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ANALYZING THE NATURE OF KNOWLEDGE IN THE IS FIELD

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Abstract

The history of the IS field is no more than fifty years. This can be considered relatively new compared to more developed disciplines such as the social sciences or the natural sciences. However, the field of IS has long been criticized based on the nature of knowledge in its domain. Moreover, the diversity and pluralism of methodologies adopted by researchers and lack of a coherent body of knowledge in the IS field invites additional criticism. This brings to the fore the important question about organization of knowledge in the field of information systems whether it can be considered as coherent, scientific or cumulative (considered generally as important factors in judging the soundness of a discipline and categorizing it as an independent academic discipline). The other related question is whether there could be alternative or possibly better ways for a discipline to organize knowledge in forms other than theories. We believe that criticisms of the IS field for lack of well-established theories or multiplicity of views of IS researchers appear to be misplaced. In this paper, we respond to some of these criticisms. Our suggestion is that diversity of views or lack of established theories in the field should not be used as the basis for criticizing the IS field as a core body of knowledge. Such criticisms should rather focus on judging whether knowledge accumulated over time in the IS field has a scientific character. We contend that the IS field is still evolving while other disciplines such as the social sciences or the natural sciences have matured over the last couple of centuries. In view of the still emerging nature of the IS field, we adopt the premise that comparison of the state of knowledge in the IS field with that in other established disciplines does not seem logical and this, in itself highlights the weakness in the argument of the critics of the IS field. Since the nature or the way knowledge is organized in a field is usually an important criterion for assessing the academic character of the field, an alternative framework for organizing knowledge in the IS field is suggested that can help accord the status of an academic discipline to IS field.

Keywords: Nature of knowledge, epistemology, information systems, philosophical foundations

Introduction

There have been numerous attempts at analyzing state of knowledge in IS field (Benbasat and Weber, 1996;Checkland and Holwell, 1998; Davis, 2000; Swanson and Ramiller, 1993; Avegerou, 2000; Falkenberg et al., 1998). We find most of the earlier attempts at analyzing the state of knowledge in the IS field as inadequate which can at most be classified as fragmented. While some of earlier attempts at describing state of knowledge in the IS field lament the field for lack of coherence or well established theories (Benbasat and Weber, 1996;Checkland and Holwell, 1998; Davis, 2000), others point to strengths of the field (Banville and Landry, 1989; Gallupe, 2000; Baskerville and Myers, 2002). This paper analyzes the nature of knowledge in the IS field. This paper serves two purposes. The first purpose is to put the state of knowledge in IS field in perspective by taking a broader view about the growth of the field since its inception and the impact of this growth on nature of knowledge in the IS field. This broader perspective helps us to respond to the some of the criticisms of the IS field. The second purpose is develop an alternative framework for organizing knowledge in the IS field based on IS philosophy to alleviate such criticisms. We believe this framework could be potentially useful to help IS field attain the status of an academic discipline.

We begin with some fundamental questions about knowledge. To understand or analyze the nature of the knowledge in a field, one must know: *What is knowledge? How is knowledge different from mere belief? What are the sources of knowledge and evidence? What constitutes knowledge in a field? When can we say we have made progress in terms of our knowledge or understanding of the subject matter of the field? ,and how do we analyze the nature of the knowledge in a field?* These fundamental questions will guide the attempts to understand the nature of knowledge in a field. These questions underlie many of our common sense assumptions and attitudes about our understanding of knowledge. We feel criticism of what we know and how we know (i.e. criticism of knowledge or methods of acquiring knowledge and linkage of criticisms to deeper understanding of what constitutes knowledge and how knowledge progresses in general) are two different things. We consider the latter to be that which forms the central point for criticism of nature of knowledge in a field. We extend this discussion on nature of knowledge further by posing the following questions: could there be a logical basis for labeling the way knowledge is organized in a field as better than that in some other field? or could there be alternative ways of organizing knowledge in a field, different from established ways? In essence, should methods of organizing knowledge in a field be the basis for criticizing the nature of the knowledge in the field? Such questions are important to answer because they help us to know degree of our openness to alternate ways of organizing and analyzing knowledge.

This paper is organized as follows. In the next section, we provide the background for the entire paper by discussing different notions of knowledge and scientific method. In the following section, we discuss evolution of information system. Then, we analyze the impact of IS evolution on methods of inquiry and body of knowledge in the IS field. In the subsequent section, we discuss criticisms of nature of knowledge in the IS field section followed by our response to such criticisms. Finally, we conclude the paper by suggesting an alternate method for organizing knowledge in the IS field.

Background

At the outset, we discuss some thoughts and conceptions about the nature of knowledge. Some of the best philosophical minds of the 20th century (among them, Bertrand Russell, H.H. Price, C.D. Broad and G.E. Moore) spent their careers trying to define what constitutes knowledge. The debate about knowledge started with philosophers wondering if knowledge is a state of mind i.e. a special kind of awareness of things. This debate continued until the 5th century B.C when in *The Republic,* Plato postulated knowledge as a mental faculty, different from believing or opining. Following Plato's conception of knowledge, it appears that there are different levels of convictions about knowing something, lowest level being guessing or conjecturing, next level as believing or feeling and finally knowing or knowledge at the highest level.

However, in his book, *On Certainty,* Wittgenstein (1969) rejected this notion of knowledge as a state of mind. Wittgenstein's notion of knowledge is that knowledge can be ascribed to some one when certain complex conditions are satisfied including certain behavioral conditions. From this standpoint, one can conclude that knowledge is tied to the capacity to perform in certain ways under certain standard conditions. Austin (1946) in his paper "Other Minds" describes knowledge as something associated with someone who is in a position to resolve a doubt in a social situation. This means, knowledge is something that can help explain some event or resolve a conflict about an event in a situation. This is akin to a descriptive notion of knowledge.

Some philosophers have focused on nature of knowledge to explain what might constitute knowledge (David Hume, 1772; Immanuel Kant, 1787; Bertrand Russell, 1926). For example, Hume (1772) and Kant (1787) focused on experiential or empirical knowledge while Russell (1926) tried to distinguish between knowledge, which is based on direct experience, and one, which is not. Russell (1926) classified knowledge into two categories: knowledge by acquaintance based on direct experience and knowledge by description, which is not based on direct experience. Russell's (1926) idea of knowledge is grounded in stratified form of knowledge i.e. some types of knowledge depend on others and some that do not and that the latter form the foundational units which give support to the whole epistemic system. From this standpoint, Russell (1926) advocated a foundational structure for knowledge creation with foundations provided by the knowledge that is created through direct observation.

In the long history of epistemology, we find two ways of generating knowledge: one, descriptive and second, justificatory or normative. The descriptive way of formulating knowledge includes description of events, relationships or features of the world. However, justificatory or normative way is associated with justification of beliefs. The focus of normative approach is to ask questions that lead to things that one ideally ought to believe. From this standpoint, certain questions seem pertinent: is knowledge same as justified true belief? What is the relationship between evidence of belief and the belief itself? What indeed is meant by "justification" and what sorts of conditions have to be satisfied before one is entitled to say that a belief or a set of beliefs is justified?

The above discussion of knowledge highlights two important aspects – one of foundational knowledge (Russell, 1926) and another of knowledge as justified true belief. We will show later in this paper that most of the criticism of the knowledge in the IS field is based on these two notions of knowledge and that knowledge in the IS field is very different from these two notions of knowledge.

Having discussed different notions of knowledge, we now move on to discuss what is scientific knowledge or what is the basis to categorize a piece of knowledge as scientific knowledge. Another relevant question in this respect is: what is a scientific method? We also discuss which factors characterize the progress of scientific knowledge –when can one say that knowledge in a field has progressed scientifically? Is the progress characterized by movement from one scientific theory to a better theory or can movement from one scientific method to another also constitute scientific progress?

Karl Popper (1985) emphasizes critical attitude as an important factor in classifying any method as scientific. Popper argues that criticism becomes the main instrument of further growth and contends that his schema of error-elimination becomes the schema of the growth of knowledge through error-elimination by way of systematic rational criticism. This, according to Popper, operates at the scientific level under the regulative idea of the search for truth. Figure 1 shows Popper's schema of error-elimination. He further contends that progress in science depends on a revolutionary use of trial and elimination of error by criticism, which includes several empirical examinations or tests. This means scientific progress in a field takes place if theories or methods in the field are subjected to severe tests to falsify them to create new theories or models or for addition to the existing body of knowledge. This is also closely related to the correspondence principle enunciated by Popper. This principle essentially focuses on information and truth content in competing theories that provides the basis for selection of a theory as superior to another if it approximates to truth better than the other. Following Popper's view, the scientific path can be construed as consisting of coming up with a theory or solution to a problem and then refining the theory based on new information or evidence and subsuming it with another better theory. This view considers scientific progress as a continuous movement from problem to problem and theory to theory in search of better approximation for the truth(s).

P1 → TT → EE → P2

Figure 1. Popper's Schema of Error-Elimination

Snyder's (1978) views on scientific progress also appear to be similar to Popper's views of scientific progress. Snyder asserts that science is what people do - a set of activities that may or may not produce organized theories. He further says that science is not a particular set of assertions or theories. From Snyder's standpoint, scientific progress may be viewed as an ability to provide a set of plausible explanations at different time intervals for what people do, not necessarily attempting to integrate these explanations.

Thomas Kuhn (1971), however, emphasized the paradigmatic nature of scientific progress. He claimed that the science is a social process and progresses through a revolutionary structure. According to Kuhn, a coherent or a common body of ideas can only lend credibility to knowledge as being scientific. This view has been used most widely and endorsed by thinkers like Anderson (1983) and Weber (1997). These thinkers contend that scientific progress is a progress through a commitment to a theory driven paradigmatic research (Anderson, 1983) with a view to providing theoretical unity and coherence for a discipline (Weber, 1997). According to this view, epistemological evaluation of the scientific rigor in a field depends on its ability to develop a set of common principles, which are widely accepted within the discipline itself.

The foregoing discussion highlights the differences amongst thinkers about what constitutes a scientific method or how knowledge progresses scientifically. It provides an appropriate framework to analyze the nature of knowledge in a field. Using the discussion on growth of information systems over time in next section, we explain (in subsequent sections) how IS philosophy (that has implication on research methods and modes of inquiry in the IS field) is not at variance with scientific philosophy.

The Historical Journey of Information Systems

We will start our discussion of the IS field by putting forward a historical perspective on the evolution of information systems. A historical perspective of information systems is quite useful because it helps us to understand not only what information systems are but also how the notion of information systems originated and changed over time. The motivation to investigate the origins of information systems is based, at least in part, on the supposition that an investigation into the provenance of information systems can help cast light on the nature of knowledge in the IS field.

The notion of information systems has changed dramatically since its origin in the early 1950s. Information systems at that time were focused more on technology than information i.e. having better technological systems that were capable of faster data processing, thereby achieving labor efficiencies. The role of information systems in organizations was similar to assembly line production and focused on enhancing the operational efficiency of the organizations and thus, can be considered as "Efficiency Model" as depicted in Figure 2.

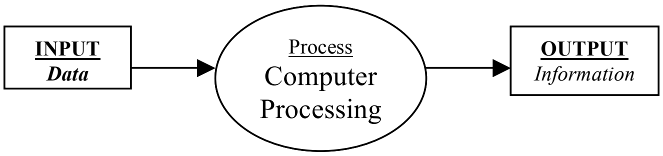

Figure 2. Efficiency Model of Information Systems

The advancements in databases and data storage technology led to increasingly sophisticated usage of information systems with applications beyond just payroll. The widespread usage of information systems in organizations –both across functions and management levels helped information systems assume the role of management reporting systems, leading to the concept of management information systems (MIS). This means that information systems were now expected to help managers arrive at better decisions besides processing data efficiently. The concept of MIS was also extended to include newer concepts like Decision Support Systems (DSS) and Group Decision Support Systems (GDSS) to bring in interaction of the information recipient with the information systems. This new role of information systems, shown in Figure 3, focused on effectiveness of the information system and can be considered as an "Effectiveness Model". The difference in this model and the efficiency model is a feedback loop from the information recipient. This new model incorporates human issues and man-machine interaction issues. Newer systems like Expert Systems, grounded in artificial intelligence, seemed to follow logically.

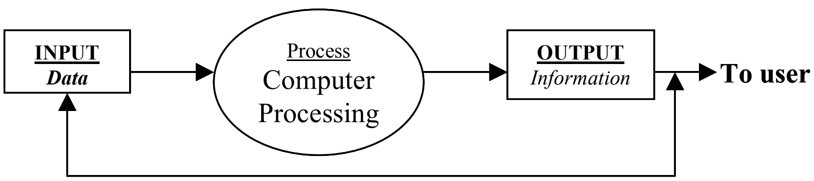

Figure 3. Effectiveness Model of Information Systems

The effectiveness model was very successful for almost two decades until the concept of networking of information systems emerged. The notion of integrating information across different organizational units, divisions and functions for better coordination and cooperation led to what can be categorized as the "Enterprise Model" (Figure 4) of information systems. This model catapulted information systems to the next higher-level cutting across the boundaries of divisions and functions and emphasized the social character of information systems. This implied a move from a socio-technical to a social nature of information systems.

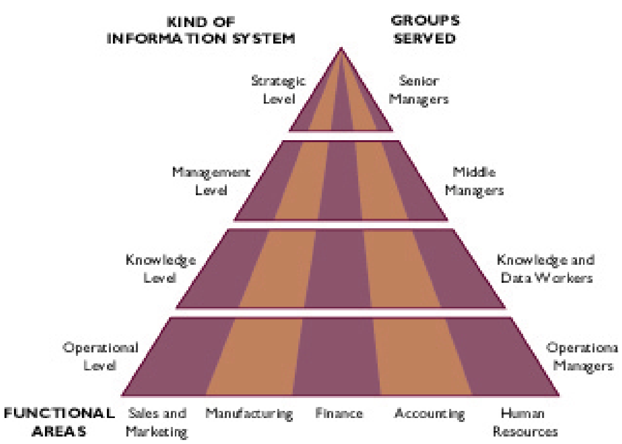

Figure 4. Enterprise Model of Information Systems (Adapted from Laudon and Laudon, 2002)

To further enhance the integration of information, organizations attempted to collaborate with their suppliers and distributors and to some extent, with their customers. The rise of technologies like the Internet and Electronic Data Interchange (EDI) just proved to be timely to undertake this integration with suppliers and distributors and the seeds for an "Extended Enterprise Model" (Figure 5) for information systems were sown. This model of information systems integrated not only assets and systems but also the processes and most importantly people across organizations. This was a substantial role change for information systems spanning beyond the boundaries of a traditional organization and required integration of knowledge from different disciplines, making it a truly interdisciplinary field. The rise in the use of the groupware, collaborative technologies and other technologies like computer-mediated communication finally highlighted the role of information systems as a mode of social interaction. This notion of information systems as a tool for social interaction gave rise to yet another model– "Social Systems Model" for information systems where information technology is only an enabler and other forces dominate its usage.

It is evident from discussion above that the notion of information systems has changed from purely technical systems (emerging as a shadow of the computer science discipline) to social systems (with knowledge derived from a number of other disciplines in the 2000s). Information systems changed or were extended at least four times in as many decades. This historical journey of information systems is summarized in Table 1.

Table 1. Historical Journey of Information Systems

Decade	1950-60	1960-70	1970-80	1980-90	1990-2000	2000-
Model	Efficiency Model	Effectiveness Model	Extended Systems Model	Enterprise Model	Enterprise and Extended Enterprise Model	Social Systems Model
Key Concerns	Data Processing	Meaningful Information for Managers	Better Managerial Decisions	Better Organizational Decision Making Better Processes	Organizational Competence Extended Processes Supply Chain Management	Social Interventions Social Productivity
Key Drivers	Labor Efficiencies /Productivity	Cost Efficiencies	Managerial Productivity	Enterprise Resources and Processes Optimization	Competitive Efficiencies	Social Benefits
Key Focus	Technology	Technology	Technology and People	People, Tasks, Processes & Technology	People and Processes	Social Interactions between People and Processes
Shift in Focus		Technology to Technology & People		Technology & people to people, process, and Technology	People, Process & Technology to People and Process	People & Process to People

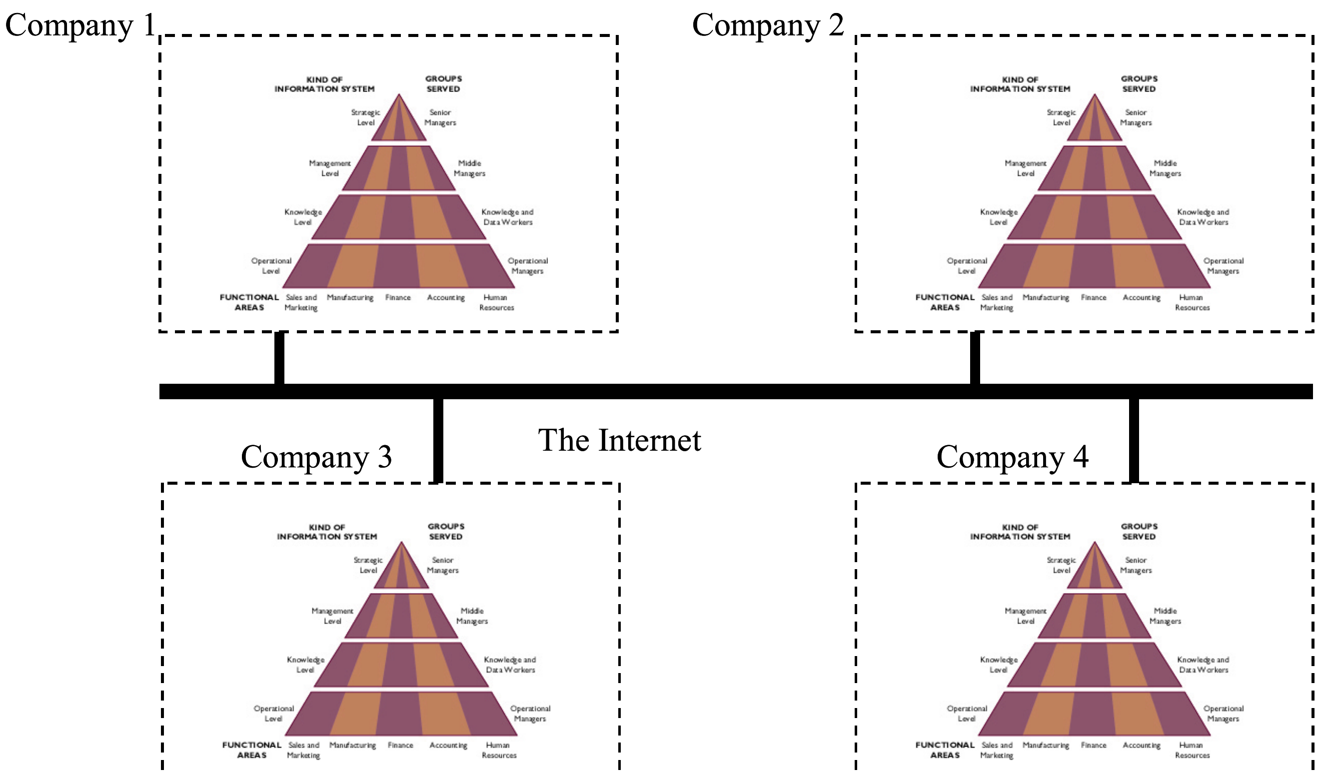

Figure 5. Extended Enterprise Model of Information Systems (Adapted from Laudon and Laudon (2002) and Kecmanovic (2002))

We will now discuss the impact of IS evolution on the body of knowledge and methods of inquiry in the IS field. Based on this discussion, we will show how research methods and modes of inquiry in the IS field reflect IS philosophy.

Impact of IS Evolution on the Body of Knowledge in the IS Field

The evolution of information systems had major implications for the way the IS field emerged, for the research methods employed by IS researchers and finally, for the body of knowledge within the IS domain. In the context of growth of IS, two kinds of epistemology can be identified in the IS field, namely, technology epistemology and research epistemology. While technology epistemology (focusing on knowledge for developing better computer technology) seems more appropriate within the field of computer sciences, research epistemology (focusing on knowledge for better use of IS in organizations) is what IS researchers contribute to. Our focus in this paper is restricted to research epistemology. In the early stages, concepts in the IS field had a firm grounding in 'computer science' principles. The efficiency model of information systems emphasized technological capabilities such as higher processing speeds of computers, better algorithms for faster data processing and higher processor utilization. The effectiveness model of information systems required IS professionals to look beyond data processing and focus on managerial information requirements in organizations. This required an understanding of business systems to specify the information requirement. To do so, IS researchers turned to the management literature on decision making and functioning of an organization. This entailed a foray of IS researchers into the fields of Decision Theory and Management Science.

A radical change in the IS field happened with the enterprise and extended enterprise models of information systems. These models required knowledge not only about decision-making at different management levels but also functional areas like accounting, sales, production or marketing within the enterprise and outside it. This was a mammoth task for the IS researchers and called for the integration of knowledge from vastly different fields, as different as accounting and organizational behavior. This challenge has led to an "incluvist" IS philosophy. Integration of knowledge from different fields like management, accounting or operations research helped widen the scope of the IS field so much as to make it loose its identity. This integration of knowledge led to a body of knowledge in the IS field which it could not claim to be its own distinct knowledge. Each piece of knowledge from different disciplines remained isolated, and IS researchers did not attempt to integrate the knowledge obtained from different disciplines. This led to an apparent lack of coherence in the body of knowledge available in the IS field. The implications of this apparent lack of integration of knowledge was the emergence of a pluralism of methodologies in the IS field. Every field from which the IS field borrowed passed its baggage of methodologies to the IS field and researchers overwhelmed with the availability of many techniques, analyzed IS problems with whichever methodological lens they found appropriate. Though multiplicity of methodologies helped IS researchers to explain some of the issues posed by the enterprise and extended enterprise models, it led to a feeling of "fragmented adhocracy" in the IS field (Hirschheim, 1995).

The social systems model of information systems pushed the IS field further towards other disciplines to search for solutions in the realms of sociological, behavioral, and political domains. Today, the IS field encompasses knowledge not only about information technologies (from computing sciences and engineering) but also the social impact of information technologies (from social sciences) and the business impact of information technologies (from management sciences). This has major implications for IS researchers – first, how to deal with knowledge from so many disciplines and, second, how to keep the identity of the IS field distinct.

Having discussed the impact of evolution of information systems on the nature of the body of knowledge in the IS field, we will now discuss the impact of evolution of information systems on methods of inquiry in the IS field.

Impact of IS Evolution on Methods of Inquiry in the IS Field

The methods of inquiry in the IS field have been greatly influenced by the type of information systems model followed in a specific time frame. In the early stages of the development of information systems, software engineering techniques were mostly used to come up with better algorithms for faster data processing. Other methods, like descriptive accounts of how information systems were developed and deployed in practice provided significant insights but lacked academic rigor. From the efficiency model to the enterprise model of information systems, the focus of IS researchers was on rigor and the scientific foundations of the IS field. This is confirmed by the fact that during the 1980's, the majority of IS researchers applied a positivist framework (during 1983-88, 97% of the IS research articles used a positivist framework, Orlikowski and Baroudi, 1991). However, the growing social nature of information systems found positivist approach inappropriate to explain the social aspects of phenomena in information systems and thus, the extended enterprise and the social systems model and to some extent the enterprise model called for a change in approach from a positivist to an interpretivist mode to study IS systems. These two models found interpretivist methods of inquiry more appropriate to study complex, conflicting and emergent phenomena in the IS field in different social and cultural contexts than positivist methods. While positivist research in the IS field is still practiced by the majority, interpretivist research is on the rise (Klein, 1999; Lee et al., 1997; Walsham, 1993). So, the IS field not only has isolated pieces of knowledge, but also multiple methods of inquiry. However, this owes its origin to the way the field has evolved over time. From this standpoint, nature of research methods and body of knowledge in the IS field reflect the " incluvist" IS philosophy in contrast to "excluvist" philosophy in more fundamental disciplines like physics or mathematics. IS philosophy is "incluvist" in the sense that IS field is more open to integration of knowledge from other more fundamental disciplines to help address the problems in its domain. IS draws its strength from the traditions from different academic disciplines.

After discussing the state of the IS field, we shall now discuss some of the criticisms of the IS field, later, we will demonstrate that some of these criticisms are unfounded, and then we will propose an alternative approach which has the potential to lend credibility to the IS field as a distinct academic discipline.

Criticism of the IS Field

We find IS field being criticized at two levels. The first level of criticism is about the nature of the knowledge and methods of inquiry used in the IS field and second level includes criticisms about identity of the IS field as an independent academic discipline. We will discuss these two levels of criticisms in sequence. In our response to these criticisms in the section to follow, we will mostly respond to the criticisms at first level and that would subsequently form the basis for responding to criticisms at second level because we believe second level criticisms are mostly grounded in the first level criticisms.

The concerns over the scientific progress of IS – or lack of it – were enunciated by Keen (1978) in his call for development of a cumulative research discipline. Considerable discussion has taken place about the "confused state" of the IS field (Benbasat and Weber, 1996;Checkland and Holwell, 1998; Davis, 2000). Others believe that IS is a "heterogeneous yet congenial community" (Swanson and Ramiller, 1993) but do not consider heterogeneity as a bad thing (Banville and Landry, 1989). Some even suggest that current diversity in theoretical foundations and research methods is a cause of celebration (Robey, 1996). However, Falkenberg et al. (1998) consider interdisciplinary nature of the field, the large variety of the interest groups, conflicting philosophical positions and complex, multi-layered communication structure as problem areas for the IS field. Introna and Whitley (1997) surmise that these are all signs of a "Kuhnian crisis" in the IS field. Their criticism is based on the skeptical nature of the IS researchers about the way the research is conducted in the IS field. There are some others who question the IS field about its 'scientific' merit and its future (Avegerou, 2000). It is claimed by Avegerou that the object of IS does not fit easily within the categories of conventional scientific discipline. She goes on to contend further that drawing from both engineering and social science disciplines, IS field's values and rigor are questioned by both. Some have called for a more strict definition of the object of the study, and more rigorous efforts to consolidate its theoretical foundations (Fitzgerald, 1996; Falkenberg, 1995).

There are some who are concerned with the reliance of the IS field on its underlying foundations (Hamilton, Ives, 1982; Culnan, 1986; Culnan and Swanson, 1986; Holsapple et al., 1993; Westin et al., 1994) while some have questioned the methodological rigor of the IS field (Farhoomand, 1987; Landry and Banville, 1992; Pinsonneault and Kraemer, 1993; Grover et al., 1993). This debate of reference disciplines for the IS field tries to create an impression that theoretical constructs deployed in the IS field are the cause of amateurism and lack of cumulative knowledge. However, such debates and studies about reference disciplines of the IS field on the whole reached contradictory conclusions about the scientific growth of IS. For example, Culnan (1986) postulated a decrease in the number of invisible foundation fields for IS from nine to three as a sign of success while Farhoomand (1987) and Weber (1987) argued, using the work of Kuhn (1970), that the IS field is fragmented and that in the absence of articulated theories, little progress has been made in the field. Still, there are others who believe that the IS field is not only a discipline in itself but should also become a reference discipline for others (Baskerville and Myers, 2002). This shows researchers do not have coherent views even on the criticism of the scientific progress of the IS field.

The dilemma which the IS field faces is that it is expected to generate knowledge for other fields while being questioned by the research community for advancement of knowledge in its own field. We believe that every applied field faces this contradiction. We call this a contradiction because some researchers in the IS field do not view this in a negative way and consider it as a service to other disciplines (Baskerville and Myers, 2002). In light of diversity of opinions and lack of common direction of movement, some researchers describe the state of knowledge in the IS field as 'fragmented adhocracy" (Hirschheim, 1996) and consider this adhocracy as disservice to IS as a discipline (Hirschheim et al., 1996). The specific dilemma of the IS field is reflected in the assertion by Gallupe (2000) that as a field of knowledge, IS has the potential to be the preeminent knowledge generator in business and management in the early 21st century.

The second level of criticism of the IS field pertains to identity of the IS field as an academic discipline. There have been considerable concerns within the IS researchers and also those from outside the IS field about the identity of the IS field. Researchers claim that the IS field is undergoing an identity crisis (Khazanchi, Munkvold, 2000). King (1993) asserts in an editorial in Information Systems Research issue "What is the information systems 'field'?" He claims that information systems field is not even a field but rather an intellectual convocation that arose from the confluence of interests among individuals from many fields. Jones (1997) refers to a decision of the American Association of Schools of Business to exclude IS from the core curriculum for accredited American Business Schools. This decision is based on the conception that IS field is dependent on external structures for the knowledge base it has. There is considerable debate in the IS literature about the nature of the IS discipline (Banville and Landry, 1989;Galliers, 1992; Landry and Banville, 1992, Lucas, 1999; Mingers and Stowell, 1997), what it means to be counted as a discipline in the first place (Jones, 1997), and what the appropriate subject matter of the field should be (Mingers and Stowell, 1997; Walsham, 1993).

Having discussed the criticisms of the IS field, we will now develop our response to these criticisms.

Response to the Criticisms

Our first way to respond to criticisms of the IS field is my contention that multiplicity or interdisciplinary nature of a field should not be the criteria for judging the intellectual contribution of the field but the nature of the knowledge generated in the field should be the prime basis to judge a field. We will now develop an argument that will show that the knowledge generated in the IS field is scientific in nature and constitutes an intellectual contribution.

Popper (Miller (ed.), 1985) advocated the idea of critical attitude as the main component of the scientific method i.e. examining everything with a critical attitude and trying to weed out errors while moving from one problem to another. From this standpoint, scientific knowledge is a result of the systematic way of criticizing and weeding out errors. Our contention about a piece of knowledge being scientific is that the scientific nature of the knowledge lies not so much in the efforts to justify it but in attempts to eliminate errors to make it approximate truth or reality. This notion of error elimination in the scientific methods entails an iterative process of identifying a problem and proposing a tentative solution (equivalent to a piece of new knowledge). The new piece of knowledge might lead to another problem and this process of search for a solution is repeated. We believe this is exactly what is being pursued in the IS field. Going back to the evolution of the information systems, one realizes that there was a constant search for methods or tools to explain the phenomena within the scope of information systems at a particular time. For example, extending the scope of information systems to include the entire enterprise as in the enterprise model of information systems provided a solution for the organizations to optimize their resources at the enterprise level but brought people related issues in focus i.e. another problem was created. This led to a search for new and multiple methods grounded in different disciplines to address people related issues in the IS domain. This search was motivated by the scientific notion of eliminating errors in earlier methods that were unable to explain or address the people related issues. The shift from the positivist to the interpretivist methods of inquiry in the IS field also supports this contention. Using the above argument, we contend that the IS field follows the scientific path as enunciated by Popper (Miller (ed.), 1985) and generates knowledge which is scientific in nature.

Popper (Miller (ed.), 1985) views science to be progressing as it moves from one problem to another and creating knowledge as a result of solutions to those problems. The progress in the IS field can also be considered analogous to the progress in science in the sense that the problems in the IS field have also moved from one domain to another (Table 1) over last couple of decades and IS professionals have successfully provided solutions to those problems. From this, one can conclude that it becomes secondary which methodological lens one uses to address a problem as long as the inquiry methods are scientific in nature. Based on this argument, we contend that interdisciplinary nature of the IS field should not be the basis of its criticism. In fact, interdisciplinary nature of the IS field is a point of strength for the field as supported by Banville & Landry (1989) and Robey (1996).

"Kuhnian crisis" in the IS field identified by Introna and Whitley (1997) appears to be grounded in Kuhn's (1970) paradigmatic notion of knowledge creation. However, the question is whether we have paradigms in IS field? Or what kind of paradigms are there in other fields? Our position on paradigmatic notion of knowledge creation is that paradigms are more plausible in fields, which are trying to study fundamental events like atomic physics or psychology. We believe the nature of problems in IS field does not lend itself to evolution of paradigmatic notion.

Our next and related argument is directed toward criticism focusing on reliance of IS field on so called "reference disciplines" (Hamilton, Ives, 1982; Culnan, 1986; Culnan and Swanson, 1986; Holsapple et al., 1993; Westin et al., 1994). Inherent in these criticisms is another criticism that arises from the comparison of the IS field with other well established disciplines like accounting, operations research or psychology. We will provide arguments to address this latent criticism subsequent to our response to the main criticism of the IS field for reliance on reference disciplines.

We believe the origins of such criticisms lie in the concept of foundationalism supported by Bertrand Russell (1926) as discussed earlier. The knowledge as per this philosophy is akin to justified true belief. However, there are criticisms of the notion of foundationalism. Lehrer's (Mattey, 2002) criticism of "semantic foundationalism" is based on "meaning postulate". Lehrer argues that what makes a belief self justified, on semantic foundationalism, is the existence of some "meaning postulate" which ties together the content of the belief and its being justified. Insofar as meaning postulates are necessarily true, claims of self-justification would have to be necessarily true. However, if meaning postulate is just assumed to be true and not verified for its falsifiability, all knowledge derived based on meaning postulate is valid as long as meaning postulate is valid. This, however, is not the case all the time. For example, before 20th century, Euclidean geometry was considered authoritative piece of knowledge in the area (a kind of meaning postulate) and everything else was based on this foundation. So, Euclidean geometry was a stopping point for all justification and therefore all knowledge. However, with the collapse of the Euclidean geometry, this very notion of knowledge being infallible and thus, theory of foundationalism has collapsed.

From this standpoint, we argue that debate about reliance of IS on reference disciplines is akin to attempting to revive foundationalism theory again and thus, makes the debate irrelevant. The problem with the theory of foundations is that we do not have a criterion of what is truth. So, the notion of ultimate truth is no longer valid. We believe solution to this problem lies in de-linking knowledge from justified true belief to formulate a new notion of knowledge in an evolving field as the IS field. What we suggest is to re-interpret the definition of "justified true belief" for emerging fields. For example, one can consider truth as correspondence to facts, similar to the correspondence principle enunciated by Popper (Miller (ed.), 1985). What this means whether current knowledge in a field corresponds better to facts that it did in the past. Therefore, truth content of knowledge is determined by better correspondence to facts than ultimate truth as suggested by foundationalism theory. In the same vein, we suggest that justification should relate to the progress of knowledge in the field and its scientific character. For example, in IS field, we do not depend on justification of knowledge but on whether our methods work or whether society as a whole is progressing based on our research efforts. We judge ourselves on the basis of whether we are better off in our understanding and learning of the phenomena we observe or have we made sufficient scientific progress in our understanding of the subject matter of the field. We appeal to the subject matter of the IS field and that too in a scientific manner and we strongly believe this is what should matter and not whether we loan our theories from other disciplines.

We now respond to the criticisms arising out of comparison of the knowledge in the IS field with that in the other well-established disciplines. We posit that this comparison is unfair in the sense that the time for which the IS field has been on the horizon is very little compared to the time frame for which other fields like social sciences have been around. We find support for our contention in Davis et al. (1997) claim that IS as a field of academic study is only 30 years old or so. Davis et a. (1997) further claim that this should be kept in mind while comparing IS with the natural or social sciences and other business areas such as economics and marketing that have a strong tradition that dates back many years or may be centuries. Our second argument in response to these criticisms is that the object of study of the IS field is not so fundamental as is the case with other disciplines. For example, pure sciences attempt to provide explanations for some basic and fundamental questions while the IS field tries to explain the phenomena which are built on these fundamental phenomena or questions. So, the research methods in the IS field do not easily lend themselves to same level of evaluations as applied to these fundamental disciplines. Thus, search for some fundamental theories in the IS field may not be relevant while it may be so in other fields to analyze the nature of knowledge in the field.

Our next argument is directed toward those who doubt the nature of progress in the IS field. There are two basic questions we need to answer while examining the progress in the IS field. One, whether IS as a field has progressed over time. Inherent in this question is another one: whether there is accumulation of knowledge through the activities of different IS researchers. The second question is whether we can label this progress, if any, as scientific.

As an interdisciplinary field, IS has attempted to solve more real world problems and the soft or ill structured problems that are typical of human organizations and their use of IS/IT than creating knowledge in the field of IS. Looking at some of the frameworks developed for IS planning in organizations such as the Stages of Growth Model (Nolan, 1979) or Critical Success Factors (CSF) (Rockart, 1979) and those related to strategic data and IS planning, one can conclude that these models helped to provide contextual level normative frameworks for use of IS/IT in organizations. One another useful model in the IS field is technology acceptance model (TAM) proposed by Davis et al. (1989) which proved to be very useful to study individual technology acceptance at the time when it was introduced. Such models or frameworks were not only helpful in explaining the empirical observations made at that time but are still useful. We may not be in a position to classify these conjectures as fundamental theories in the IS field but these are useful frameworks that help us incorporate the constructs used in the IS field. The objective of these frameworks was more to address current business problems and not as much to address pure academic issues.

Over time, research in information systems management has been cross-fertilized with other business studies areas such as strategic management and more specific management themes like Total Quality Management or Business Process Reengineering. In this context, the IS progress is determined by its ability to provide an acceptable explanation of the problem it is trying to address and contribute to the existing body of knowledge. For example, Markus' findings of the study of information technology and organization have impacted research in many disciplines outside IS owing to the pervasiveness of the problem of resistance to new technologies (Lee et al. 2000). Similarly, Davenport and Short's (1990) original article on BPR has been used extensively and has been cited more than 250 times in different fields including computer science, business and management. These two examples reinforce the conception that research in the field of IS has come up with acceptable explanations for the real world problems and has the potential to generate knowledge for other research fields and communities as well. This, we believe, is a definite sign of IS progress and maturity over time. Our knowledge in the IS field is transient because our problems are transient and our solutions are transient as demonstrated by the change of scope of information systems four times in as many decades. In the IS field, we are not afraid of innovating and subject ourselves to the risk of being refuted and that is the true picture of science. Our methods are changing, as is the context of our problems and for us, knowledge in the field progresses from problem to problem as is in the true science. We observe a definite cumulative trend in technology epistemology where subsequent generations of growth in information technology are fueled by the knowledge and experience gained in previous generations. For example, generations of software programming languages depict a cumulative knowledge trend. We find a cumulative trend in IS research also. For example, formulation of models like the extended systems model and the extended enterprise model of information systems depicts the trend of capitalizing on existing knowledge base available in the field and thus, is an example of cumulative knowledge trend in the field. Based on these arguments, we contend that the progress of the IS field is scientific and cumulative in nature.

Finally, we will like to respond to criticisms about lack of coherence in the field and state of confusion in the field (Benbasat and Weber, 1996;Checkland and Holwell, 1998; Davis, 2000; Hirschheim, 1996). We contend that lack of coherence in the field is a result of lack of coherence in the subject matter of the field. Just as we mentioned that our problems are transient and so are our solutions, so coherence seems very unlikely or may even be undesirable for the field. We believe lack of coherence is a sign of ability of researchers to come up with alternative explanations for same phenomenon so that we can find better approximation of truth in the true scientific tradition. We consider lack of coherence not as a problem but as a cause of celebration, thereby, echoing the sentiments of Robey (1996). Seeming lack of coherence depicts the richness of the IS field and ability of the field to use knowledge from such diverse fields to explain the complex phenomena involving human beings and information technology, a capability unavailable in any other field.

It appears from the previous discussions that criticism of IS field is mainly centered around state of knowledge in the field, lack of well established research methods/theories and seeming lack of direction for the field as a whole. Though we have attempted to respond to some of the criticisms, we believe it would be appropriate for IS researchers to look at how the knowledge is organized in the field and identify ways to re-organize it so as to not only alleviate such criticisms but also to provide legitimacy to IS field as an independent academic discipline. From this standpoint, we will now propose an alternative framework for organizing knowledge in the IS field which has the potential to lend credibility to the field as an independent discipline. We build this approach based on Umpleby's (2002) and Nowotny et al. (1994) ideas of how to organize knowledge in the management field.

Alternative Approach for Organizing Knowledge in the IS Field

Conventionally, theories are considered the most appropriate way to organize knowledge in any academic discipline. There are two reasons for choosing theories as a way of organizing knowledge. First, theories are the ways the philosophy of science says knowledge should be constructed. Second, academics are expected to develop theories and this approach provides legitimacy to an academic discipline. Theories provide a useful framework for organizing knowledge because theories operate at either abstract or cognitive level and thus, lend themselves to generalization. From that standpoint, theories can be developed more easily in disciplines whose object of study is more fundamental as in natural sciences. In such disciplines, focus is on the phenomenon to be described using theoretical statements rather than the subject observing the phenomenon. However, for applied fields such as IS field, it is difficult to isolate the observer from the phenomenon. In IS field, we attempt to understand relationship between technology, individual and organization, so it acts a social system consisting of knowing and competing subjects. Philosophy of science has little to contribute in situations, which involve knowing subjects. From this standpoint, theories may be more appropriate to disciplines attempting to investigate fundamental or basic questions related to natural world (as is the case with natural sciences or social sciences) than those disciplines, which are trying to find solutions to the problems in organizational settings involving knowing subjects (thereby, basing their solutions on theories provided by the disciplines that investigate fundamental questions).

Using this idea, Umpleby (2002) argues in favor of structuring knowledge in the form of methods, particularly in management where a large part of the task is to achieve agreement among a group of knowing subjects on an appropriate set of actions. Umpleby (2002) attempts to answer the question whether knowledge of management should be organized as theories or as methods. His argument is based on the observation that managers in organizations have very little interest in theories but show a very strong interest in methods. So, if knowledge can be organized in the form of methods without sacrificing the scientific nature of methods of inquiry, it could form a potential alternative to established notion of organizing knowledge in the form of theories. We find this reasoning more appealing than the notion of organizing knowledge in the form of theories in the IS field. This line of logic is also somewhat similar to when Lee (1991, 1999) called for modeling MIS research based on research in professions, such as architecture and not so much on research in positivist and interpretive sciences.

Having laid the background for methods as an appropriate way for organizing knowledge, we will first try to explain what is meant by the term "methods". In natural conception of science, there are two kinds of propositions, theoretical and methodological. Theoretical propositions set forth the cause and effect relationship for the system being observed by an observer. This is what refers to a theory of a referent system. Second set of propositions, methodological propositions, specify how the observer should interact with the system observed, how should observer collect the data or test the theoretical statements. These methodological statements specify the procedures and by themselves do not constitute any scientific theory. This is what is meant by the term "methods" or more precisely, scientific method.

However, an important issue raised by the idea of organizing in the form of methods is how can someone test methods the way he/she tests theories? How can one ensure that a particular method applied by two different people produces the same result? In theoretical tests, if-then proposition are used. What this means is, if an experimenter does A, then the experimenter should observe B, assuming all other variables are held constant. However, for testing a method, Churchman and Ackoff (1950) provide a solution by suggesting use of producer-product relationship and necessary and sufficient conditions test. For example, to produce an oak tree, acorn is necessary but not sufficient. Much more like water, soil, sunlight and proper climate are also needed. What this means is one needs to ensure that conditions for a method to produce the same results if tested by two different people are not only necessary but also sufficient. Testing of methods is different from cause-effect relationship and if-then propositions tests used by most philosophers of science. This way of testing methods ensures that they retain the scientific rigor as is found in theories.

Based on the ideas of Umpleby (2002) and Nowotny et al. (1994), we extend this argument further to conceptualize organization of knowledge in two forms – Form 1 which uses theoretical propositions to describe the physical world events or systems and Form 2 which is grounded in the ways scientists interact with the physical systems or world and use that knowledge to arrive at a set of theoretical propositions, if any. From this perspective, it is evident that the Form 1 is strongly grounded in a theoretical framework and recognizes knowledge in the form of theories or abstractions while Form 2 conceptualizes knowledge in the form of methodological statements. The strength of Form 2 lies on the scientific nature of these methodological statements. This is analogous to a scientific method but not necessarily scientific theory.

We contend that knowledge in the IS field (which is not fundamental compared to other fields like the physical sciences) bears a close resemblance to the Form 2 knowledge. We conceptualize the organization of this knowledge as depicted in Figure 6.

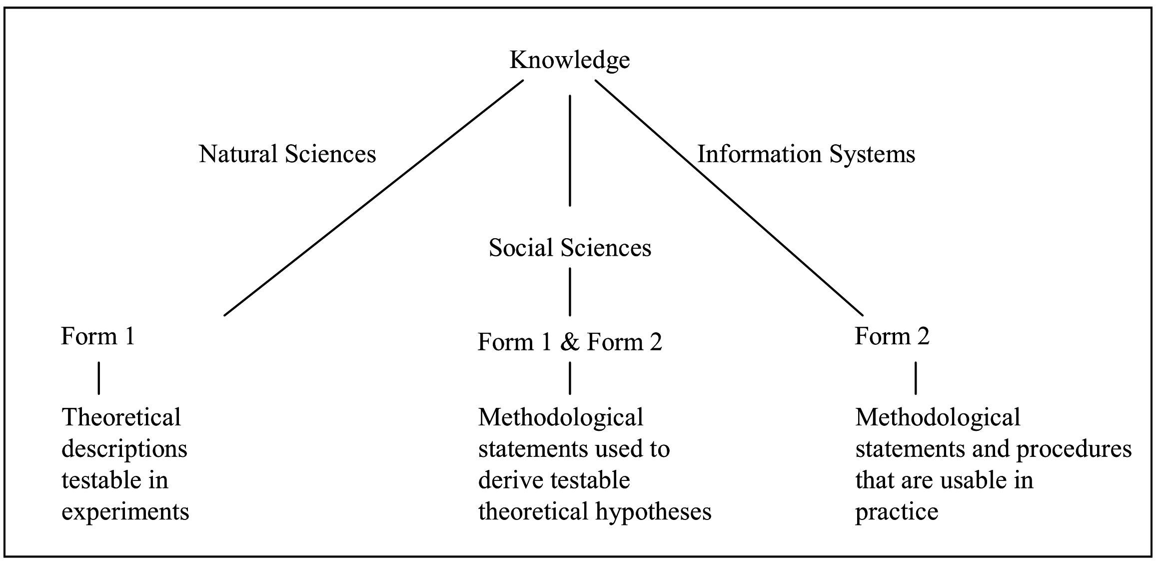

Figure 6. Organization of Knowledge (Adapted from Umpleby, 2002)

We will now discuss what the potential of the framework suggested by us is or what it has in store for the IS field? The proposed framework helps to address the criticisms of IS field on count of being not so scientific, coherent, and cumulative. In the previous discussions, we outlined how methods can retain the scientific rigor of theories by testing them along similar lines. We believe Form 2 knowledge in the form of methods is not only cumulative but also coherent. It is cumulative in the sense that it is generated through repeated configuration of human resources in flexible, essentially transient forms of organization. We see some parallels in the IS field that indicate cumulative trend in methods. For example, business improvement applications such as Business Process Re-engineering (BPR), Enterprise Resource Planning (ERP) or Customer Relationship Management (CRM) are representative of methods that help improve organizational processes. These applications owe their origin to cumulative knowledge acquired through the earlier use of technology in organization that provide directions for further improvement of processes. We believe knowledge in the form of methods is coherent from the standpoint that there is adequate quality control exercised as a socially extended process which accommodates many interest in a given application process.

This framework also has the potential to bridge the relevance gap in IS research. If knowledge is organized in form of methods, it will be more appropriate form for community of practitioners and help narrow the gap in academics and industry. The apparent biggest advantage of conceptualizing knowledge in the IS field in Form 2 is its potential to lend IS field a distinction of being a core body of knowledge to be recognized as an independent discipline. Form 2 knowledge is a valid form of knowledge since solutions to problems comprise both empirical and theoretical components and undeniably provide invaluable contribution to the knowledge. This knowledge contribution might not necessarily be to the disciplinary knowledge as is recognized currently. The debate on the nature of knowledge and the independent disciplinary status for the IS field assumes that foundational theoretical knowledge cannot be produced and sustained outside of disciplinary structure and thus assume linear model of innovation. However, in an applied field like IS, theories are conceptualized in the context of the application and that these continue to fertilize lines of intellectual advances that lie outside the disciplinary frameworks. Form 2 knowledge represents its own set of cognitive and social norms and somewhere contrasts sharply with the deeply held beliefs about how reliable theoretical and practical knowledge should be generated. However, those beliefs should not be the reason for regarding the Form 2 knowledge as either inferior or superior to that in Form 1. We must keep in mind that Form 1 and Form 2 are just two forms of knowledge and those two forms are simply different. There is a growing acceptance for this form of knowledge. Management writers such as Beer (1986) and Checkland (1981) have also knowledge in the form of methods. At present, some management schools are basing their curricula upon the idea that management knowledge should take the form of methods more than theories (Baburoglu et al. 2000).

Based on above discussion, we contend that organizing knowledge in the IS field in Form 2 provides a plausible resolution to the debate on nature of knowledge in the IS field and its status as an independent discipline. The only thing required now is for IS community to arrive at a consensus for organizing knowledge in this form and use it as the basis to strengthen its argument for an independent academic discipline status for the IS field.

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