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The Determinants, Nature, and Value of Electronic Information Intermediation

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Introduction

The development of the World Wide Web (WWW) architecture has greatly enhanced the capability of the Internet as a medium for disseminating information. The Internet has helped bring information producers and users closer, and has the potential to enable a non-mediated relationship between producers and users of information (Gellman, 1996).

The Internet bestrewns information that varies widely in content. One such kind is medical information (Ferguson, 1996; Goldstein and Flory, 1997), which is useful for the diagnosis and prognosis of ailments, and for decisions on choice of treatment. Uncertainty surrounds clinical decision making due to the probabilistic nature of the relationship among symptoms (patients' presentation of complaints), signs (physicians' interpretations of symptoms) and diseases (Griffin, Schwartz and Sofronoff, 1998). Appropriate medical information is critical in reducing uncertainty in clinical decision making. To this end, the Internet is emerging as a new medium to diffuse medical information.

While the Internet is capable of supporting non-mediated relationships between producers and users of information, most medical information that is disseminated through the Internet is mediated. A variety of information intermediariesⁱ provide mediated medical information on the Internet that helps physicians (decision-makers) and patients (decision-receivers) in clinical decision-making (Detmer and Shortliffe, 1997; Ferguson, 1996; Goldstein and Flory, 1997). These intermediaries include web-based medical literature providers, Internet patient records providers, integrated medical information providers, electronic journals and web-based medical support/ discussion/ chat groups, who perform the task of information intermediation. Some of these are just Internet-automated versions of traditional forms of information intermediation (e.g. electronic journals) while others are new forms of information intermediation (e.g. web-based discussion groups).

The emergence and growth of information intermediation through the Internet has not been accompanied by adequate theoretical explanations on the causes, nature or the value of this phenomenon. The focus of this research thus, is to understand information intermediation through the Internet as outlined earlier. The term electronic information intermediation will henceforth be used to denote information intermediation through the Internetⁱⁱ. The specific purpose of this research is to understand the key determinants, dimensions and the value of electronic information

intermediation. These issues are studied in the context of clinical decision making, where various forms of electronic information intermediation are being deployed to reduce uncertainty associated with diagnosis, prognosis and choice of treatment. The specific research questions that will be addressed are:

1. What are the critical determinants of information intermediation in problem solving processes?
2. What are the salient dimensions of electronic information intermediation?
3. How does electronic information intermediation add value to the decision making process?

These questions are first addressed theoretically by developing a research model. A partial empirical test of the model will be done to support the third question. The next section presents the contingency framework, the key constructs, their definitions and the interrelationships among these constructs.

Framework and Construct Development

Electronic information intermediation framework is developed based on the following premises: (1) Information is critical for decision-making under uncertainty. 'Rich' information can help reduce uncertainty and equivocality in decision-making thus improving decision-making performance (Daft and Lengel, 1986). (2) The decision-making process involves decision-makers' (information users') search for information (Simon, 1977). (3) Information users do not have the ability to locate or evaluate all the information that is relevant to a particular problem. Information overload leads to bounded rationality in decision making (Simon, 1947). (4) Information users' attention to information stimuli is selective. Some information stimuli are attended to more than other stimuli (Broadbent, 1958, Cowan, 1988). (5) Decision-makers process information so that it is useful for problem solving. Information processing typically involves the following activities: information gathering, storing, manipulation, retrieval and transmission. (Davenport, 1993) (6) Information processing activities typically consume decision makers' resources. These are cost incurring activities that a decision-maker needs to economize (Radner, 1996). (7) Information characteristics (Choudhury and Sampler, 1997; von Hippel, 1994), information market characteristics (Monastyrskaia, 1998) and transaction characteristics (Choudhury, Hartzel and Konsynski, 1999) affect decision-makers' information processing ability and also increase the cost of information processing if undertaken by the decision-maker. (8) Contingency

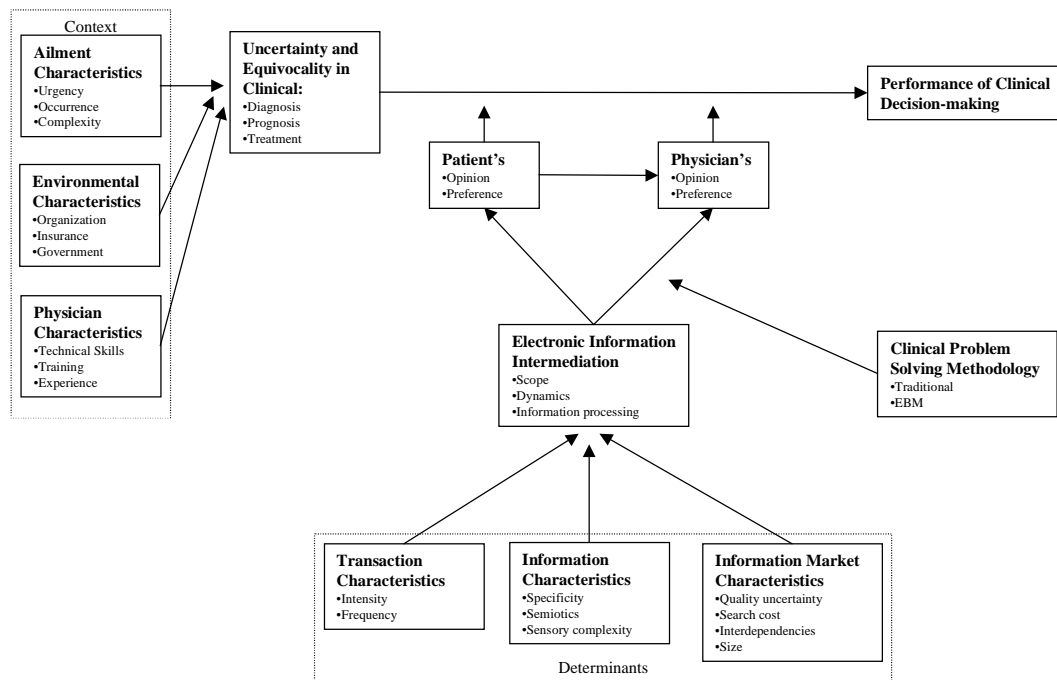


Figure 1 - Research Model

factors (Lawrence and Lorsch 1967) like the problem, environmental and decision-maker characteristics affect uncertainty and equivocality in a problem solving process. (9) A systematic clinical problem solving methodology like the evidence-based medicine (EBM) increases the need for information in clinical decision-making (Guvatt and Cairns 1992). (10) Information intermediaries can help alleviate information processing related problems encountered by users in a direct information user-producer interaction.

The above premises highlight the importance of information for decision making under uncertainty and the shortcomings of decision-makers' direct search for information. Thus, the metatheory or the organizing framework guiding this research is the information processing approach. It can be noted that the framework developed is not rooted in one reference discipline but rather draws support from a variety of disciplines that include organization studies, cognitive psychology and economics. Ambivalence in earlier intermediation research can be attributed to excessive reliance on one dominant reference discipline.

Figure 1 presents the framework, the constructs and their relationships. It is to be noted that we are only examining the effect of electronic information intermediation on uncertainty and how this can lead to improved decision-making performance. Thus we are not examining the effect of other sources of information or all aspects of clinical decision-making. We now briefly explain the constructs and their relationships as follows.

The framework depicted in Figure 1.1 portrays a moderating effect of electronic information intermediation on the influence of uncertainty and

equivocality in problem solving on the quality of clinical decision making. The key predictor construct is "uncertainty and equivocality in problem solving". The key criterion construct is "performance of decision making". The key moderating construct is "electronic information intermediation". It should be noted that these constructs are multidimensional. The electronic information intermediation construct is detailed below. Other key constructs are also briefly discussed.

Electronic Information Intermediation

Electronic Information Intermediation (EII) is defined as the extent to which the information processing activities, scope of coverage and interaction dynamics of non-principal information providers vary, to provide information to principals in a transaction, through networked information technology.

More specifically, electronic information intermediation involves:

1. *The extent to which the information processing activities of information intermediaries varies.* Information intermediaries perform some or all of the following functions that help reduce information search cost of principals in a transaction. (1) *Communication*: This includes activities associated with input and output of information. We have observation activities that include sensing, accessing and acquiring information, and distribution activities that consists of identifying, offering and transmitting information to users. (2) *Conservation*: This includes activities associated with information storage and retrieval. (3) *Computation*: This involves the manipulation of information or semiotic processing to present it in a user desired format. Information can be presented in morphological, syntactic, semantic or

pragmatic levels (Ramaprasad and Rai, 1996). An information intermediary may manipulate information to present it in some or all semiotic levels.

The extent of information processing of an information intermediary is high when the intermediary performs all of the functions listed above. The functional focus is low if the intermediary performs just one function or part thereof.

2. *The extent to which the scope of coverage varies.* The scope of coverage can be local or global at the extremes. The scope is local or low if the information coverage is restricted to a very narrow problem domain. The scope is global or high if the coverage includes a wide variety of problem domains. For example, the scope of coverage of an edited book covering one phenomenon is local. On the other hand, the scope of an encyclopedia is global.

3. *The extent to which the interaction dynamics varies.* Interaction dynamics can be passive or active at the extremes. A passive intermediary does not disseminate information to users on his own accord. He rather lets the user locate and access his services. Thus a passive intermediary looks to user pull for information dissemination. An active intermediary on the other hand pushes information to the users depending on their needs.

Uncertainty

Uncertainty and equivocality in decision-making is defined as the extent to which the knowledge possessed by the decision-maker and decision-receiver is able to generate unambiguous solution(s) to the problem.

Decision Making Performance

Performance of decision-making is defined as the extent to which the decision achieves the objectives established by the decision-maker and the decision receiver. These objectives will include decision-maker satisfaction, decision-receiver satisfaction, decision quality, decision process quality, decision efficacy and decision process efficacy.

Other Constructs

Electronic information intermediation moderates the relationship between uncertainty and equivocality in problem solving, and decision performance by influencing the physician's and the patient's opinion or preference. *Physician's (or patient's) opinion* is the extent of the physician's (or patient's) interpretation of the symptoms. *Physician's (or patient's) preference* is the extent of physician's (or patient's) belief on the appropriateness of a solution to the problem.

The moderating effect of electronic information intermediation is in turn contingent on the problem solving methodology adopted. We contrast two type of problem solving methods that can moderate the way in which EII moderates the relationship between uncertainty and decision making performance. One approach relies on formal problem solving skills that were acquired through a formal training program, intuition and unsystematically accumulated experience. The other approach relies on

systematic search for evidence, formal training and systematically accumulated experience to solve a problem. In clinical decision making literature, the former is termed as the traditional approach to clinical diagnosis and treatment, and the later as the evidence based medicine approach (Guyatt and Cairns 1992). EII will have a greater impact when the evidence-based approach is used for clinical problem solving.

The need for EII arises on account of information, information markets and transaction characteristics. *Information characteristics* refers to its stickiness (von Hippel, 1994) or specificity (Choudhury and Sampler, 1997), and is the extent to which the value of information is restricted to its use and/or acquisition by specific individuals or during specific time periods (Choudhury and Sampler, 1997). *Information market characteristics* refers to the extent to which the quality uncertainty, information user search cost interdependencies among various entities in information markets and the size of the market vary. *Transaction characteristics* refers to the extent to which the intensity and frequency of transactions, and the scope for opportunism in the transaction vary. Uncertainty arises in clinical decision making on account of problem, environmental and decision-makers' characteristics as indicated in the framework.

Research Hypotheses

Research hypotheses were in the process of being formulated at the time of publication. Hence they are not included here.

Research Methodology

The model developed will be validated through a pilot study where the survey instrument will be administered through structured personal interviews with a convenience sample of physicians. The main quantitative phase of this study will consist of a mail survey administered to a randomly selected sample of physicians. Data will be analyzed using Partial Least Squares, a 2nd generation multivariate technique used for theory building. (Chin, Marcolin, and Newsted, 1996).

References available upon request from the author.

ⁱ Intermediaries in general are non-principals who facilitate transactions between principals (Bailey and Bakos, 1997; Fien, 1996). An information intermediary primarily facilitates an information transaction.

ⁱⁱ We do not include other forms of IT enabled-information intermediation that do not have an internet component under the umbrella of electronic information intermediation.