Investigate the Social Actor Model of ICT Use in Organizations

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Abstract
This research advances the study of social factors in information systems through an empirical exploration of communication and information technology (ICT) use as hypothesized in the social actor model proposed by Lamb and Kling [1]. The findings support the social actor model in the context of professional organizations, and reveal that individual characteristics play a more prominent role in use of technology than organizational structural properties do. In addition, the results suggest that the social actor model can be conceptualized more parsimoniously in three dimensions and can explain ICT use more precisely by considering moderating and mediating effects.

1. Introduction
Studies in organizational research have consistently shown that organizational structural properties and individual user behaviors not only can shape the use of technology, but also can be shaped by the technology (e.g., [2], [3], and [1]). Although contemporary information systems literature offers a myriad of causal models of information and communication technology (ICT) use from the deterministic information systems (IS) research stream (e.g., [4] and [5]), none of them seems to be able to portray a good picture of technology use in a rich organizational context. While the social models of the technology research stream (e.g., [6], [7], and [8]) put serious emphasis on the social and organizational settings as the premise of IS research, they do not provide empirical evidence. The problems lead to inconsistent and imprecise findings in both streams.

Although Lamb and Kling [1] attempt to bridge the gap by redefining ICT users as social actors in a rich social setting with some grounded qualitative data support, their model is still inadequate and imprecise. For example, the model suggests that ICT use can shape and be shaped by organizational resources, but it does not point to when, by how much, for which type of technology, and in what measures the criterion effect(s) would take place. Another problem in IS literature is the lack of measurement models on different types of ICT use. As a result, research on ICT use tends to be idiosyncratic in that a large body of work claims to discover certain patterns of ICT use intentions and behaviors, but the results only apply narrowly to a specific form of technology use. This leads to more unanswered questions.

This paper explores ICT use in professional organizations through the social actor model conceptual framework proposed by Lamb and Kling [1]. We develop a scale incorporating several dimensions of ICT use that includes some measures specific to our study population and employ it for an empirical test of the four major dimensions of the social actor model [1]. Based on the findings, we propose some modifications to the social actor model.

2. Review of Literature
2.1. The Paradox of Information Systems Research on ICT Use
The information systems (IS) literature includes two dominant streams of research that incorporate social variables: deterministic models and social models [9] and [10]. The deterministic models are rooted in the positivist research paradigm. This school emphasizes cognitive processing that is involved during decision making about technology adoption and use at the individual level, including research in the realms of peer influence (e.g., [11], [12], and [13]), technology acceptance (e.g., [4], [13], and [14]), channel expansion [15], social information processing theory [16], and experience and media richness (e.g., [17] and [18]). These models focus on users’ attitudes and perceptions of the media and technologies as well as the opinions and behaviors of others. This school of thought believes that use of
technology is deterministic in that users’ perceptions and attitudes would lead to favorable or unfavorable intentional and behavioral outcomes.

Critics argue that this body of work is individualistic and technologically deterministic or “technocentric” [10]. These studies pay little attention to the context and content of the communication [19]. Other critics argue that research needs to seek interrelationships of a system rather than individualistic things in the system [20] and [21]. Yet others believe that the interaction and mutual influence between users, organizations, and ICT shape the process of adoption, use, and effect of ICT [6], [3], and [7].

These criticisms led to the emergence of the social models of technology including structurational, socio-technical network, and other related social models. This research stream follows the tradition of the interpretive research paradigm. The structurational approaches emphasize the complex relationships between users (as actors), their organizational environment, and the technology through a series of interactions over time. Users and organizations not only can shape the use of ICT but also can be shaped by it. This mutual influence relationship is complex and can only be understood through the social context (e.g., [10], [22], [6], and [23]). However, as Lamb and Kling [1] and Bouwman et al. [9] point out, such studies are somewhat vague and indeterminate in nature. Because of the mutual influences between variables, as well as the highly contextualized premise, it is hard to distinguish causes and effects [9]. Also, studies in these streams are largely conceptual, raising the need for empirical grounding. Lamb and Kling [1] attempt to address the literature gap through their social actor model of technology.

2.2. The Social Actor Model

The traditional views of ICT use have been reconceptualized by Lamb and Kling [1]. Blending the perspectives of social construction (e.g., [24] and [25]), institutional theory (e.g., [23, 26]), system theory (e.g., [20]), social technology from the work of Kling and associates (e.g., [27], [8], and [28]), and the work of the structurational models (e.g., [6] and [29]), Lamb and Kling provide a conceptual definition of a social actor as “an organizational entity whose interactions are simultaneously enabled and constrained by the socio-technical affiliations and environments of the firm, its members, and its industry” (p. 218). Social actors are not merely ICT users, for they (1) “have conflicting and ambiguous requirements about the activities they perform, and the socially legitimate ways in which to perform their work” (p. 218), (2) have little control over their ICT choices and usage because they act as a collective unit, (3) use ICTs to interact with other actors at various levels within and among organizations, (4) shape their identities as organization members and representatives as well as facilitate the presentation of their professional competence through the use of ICTs. These definitions are conceptualized into the following dimensions: organization affiliations, environment structures, interpersonal interactions, and self identities. These four facets are integral individual and structural properties that play a role in shaping actors’ behaviors related to ICT use.

3. Data and Method

The data for this analysis are from a national survey of Japanese Studies in both American and Canadian colleges and universities, libraries, and research institutions. The project was initiated in the early 1980s as an effort to create a comprehensive directory of Japanese specialists and Japanese Studies institutions in North America. The data were collected in mid 1990s and again in mid 2000s. Extensive survey data on the work practices and needs of Japan specialists in North America were collected in connection with the second and third editions of the directory and used by the second author of this paper. This paper uses the data from the most recent survey, which contains extensive information related to ICT use.

3.1. Sample and Data Collection

The dataset consists of four units of analysis: Japan specialists, Japanese libraries, Japanese Studies programs, and Japanese Studies institutions. The focus of the study was on academic programs in Japanese Studies offered by colleges and universities and related support institutions such as libraries and research institutes, and on people who work professionally in the field based on their expertise on Japan. Thus the context is persons who work primarily in professional bureaucracies. Japan specialists are highly trained scholars and administrative staff whose work is related to Japan. Even though they work in the field related to Japan, they are by no means Japanese.

This paper analyzes the data at the individual level (i.e., specialists) because the objective of the study is to investigate ICT among individual actors. Data from the other three units of analysis (libraries, programs, and institutions) are combined into
measures at the institutional level that are added to the specialist data in order to examine all four components of the social actor model. The data for specialists, programs, and libraries come from the study’s own survey data. The measures for institutions were developed using standard sources of data on academic institutions.

The primary data collection method utilized online forms and email communications, but these were later supplemented with other means, such as paper-based forms sent via fax, email, or regular mail, in order to reach additional respondents. The dataset contained responses from 1,426 specialists. However, 501 specialists did not complete relevant portions of the questionnaire, leaving a sample of 925 specialists for the present study.

For the institutional data (e.g., enrollment size, faculty size, selectivity, and degrees awarded), we used data from a national mailing list of colleges and universities in the United States, supplemented with information from Peterson’s Guide to Four Year Colleges, the Gourman Report [30], U.S. News and World Report [31], and information collected from the institution’s web site for Canadian colleges and universities. Institutional data were added for each specialist with an institutional affiliation, for a total of 152 institutions. Independent scholars were coded “0” for these variables.

3.2. Instrument

The survey instrument was designed by a joint effort of the Japan Foundation and an extension of the previous research conducted by the second author. The questionnaires for both institutions and specialists were available since the first study of the research in 1986. The institutional-level module included information about their courses, degree programs, the program’s own library holdings, staff, doctoral student, and more. The individual-level module includes socio-demographic, attitudinal, and behavioral questions, such as whether or not respondents used a particular technology. The instruments were modified in the second and the latest study to include changes to the field. These changes primarily reflected the expansion of online resources over the past decade and their impact on how specialists obtained resources and carried out their work. Indeed, the list of technologies available to the specialists that were included in the study has doubled in the last decade. Many of the rarely used computer tools in the 1990s, such as e-mail, specialized databases, and online media have gradually gained wide acceptance since the advent of the Internet. A total of 49 technology use items were presented as yes/no statements within broad question sets about their use for research, teaching, or generally keeping up in their field.

3.3. Measurement of ICT Use

The central thrust of this paper is to investigate ICT use in professional organizations by identifying a set of reliable and valid measures of ICT use and then evaluating the use of these measures. We first develop a multi-item scale that encompasses a comprehensive measure of ICT use. The 49 ICT use items were first organized into categories based on their content. Exploratory factory analysis was not utilized in this stage because the items are dichotomous and the solution was not interpretable. Confirmatory factor analysis with asymptotic-free estimator (robust maximum likelihood) was used to test the assignment of the items [32]. Based on factor interpretability and model fit indices, a seven-factor solution using 37 items was adopted (RMSEA = 0.07, SRMR = 0.07, CFI = 0.90). The indices indicated an appropriate model fit; hence a tenable ICT measurement model. The seven factors retained in the solution represented seven categories (or types) of ICT commonly used in organizations: communications (e.g., email, discussion group, and list serve), online news and journals, word processing, information portals (e.g., online databases and websites), data management (e.g., personal databases and spreadsheets), multimedia and entertainment (e.g., music, video, pictures), and information presentation and analysis (e.g., maintain website, present teaching material, and analyze research data). The factors were then transformed into latent variable scores, which represent the unbiased composite score for the corresponding observed indicators [33]. The seven extrapolated latent variable scores were factor analyzed (with principal component analysis and varimax rotation) in order to develop the final ICT scale. The findings indicated a one component solution with factor loadings 0.67 or above. Coefficient alpha (α) is 0.91, which exhibited strong scale reliability. In sum, the seven-item ICT scale was able to retain 65% of the variance of the latent ICT use construct.

3.4. Test of the Social Actor Model

The social actor model conceptualizes that ICT use is directly related to individual and organizational characteristics pertaining to four core dimensions: identity, interaction, affiliation, and environment. We identified 20 independent variables that are related to these four dimensions, as shown in Table 1. These
variables are hypothesized to have a direct influence on actors’ use of technologies, except for the online identity presentation variable, which is modeled as a covariate because of its unknown relationship with ICT use. A series of preliminary analyses (not shown here) explored the relationships of the independent variables on each of the seven ICT indicators separately [34]. Based on the initial findings and subsequent elaboration, mediators and moderators are included in the present research model. This was tested with structural equation modeling using LISREL.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Indicators of the four dimensions of the social actor model in the context of inquiry</th>
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<tbody>
<tr>
<td>Dimension</td>
<td>Variable</td>
</tr>
<tr>
<td>Identify</td>
<td>Gender, age, culture, language competence, professional experience, occupation, employment status, online identity presentation</td>
</tr>
<tr>
<td>Interaction</td>
<td>Social network size, perceived utility of contact, perceived supportive attitude, collaborative effort</td>
</tr>
<tr>
<td>Affiliation</td>
<td>Affiliated membership, inter-organization relationship</td>
</tr>
<tr>
<td>Environment</td>
<td>Program size, program funding, program resource, institution funding, institution competitiveness, institution size, institution type</td>
</tr>
</tbody>
</table>

4. Findings

The results, which are shown in Table 2, represent the final research model of the analysis. This model includes parameter estimates that have significant direct, mediating, and moderating effects on the ICT use criterion construct. The moderators are represented in the model as interaction terms. The table also shows the effect of the mediator “perceived contact utility” on the path coefficients that are shown in parentheses. The fit statistics of the research model indicate an appropriate fit between the data and the hypothesized model (RMSEA = 0.07, SRMR = 0.03, CFI = 0.96). The model explains ICT use fairly well and is able to account for 45 percent of the variance of the response measure (R² = 0.45).

4.1. Identity Dimension

Lamb and Kling’s [1] social actor model conceptualizes that actors’ avowed and ascribed identity shape their use of ICTs. Of the seven hypothesized identity factors, age, culture, language competence, and employment status are significant predictors of actors’ technology use. The findings suggest that younger Japan specialists who have a strong western cultural background, good Japanese language ability, and/or are currently employed utilize significantly more technology at work than specialists who do not have these socio-demographic characteristics. In addition, actors’ cultural background effect is conditioned by their language proficiency. This result sheds light on the inconsistent initial findings regarding the culture effect, in that specialists with more eastern cultural background generally have better Japanese language skills than their more western counterparts (Pearson correlation coefficient, p < 0.001), but Japanese language proficiency is also highly related to ICT use, particularly because some of the ICT measures involve the use of Japanese language resources. Specialists who have a strong western background use more technology once the interaction between cultural background and Japanese language ability is controlled. In sum, individuals’ socio-demographics account for most of the variance in the model (R² = 0.32).

Japan specialists’ age and their Japanese language competence explain a fair amount of variability of ICT use. Indeed, these two demographic characteristics consistently influence every aspect of their ICT use when they are tested with the seven ICT indicators in a series of separate analyses (not shown here). The usual education and class-based digital divide does not apply in the study because Japan specialists are highly trained professionals who possess the necessary skills to operate any computer applications, as observed in most professional bureaucracies. On the other hand, specialists’ age, language ability, cultural background, and occupation significantly influence the extent to which Japan specialists utilize technologies at work. Language competence is particularly important for Japan specialists who wish to utilize word processing and information portal services because some components of the measurement of these technologies demand a fair amount of Japanese reading and writing skills. Specialists who have a strong Western background and/or non-faculty members are also found to use more technologies than their counterparts.
Table 2
Results of the research model: The influences of identity, interaction, affiliation, and environment factors on ICT Use

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Path Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Identity Dimension</strong></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.35***</td>
</tr>
<tr>
<td>Cultural background</td>
<td>-0.32**</td>
</tr>
<tr>
<td>Language competence</td>
<td>0.19***</td>
</tr>
<tr>
<td>Culture × language</td>
<td>0.35**</td>
</tr>
<tr>
<td>Employment status (employed)</td>
<td>0.05*</td>
</tr>
<tr>
<td>Online identity presentation</td>
<td>0.13***</td>
</tr>
<tr>
<td><strong>Interaction Dimension</strong></td>
<td>(0.39)***</td>
</tr>
<tr>
<td>Perceived contact utility</td>
<td>0.41***</td>
</tr>
<tr>
<td>Perceived supportive attitude</td>
<td>-0.05*</td>
</tr>
<tr>
<td>Collaborative effort</td>
<td>0.06*</td>
</tr>
<tr>
<td><strong>Affiliation Dimension</strong></td>
<td>(0.35)***</td>
</tr>
<tr>
<td>Affiliated membership</td>
<td>(0.14)***</td>
</tr>
<tr>
<td>Inter-organization relationship</td>
<td>-0.07*</td>
</tr>
<tr>
<td><strong>Environment Dimension</strong></td>
<td></td>
</tr>
<tr>
<td>Program resource</td>
<td>0.21*</td>
</tr>
<tr>
<td>Institution funding</td>
<td>-0.34**</td>
</tr>
<tr>
<td>Institution competitiveness</td>
<td>0.13*</td>
</tr>
<tr>
<td>Inst. type × inst. size</td>
<td>0.10*</td>
</tr>
</tbody>
</table>

Note: Standardized path coefficients that are significant are presented; numbers in parentheses are path coefficients for the variable perceived contact utility.

*p < 0.10; **p < 0.05; ***p < 0.001.

The variable is modeled as a covariate.

The variable is modeled as mediator for social network size, collaborative effort, and affiliated membership; $R^2 = 0.41$.

4.2. Interaction and Affiliation Dimensions

The Interaction dimension of the research model defines actors’ ICT use as a consequence of their social network size, perception of the usefulness of network contacts, perception of the supportive attitude of their discipline, and the breadth of collaborative effort they engage in. The Affiliation dimension, however, conceptualizes that individual-level (affiliated membership) and organizational-level (inter-organization relationship) affiliated relationships play a role in members’ technology use. Factors of the interaction dimension explain a fair amount of variance of ICT use ($R^2$ differential is 0.15), while variables of the affiliation dimension explain little to no variance of the model. The final model suggests that actors’ perception of the utility of their network contacts fully mediates the influence of the size of their social network, while the number of academic and professional memberships they maintain partially mediates the means by which they collaborate with other actors. In sum, Japan specialists’ technology use is a direct consequence of their perceptions of how useful their relationships with other Japan specialists and with Japanese scholars in Japan are (e.g., to provide introduction and references, to critique their work, to collaborate and present their research, to keep them abreast of developments of the field, to network, to provide research materials, and more). Hence, contact utility seems to be perceived by specialists as a value proposition or a driving force of technology use.

Although the results for the Affiliation dimension are weak overall, the one strong finding shows that the affiliated memberships of Japanese specialists have an effect on ICT use when the mediator of contact utility is incorporated. That aspect of the Affiliation dimension is actually measuring the individual affiliations of Japan specialists, and thus is another measure of their Interactions. The second construct of Inter-organization relationships measures institutional factors that are related to the measures of the Environment dimension. This suggests that unless there are better measures of what the social actor model calls Affiliation, or unless such measures are more important in other types of organizational environments, Affiliation can be subsumed within the Interaction and Environment dimensions, thereby simplifying the model itself.

4.3. Environment Dimension

The Environment dimension of the research model conceptualizes members’ ICT utilization as a function of variables at the program level and institution level. However, the seven hypothesized organizational structural properties explain little to no variance of ICT use. The research model reveals that dedicated program resources and institutions’ competitive culture are significant predictors in the expected direction, while institutions’ funding is significant but in the opposite direction. The institution type-by-size interaction term is also significant. The findings suggest that actors who belong to small private institutions use more ICTs than those who belong to large private institutions; however, the relationship is reversed in public institutions. In addition, the negative relationships of perceived supportive attitude of the respondent’s discipline, inter-organization relationships, and institutional funding are important findings, as they may suggest that actors would turn to technology for...
solutions when confronted with problems such as resource segregation and lack of institutional support.

5. Discussion

First, the findings generally confirm that the use of ICTs can be influenced by the four actor dimensions. However, in the case of Japanese Studies, individual-level factors explain the variability of technology use substantially better than the organizational-level factors do. The results are reasonable because Japan specialists enjoy a great degree of job flexibility and autonomy in an academic institution setting or a professional bureaucracy, as Mintzberg [35] calls it. Similar studies need to be done to identify the types of organizational settings in which the environment dimension may play a larger role.

Second, while our findings generally support the Lamb and Kling’s social actor model [1], they call into question whether the Affiliation dimension really is needed. One of the challenges to the research is the fuzzy conceptual distinction between affiliation and environment in the social actor model. For instance, an actor’s affiliated environment can be categorized as either affiliation or environment. Lamb has acknowledged that these two dimensions share a great deal of commonalities. Lamb noted that institution-level variables could be conceptualized in either dimension (R. Lamb, personal communication, January 13, 2006). Unfortunately, both Kling and Lamb passed away before the present research was completed; otherwise, they might have provided more details distinguishing the two facets. The current study offers some insights into the problem, as noted above. Thus indicators for the affiliation dimension found little effect of either individual-level or inter-organizational-level affiliated membership on ICT use. However, our individual-level affiliation variables can be re-specified as elements of the interaction dimension, while inter-organizational-level affiliation variables can be reclassified as components of the environment dimension; hence this configuration would provide a more parsimonious conceptual definition for the social actor model.

6. Conclusion

The goal of the present research is to validate and extend the social actor model posited by Lamb and Kling [1] through empirical evidence. This in turn helps to bridge the gap between the deterministic and social streams of information systems research because the social actor model provides a general theoretical framework that conceptualizes the relationships of individual- and organizational-level factors on members’ ICT use in the context of contemporary institutions. Lamb and Kling’s social actor model [1] defines use of technologies as shaped by four general dimensions of individual and organizational factors including organization members’ (or actors’) demographic and background characteristics, interpersonal interaction properties, individual-level and inter-organizational-level affiliations, and contextual properties of the workplace. The study finds support for the model by empirically testing factors underlying the four social actor facets. The empirical results provide quantitative measures of the relationships between the postulated effects and ICT use.

The results suggest that the four dimensions of the social actor model can be re-constituted more parsimoniously into three dimensions that incorporate the content of the affiliation dimension. In line with this theoretical implication, the present study also suggests that ICT use is more an individual-oriented decision than an organization enabled or constrained consequence in the context of professional organizations, but this needs to be tested in other types of organizations.

The investigation also uncovers a number of interesting findings which extend the social actor model and the social technology research stream. First, the study demonstrates that some of the well-studied variables (e.g., size of social network, collaborative effort, and size of professional membership) have indirect rather than direct effects on ICT use because they are mediated by other factors (e.g., perceived contact utility). A more important discovery is the moderating effects which condition the characteristics of other variables. Moderator effects have been largely ignored in the social technology literature. This is a problem inherited from the dominant qualitative methodological approaches within this body of work. The results of the present study add to information systems research by suggesting that some inconsistent findings in the literature may be explained by moderating effects rather than as a consequence of some complex and reciprocal interactions between actors and the context, in business processes such as the process of innovation diffusion, as some researchers suggest (e.g., [24], [9], [6], [3], and [23]).

A further contribution of the study is the development of a comprehensive ICT scale that includes seven distinct components of ICT use. Although the scale used for this analysis is specific to
the study population and includes a number of highly specialized ICT indicators concerning Japanese language and Japanese Studies resources, we are currently developing a more general scale that can be used or adapted for different organizational contexts.

In sum, this research clarifies and extends the social actor model and the social technology stream by offering a more precise causal model of how actors utilize technologies in the context of professional organizations. The present study also illustrates a means to investigate the social stream of information systems research using quantitative methods and an ICT scale. The results help provide a better understanding of the social actor model and contribute to social information systems research by answering how, by whom, by how much, and in what measure ICT use takes shape.

7. Limitation

The current study did not examine the mutual influence between the independent variables and the ICT dependent variable, as this would have required longitudinal data. While the study did have longitudinal data from the earlier data collection, only about half of the sample was represented at both time points, because of an unusual amount of generational turnover in the field of Japanese Studies during the decade between the two studies. And although virtually all of the 1995 questions were replicated in the 2005 study, advances in technology had necessitated the addition of a large number of new variables. Hence there simply was not sufficient correspondence between the two datasets to support a true longitudinal study to sort out mutual influences. And although some further exploration of nonrecursive structural modeling would be interesting, it is beyond the scope of this paper and indeed is not recommended in the statistics literature. Moreover, the mutual influences that have been commonly suggested by many informatics models are imprecise; our findings suggest that mediation and moderation effects may better explain ICT use in organizations.

8. Acknowledgments

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9. References


