends to the contrary undertaken in MIS literature. Given that the perceived measures are valid reported measures, it is thought important to analyze the underlying motivation to explain for perception of agency IT capabilities. IT managers evaluate their capability not only to predict user acceptability and subsequent satisfaction but also to explain the organization dynamics that go into formulating those capabilities. In this sense, it is important to understand how user participation and user satisfaction can influence perceptions of agency's IT capability.

From causal perspective, it may seem that the regression results signify the direct implication of developing citizen oriented solutions to promote website effectiveness but development of business oriented solutions can boost user acceptance and familiarity with more complex systems. But the overarching effect is the experience with developing and hosting a public website. The experience thus gained brings forth the familiarity and gradual user acceptance of information systems. It also puts in place an effective feedback system to assuage the citizen concerns that is likely to boost the user-developer communication. The increased communication can lead to more collaborative

efforts towards systems development more in tune with the client needs. The results are consistent with a user-developer communication > use participation > user satisfaction > enhanced perception of website effectiveness chain of causality. This chain of causality is independent of the type of communication that an agency undertakes with its clientele. It cannot be significantly deciphered for the one-way communication pattern that some agencies adopt i.e. they prioritize in sending out messages to promote their agency policies or inform the publics about agency plans and activities.

It is a challenge to integrate the experiences of IT managers in the mostly for-profit agencies, as seen in the MIS literature, into prediction of results in a typical public agency. Theories of user satisfaction and participative decision making in the public sector are generally attractive to predict MIS success. The underlying constructs of user-participation and satisfaction seemed applicable to perceived success of the agency information system, independent of agency orientation. But it is important to understand the organization dynamics that lead to enhanced user participation. Further research in the role of user-developer collaboration in the application of internet-based solutions can elucidate the chain of causality.

It should also be noted that most public agencies tend to contract their MIS needs to an external agency as opposed to in-house development but boundaries between government and business are blurring as public-private partnerships can seek to train public employees to be self-sufficient to regain self-sufficiency. It is important to understand the limited success of public agencies in recruiting IT talent to staff their MIS departments. Research that leads to understanding the agency proclivity to develop in-house internet-based solutions as opposed to external contracting will be more enlightening. These agencies can be assumed to gain the status of a learning organization that promotes technological innovation. The organization includes not only behavioral constructs of individuals and groups but also the structural constructs that

alter the information flows believed to transform collaborative tendencies and satisfaction levels (Nelson, 1990). These innovative tendencies can alter the perceptions of an organization's information system outcomes.

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Tables

Table 1: List of Outcome and Predictor Variables		
Measures	Modification	Resulting implication
OUTCOME VARIABLE		
WEBHELP3 – WEBEFF highlighted by success of website in improving the quality and timeliness of services to clients; Ranked on a 7-point scale (1- not at all, 7-a great deal)	Replaced by 3-point scale i.e. Not effective, somewhat effective and very effective	Perception of agency website’s success as a measure of user participation and satisfaction with the development of systems
PREDICTOR VARIABLES		
TECHRNK 1-5 - ranked on a 5-point ordinal scale ranking from “far behind” to “far ahead	retained	perception of their organization’s capability in developing internet-based solutions
TECHRNK 1 - placing citizen services (transactions) on the internet	Replaced by CITIZEN	perception of organization’s capability to transfer real-time services to the internet
TECHRNK 2 - provision of information to citizens on the	Replaced by CITIZEN; ; recoded to	perception of organization’s capability

internet	adjust for 5-scale categorical distribution	to provide information via Internet
TECHRNK 3 - interactive communications with citizens using the internet	retained	perception of organization's capability to develop high-end communication systems
CITIZEN – development of citizen services solutions	Computed from means of TECHRNK 1, 2 & 3; recoded to adjust for 5-scale categorical distribution	Perception of organization's capability to develop citizen oriented solutions
TECHRNK 4 - procurement of agency supplies using the internet	Replaced to BUSINESS	Perception of organization's capability to develop inward business internet-based solutions
TECHRNK 5 - contracting for agency services using the internet	Replaced to BUSINESS; recoded to adjust for 5-scale categorical distribution	Perception of organization's capability to develop outward business internet-based solutions
BUSINESS – development of business procedures solutions	Computed from means of TECHRNK 4 & 5	Perception of organization's business procedures solutions
WEBSITE – RECDWEB –	Replaced by 3-point	Reflects the agency's

Interval level; measures the number of years an agency has developed and posted a public website	ordinal scale (0-3 years – 0, 4-7 years – 1 and 8-10 – 2)	familiarity and experience in developing and dealing in a public website.
EXTCOMM – ONEWAY 4-point nominal level variables; described the communication pattern with external publics	Replaced by dummy categorization (1-oneway pattern, 0 – two way pattern)	Reflects the communication pattern an agency considers its primary mission.

Table 2: Descriptive Statistics of Variables used in analysis

Improving the quality and timeliness of services to clients (webhelp3)

Not at all	(1)	(2)	(3)	(4)	(5)	(6)	(7)	A great deal
Percent	12.6%	19.6%	18.7%	17.0%	18.3%	7.0%	7.0%	

Improving the quality and timeliness of services to clients (webeff)

	(1)	(2)	(3)
Not at all	Not effective	Somewhat effective	Very effective
Percent	31.0%	34.3%	31.0%

Placing citizen services (transactions) on the internet (technrk1)

Far behind	(1)	(2)	(3)	(4)	(5)	Far ahead
Percent	17.8%	31.7%	17.4%	26.5%	6.5%	

Provision of information to citizens on the internet (techrnk2)

Far behind	(1)	(2)	(3)	(4)	(5)	Far ahead
Percent	3.5%	16.5%	34.8%	37.4%	7.8%	

Interactive communication with citizens using the internet (techrnk3)

Far behind	(1)	(2)	(3)	(4)	(5)	Far ahead
Percent	16.5%	30.4%	25.2%	23.5%	4.3%	

Development of citizen services (citizen)

Far behind	(1)	(2)	(3)	(4)	(5)	Far ahead
Percent	8.4%	32.2%	28.9%	23.8%	3.3%	

Procurement of agency supplies using the internet (techrnk4)

Far behind	(1)	(2)	(3)	(4)	(5)	Far ahead
Percent	24.2%	30.5%	31.8%	9.4%	4.0%	

Contracting for agency services using the internet (techrnk5)

Far behind	(1)	(2)	(3)	(4)	(5)	Far ahead
Percent	27.6%	28.5%	30.3%	10.9%	2.7%	

Development of business procedures solutions (business)

Far behind	(1)	(2)	(3)	(4)	(5)	Far ahead
Percent	23.8%	33.9%	29.3%	4.6%	2.1%	

agency's communication with external publics (extcomm)

	<i>one way</i>	<i>one way</i>	<i>some listening</i>	<i>two way</i>
	<i>promote & sell</i>	<i>inform</i>	<i>Influence</i>	<i>with listening</i>
	(1)	(2)	(3)	(4)
Percent	3.8%	16.5%	28.4%	51.2%

agency's communication with external publics (recoded) **(oneway)**

	<i>one way communication</i>	<i>Two way communication</i>
	(1)	(0)
Percent	20.1	78.7%

agency first developed and posted a public web site? **(website)**

	Mean	Std. Dev.	
Years ago	4.40	2.07	n=226

agency's communication with external publics **(extcomm)**

Years ago	<i>0-3years</i>	<i>4-7 years</i>	<i>8-10 years</i>
	(1)	(2)	(3)
Percent	36.0%	45.2%	13.0%

NOTE: The percentage may not add up to 100% due to missing values

Table 3: Reliability Analysis for Combining Variables

Reliability Analysis for factoring variables		
Reliability Coefficients for TECHRNK 1, 2 & 3	Alpha = 0.82 *	Combined variable: CITIZEN

Reliability Coefficients for TECHRNK 4 & 5	Alpha = 0.77*	Combined Variable: BUSINESS
* standardized item alpha value		

TABLE 4: Correlation Matrix for Predictor Variables.

Variables*	TECHRNK1	TECHRNK2	TECHRNK3	TECHRNK4	TECHRNK5
TECHRNK1	1.00				
TECHRNK2	0.607**	1.00			
TECHRNK3	0.624**	0.577**	1.00		
TECHRNK4	0.331**	0.273**	0.378**	1.00	
TECHRNK5	0.417**	0.347**	0.508**	0.621**	1.00
* explanation of variables given in table 2					
** correlation is significant at the .01 level (two-tailed)					

TABLE 5: Non-Parametric Correlation Matrix for outcome and Predictor Variables.

Variables	Website effectiveness	Citizen oriented services	Business oriented services	One-way communication pattern	Experience with websites
Website effectiveness	1.00				
Citizen oriented services	0.396**	1.00			
Business oriented	0.288**	0.445**	1.00		

services					
One-way communication pattern	-0.041	-.122	-.078	1.00	
Experience with websites	0.204**	0.130	0.116	-0.164*	1.00
** correlation is significant at the .01 level (two-tailed)					
* correlation is significant at the .05 level (two-tailed)					

TABLE 6: Test of Proportional Odds Model and Goodness-of-fit Test

Testing Global Null Hypothesis: BETA=0			
Test	Chi-square	Degrees of Freedom	Pr>ChiSq
2 Log Likelihood ratio	204.260	4	< 0.0001
Goodness-of-fit Test			
Pearson	114.836	124	<.710
Deviance	128.383	124	<.376

Table 7: Ordinal logistic regression analysis of website effectiveness

		Estimate	Std. Error	Wald	df	Sig.
Threshold	Website effectiveness = .00	2.573	.588	19.152	1	.000
	Website effectiveness = 1.0	5.509	.697	62.542	1	.000
Location	Citizen oriented solutions	.705	.161	19.179	1	.000
	Business oriented solutions	.252	.157	2.580	1	.108

	Experience with website	.480	.207	5.369	1	.020
	One-way communication with external publics	.184	.347	.281	1	.596

Link function: Logit.

Note: Estimate = unstandardized regression coefficients; Wald=standardized regression coefficient. Outcome variable coded 0 (not effective), 1 (somewhat effective), 2 (very effective).

Table 8: Nominal Logistic Regression

		Sig.	Exp(B)
.00 (Not effective)	Website effectiveness		
	Intercept	.000	
	Citizen oriented solutions	.000	.324
	Business oriented solutions	.125	.662
	Experience with website	.059	.506
1.00 (Somewhat Effective)	One-way communication with external publics	.998	.998
	Intercept	.002	
	Citizen oriented solutions	.023	.575
	Business oriented solutions	.576	.882
	Experience with website	.932	1.027
	One-way communication with external publics	.406	1.645

EXP (B) = odds ratio computed by exponentiating the regression coefficients i.e. log odds of the variables.

Notes:

¹ Caldwell, French. "E-Government Transformation", Gartner Research, 2000

² NASP-I was a database derived from a survey designed by doctoral seminar participants in Barry Bozeman's class in Syracuse University in 1992. This first survey was administered to a sample of public and private managers in New York and data collected by the project formed the backbone for numerous peer-reviewed publications and doctoral dissertations.

³ NASP-II extended the survey's reach to a national level but restricted it to state health and human service agencies only.

⁴ The principal investigator, Sanjay Pandey prepared the initial draft of the questionnaire, assisted by the questions on administrative communication contributed by James Garnett and Eric Welch crafted the section on Information Systems

⁵ Suggestions and modifications by eleven of the reviewers prompted a responsive second draft.

⁶ These agencies were identified in accordance with the definition provided by American Public Human Services Association (APHSA, formerly APWA) and are inclusive of associate agencies housing programs such as Medicaid, SCHIP, TANF, Public Health, Senior Services, Disability Determination etc (Pandey, 2003)

⁷ The primary features of this approach are the use of multiple personalized contacts, each contact accompanied with a carefully crafted message to encourage the respondent to complete the survey questionnaire, use of real stamps on return envelopes, use of features such as pre-notice letter, fax message, phone call at key points in the survey administration; and use of special delivery (combination of 2-day

delivery by Airborne Express and Priority Mail service of US Postal Service (Pandey, 2003).

⁸ “The interpretation of an ordinal regression is more complex than that of an OLS regression because the response variable in the former is the log of the odds ratio of the probability of being in categories 2 & 3 compared to category 1 and of being in category 3 compared to category 1. From these estimated odds, we can calculate the probability of” website being in a particular effectivity category, “given its values for the independent variables.” (Leveaiae, 2001)

⁹ The estimated regression coefficients represent the change in the log odds ratio for one unit increase in the predictor variables⁹ (Ibrahim, 2000). We fit the proportional odds model for the data as presented in data:

$$\text{Log} [\pi_{\text{not eff}} / \pi_{\text{somewhat eff}} + \pi_{\text{very eff}}] = \beta_{01} + \beta_1 \text{Citizen} + \beta_2 \text{Business} + \beta_3 \text{Website} + \beta_4 \text{One-way}$$

$$\text{Log} [\pi_{\text{not eff}} + \pi_{\text{somewhat eff}} / \pi_{\text{very eff}}] = \beta_{02} + \beta_1 \text{Citizen} + \beta_2 \text{Business} + \beta_3 \text{Website} + \beta_4 \text{One-way}$$

The parameter estimates for our model are also presented in Table 6, with $\beta_{01} = 3.185$, $\beta_{02} = 6.238$, $\beta_1 \text{Citizen} = 0.705$, $\beta_2 \text{Business} = 0.252$, $\beta_3 \text{Website} = 0.480$, and $\beta_4 \text{One-way} = 0.184$. The odds ratio can be computed by exponentiating the log odds i.e. EXP (log odds) or EXP (estimated coefficient), which is EXP (0.705) = 2.02 for CITIZEN, EXP (0.252) = 1.29 for BUSINESS, EXP (0.48) = 1.61 for RECDWEB, and EXP (0.184) = 1.20 for ONEWAY. The proportional odds model is based on the assumption that the effects of the covariates are the same for all categories, on the logarithmic scale

¹⁰ The EXP (odds ratio for Citizen oriented solutions) = 0.324 for a response of “not effective” can be interpreted as at a given level of business oriented solutions development capability, agencies developing citizen oriented solutions are 0.324 times

less likely to rate website effectiveness as “not effective” as compared to a “very effective”, given that the agency has same experience in website hosting and enjoys a two-way communication with its clients. Similarly, the EXP(odds ratio for Citizen oriented solutions) = 0.575 for a response of “somewhat effective” can be interpreted as at a given level of business oriented solutions development capability, agencies developing citizen oriented solutions are 0.575 times less likely to rate website effectiveness as “somewhat effective” as compared to a “very effective”, given that the agency has same experience in website hosting and enjoys a two-way communication with its clients.