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Structuring Environmental Scanning and Organizational Information Interpretation: An Organization-Level Contingency Model

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STRUCTURING ENVIRONMENTAL SCANNING AND ORGANIZATIONAL INFORMATION INTERPRETATION: AN ORGANIZATION-LEVEL CONTINGENCY MODEL

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Abstract

Organizational environmental scanning (OES) and organizational information interpretation (OII) are two critical organizational information processing (OIP) activities, whose importance is only intensified with globalization, intense competition and dynamic environments. This paper proposes a theoretical model in which environmental uncertainty reduction and organizational equivocal resolution are each viewed as influential in establishing appropriate governance structures for enterprise-wide OIP.

Keywords: Organization, authority, information processing, structure

Introduction

How an organization learns about its environment, how it selects and interprets information through its information system, and how it forms its information system structure to get its information processing goals supported by appropriate resources are all fundamental aspects of how an organization processes information effectively and efficiently.

From the information processing perspective, organizations are integrated by information-based decision processes (Galbraith 1977). Organization information processing (OIP) activities typically consist of several related processes that occur within an organization. These processes include gathering, communicating, and organizing information (Egelhoff 1982; Glazer 1991); interpreting and synthesizing information (Daft and Macintosh 1981); and giving meaning to collected information (Moorman 1995). In order for organizations to compete more successfully and survive in a globalized environment, nearly all the above processes need to be more effective and efficient. However, for the purpose of this paper, we are particularly interested in organizational environmental scanning (OES) and organizational information interpretation (OII).

While previous IS researchers have studied environmental scanning intensively, the majority of this work is descriptive and usually examined independent of related OIP activities, such as information interpretation (Aguilar 1967; Kefalas and Schoderbeck 1973; Hambrick 1981b; Hambrick 1982; Ghoshal 1988; Watson 1990; Ram 1993; Mohan-Neill and Indra 1995; Xu and Kaye 1995; Choudhury and Sampler 1997; Vandenbosch and Huff 1997; Raymond, Julien et al. 2001). And, while information interpretation has long been recognized as an important OIP activity (Daft and Weick, 1984), it has not been examined in IS research.

Because it has not examined environmental scanning and information interpretation in an integrated manner, the existing research literature offers scant help to, and might even mislead, managers desiring to develop holistic OIP solutions. This is particularly problematic when organizations are operating in widely variant cultural environments in which information interpretation becomes an increasingly important aspect of OIP.

By theoretically linking two key OIP activities – OES and OII -- this paper attempts to contribute to developing a more integrated treatment of OIP. Using a contingency approach, the paper proposes that environmental uncertainty reduction and equivocality resolution operate jointly in determining the structural diversity of enterprise-wide OIP systems.

Information Processing in Organization

Organizational Information Processing (OIP) Activities

OES is generally understood as an organizational activity of broadly collecting environmental information (actually, data) needed by an organization (Daft and Weick 1984). OES is a crucial element in organizational decision-making (Aguilar 1967) as effective scanning can enable an organizations to gain better knowledge regarding their many "local" environments and, hence, be able to better cope with strategic uncertainty and thus enhance performance.

In contrast, OII is usually defined as an organizational activity of translating environmental information, of developing models for shared understanding, of bringing out meaning, and of assembling conceptual schemes among key decision makers (Daft and Weick 1984). The purpose of this activity is to generate information making sense throughout the organization. Organizational scanning, in the absence of effective OII processes, is in danger of generating useless data.

The OIP process with OES and OII as its two key components can be understood by a three-stage model (shown as Figure 1) proposed by Daft and Weick (1984). Additionally, since mutual communication is needed in every step, interaction between each two of the three stages follows a retrospective and dynamic pattern.

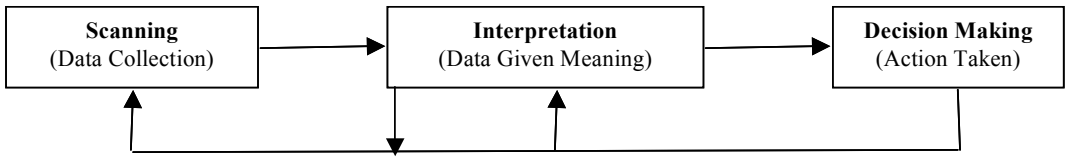


Figure 1. Relationships among Organizational Scanning, Interpretation, and Decision-making

According to the above model, OES plays a role of identifying information sources and extracting information from those sources. It is a first and necessary step by which external data flow into an organization. In comparison, OII translates and makes sense of the primitive data from OES applying existing organizational language and knowledge. Only after OII do primitive data have suitable content and format for decision makers. Essentially, OES serve as a bridge between external sources of data and an organization's decision makers, and the role of OII is to serve as gates that transform these data into meaningful (thus useful) information for decision makers. In a global context, the OES 'bridges' and the OII 'gates' are both highly localized. Data items can move through and be exchanged across none or multiple gates, data transformations executed by each gate are not necessarily meaningful to all decision makers in the organization.

OII has a particularly important influence on organization decision-making (ODM) that is often overlooked. OII provides decision makers with both data and sensitivity to these data. Essentially, OII determines what information decision makers actually work with in the process of decision-making. It is not surprising then, that the information used by decision makers reflects the perspective or understanding of the interpreters of primitive data. Whoever controls the interpretation of primitive data can influence where scanned information is sent and how much attention it receives.

Structural Arrangements for OIP

The Time Sequence Distribution of OES and OII

As Daft and Weick (1984) suggest, OES and OII occur sequentially in organizations. Normally, primitive data can only be interpreted after a scanning process captures it. This principle leads organizations to arrange their information processing

activities logically in temporal sequence. Primitive data is thus not available to decision makers until it has flowed through both OES and OII processes, with total processing time for any data item being the sum of the time spent in capturing and then interpreting it. Thus, in order for organizations to respond quickly to environmental disturbances, the efficiencies associated with both OES and OII must be enhanced and communication delays between OES and OII must be reduced. It follows that when developing their OIP capabilities, organizations need to have their OES and OII processes operating in a nearly synchronous fashion.

The separation of OES and OII by time requires organizational arrangements to coordinate the two activities. For example, firms usually have to develop a specialized knowledge base at the same time they develop a sophisticated intelligence scanning system (Xu and Kaye 1995). Traditionally, many firms located their OES and OII functions together in order to minimize OIP delays and errors. The emergence of global information networks has essentially eliminated such a structural requirement, as it is possible today to keep widely dispersed OES and OII activities operating simultaneously without temporal delays and without data errors. The necessity to coordinate these OIP activities, however, remains.

The Authority Space Distribution of OES and OII

In addition to the separation by time and geography, we note that OES and OII can be separated in authority space also. This is particularly true in a global context where the magnitude of geography and time is too large to be managed by single authority node. However, this aspect of OIP functional separation has not been given much scholarly attention.

Our consideration of the authority space dimension can be supported by both the theory and practice of organizations. In reality, OES can be performed across many locations and can involve many different organizational units. Even small businesses, for example, can employ distributed OES (Raymond, Julien et al. 2001). Similar issues arise with OII -- given that information interpreters and their audiences can be and are located across all organizations. Many multinational corporations, for example, typically allow their subsidiaries to scan and interpret their local environments in a relatively independent manner (King and Sethi 1999). From a theoretical perspective, both OES and OII need specialized knowledge, personnel, and other resources. Organizations must determine how best to arrange these scarce resources in order to perform OES and OII effectively and efficiently (Choudhury and Sampler 1997).

The consideration of the authority space dimension implies that in addition to a vertical chain model as suggested by Daft and Weick (1984), OIP can also be conceptualized as a horizontal network model. Here, physical locations and personnel become logic nodes, and distinctive distributions of OES and OII authorities across these nodes can affect organization decision-making. For such a network model, Van de Ven and Ferry (1980) suggested that the degree of centralization reflects autonomous actions of individual nodes. Centralization, here, involves two elements: the degree of participation in a process and hierarchical authority (Dewar, Whetten et al. 1980; Fry and Slocum 1984).

Centralization/Decentralization reflects the distribution of organizational resources and activities in authority space (Hage 1965; Pugh, Hickson et al. 1969; Mintzberg 1979; George and King 1991; Smith, Grimm et al. 1991; Pennings 1992; Fiedler, Grover et al. 1996; Jain, Ramamurthy et al. 1998; King and Sethi 1999). Centralization/Decentralization of OIP tends to be a major influence on OIP capacity and analyzing mechanisms (Egelhoff 1982). Organizations are challenged to devise centralization/ decentralization configurations that are appropriate for the OIP requirements of the tasks to be performed (Scott 1987). An optimum centralization/decentralization structure can enhance the effectiveness of OIP by imposing patterns and constraints on information flows to encourage needed exchanges and prevent burdening decision makers with unwanted and unneeded information (Walker and Ruekert 1987).

A Contingence Framework for OIP

Achieving congruence between the state of environment and the internal structure is seen as a common pathway to organizational effectiveness (Van de Ven and Drazin 1985; Mintzberg 1991). High performing organizations are those that have developed the capability to cope with external complexity through both differentiating their internal configurations and then successfully integrating these differentiated units (Lawrence and Lorsch 1967). It is suggested here that how an organization structures its OES and OII activities can be crucial to its ability to both effectively monitor the external environment and then interpret this monitored manner appropriately as it is input into decision making processes (Duncan and Weiss 1979).

Further, the two constructs of uncertainty reduction and equivocality resolution are posited to serve as a fundamental basis for organizational designs regarding OES and OII (Daft and Lengel 1986). Uncertainty reduction refers to the extent to which it is desired to enact specific OIP routines as a means of coping with increasing environmental uncertainty, while equivocality reduction refers to the extent to which it is desired to enact other OIP routines as a means of coping with increasing organizational equivocality.

Environmental uncertainty is defined as "an individual's perceived inability to predict [an organizational environment] accurately" (Milliken 1987). Milliken (1987) suggests that there are three types of uncertainty about environments: state uncertainty is an inability to predict the nature of the environment, effect uncertainty is an inability to predict how a future state of the environment will affect the organization, and response uncertainty is an inability to predict what the organization's response options are as well as the likely consequences of a response choice.

Although state uncertainty may be partially a function of characteristics of the environment, current understanding of environmental uncertainty emphasizes the importance of the individual perceptual process in the determination of environmental uncertainty (Lawrence and Lorsch 1967; Duncan 1972; Downey and Slocum 1975; Starbuck 1976; Pfeffer and Salancik 1978; Milliken 1987). In this perceptual process, uncertainty occurs because of a "lack . . . of information" or "an inability to discriminate between relevant and irrelevant data" (Milliken 1987). Thus, when high levels of environmental uncertainty exist, organizations tend to collect more information and strengthen their ability to identify relevant information in order to reduce uncertainty.

The concept of uncertainty reduction then refers to eliminating the lack of relevant information and is often an objective exercise involving the gathering of various kinds of information from a variety of sources (Daft and Weick 1984). The process of uncertainty reduction, as an information search process, can be viewed as an OES process. Scanning a broad range of information sources leads to accumulation of related information and improvement in reducing environment uncertainty. As managers become increasingly uncertain about environment, their scanning behavior tends to increase to enable them to identify opportunities, detect and interpret problem areas, and implement strategic or structural changes (Aguilar 1967; Jain 1984; Ram 1993).

An organization's increasing investment in OES is reflected in three distinct but related attributes: the intensity, breadth, and depth of OES. OES intensity of refers to the effort expended in OES activities across an organization during a given period of time, thus delineating both the workload associated with and the importance of OES (Menon and Varadarjan 1992). The OES breadth reflects the range in data sources accessed during OES activities. Finally, OES depth captures the fineness of measurement associated with OES. With increasing depth, data accuracy, validity and reliability would be expected to increase through the adoption of more sophisticated OES techniques. Thus, when an organization perceives that it lacks needed information or is unable to determine the relevance of available information, it will increase its intensity in OES, broaden the scope of OES, and enrich the depth of OES. For example, the organization can update its OES technology, build more industry ties with external information source or heavily invest on its R&D. This leads to our first three propositions:

Proposition 1: *An increasing need for environmental uncertainty reduction is associated with increasing OES intensity.*

Proposition 2: *An increasing need for environmental uncertainty reduction is associated with increasing OES breadth.*

Proposition 3: *An increasing need for environmental uncertainty reduction is associated with increasing OES depth.*

Information equivocality reflects the organizational reality that available data tends to be interpreted differently across the organization (Weick 1979; Daft and Macintosh 1981) because organizations are collections of distinct individuals, as well as distinct subgroups, possessing differing goals, interests, norms, values, ideologies, languages, knowledge and backgrounds. As a consequence, the differentiated (individual and collective) mental models applied when processing the same primitive data produces a variety of interpretations, i.e., information. This characteristic of OIP is inherently neither good nor bad. Positively, it enables data relevancy to be ascertained situationally, thus exploiting local knowledge in reacting to local events. Negatively, it makes it difficult to establish a global consistency in enterprise responses to the same local events. Further, excessively high equivocality can lead to unwarranted organizational confusion and conflict. Clearly, it is desirable that an appropriate balance be achieved in the global/local nature of OIP.

Equivocality resolution, when appropriate, is addressed through the development of OII systems that govern information-processing behavior among managers (Daft and Weick 1984). Equivocality resolution occurs as an organization's members collectively surface and discuss relevant issues, resolve differences, exert influence, and, as a result, establish models for shared understanding. What, then, is the functionality of an OII? It consists of complex assemblages of filtering, elaborating, condensing and assembling procedures (and rules) that input scanned data and output interpreted information.

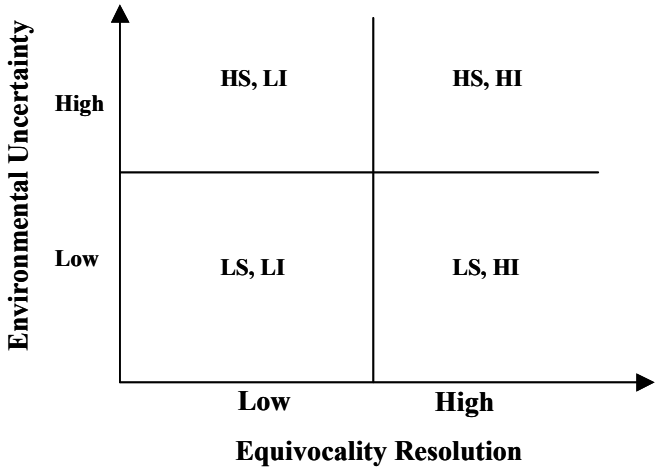
An organization's investment in OII is characterized by the same three attributes earlier applied to OES: OII intensity, breadth and depth. While intensity is defined in a similar manner (i.e., the overall effort expended), breadth and depth are conceptually different as the focus here is on the organization itself rather than on environmental data sources. The breadth of OES refers to the range of organizational subunits included in a particular OII initiative. It is a measure of the number of vertical information flow levels participating in an OII. It tells us the scope of OII across an organization's hierarchy. The depth of OII is the level of penetration within the hierarchy of the organizational subunit in terms of its nature. Interpretation of data is at a less deep level in comparison to that of organizational goals and culture. Similarly, sense making is at a deeper level than translation of language. Generally, organizations will invest more in OII in terms of time or organization resources or higher-level administrators and deeper natures of interpretation when they perceived that excessive equivocality (more serious divergence of people's opinions) exists given the desired balance in global/local decision-making. This leads to the following three propositions:

Proposition 4: *An increasing need for organizational equivocality reduction is associated with increasing OII intensity.*

Proposition 5: *An increasing need for organizational equivocality reduction is associated with increasing OII breadth.*

Proposition 6: *An increasing need for organizational equivocality reduction is associated with increasing OII depth.*

Figure 2 summarizes the arguments so far developed that related environmental uncertainty and organizational equivocality with OIP behaviors. Note not only do environmental uncertainty and organizational equivocality determine OIP behaviors that it is possible to have differentiated OES and OII requirements. As a consequence, organizational arrangements established for governing OES and OII might be distinct as well.



L: Low; H: High; I: Interpretation; S: Scanning

Figure 2. Organizational Purposes of OES and OII

Centralization/Decentralization of OES and OII

Governance arrangements for organizational activities are determined by two key elements: the location of decision-making authority regarding an activity and the extent to which members share in the activity (Dewar, Whetten et al. 1980; Fry and Slocum 1984). In the context of OIP, location of decision authority identifies who controls the processing activity (i.e., establishes processing policies and rules) while degree of participation identifies who carries out the processing activity.

Prior research suggests that OES tends to be centralized in relatively stable environments (Rueker and Walker 1987). In such environments, work tasks tend to be repetitive and, hence, requires less (environmental} information than non-repetitive tasks (Perrow 1969). A centralization of OES is preferred in such contexts because it both reduces the agency costs associated with OES and maximize OES performance (Choudhury and Sampler 1997). However, as environmental uncertainty increases, a centralized OES can become problematic because of the resource specificity, knowledge specificity, and time specificity of information scanning. Here, resource specificity of OES means specific hardware, software or other facilities that are required by OES. Knowledge specificity refers to specific knowledge about information source or information relevance. Time specificity of information scanning is the extent to which information loses value if not captured very soon after it first becomes available. Problems related to resource and knowledge specificity arise because of the difficulties in concentrating all needed OES resources and knowledge assets in one organizational unit; and, problems related to time specificity arise because it is unlikely that one organizational unit will be able to appropriately react to the "temporal importance" (Saunders and Jones 1990) of external events, e.g., the magnitude of an earthquake must be captured at the time the earthquake strikes (Choudhury and Sampler 1997). For example, it may be difficult for MNC's headquarter to find out particular information timely in another country. "The magnitude of an earthquake must be captured at the time the earthquake strikes: it will never be available again" (Choudhury and Sampler 1997).

As established earlier, higher levels of environmental uncertainty require greater OES efforts. But, again as argued earlier, greater OES efforts involve not only more intense scanning activity but also a greater breadth and depth in scanning. It has further been suggested that greater OES efforts usually require more specific scanning resources, knowledge and temporal reactivity (Xu and Kaye 1995). Organizations, thus, may prefer to decentralize their OES activities in highly uncertain environments in order to both reduce scanning cost and improve scanning performance. Jurkovich (1974) observed, for example, that decision makers in highly uncertain environments directed their attention to the act of decision making and delegated information scanning to decentralized scanning units.

Such a decentralization of OES can be enabled through two paths: providing organizational subunits with greater autonomy with regard to OES and/or allowing a greater number of subunits to participate in OES. Note that these two pathways can be independently orchestrated: an organization could feasibly …

- Retain the locus of authority for OES with a central unit but delegate responsibility for carrying out these global OES behaviors to subunits;
- Allow subunits to individually direct the behaviors of a central scanning unit; or,
- Have each subunit to independently establish and handle its own OES.

These ideas lead to two more propositions:

Proposition 7: *Increasing environmental uncertainty is associated with a greater decentralization of OES authority.*

Proposition 8: *Increasing environmental uncertainty is associated with greater participation in OES activities.*

From the arguments just developed, a decentralization of OES would be particularly suited for organizations coping with higher environmental uncertainty. But, consider the situation of a large, highly diversified multinational. Decentralization of OES can best meet the needs of OES in local environments when selecting needed information system resource or projects for OES (Jain, Ramamurthy et al. 1998). However, decentralized autonomy of OES may lead to tremendous equvocality, making it difficult to implement various standards and set up consistent interpretation across an organization. This high level of equivocality may prove problematic in coping with the high levels of inter-unit information dependency (Jain, Ramamurthy et al. 1998). But it may not

be a problem in conditions where inter-site information dependency is relatively low (Jain 1984). Therefore, from a governance perspective, the issue is not the extent to organizational equivocality but rather the extent of problematic organizational equivocality. Though considerable organizational equivocality exists in a decentralized organization, this equivocality is not problematic in the absence of inter-unit information dependencies.

From earlier analyses, a higher level of OII is needed in order to obtain consistent and shareable information (i.e. resolve the organizational equivocality). However, OII can face problems of resource specificity, knowledge specificity, and space specificity when organizational equivocality increases. Here, resource specificity of OII means specific facilities, languages, or institution resources that are required by OII. Knowledge specificity refers to specific knowledge about "frame of reference" (Cantril 1941). Space specificity of OII is the extent to which information needs to be shared across organization nodes after it is scanned. Resource and knowledge specificity of OII exist because of the potential difficulties for organizations to concentrate all needed OII resources and knowledge assets together in one organizational node. Space specificity of OII occurs because some information can only be interpreted in limited range of organizational nodes. This includes both the horizontal division range and the vertical hierarchy range. For example, interpretation of secret competitors' technique intelligence will be controlled in very limited numbers of top managers. Higher level of OII usually requires more specific interpretation knowledge and resources and can need a clearer definition of the space constraints of the interpretation. Organizations thus may prefer to decentralize their OII to reduce their interpretation cost (learning interpretation knowledge and acquiring interpretation resources, etc.) and improve interpretation performance (e.g. a more clearly defined information usage range, etc.).

Since organizational equivocality is a collective construct, effectual governance arrangements become more complex. Three OII governance alternatives exist: centralization, networked and decentralized. With a centralized arrangement, a centralized group both establishes and carries out interpretation activities. For example, many small firms usually give OII in the control of headquarters or CEO himself. With a decentralized arrangement, each local unit establishes and carries out interpretation activities in an autonomous manner. For example, since local marketing franchises know local markets better than central marketing management, their interpretation of the local market is usually authorized as a creditable interpretation for the entire firm to take actions. But, with a networked arrangement, the locus of authority for interpretation is distributed across the enterprise and a high degree of intra-unit (joint) participation is observed in interpretation activities. For example, in a very cooperative R&D joint venture, multiple units collaborate on their OII activities. This leads to our final two propositions:

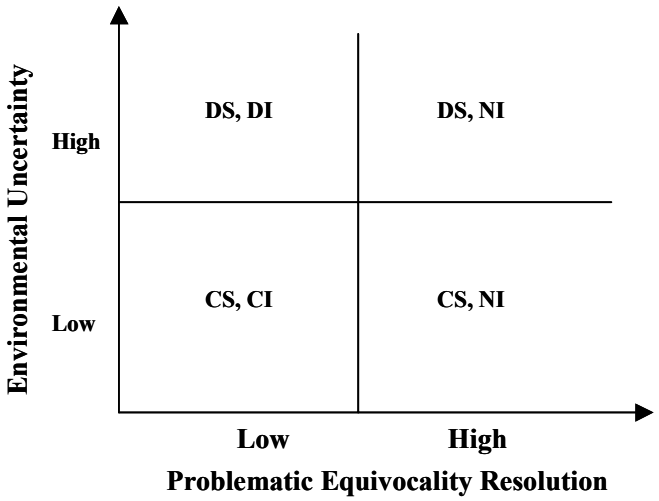
Proposition 9 *Increasing problematic organizational equivocality is associated with a greater distribution of OII authority.*

Proposition 10 *Increasing problematic organizational equivocality is associated with a greater joint participation in OII activities.*

Figure 3 provides a synthesis of the proposed governance model for OES and OII. As environmental uncertainty increases, OES resources and activities should correspondingly be decentralized. As problematic organizational equivocality increase, OII resources and activities should increasingly be governed in a networked, i.e., distributed, fashion. Under conditions of low problematic organizational equivocality, however, OII resources and activities should be organized in a manner consistent with OES resources and activities.

Conclusion

This paper contributes to our current knowledge regarding both OIP and the management of OIP. First, the paper clarifies that governance structures for OES and OII are determined by the need for environmental uncertainty reduction and problematic organizational equivocality resolution respectively. By separating the authority of interpretation from that of decision-making, this analysis suggests that interpretation, as an independent power source, can have its own authority arrangement that is different from scanning and decision-making. Second, the paper argues that distinctive governance structure may be desirable for OES and OII (and, implicitly, for organizational decision-making itself). Third, the governance constructs applied, i.e., degree of participation and hierarchy of authority, are shown to provide a sound basis for future exploration of OIP governance in complex organizational contexts. We strongly encourage further research that both deepen the theoretical analysis provided and that empirically assess the propositions offered.



C: Centralization; D: Decentralization; N: Networked, I: Interpretation; S: Scanning

Figure 3. Organizational Arrangement of OES and OII

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