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Organizational Structure

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INTRODUCTION

For many decades, organization scientists have paid considerable attention to the link between knowledge and organization structure. An early contributor to these discussions was Max Weber (1922), who elaborated his concepts of professional bureaucracy. History shows a multitude of other descriptions and propositions which depict knowledge-friendly organization structures such as the 'organic form' for knowledge-intensive innovation promoted by Burns and Stalker (1961), professional bureaucracies and adhocracies described by Mintzberg (1983), and the brain metaphor for organization structure (Morgan, 1986). Discussions on such knowledge-friendly organization structures led to many neologisms including the flexible, intelligent, smart, hypertext, N-form, inverted, network, cellular, or modular organization.

This article discusses the fundamental importance of organization structure for a knowledge perspective on organizations. This discussion involves two classes of questions. Organization structure can be studied as the backdrop against which the knowledge aspects of organizations take shape. Key questions then are how different structural configurations involve stimuli and barriers to the generation and embedding of organizational knowledge through such processes as knowledge exploration and knowledge sharing. Organization structure can also be studied from the perspective of organization design, which is the premeditated construction or change of organization structure (see Bowditch & Buono, 1985). Questions that appear then include: what are possible design interventions and how does one assess their knowledge-friendliness? The article addresses both classes of questions. Its objective therefore is: (1) to look at what defines a knowledge-friendly organization structure, and (2) to explore which interventions organizations have at their disposal when trying to achieve such a structure.

BACKGROUND

The importance of organization structure is well established in the discussions that address matters of organizational knowledge and associated concepts such as creativity, learning, or R&D activities in organization

design (e.g., Myers, 1996). Yet, in the stricter circle of studies that explicitly present themselves as knowledge management (KM) studies, organization structure plays second fiddle to issues of ICT and HRM. Organization structure concerns patterns of work relationships (a more elaborate definition of organization structure is given below). Such work relationships can be predefined (formal organization structure) or organically evolving (informal organization structure). There is a general recognition that relationships among individuals in collectives are centrally important in the organizational production of knowledge and its organizational embedding (e.g., Blackler, 1995). Several trends lend support to the idea that the perspective of knowledge workers and their work relationships should guide discussions of organization design. These trends include the increased complexity in the competitive environment, the greater pressure on innovation and proactive manipulation of markets, and the emergence of provisional structural arrangements such as in network organizations and organizational networks.

A common undertow in these discussions is that knowledge workers need the freedom or autonomy to decide for themselves when to establish work relationships. Such accounts stress that the formal organization structure can be a burden to knowledge aspects of work. They argue that organizational knowledge shows up much better in the informal organization structure (such as communities of practice, e.g., Brown & Duguid, 2001). As Teece (2000, pp. 39-40) puts it: "The migration of competitive advantage away from tangible assets towards intangible ones [forces organizations to] focus on generating, acquiring, transferring and combining such assets to meet customer needs. In order to be successful in these activities, firms and their managements must be entrepreneurial." This implies, according to Teece, that knowledge-intensive, entrepreneurial firms must have:

- flexible boundaries,
- high-powered incentives,
- non-bureaucratic structures,
- shallow hierarchies, and
- an innovative and entrepreneurial culture.

In short, the following suggestions are made for the design of knowledge-intensive forms: reduce hierarchy,

only provide the basic outline of production structure, and transfer decisions to connect knowledge worker tasks from the formal to the informal organization structure. Note, however, that loosening control for knowledge work is a disputed issue (e.g., Butler, Price, Coates, & Pike, 1998).

Many of the proposed prescriptions for building knowledge-friendly organization structures (e.g., Quinn, 1992; Sanchez & Mahoney, 1996; Miles, Snow, Mathews, Miles, & Coleman, 1997) share with Teece's prescription a 'one-size-fits-all' character. The assertion that no single organization structure can be a panacea for all management ills, which underlies several organization theories (e.g., the contingency and configurational approaches; see Donaldson, 2001), seems to be fairly broadly accepted. Nevertheless, it appears to be weakly developed where organization structures for knowledge work are concerned. When authors do introduce contingencies (e.g., Nonaka & Takeuchi, 1997; Hobday, 2000), these are usually of a general nature (e.g., complexity or turbulence of the environment, analyzability of the task, size of the firm, type of technology), and not specifically knowledge related. The characteristics of an organization's knowledge base can also serve as contingency variables, as Birkinshaw, Nobel, and Ridderstrale (2002) show in a study of international R&D. Particularly the importance of system embeddedness, which is the extent to which knowledge is a function of the social and physical system in which it exists (Winter, 1987; Zander & Kogut, 1995), emerges from their study as an important contextual variable.

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Defining Organization Structure

In order to be able to assess the suitability of specific design advice for organizations from a knowledge perspective, we need to understand the denotation of the twin concepts of organization structure and organization design. The division of labor is the key concept underlying organization structure and design. When labor is divided among people and machines, the need also arises to integrate the tasks involved. These two elements, which Lawrence and Lorsch (Lawrence, Lorsch, & Garrison, 1967; Lawrence & Lorsch, 1969) identify as differentiation and integration, are generally recognized as the building blocks of organization structure. For instance, the definition of organization structure that Bowditch and Buono (1985, p. 258) give, which combines Mintzberg's (1979, 1983) well-known definition with the approach taken by Lawrence and Lorsch, states:

Organization structure can be broadly defined as the sum total of ways in which an organization divides its tasks and then coordinates them, in essence balancing job-related specialization (differentiation) with group-, intergroup, and organization-based coordination (integration) as appropriate.

Implied in any system of job definition are the relationships among the totality of tasks. Work relationships therefore define organization structure. A work relationship exists if and when the output of one task is used as part of the input of another task. Work relationships may be distinguished by their content or form. Regarding their content, two types of relationships are commonly discerned. Firstly, relationships exist within the production process (e.g., knowledge workers using the ideas or products of others as inspiration, or input, for their work). The pattern of these relationships defines what is commonly called 'the production structure'. Secondly, relationships can be discerned which affect the definition and realization of work relationships (e.g., knowledge workers deciding for themselves or being directed by a manager to use specific outputs as inputs). The pattern of these relationships is usually referred to as the control structure. As to their form, Thompson (1967) distinguishes three types of input-output connections or—as he calls them—three types of interdependencies: pooled (one actor receives input from multiple others), sequential (one actor transforms the output of an actor before passing it on as input for a third actor), and reciprocal interdependencies (two actors use each other's outputs as input).

The organization structure seen as patterns of work relationships concerns the content side of these relationships. Addressing issues of organization structure implies an abstraction from the personal elements in these relationships, such as individual preferences for work contacts, motivation, trust, and so forth. Obviously, such factors are important in the sense that they are affected by existing organization structures. They are also critical in the sense that they codetermine the success of organizational design choices. Therefore, fully understanding issues of organization structure is not possible when these are addressed in isolation.

From this account it follows that decisions of organization design fall into two basic categories. They concern: (1) either splitting or integrating tasks within production, and (2) either separating production from control or integrating production and control. Four archetypes of organization structures then appear situated on a continuum (see Table 1). The archetype of maximal splitting within production, combined with maximal separation of production from control, defines one end of the continuum (this describes the classical Tayloristic bureaucracy with its focus on specialization within production and elaborate

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Table 1. Effects of separation, splitting, and integration of tasks on knowledge processes

	Separation of production from control	Integration of production and control
Splitting of tasks within production	Tayloristic bureaucracy: knowledge application and retention via formal routines, knowledge transfer via the hierarchy, improved retention and exploitation of explicit knowledge, possible specialization in knowledge development, problems of tacit knowledge sharing.	Professional bureaucracy designed around small cells with specialized task elements within a larger task that manage their own work and connections to other cells within their production chain (e.g., in health services): possible specialization in knowledge development, advantages of tacit knowledge sharing within the cells, but across-cell transfer limited to explicit knowledge.
Integration within production	E.g., the hypertext organization with integral tasks but separate control structures: flexible knowledge exploration within teams and exploitation within the hierarchically organized layer, but possible conflicts of transferring and connecting ideas and plans developed in the project team layer and the application of these in new business (possible clashes between innovativeness and conservatism).	The integrated team-based organization: more flexible knowledge development in connected knowledge domains, advantages of within team transfer of tacit knowledge, possible problems of reinventing the wheel by teams, barriers to inter-team cooperation and knowledge sharing.

control hierarchies). Full integration on both aspects defines the other end of the continuum (here one finds the team-based or project-based organization in which autonomous, multi-skilled work teams are responsible for their own work; e.g., Sitter, Hertog, & Dankbaar, 1997; Hobday, 2000). Intermediate positions are taken by the two remaining archetypes that combine splitting in production with integration in control and vice versa. A team-based organization becomes a network organization when decisions as to integration within production and control are not specified beforehand, but are left to individual team or network members.

An important question for KM is how different organization structures affect knowledge aspects of work. A basic way of addressing this question is to inspect how splitting or integrating in production and separating or integrating in control affect the knowledge processes within an organization (see Table 1). Splitting production into sub-functions, leading to specialization in the production of knowledge, has both positive and negative impacts on all knowledge processes (knowledge exploration, knowledge exploitation, knowledge sharing, and knowledge retention; see Hendriks & Vriens, 1999). What the effects will be depends on the criteria used for splitting. For instance, splitting according to knowledge domains or areas of expertise will stimulate knowledge exploration within these domains, but it will hinder knowledge sharing across domains. Splitting according to market knowledge, on the other hand, puts more emphasis on individual, tacit elements in knowledge. It comes with the boons of improved customer presence in knowledge exploitation and knowledge exploration. However, it also brings the risks of

impaired knowledge sharing and knowledge retention within domains.

The Tayloristic machine bureaucracy is the archetype of an organization that combines maximal splitting in production with maximal separation of production from control. This organizational form is characterized by advantages of possible specialization in knowledge exploration, by the fact that knowledge sharing takes the form of formalized knowledge transfer, and by the fact that procedures mainly address explicit knowledge, which is an important vehicle in knowledge retention.

Combining sub-functions in production, which leads to integrated knowledge in production, may in turn involve problems of knowledge retention associated with the risk of reinventing the wheel by different integrated units. Conversely, it implies combination benefits of knowledge from different knowledge domains in knowledge exploration and knowledge exploitation. An example of the archetype that combines maximal integration in production with maximal integration of production and control is that of the team-based project organization. This organizational form does not stimulate specialization in knowledge exploration, as it aims at broad employability. It focuses on mostly informal knowledge sharing via communication in teams and retains knowledge mainly through the team members. This organization type also aims to facilitate the exchange of tacit, implicit knowledge.

Blackler (1995; Blackler, Crump, & McDonald, 2000) and Lam (2000) provide examples of an alternative way to link organization structure to knowledge. They identify contingencies for organizational effectiveness as dimen-

Table 2. Structural configurations and knowledge types (Blackler, 1995; Lam, 2000)

	Focus on problems with low complexity and variability, and high analyzability	Focus on problems with high complexity and variability, and low analyzability
Focus on individual knowledge agents	<ul style="list-style-type: none"> - <i>typical organization structure</i>: professional bureaucracy, which is individualistic, functionally segmented, hierarchical; experts have a high degree of autonomy - <i>key knowledge type</i>: embrained knowledge, or knowledge of generalizations and abstract concepts - <i>learning</i>: organizations have a narrow learning focus facing problems of innovation; power and status of experts inhibit knowledge sharing 	<ul style="list-style-type: none"> - <i>typical organization structure</i>: adhocracy with its diverse, varied, and organic knowledge base, or other knowledge-intensive form - <i>key knowledge type</i>: embodied knowledge, or the tacit skills of key members - <i>learning</i>: fast and fluid learning and unlearning, but has problems of widely diffusing knowledge
Focus on collective knowledge agents	<ul style="list-style-type: none"> - <i>typical organization structure</i>: machine bureaucracy, which is characterized by specialization, standardization, control, functionally segmentation, hierarchy, seeking to minimize role of tacit knowledge - <i>key knowledge type</i>: encoded knowledge, or knowledge in documents and other registrations; a clear dichotomy exists between application and generation of knowledge - <i>learning</i>: learns by correction, through performance monitoring; unable to cope with novelty or change 	<ul style="list-style-type: none"> - <i>typical organization structure</i>: communication-intensive organization organized as an adhocracy or other knowledge-intensive form; communication and collaboration are key processes; empowerment through integration; expertise is pervasive - <i>key knowledge type</i>: encultured knowledge, shared sense-making - <i>learning</i>: the organization is adaptive and innovative, but may find it difficult to innovate radically (learning is potentially conservative)

sions of a matrix, and enter a combined description of design choices and knowledge types of individual organizations or classes of organizations in the cells of the resulting matrix. Table 2 presents the approaches of these authors condensed into a two-by-two matrix. The arguments presented above calling for openness in the production structure and flat hierarchies imply calls to elaborate the right-hand column of the table.

Designing Knowledge-Friendly Organizational Structures

We now turn to the second theme of this article, which is designing knowledge-friendly organization structures. This theme involves looking at the interventions available for defining or changing organization structures. Two different types of such interventions, or KM practices, exist with respect to the organization structure: (1) practices that involve (re)designing the basic production structure from a knowledge standpoint, adjusting the control structure to the resulting production layout; and (2) practices that involve adapting existing production and control structures to knowledge-related demands with additional interventions of organization design. The following two sections will address both types of KM

practices in more detail, under the labels of ‘basic structures’ and ‘support structures’, respectively.

Knowledge-Friendly Basic Structures

The literature describes several knowledge-friendly organization structures. Among these, the three that appear to have received the most attention are: the team-based organization, the network structure, and the hypertext organization.

Team-Based Structure

A team is generally defined as a group of people working together towards a common goal. The team concept and the associated project structure (Hobday, 2000) have a rich history in organization studies, which also includes references to knowledge work (e.g., Mohrman, Mohrman, & Cohen, 1995). Two traditions provide the most extensive exploration of team concepts (Benders & Van Hootegeem, 1999). The first of these is the sociotechnical system design approach, which focuses on self-managing teams (e.g., Sitter et al., 1997). Team concepts also play a central role in Japanese management studies, which focus on such concepts as ‘lean teams’ and ‘just-in-time’

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teams. From a knowledge perspective, the team structure involves both pros and cons. The main advantage of a team structure is that teams can be designed to integrate the knowledge needed for a particular task (e.g., a team of experts from various specialties that share the goal of serving a particular regional market). This may lead to improvements in all of the knowledge processes within the team. The main disadvantage of teams is that the cohesion they need for success erects barriers for establishing lateral linkages with other teams. This will impair cross-team cooperation in knowledge exploration and knowledge exploitation. Several authors describe structural configurations that show resemblance to the team concept, but are at best less-developed accounts of elements of team concepts. These include the cellular structure (e.g., Miles & Creed, 1995; Miles et al., 1997) and the inverted organization (Quinn, 1992; Quinn, Anderson, & Finkelstein, 1996).

Network Structure

The network structure involves the largest degree of freedom for knowledge workers to establish work relationships. The term 'network structure' is not a neatly delineated concept in organization studies, but it serves as an umbrella for several organizational forms that show similarities with or are elaborations of the adhocracy structure described above (see Thompson, 2003). The network organization comes under several names: Hedlund (1994) labels it the N-form organization ('N' for 'new'), and Quinn (1992, 1996) uses the term 'spider-web organization'. At least three elements connect the various network concepts of organizations (Hedlund, 1994, p. 83ff.). First, they promote temporary constellations that use the pool of people and their competencies as a touchstone for design. Second, they stress the importance of lateral communication networks within and among production units. Third, they see top management as catalysts, architects, and protectors. Several different variants of the network structure exist. These range from an organization which adopts a web structure to connect its own semi-permanent parts via a network organization that consists as a network of semi-autonomous organizations, to an organizational network that is built around the semi-permanent relationships between autonomous organizations.

Hypertext Organization

Nonaka (1994; Nonaka & Takeuchi, 1995, 1997; Nonaka, Takeuchi, & Umemoto, 1996) describes a structural form that combines the traditional functional structure that is associated with efficiency gains with a project-based organization, that comes with the benefits of flexibility needed for a knowledge-creating company. It is grounded

in a business system layer, which is the central layer for normal, routine operations organized as a hierarchical pyramid. On top of that layer, Nonaka identifies a project team layer for knowledge-creation activities. This layer involves the exclusive assignment of team members from different units across the business system to a project team until the project has been completed. These two layers are complementary rather than mutually exclusive. A strong corporate culture is therefore needed to combine the team-based project part of the organization with the hierarchical, bureaucratic part. This connecting culture Nonaka calls the organization's knowledge base. It involves the recategorization and recontextualization of knowledge newly generated in the other two layers. Nonaka uses the term 'hypertext' to indicate that combining knowledge contents more flexibly across layers and over time calls for the existence of dormant links between various parts and layers of the organization that can be activated when needed. This resembles the hypertext links connecting Web sites.

Knowledge-Focused Support Structures

Several mechanisms are described in the literature for improving existing organization structures from the perspective of knowledge processes. These include:

1. **Knowledge centers:** An organization may decide to assign tasks aimed at furthering the flow of knowledge processes to dedicated departments (e.g., Moore & Birkinshaw, 1998; Hertog & Huizenga, 2000). As an example, consider a library that adopts an active role of offering knowledge mapping services to further possibly fruitful cooperation based on the documents it stores. Thus, it facilitates the processes of knowledge transfer.
2. **Knowledge-centered roles and functions,** such as chief knowledge officer (CKO), knowledge manager, and knowledge broker (see Davenport & Prusak, 1998; Earl & Scott, 1999; Snyman, 2001; McKeen & Staples, 2003). The tasks involved are typically control tasks at strategic or operational levels that aim at providing knowledge workers with the appropriate infrastructure required for task completion.
3. Den Hertog and Huizenga (2000) describe several forms of **lateral knowledge linkages** between organizational units that aim to transcend the boundaries involved in the basic structure. These include the establishment of 'expertise circles' that bring together the domain specialists of several teams or other organizational units to discuss developments in that domain and exchange best practices. Pro-

grams of job rotation may also be appropriate tools to install lateral linkages.

4. Communities of practice (CoPs) and communities of interest (CoIs) are elements of the informal organization structure that, because of their organic nature, are generally recognized as important to knowledge flows. Within the domain of formal organizational design, an organization may want to use instruments that aim at *facilitating existing communities* and stimulating the emergence of new ones. As an example, consider an organization that uses project evaluation procedures as a vehicle to stimulate individuals to explore possibilities for community formation.

FUTURE TRENDS

In the discussions of organization structure, the links to knowledge have played an important role for many decades. Some of these discussions have presented themselves as KM studies, but most of them do not adopt that label. The contribution of KM studies in organization structure usually comes from two areas. The first area concerns the recognition of organization structure as a contextual factor influencing the choice and success rates of KM programs (Bennett & Gabriel, 1999; Gold, Malhotra, & Segars, 2001). The second area involves the design and implementation of concrete measures, management practices, and the like, which all involve an adaptation of the existing organization structure. KM may serve as an integrating umbrella to connect disparate thinking around knowledge aspects of organization structure. One form this integration is likely to take is through a further development of the knowledge element in the contingency theory of organizations. Many discussions of knowledge-friendly organization structures are contemplative in nature, and lack a firm basis in empirical research. Therefore, one would anticipate an increase of empirical studies which address how organizations choose among the alternatives available for making their organization structures knowledge friendly. A final trend that has become more apparent is the trend in which KM research on organization structure has increasingly turned to existing analysis models that allow focusing on relationships, such as social network theory or actor network theory (e.g., Benassi, Greve, & Harkola, 1999; Nelson, 2001; Chang & Harrington, 2003; Sorenson, 2003).

CONCLUSION

Organization structure is an important aspect of knowledge work as it concerns the establishment of work

relationships. Any organization structure will stimulate the establishment of certain relationships at the expense of others. It is important to note that flatter, fuzzier, or less structure is by no means inherently superior to crisper or more structure. Too much openness in organization structures not identifying possible work relationships may well result in limited identification and exploitation of such relationships. Too much closure introduces the risk of virtually making it impossible for specific classes of possibly productive relationships to come about. The challenge for knowledge management is to come up with the appropriate mix of design interventions which will guide individuals when they try to establish work contacts, without depriving them of the freedom they need to be knowledgeable and to continue learning. This involves a threefold challenge: (1) choosing a basic structure that honors the key elements of knowledge exploration and knowledge exploitation; (2) identifying the drawbacks of the basic structure for the flow of knowledge processes, and correcting these with the appropriate support structures; and (3) addressing the limitations of organization design with interventions from other management realms, such as human resource management.

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KEY TERMS

Hypertext Structure: Organization structure described by Nonaka, distinguishing a functionally organized, hierarchical, and bureaucratic business system layer for regular knowledge exploitation, a project layer for development work, and a knowledge base layer connecting the first two layers.

Knowledge Centers: Support structure that assigns a distinct set of knowledge-related tasks, usually within the coordination domain, to a separate department.

Knowledge-Friendly Organization Structures: Organization structures that, in the combination of their basic structures and support structures, provide an appropriate infrastructure for knowledge to gain organizational value.

Knowledge Managers: Support structure that assigns a distinct set of knowledge-related tasks, usually within the coordination domain, to an individual person.

Network Organization: Relatively loose organization form, which does not predefine all possible work relationships, but establishes these when needed.

Organization Structure: Patterns of work relationships (or task interdependencies). Production structure refers to work relationships among production tasks. Control structure refers to the hierarchical work relationships involved in coordinating production work. Informal organization structure concerns organically developing work relationships, whereas formal organization structure concerns predefined work relationships.

Team-Based Organization: Organization structure that gives a group of people responsibility for a coherent part of production, and assigns the associated control responsibilities to that group (self-managing teams).

Work Relationships: The task connections or interdependencies involved in input-output combinations: output of one task gets used as input for another. The concept of work relationships focuses on the content side to these combinations, and involves an abstraction from the personal elements in work-related cooperations.