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The Social Demand of Information Technology Innovation

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Abstract

Application of Information systems has significantly contributed to the growth of various sectors both in developed as well as developing countries. This significant contribution can be attributed to the careful adoption of IT innovation. There exist varied views of the very same technology by different users based on the individual's sense-making, resulting in diversified notions regarding the adoption of technological innovation. This paper presents framework and propositions highlighting how the interpretive schemes of the users affect the process of adoption of a new technology. We have also explained the determinants of the interpretive schemes that are being developed and redeveloped by the users.

Keywords: Interpretive schemes, Sense-making, Self-efficacy, IT, Organization.

1. Introduction

Technological innovation has been a hot topic in recent days as increasing number of companies are interested in deciding the amount of capital to be invested in R&D work of the technological innovation. Information Systems has been on the forefront of the fastest growing innovations and its future appears to be bright (Vijay, Kenneth, Raman & Yap 1994). Information technology is evolving along several dimensions and so is the complexity of the social, procedural and communication arrangements associated with its use (Chin, Gopal and Salisbury 1997). Adoption of IT innovation is an unpredictable and complex phenomenon. The role of social interaction has been overlooked by initial literature (Fulk1993, Wilkinson 1983 which considered the features of technology to be the only contributing factor for the adoption of the IT innovation and the users were viewed as a social group, which is imposed to use the innovation. Recently many of the literature have studied the IT innovation and adoption under the notion of social construction and structuration theory by Gidden's (Orlikoswki 2001, Griffith 1999 and Poole 1985). The adaptive structuration theory (Poole and Desanctis 1994) illustrate the fact that same technological innovation leads to different outcomes in the level of adoption in different segments under the same circumstances because, groups are not information processing entities but an active social participant that exhibits different behavioral pattern. (Orlikowski & Gash 1994) have stressed the need for giving importance to the users' perception of the technology, since it contributes significantly on how the actors in an organization think and act towards the technology. Nature of adoption of technology is not known a priori, but is contingent on individual perception and legitimacy attributions (Brown 1998). The difference in the outcomes of the same technology which when embedded in different social system has also been studied by Barley (1986) where the technology has been viewed as a social object rather than just a physical object. In later literature, adoption of technology was viewed as a political process open to contestation and deployment (McLoughin, Badham, and Couchman 2000). Blosch and Preece (2000) have viewed technology as a socio-technical ensemble, which emerges from the socio-political concept of organization. Even though past literature have studied at macro level, the various

factors affecting the sense-making of IT innovation and the factors which contribute to the adoption independently, a holistic view has been lacking. The interpretive schemes of the users' that affect the IT adoption has also not been studied in detail. This paper presents an extensive study of literature and contributes framework and propositions related to the interpretive schemes of the users along with the organizational, technological and socio-political factors that influence in IT adoption. We have also explicated how the self-efficacy and the attitude of the users' towards the construtivism and instructivism learning act as determinants of the interpretive schemes that are being developed and redeveloped by the users'.

2. Sense-making of Technology

This section is an extensive study of literature that elucidates how the technological features, organization and socio-political aspects affect the users in making a technological frame or sense-making of technology, that greatly influences adoption decision of IT innovation.

2.1. Triggers for Sense-making

There has always been a wide gap between the perception of technology by the users and the innovators. Users, most of the times, have just a fuzzy image of the innovator's perception. This fuzzy image of the innovator's perception results in users having different conception of the technology and its features. A fine example is the seminar work of Barley (1986), on the study of structuration process in the CT scan technology adoption in which, users in varied contexts at the two hospital Urban and Suburban developed different structures over time of the same technology. User's vague image of the innovator's perception has also been emphasized in Decision-Episode framework of Swan and Clark (1992). Understanding of people's interpretation of technology is of great importance in understanding their interaction with it because, the user's sense-making develop particular assumptions, expectations and knowledge of technology which eventually leads to the same technology being interpreted differently by different stake holders, depending on their technological frames. The difference in the interpretation of the users can be attributed to the features of the technology that acts as triggers in the users' sense-making process. MacMillian and McGrath (1996) illustrated the importance of knowing the features, which the user considers to be salient and the effect of perception mismatch between the users and developers outlook on a particular feature. Many of the researchers (Louis and Suttan 1991) have given importance to the sense-making itself rather than the triggers of sense-making. But in his work Griffith (1999), gives a perception of how the features of technology affect the thought process of the users, thus reacting as triggers of sense-making of the technology. While adaptive structuration theory describes about the influence of technology, human actions and social structures over the technology in use, FBST (Feature based theory of sense-making triggers) Griffith (1999) is a building block which gives shape to the technology aspect so as to be mixed with the social structures and human actions. According to FBST there are two different dimensions of features, which are classified as, abstract versus concrete, core versus tangential. The features that are more directly specified are termed as concrete features whereas the features that are specified indirectly are known as abstract features. There exist subtle differences between the two. The more difficult it is to observe a feature; the greater is the tendency to categorize it under the abstract one. The other dimension called the core features are the defining factors of a technology, which when altered changes the purpose of the technology itself, whereas the tangential features are just like supplement features. The triggering conditions are classified into three: the Novelty, Discrepancy and Deliberate. A totally unknown feature of the technology when overcome by the user leads to novelty condition, while a feature that drives the interest of the user to think in a new way creates deliberate initiative condition for

sense-making. Methods that are totally inconsistent with the present situation by using latest technology gives rise to discrepancy condition. Griffith (1999) hypothesized and tested that newly adopted concrete, core features are more likely to be experienced and recognized as discrepant and Novelty than the abstract and tangential features. Similarly, newly adopted abstract, tangential features are the ones that trigger the conscious deliberation. The users' perceptions of technology give adequate information to the developers of technology during the process of implementation and up-gradation. Depending on the users' nature and the features of technology, users' sense-making of the technology vary considerably. Eventually as the sense-making of technology varies, there is discrepancy in the decision on adoption of a new technology due to the different technological frames created by users.

Introduction of a new information technology in an organization invokes the actors to initiate the process of interpreting the technology and its features based on their nature, bounded by various factors that are explained in Section2. The extent of diversification in the interpretation of technology by users increases when the technology is embedded with more of abstract and tangential features. While organization and group behavior play important role in the adoption of a new technology, the users' sense-making can be considered as the preliminary step in studying the whole process.

2.2. Role of Organization in the Adoption of IT Innovation

While user's individual sense-making is the preliminary step in studying the adoption of IT innovation, the role of organization and group sense-making considerably affects interpretation of the technology, eventually resulting in the new technology becoming a success or a failure. The design, development and implementation of IT are highly dependent on the organizational factors. The organizational characteristics like task variety, user participation and executive support significantly shapes the outcome of adoption and implementation of the new technology. The intertwining relationship of organization and Information technology (Orlikowski 2001) expounds the need for studying the process of IT adoption from the techno-socio view. Such dependency has kindled the development of many strategic, cognitive and political outlooks of organizational life in IT literature. Recent trend in such a study is the borrowing of concept on institutionalization into IT study. The institutional perspective on expanding the use of internet technology (Orlikowski 2001) and the intervention of institution in IT innovation like the regulatory authorities, thus enhancing or curbing the IT diffusion (Vijay, Kenneth, Raman and Yap 1994) are excellent examples of this.

2.3. Organization: Structure & Action

Researchers have viewed organizations in multifarious ways. Traditionally, most of the theorists understood organizations as instrumental, deterministic structures and hence ignored the role of human intervention. Deterministic, objective and static view of structure enunciates that organizations are predictable instruments and the cause and effect relationship is explicitly pronounced as in natural science. Another school of thought conceptualizes organizations as voluntaristic structures and management as a symbolic action (Pfeffer, 1981). The voluntaristic, subjective and dynamic view of the structure takes a completely divergent stand and states that structures are not "real". Reality exists in the interpretive schema of the actor. Hence the same structure may mean differently to different people depending on their organizational sense-making (Griffith, 1999) and the same technology may mean differently to different stake holders depending on their "technological frames" (Orlikowski and Gash, 1994).

Lately, theorists are realizing that neither of the two extreme viewpoints offers a comprehensive understanding of the organizations. In an effort to offer better explanation of

structures, some bold theorists have tried to synthesize the two extreme explanations of structures. Negotiated order theory (Strauss, 1978) and Structuration theory (Giddens, 1976) are two such attempts. Negotiated order theory (Strauss, 1978) derives from the symbolic interactionism, which states that routine events in the life of actors (agents) lead to the emergence of a negotiated structure which guides their future negotiations. Structuration theory (Giddens, 1976) argues that structural properties of the social systems are both the medium and outcome of practices that constitute those systems (Giddens, 1979).

2.4. Social Construction of Technology
Initial literature on organization looked at information technology as deterministic object and hence ignored the role that human intervention in the designing and use of technology. It was the seminal work of Joan Woodword that drove the attention of the organizational researchers into the effect of technology on organizational forms, like the work on, impact of IT on the skill level (Attewel and Rule 1984, Todd and Benbasat 1999). As more researchers started looking at the social construction of technology the view of technology as a deterministic one changed and it was perceived as a social object that is both a product of human action as well as medium of human action. Technology artifacts are not unproblematic predefined packages but *equivoques* (Weick 1990) that possess high degree of *interpretive flexibility* (Bijker 1987). Technology produces two different social features described as structural features of technology and spirit of the feature set. Structural features are the specific types of the rules, resources and capabilities offered by the system. Spirit is the official line which the technology presents to the people as to how they can act when using the system and how to interpret the features of the system (DeSanctis and Poole 1994). The view of technology as a social object accentuates the study of development and deployment of technology as a social phenomenon. Orlikowski (1991) developed a framework based on the Giddens theory of structuration to study the development and deployment of technology in which organizational consequences of technology were viewed as product of both material and social dimensions. Gidden (1979) elucidated that structural properties of the social systems are both the medium and outcome of practices that constitute those systems and hence the duality theory emphasizes that the subjective human behavior contributes to the objective institutional properties, which in turn gives input to the human behavior. Structures are recursively organized rules and resources that individuals draw on and reconstitute in their day to day activities (Sarason, 1995). All these emphasize the duality of structure wherein it reflects as well as constrains action. Actors interpret from the institutional patterns of signification, domination and legitimation to construct roles (action) of communication, power and sanction through the modalities of interpretive schemes, resources and norms (Giddens, 1976, 1979). Under similar setup, the structuration model of Information technology recognizes 4 key influences that operate continuously and simultaneously in the interaction between technology and organization (1) Information technology is outcome of human action (2) Information technology as a medium of action (3) Information technology is built and used within particular social context (4) Interaction with information technology influences social context (Orlikowski 1991). Information technology has been built within certain social and historical circumstances by humans and hence possesses the assumptions and objectives of its designers. The maintenance and adaptation of technology also preserve the utilization of the information technology by humans. Thus information technology is a product of human action. Information technology once adopted in an organization is being used by the users in the organization and thus the technology facilitates as well as constrains their activities. This explains as to why information technology is considered as the medium of human action. When users in an organization use a particular technology, they are being guided by the knowledge, resource and norms that constitute their organizational structure. Not only are the

users molded by these structures but also the developers of the technology. Thus information technology is being built and used within a social context. Apart from users being bounded by the structure of the social context, they in turn also affect these structures by either sustaining it or changing it. This results in the interaction with the technology to influence the structure of the social context. These changed structures become the modified molding structures acting as norms, guiding the interaction between humans and technology. The social construction of technology explains how the objective and subjective nature of technology influences and being influenced by the social context. Difference in the structure developed in a specific social context, directly results in the difference in the adoption behavior of the technology.

2.5. Exercising Power in Social Construction

The process of social construction is an outcome of the exercise of power, the political process. Organizations are political entities and thus cannot be devoid of power and politics. An organization comprises of people with varied interests which results in conflicts that are to be resolved. Such activity requires mobilization of power resources through political activity. The powerful actors influence the structures and actions in organizations. Ranson, Hinings & Greenwood, (1980) discuss the importance of "power play" in framing alternative interpretive schemes leading to a "cleavage" and "consensus". This point can also be understood with the background of negotiated order theory (Strauss, 1978). In this theory he points out that the structures emerge and change as a result of constant negotiation among the actors. An organization comprises of different groups, each with independent technological frames. Then, the role of political behavior is to determine the ascendancy (dominant ideology) for a particular technological frame. Thus the adoption of any technology is a complex decision making process which is dependent on the habituated practices and relations of the power between diverse specialisms in an organizations. Some groups have more opportunity than others to shape the socio-technical ensemble during the process of implementation and utilization (Blosch and Preece 2000).

3. Framework and Proposition on Interpretive Schemes

Figure-1, gives the framework of factors that influence the acceptance of an IT innovation. The figure has got two phases. One of the phases comes out from the existing literature that encompasses the technical, social and political features that affect the decision process fusing structuration theory and negotiated order theory. The second phase is regarding the contribution of the paper, which expounds the determinants of the interpretive schemes of users and how it acts as technological frame for the uses during their interaction with the IT innovation. The framework comprises of three portions, arising from the theoretical background of technological, social and socio-political concepts. The social portion has been split into two, one from the institutions' perception and the other from individual's perception. The features of new technology act as triggers in the users' *sense-making* of technology. The concrete features that are more directly specified have the greater chance of being interpreted uniformly by majority of the users, whereas the abstract features that are not directly specified can be interpreted in a varied manner. The degree, to which the features are observable, determines the extent of diffusion of the technology among the users. Hence newly adopted concrete features are highly probable of being noticed than newly adopted abstract features. In Figure-1, the concrete and abstract features are differentiated by the transparency of the sense-making process of users (translucent for concrete features and opaque for abstract features). Unlike concrete features, abstract features necessitate the user to be of exploratory nature. Since the abstract features are not directly specified, it is more open to negotiations and hence creates opportunities for deliberate sense-making initiatives.
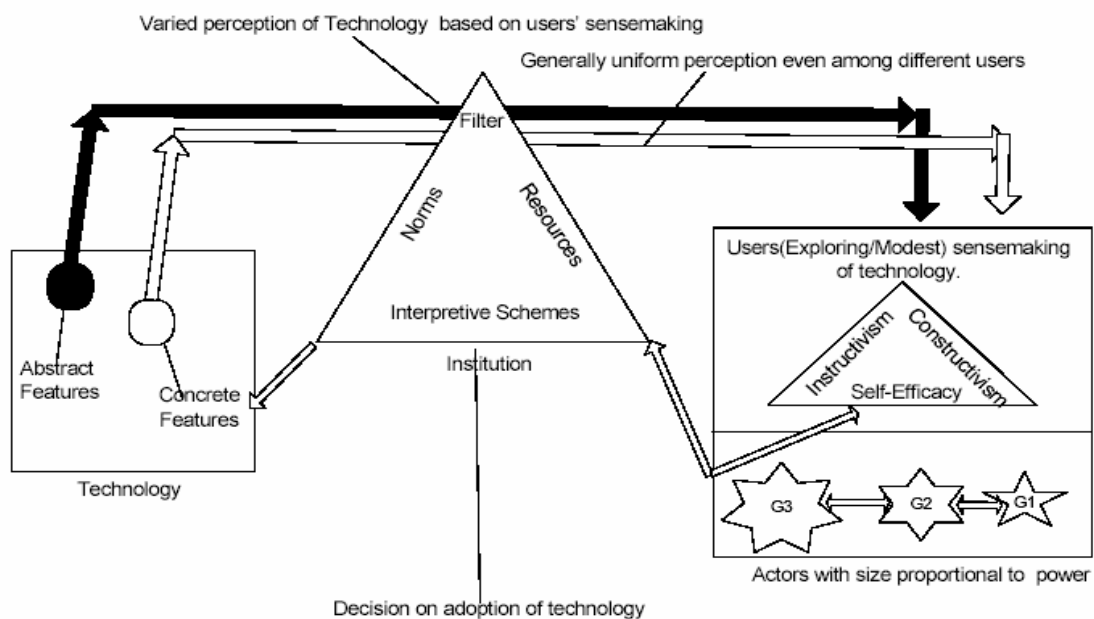
Figure-1: Factors influencing adoption of IT Innovation

As a result of this, there is less observable variance in the concrete features and its outcomes as compared to the abstract features. The more abstract features the new technology is embedded with, the more varied would be the sense-making of the features of technology by the users. Griffith(1999) work specifies how the features of the technology influences the sense-making process. But apart from the features, the attitude of the users' towards learning also influences the sense-making process. The two strategies of learning are instructivism and constructivism (Ali and Rezaei 2002). Instructivists' advocates direct instruction, believing that knowledge is transmitted to and acquired by learners. It mostly relies on the traditional method of learning from someone rather than exploratory learning. On the other hand constructivist learning depends on learning derived from branches of cognitive science. It argues that conceptions arrived by the learners on their own through their exploration is more meaningful than those that are proposed by others. The sense-making of the technology also depends on whether the users believe in learning based on constructivism or instructivism. Abstract features, which requires the users to be of investigating nature will be noticed and appreciated by constructivistic learners than users who believe in instructivism. Similarly the constructivistic learners are capable of favoring IT innovation while the instructivistic learners have higher inclination towards traditional methodologies. Hence

Proposition 1: The sense-making of the features of the technology is dependent on the interpretive schemes of individual users' attitude towards learning the technology and the factors that motivate them in using the technology.

Apart from the attitude of the users' towards learning, sense-making process also depends on the self-efficacy of the users in using the IT innovation. Self-efficacy is people's judgement of their capabilities to organize and execute courses of action required to attain designated types of performances (Bandura 1986). Self-efficacy is better predictor of individual behavior because such self-beliefs are instrumental in determining what individual do with their knowledge and skills. Self-efficacy is helpful in explaining the difference in motivation of users possessing equal knowledge. The various components for measuring self-efficacy typically used in literature are organization support, outcome expectations, scholastic

competence and experience in the field (Sock, Paul, Douglas 2002, Compeau and Higgens 1995). The self-efficacy of an individual in using the technology also contributes to their motivation and involvement in appreciating the technology and its uses. A person who has positive attitude in learning or interacting with an IT innovation, his motivation in using the technology increases considerably. In contrast, if a person lack the confidence while interacting with the new technology, his motivation is utilizing the technology will be less influencing the person to prefer traditional medium rather than the innovation. Hence

Proposition 2: Self-efficacy of the users in using the technology as measured by their competencies, expectations, experiences and support act as interpretive scheme in the process of sense-making of the features of the technology.

Apart from the nature of the users, sense-making process is also influenced by the social context. Human actions can be seen to be constituted by the institutional properties. The institutional structures shape the pattern of interaction of humans with the technology. Even though these structures just have a virtual existence, people readily allow these structures to constrain their actions. Thus, structure is also objective since it guides the human action. This is represented in the framework by the institution triangle that acts as a filter, guiding and constraining the users along the three dimensions, resources, interpretive schemes and norms of the institution during the process of sense-making. In order to explain the influence of users' nature in the sense-making process, a triangle with three determinants Constructivism, Instructivism and Self-efficacy is represented in the users' rectangle. The users' rectangle is partitioned into two because the portion above is to depict the influence of nature of users' in the process of sense-making. The portion beneath is to expound the cyclic linkage between the realm of action and the realm of structures. While the users' actions are influenced by the structures as represented by the triangles, the structures are also influenced by the human actions. The structures are also outcome of human actions, which is represented in the framework by an arrow that goes into the institution from the user's rectangle. The structural properties are thus evolving over time wherein the human actions contribute to the evolution process. Thus, structure apart from being objective, can also be viewed as subjective since it emerges out of human actions. In deciding on the human actions that contribute to the evolution process, the dominant ideology comes into picture. When an organization comprises of groups of people with varied conception of the technology, it is the action of powerful actors (negotiated order theory) that influences the structure of the organization. In other words, powerful actors have greater role in the evolution of the structures compared to the less powerful actors. The three stars in the user rectangle explain this influence. More stars imply increased power. There exists constant conflict among these groups as represented by the arrows linking the groups, but ultimately it is the group G3 with higher number of stars or greater power that contributes to the evolution of structure given by the arrows that goes into the institution from G3. Similar to the structures, the attitude and nature of the users' gets modified constantly by prior actions and experiences. The modification of the structures of the institution is a less frequent phenomenon as explained by Orlikowski (1991). But the modification of the interpretive schemes of individual actors is a typical phenomenon. The power of politics can also be experienced during this modification while some of the actors' nature and attitude gets modified when they try to follow powerful actors having them as role model. This is explained in the framework by the upward arrow within the user's rectangle pointing towards the individual users' determinants of interpretive schemes. Hence

Proposition 3: The individual users' interpretive scheme as measured by their knowledge, attitude towards learning and self-efficacy in using the technology gets modified constantly by their motivation in using the technology during prior interactions with the technology.

4. Conclusion

The contribution of Information systems in the success of all sectors is mainly due to the successful design and implementation of information technologies. The variance in the decision of adoption of IT has persuaded the literature to concentrate on the social construction of technology. The framework and propositions that explains the factors influencing the decision of accepting or rejecting an IT innovation attempts to integrate the effect of features of technology as triggers of sense-making process and social construction of technology. While studying the social construction of information technology, the importance to interpretive schemes of individuals apart from the institutionalized interpretive schemes has been emphasized that was undermined by most of the prior literature. The influence of self-efficacy of the users in using the IT and their attitude towards the construtivism and instructivism learning have been identified by the authors as determinants of interpretive schemes that developed and redeveloped over time by the users' through continuous interaction with the IT innovation. Even though past literatures have questioned about the empirical investigation of the Giddens' structuration theory, a study on the change in interpretive schemes of users' over time, as measured by the determinants identified by the authors can be conducted. As a future research opportunity, a measure to link the change in the interpretive schemes of the users with that of institutionalized interpretive schemes having power of users (Negotiated Order theory) as a moderator can be explored.

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