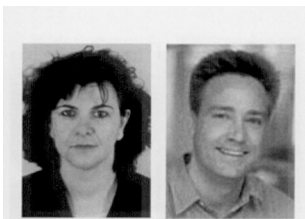


# MNCs and knowledge management: a typology and key features

Snejjina Michailova and Bo Bernhard Nielsen



Snejjina Michailova is based at the Department of International Business, The University of Auckland Business School, Auckland, New Zealand. Bo Bernhard Nielsen is based at the Department of Management, College of Business and Economics, Western Washington University, Bellingham, WA, USA.

## Abstract

**Purpose** – In the literature there is inherent lack of process-oriented, evolutionary perspectives of organizational knowledge as it pertains to international business. To fill this gap, the aim of this paper is to draw on existing theories of the multinational corporation (MNC) and integrate it with knowledge management research to analyze key knowledge management features and dynamics of different types of MNCs. The paper aims at proposing a link between types of MNCs and knowledge management strategies applied by MNCs.

**Design/methodology/approach** – The paper uses a series of examples from MNCs worldwide to propose a knowledge management based typology of MNCs and to illustrate how they exhibit different strategic dynamics related to knowledge management.

**Findings** – An important stream of literature on MNCs distinguishes between two traditional models for established MNCs, originally described as ethnocentric and polycentric models. A common theme in these studies propose that dramatic changes in the competitive environment has reduced the effectiveness of traditional MNC approaches, highlighting the need to move toward network-based structures. Building on the evolutionary perspective of MNCs, the paper suggests a third type of MNC characterized by a virtual infrastructure based on an e-business model. The paper argues that this type may be more appropriate for organizing managerial activities across organizational and national boundaries in the new web-based knowledge economy.

**Practical implications** – The paper suggests that whereas traditional MNCs invite for management interventions based on centralized economies of information, it makes more sense to manage networked MNCs as integrated learning organizations and e-business based MNCs as boundary-less virtual communities of practice.

**Originality/value** – The paper develops a new typology of multinational corporations based on key features and dynamics related to knowledge management. The paper distinguishes between traditional MNCs, knowledge networks and MNCs as e-businesses. It particularly addresses strategic, technical, organizational and human dimensions of knowledge management and how these differ in the three MNC models.

**Keywords** Multinational companies, Knowledge management

**Paper type** Research paper

## Introduction

The present and future society is based on knowledge (Bell, 1973; Drucker, 1988). Knowledge production is the most important value creating activity, not only for large knowledge-based firms, but also for society in general (Drucker, 1993; Stehr, 1994). Today, knowledge is assumed to be the key asset, the effective exploitation of which determines success for the firm. The idea about the importance of knowledge, and especially tacit knowledge, for constituting competitive advantage, organizational performance and organizational success has been put forward by, among others, Bartlett and Ghoshal (1989), Nonaka and Takeuchi (1995), Grant (1996), Spender (1996), Stewart (1997), and Chakravarthy *et al.* (2003). At the same time, knowledge production is becoming increasingly multidisciplinary and dispersed over many different organizations, institutions, and national borders (Nowotny *et al.*, 2001). Hence, it is hardly surprising that many

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managers and management scholars have proclaimed an era of knowledge management. What is surprising, however, is the inherent lack of process-oriented, evolutionary perspectives of organizational knowledge as it pertains to international business. To fill this gap, this paper draws on existing theories of the multinational corporation and integrates it with knowledge management research to analyze key knowledge management features and dynamics of different types of MNCs.

### Types of MNCs from a knowledge management perspective

The unprecedented escalation in the number of organizations that have decided to internationalize their operations in the last two decades, and the international movement of labor that has accompanied such expansion, has increased the importance of understanding knowledge management. A growing body of literature has suggested that international businesses need to create conditions for efficient knowledge sharing between headquarters (HQs) and subsidiaries as well as between subsidiaries themselves in order to build competitive advantage both at home and abroad (Haspeslagh and Jemison, 1991; Capron and Mitchell, 1998; Bresman *et al.*, 1999). More and more often the primary acquisition motive is the distinctive knowledge possessed by subsidiaries that tend to establish themselves as centers of excellence (Moore and Birkenshaw, 1998). Whether centered around the distinct knowledge base of the HQs or of the subsidiaries, it has been widely recognized that knowledge management is a key managerial function necessary for achieving competitive advantage (Grant, 1996; Probst *et al.*, 2000; Jashapara, 2004).

Market complexity as well as internal organizational trends and developments have changed the way firms organize their activities locally as well as globally, both in terms of tangible and intangible assets. An important stream of literature on MNCs distinguishes between two traditional models for established MNCs, originally described by Perlmutter (1969) as ethnocentric and polycentric models. These models essentially represent centralized and decentralized approaches to organizing and managing worldwide operations. Building on the polycentric model, Hedlund (1986) and others argued for network-based MNC models[1], characterized by an integrated worldwide strategy through globally distributed but interdependent resources and activities. A common theme in all these discussions has been that dramatic changes in the competitive environment has reduced the effectiveness of traditional MNC approaches, highlighting the need to move toward network-based structures. Building on the evolutionary perspective of MNCs, we argue for a third type of MNCs characterized by a virtual infrastructure based on an e-business model, which may be more appropriate for organizing managerial activities across organizational and national boundaries in the new web-based knowledge economy.

While previous studies have developed a rich administrative perspective on these models, one topic not adequately addressed has been investigating the process of how MNCs are linked with different managerial dynamics related to knowledge management. Investigating this process, we use a series of examples to propose a knowledge management based typology of MNCs and to illustrate how different types of MNCs exhibit different strategic dynamics related to the management of knowledge. Different models of development of knowledge management in MNCs can be identified on the basis of a number of specific features (see Table I).

The three models presented in Table I, the traditional MNC, the networked MNC and the e-business MNC, differ on a number of key dimensions. First of all, each type is based on different key assets and has a different strategic focus. Additionally, the models apply

**Table 1** Types of MNCs and their key features from a knowledge management perspective

	<i>Traditional MNC</i>	<i>MNC as knowledge network</i>	<i>MNC as e-business</i>
Key asset Focus	Information Global information management; transfer of know-how to new segments/markets and scale economies	Knowledge Global knowledge management; (re)combination and creation of knowledge and entrepreneurial empowerment to innovate	Innovation Global innovation management; instant and continuous (mobile) access to knowledge from all sources, at all times and at all places
Strategic approach	Global, emphasis on scale efficiency	Transnational, emphasis on integration of dispersed resources	Symbiotic, emphasis on synergies of knowledge and innovation
Knowledge management practice	Centralized customization of information dictated from HQ (economies of information)	Globally networked flows of knowledge dispersed throughout organization (learning organization)	Free flows of knowledge among knowledge workers, separated in time and space and connected via the Internet (knowledge synergies)
IT application	Traditional database systems, data warehouses, data mining, digital libraries, and document user interface	Business intelligence, group support systems, intranet, multimedia technology and graphical user interface	Business analytics, on line analytical process, and browser user interface
Organizational configuration	Centralized hub; divisional or matrix	Integrated network; alliances, networks, and spin-offs	Distributed system; boundary-less, fluid and <i>ad hoc</i> communities of practice
Communication patterns	One-way communication from hub (HQ) to subsidiaries	Two-way communication enterprise-wide via centers of excellence ↓	Multi-way communication industry- and cross-industry-wide
Managerial implications	Develop competitive advantage through full control of upstream value-added activities	Complex process of coordination and cooperation of dispersed interests and shared decision making	Differentiated management process based on autonomy of decision making

different knowledge management practices associated with respective different ways of applying information technology (IT)[2]. Moreover, each model differ in terms of organizational and communication configurations. The following discussion focuses on these differences and illustrates how different types of MNCs adapt different processes related to knowledge management. We argue that the different models require substantially different managerial interventions and we outline some key managerial interventions appropriate for each model.

### Knowledge management in traditional MNCs

#### *Key asset and strategic focus*

In the traditional MNC information is considered to be the primary intangible asset. Knowledge management practices are focused on centralized customization of information with the explicit purpose of transferring know-how to new markets (see Table 1). This is consistent with the global strategic, export-based internationalization approach utilized by many Japanese firms since the 1960s based on scale efficiencies in particularly the upstream value-added activities, such as product development, procurement, and manufacturing. Strategically, overseas operations are managed as a portfolio of independent businesses.

#### *Knowledge management system and IT application*

The traditional MNC utilizes IT to capture and store relevant information about employees, customers, competitors, suppliers, and institutional and organizational regulations. This

information, obtained either from the internal or the external environment, is typically stored as documents or raw data in large database systems, data warehouses or using document management applications. Those information applications provide centralized repositories of information, operational processes, expertise, or know-how generated by individuals or groups facilitating document search and distribution of knowledge. HQs act as information brokers, coordinating and controlling information flows in an effort to benefit from economies of scale on information. For instance, the top management of US headquartered Fluke Corporation, the world leader in the electronic test tools and software business with 2,400 employees in Europe, North America, South America, Asia and Australia is concerned about keeping strict control with subsidiaries in order to secure quality and compatibility of products worldwide. Subsidiaries of this company have little or no independence and very limited budgets.

#### *Organizational configuration and communication patterns*

Traditional MNCs typically have a divisional organizational structure, which does not facilitate free information flows across units and departments. An example is Dow Chemical in the early 1990s, who realized that it lacked a system for managing its close to 30,000 patents, many of which were never licensed because only the research and manufacturing departments knew about it. The business department, in charge of the commercialization of the technologies, was kept in the dark. In addition, Dow Chemical had no processes in place for creating new intellectual property that related not only to patents, but to trademarks and, more importantly, to know-how. Later on, Dow Chemical started by developing a widely accessible database to keep track of its patents and appointed a vice president of licensing to oversee the process of turning patents into revenue. In traditional MNCs HQs serve as hubs for information capturing and storage, from where learning achieved in one market can be transferred within the company in order to produce products and services for a group of related customers. In this model, the MNC is the vehicle that makes the needed hierarchical transfers for efficient utilization of fragmented knowledge, especially if the MNC is able to absorb the knowledge of the acquired firm and subsequently articulate and assimilate it. All key decisions in Fluke, for instance, are still predominantly made at HQs and knowledge is only shared with subsidiaries when HQs has agreed upon its global value. Another example of a more traditional MNC is Coloplast, a Danish-based multinational manufacturer of medical devices. Not until 1996 did Coloplast realize the disadvantages of the lack of intensive communication across departments, divisions and strategic business units and thus started the development of a centralized, structured intranet (InSite) enabling information to be captured, stored and shared across the organization. A couple of years later, the company began reporting the value-creating effects of knowledge management in the form of an intellectual capital statement.

#### **Knowledge management in knowledge networks**

##### *Key asset and strategic focus*

It is widely accepted that the major reason why MNCs exist is their ability to transfer and exploit knowledge more efficiently in the intra-corporate context than through the market (Gupta and Govindarian, 2000). Today's leading MNCs leverage knowledge in a far more networked way since the sources of competitive advantages are often to be found outside the individual firm – in the network of relationships in which the firm is embedded (Haywood, 1999; von Krogh, 2003). Knowledge has been recognized as the principal value-adding asset as firms navigate the hyper-competitive, global business environment in search of market opportunities (Delapierre and Mytelka, 1998; Seufert *et al.*, 1999) (see Table I). This may help explain the 1990s wave of strategic alliances motivated by knowledge-related objectives, such as knowledge exploration or exploitation. The rationale of these so-called knowledge-based alliances is to create synergistic effects through an efficient combination of the knowledge bases of the allying firms (Nielsen, 2005). The expectation is that the two firms' knowledge bases will broaden as firms simultaneously transfer best practices and create new knowledge-related capabilities, which, in turn, will facilitate changes in rigid and inert routines. In the networked MNC model the focus is on (re)combining and exploiting

existing internal and external knowledge in order to customize the existing product portfolio as well as creating new, innovative products and services. Strategically, this is consistent with the transnational model of multidimensional coordination of dispersed resources and shared decision-making (Bartlett and Ghoshal, 1989).

#### *Knowledge management system and IT application*

In MNCs organized as networks, knowledge is captured, codified, stored and categorized for multiple use throughout the entire organization. In order to protect vital knowledge, access is usually restricted to members of the community, however, as MNCs increasingly "trade in" knowledge with external parties, such as customers, suppliers, distributors, and even competitors, temporary access can be granted to certain parts outside the immediate community. Firms utilize a variety of IT applications, such as business intelligence systems, in order to make sense of increasing amounts of relevant information. Many of these systems are based on statistical techniques analyzing historical data in order to optimize current processes and/or predict future opportunities. The MNC as a knowledge network, thus, is based on utilizing the existing knowledge made globally accessible via multimedia technology and graphical user interfaces. In this model it is typical for the MNC to designate specific positions, such as chief knowledge officers, explicitly related to knowledge management activities. The idea is to transform corporate-level policies into operational tasks that empower local units and individuals to implement flexible and coherent solutions. In the networked model, IT is a powerful instrument assisting knowledge-related activities (O'Dell and Grayson, 1998; Ruggles, 1998). At the same time, leading companies have for long realized that system-centered approaches that are distanced from people and their practices and preferences may seriously backfire on companies' efficiency. The chemical giant Buckman Labs is well known for the way the management of the company views IT and its application as an important assisting and supporting tool for establishing and developing a strong culture of knowledge sharing. The management has realized long ago that the way technology is designed and adopted depends heavily on people's interests and perspectives. In similar fashion, Frito-Lay, Pepsico's snack food division, was aware of the fact that introducing the company's customer community portal could be a double-edged sword. Thus, management put a serious effort into making sure that the system conveys a feeling and sense of connection among employees, which has paid off in terms of retention rates.

#### *Organizational configuration and communication patterns*

Recognizing that knowledge is a product of social exchange and the need to supplement internal knowledge with access to external knowledge, network-based collaboration has become of increasing importance to MNCs (Lesser and Prusak, 2004). Hence, knowledge networks organize their activities around an increasing number of inter-organizational arrangements, ranging from strategic alliances via extended enterprise networks to federations. In addition, many firms use entrepreneurial spin-offs to pursue innovative ideas. At the core of these organizational arrangements is a desire to encourage entrepreneurship and become a learning organization by allowing for globally networked flows of knowledge. In contrast to the traditional MNC model, the need for direct lateral mechanisms between individual subsidiaries is emphasized thus avoiding MNC HQs acting as information brokers. Subsidiaries are recognized as centers of excellence in their own right (Moore and Birkenshaw, 1998), and the knowledge management systems in this model are organized around company-wide, two-way communication. The Japanese automaker Toyota is

**“International businesses need to create conditions for efficient knowledge sharing between headquarters and subsidiaries as well as between subsidiaries themselves.”**

well-known for its ability to tap into the knowledge of its suppliers and their networks as well as facilitating knowledge transfer not only internally in the organization but with its suppliers as well (Dyer and Nobeoka, 2000). Biotech-pharmaceutical alliances, now also including leading universities, represent another example where the objective is to keep the small biotech firms autonomous as entrepreneurial centers of excellence rather than acquiring them as the big Pharmas used to do during the 1980s and 1990s. Alliances are more flexible and allow for the uniqueness and innovativeness of these smaller organizations to survive – something that typically is lost if they are integrated into a larger MNC, such as Pfizer, Hoechst, or Eli Lilly.

In the modern knowledge-based network society, the main purpose for firm participation in knowledge networks is not simply to access existing knowledge, but rather to be involved in the production of new knowledge that is dispersed over disciplines, institutions, and national boundaries. This change in corporate justification for engaging in knowledge networks also calls for refocusing attention towards knowledge creating processes. The main challenge for each of the participants in the network is to contribute to and influence the ongoing knowledge production in a fashion that increases the likelihood of creating advantage for the individual participant without harming the participation in the network. By participating in networks organizations aspire to exploit knowledge synergies by taking on challenges which none of the participating organizations would have been able to meet individually. Relation-specific investment and combining resources in unique ways may lead to competitive advantages over firms who are unable or unwilling to participate in such networks.

In networked MNCs subsidiaries have a high level of independence and autonomy and they are highly unrestricted in localizing the HQs' philosophy and corporate behavior. One example of this polycentric-oriented MNC where subsidiaries to a high degree remain embedded in local relationships is the Royal Dutch/Shell corporation. Other subsidiaries act as supportive scanning units, with the purpose of creating or adopting local knowledge that later is disseminated through upstream transfers to HQs or other affiliates. L.M. Ericsson's Italian subsidiary serves as the company's global center for the development of transmission systems whereas the Finnish subsidiary has the leading global role for mobile telephones. Other subsidiaries may take on the role as integrated player, responsible for both creation of knowledge that can be utilized by other units and relying on knowledge inflows from other subunits. IBM's Japanese subsidiary, responsible for high levels of both knowledge inflow and knowledge outflow, represents an example of a subsidiary with such a role. In the networked model communication is largely informal. Nucor Steel is, for instance, known for arranging quarterly management conferences where joint problem-solving sessions include people from different functions, teams and locations are well-received and much appreciated by participants. In this way new relationships and networks get established and existing ones maintained and developed. In Xerox a lot of information and knowledge sharing is known to take place among customer service representatives over breakfast, lunch and coffee breaks. These informal gatherings were initially seen by the management as a threat to service people's efficiency and, consequently, they were prohibited. Not after long, however, they were reinstated since their importance in terms of knowledge sharing and subsequent efficiency was recognized and acknowledged.

## Knowledge management in e-businesses

### *Key asset and strategic focus*

Innovation, innovating and using innovations are key terms in knowledge management practices in companies that can be termed "e-companies" (Liataud and Hammond, 2001). The focus is shifted from products to processes; knowledge and information are useful assets only when integrated with the ability to innovate (Skyrme, 2001). As customers increasingly require tailored business solutions spanning the entire value system, MNCs will seek to create entire new markets and industries by creating the conditions for collaboration-driven innovation to flourish. The 150-year old Siemens AG is one of the companies on its way to become a global network of innovations. With 480,000 employees in

**“The challenge for managers of MNCs is to ensure that the knowledge management practices fit the respective structural configurations and communication patterns.”**

over 90 countries, the company is known for its practice of sensibly combining a rigorous, success-oriented culture typical for such a large MNC with the equally important relevance of giving individual units entrepreneurial freedom in their daily operations. Siemens' strategic goal is to emerge as a true e-business with emphasis on synergies of knowledge and innovation through a differentiated management style of autonomous decision making. Strategically, the emphasis is on adaptation and continuous innovation through distributed worldwide, systemically integrated and timely interaction, facilitated through a fluid and virtual organizational structure.

#### *Knowledge management system and IT application*

Viewing the MNC as an e-business is associated with the development of industry-wide, or perhaps even industry-defining, knowledge management systems enabling instantaneous access to multi-layered information and knowledge among relevant knowledge workers, the so-called "gold collar" workers. The pivot for this type of e-business is the internet, which becomes the central platform for e-business along the entire value system. IT applications used for this type of web-based analytic connectivity, such as online analytical processes, business analytics systems, and browser user interface, are already under development and use in cutting-edge, high-tech organizations today, however, these will be implemented in day-to-day management of MNCs in the future as the key asset becomes continuous innovation. In the e-business based model, the MNCs' knowledge base is broadened through intensive inflows and outflows of knowledge in both the HQs and the subsidiaries. Co-operation is emphasized in this symbiotic approach, where several organizations adapt and learn from the best practices of the others. Siemens' establishment of centers of e-excellence, the first of which was established in October of 2000 in Munich, is an example of attempts to build an e-business model with the internet as the central platform for knowledge exchange. Siemens is putting its entire business on a new foundation; an e-business infrastructural base, thereby transforming itself into a company whose entire value chain will be characterized by e-business. Thus, all aspects of Siemens' global value chain – from purchasing, sales, and after-sales service, to internal business and production processes, from research and development to training, and the worldwide management of knowledge and expertise – will be networked and handled electronically via web-based technologies[3].

#### *Organizational configuration and communication patterns*

The e-business model of the MNC requires organizational structural plasticity leading to the breakdown of traditional boundaries of the firm as companies will need to be capable of multiple symbiotic business models simultaneously. This is reflected in the general trend towards less bureaucratized and hierarchical structures and strong orientation towards organizing the work around flexible teams. Rather than employing people full-time on site, the e-business MNC engages, often external, knowledge workers for specific projects on an *ad hoc* basis, thereby virtually eliminating middle managers and centralized operations. These knowledge workers, who are highly skilled specialists, are separated in time and space and connect mainly via the world wide web, through which they are granted access to the information and knowledge pertinent to their particular project. Organizationally, e-businesses are structured around communities of practice (Brown and Duguid, 2000; Lave and Wenger, 1991) of knowledge-related capabilities necessary in order to create synergies of knowledge, whether these be internal or external. The following examples illustrate how different companies face structural and communication challenges typical e-players. Microsoft has developed a number of instruments that allow large teams to work

like small teams. Additionally, when promoted to managerial positions, employees at Microsoft are assigned to continue working as developers on a part-time basis in order to preserve and improve their technical expertise and skills.

British based telecommunications multinational Devonian utilizes flexible virtual teams to create new knowledge and retain relevant knowledge in the system when bidding for global projects. Hence, while local specialists are brought in as key parts of each bid team, key members of past teams are used in order to retain relevant knowledge under the management of "the major bids department". Apple Computers is known for engaging people from different units in collective decision-making. Through involving relevant input from units across the globe Apple Computers' management works systematically towards enhancing inter-unit cooperation and also nurturing personal relationships realizing that e-business may have serious negative consequences on the way people perceive and exercise trust in business. Cisco Systems is another company that has become a globally, integrated web-based "e-company". Cisco pioneered e-business during the 1990s and, as result, grew by 50 percent or more a year, leaving competitors behind. The basic philosophy at Cisco is that the speed and ease with which customers can do business with the company determines its competitive advantage. The management applies the same principle to the employees. Hence, within Cisco, all functions between employees are web-enabled. Moreover, there is a direct flow of information and knowledge between the company, its customers and its partners. Orders by customers are placed online, which automatically triggers orders from suppliers, adding to speed and eliminating the need for infrastructure. According to William H. Weber, GM of Cisco sub-Saharan Africa, internet enabling saved Cisco \$825 million on 1999 revenue of more than \$12 billion.

In the e-business model, the value of knowledge sharing and creation with the purpose of innovation is clearly communicated in various ways. One of the instruments used by management in this respect is the design of the incentive systems. At Siemens, Cisco and IBM, for instance, knowledge creation and sharing is part of the employee performance reviews and directly linked to professional advancement within the organization. Similarly, at Bain & Company the partners are evaluated each year on a variety of dimensions, including how much direct help they have given colleagues. The degree of high-quality person-to-person dialogue a partner has had with others can account for as much as one-quarter of his or her annual compensation.

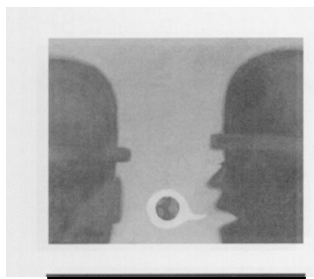
### Managerial implications

The dimensions summarized in Table I are closely related to each other. It is difficult, for example, to separate knowledge from the development of contemporary information and communication technologies and a number of authors have considered technology as an important enabler in knowledge management (O'Dell and Grayson, 1998; Ruggles, 1998). If applied with a well-defined purpose and in a culturally and financially sensible manner, groupware, databases, portals, intranets and other formal knowledge repositories and electronic networks can be used meaningfully for the purposes of knowledge creation and knowledge sharing between individuals within – or among organizations. If introduced and monitored carefully, these tools can provide powerful opportunities for learning that translates into value creation. However, one should not underestimate the fact that managing knowledge relies heavily upon social patterns, practices and processes and goes far beyond computer-based technologies and infrastructures (Davenport and Prusak, 1998; Coleman, 1998; Liebowitz, 1999). Much empirical evidence provided in relation to inhibitors to knowledge sharing tends to stress the importance of behavioral and cultural factors rather than to outline reasons associated with technology. Cautiously navigating the difficult balance between the hard-edged bits of information technology and the softly fashioned shapes of organizational behavior, interpersonal relationships and communication is a management challenge that requires much more work than it appears to be at first glance.

It is difficult to imagine effective management in today's MNCs without introducing appropriate knowledge management practices. As indicated in Table I and illustrated through the examples, different types of MNCs organize management of knowledge assets



in different ways, leading to quite different managerial implications. Traditional MNCs seek to develop global competitive advantages through centralized economies of information, whereas networked MNCs act more as integrated learning organizations. The e-business MNC is further differentiated and seeks to reap advantages from a distributed, boundary-less system of virtual communities of practice. Although each model has its advantages, depending on the competitive context, they all exhibit considerable weaknesses as well. For instance, while the traditional model lacks the dispersed knowledge flows and ability to create new knowledge due to a concentration of decision-making, the network model suffers from high costs of coordination and potential conflicts of interests in the dispersed network. Similarly, the e-business model requires sophisticated technologies and skilled employees as well as coordination of autonomous decision-making; something that may only be appropriate in certain industries. The challenge for managers of MNCs is to ensure that the knowledge management practices fit the respective structural configurations and communication patterns established and exercised within the company, as well as the competitive dynamics exhibited in the industry and context at large. Recognizing the importance of these dimensions as components of a system and carefully following the dynamics in this system is a prime challenge for management in modern MNCs. If, for instance, the structural configuration and the communication patterns pull in a direction different from the way the knowledge management system is designed and the IT applied, or if any of these elements are distant from the competitive dynamics of the industry, within which the firm is embedded, the entire system is likely to collapse. An alignment of the different elements is needed in order to secure not merely a well-functioning fit, but a positive synergy of integrating the single elements into a larger system. Only then can the effective management of knowledge become an important ingredient of sustainable competitive advantage.



### Notes

1. These models include geocentric (Perlmutter, 1969), heterarchy (Hedlund, 1986), multifocal (Prahalad and Doz, 1987), transnational (Bartlett and Ghoshal, 1989), and horizontal organizational (White and Poynter, 1990) models. Perlmutter (1969) stresses the mindset of top management, while Bartlett and Ghoshal (1989) stress structural and managerial characteristics.
2. Many researchers have found IT to be a crucial element for knowledge creation, as it facilitates collection, storage, and exchange of knowledge on a scale not practicable in the past. Moreover, a well-developed technology infrastructure integrates fragmented flows of knowledge, thereby eliminating some of the barriers to communication among departments in a dispersed organization (Davenport and Prusak, 1998; Gold *et al.*, 2001; Roberts, 2000).
3. See Nielsen and Ciabuschi (2003) for a discussion of Siemens knowledge management system.

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### About the authors

Snejina Michailova earned a PhD at Copenhagen Business School, Denmark. She is Professor at The University of Auckland Business School. Her areas of research include knowledge management (with an emphasis on organizational behavior related themes) and cross-cultural management (with a focus on Russian-Western business relationships). Her work has appeared in *California Management Review*, *Employee Relations*, *European Management Journal*, *Management Learning*, *International Management*, *Journal of Management Studies*, *Journal of World Business*, *Organizational Dynamics*, and *The Academy of Management Executive*, among others. Snejina Michailova is the European Editor of the *Journal of World Business*. Snejina Michailova is the corresponding author and can be contacted at: s.michailova@auckland.ac.nz

Bo Bernhard Nielsen is assistant professor of International Business and Strategy at the College of Business and Economics, Western Washington University. He earned his PhD from Copenhagen Business School, Copenhagen, Denmark. Dr Nielsen's main research is within management of international strategic alliances and multinational corporations with particular emphasis on the role of sociological variables and knowledge. His works has appeared in *Journal of Business Research*, *European Management Journal*, *Journal of Knowledge Management Practice, Management, Business Strategy Review*, among others. Dr Nielsen is the co-founder of Consultos.com, an innovative consulting firm specializing in strategic business development and integrated communication and brand management.

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