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Knowledge Management in the Global Food System: Network Embeddedness and Social Capital*

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Abstract: Because knowledge is becoming recognized as a strategic asset of a firm, knowledge and the management of it is emerging as a potential source of competitive advantage. This analysis focuses on the relationships among social capital and both structural and relational embeddedness. Firm strategy may involve exploitation and exploration. Significant brand equity may change the fundamental characteristics of the food supply chain to strong ties and close networks. Some specific characteristics would be relatively high embeddedness, high social capital, more easily exchanged tacit knowledge, and higher levels of trust. The food supply chain can be analyzed using the conceptual foundations of knowledge management to enrich our understanding of the food system and how it operates.

Keywords: [Knowledge management, embeddedness, food supply chain](#)

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Introduction

There are a number of events emerging that provide the incentive for analysts of the global food supply chain to better understand the complexity firm managers face relative to information and knowledge. These cascading events result in the need for enhanced flow of information and knowledge vertically within the supply chain. These events include the advent of biotechnology that has application to agricultural commodities and to food processing, the global concern about food safety, and the newest concern of animal welfare. Although these events are disparate and independent in character they all have a similar result of shifting the demand for vertical information flow in the global food supply chain.

Agricultural biotechnology has raised issues in commodity marketing subsectors relative to identity preservation and traceback as well as labeling. The need for enhanced information on numerous aspects of the production protocol, such as geographic origin or seed variety, at downstream portions of the supply chain is common (Sporleder and Goldsmith, 2001; Caswell; Hobbs and Young; Hobbs et al). The application of the technology to crop and livestock production has contributed to the need for enhanced vertical information.

Similarly, food safety concerns with 'mad cow disease' and StarLink corn add another dimension to vertical information flow within the global food supply chain. The place of origin for meat and the assurance that flour was made from sources containing no StarLink corn are specific examples of the need for enhanced flow of information from upstream suppliers to downstream

customers. More recently animal welfare concerns have raised specific issues about the transfer and sharing of information vertically within the supply chain. For example, cage space minimum requirement for chickens is now mandatory if a supplier serves certain chain restaurants (Sporleder and Goldsmith, 2002). As of March 2002 the Food Marketing Institute and the National Council of Chain Restaurants were establishing uniform industry-wide animal husbandry standards for chain restaurants and supermarkets to use in relationships with suppliers (Smith). Such husbandry practice information typically has not been collected or disseminated vertically within the supply chain.

One recent conceptualization of the vertical flow of information problem relative to these events has been to view the management problem in the context of signaling (Sporleder and Goldsmith, 2001). Managerial alternatives regarding information strategies are viewed as alternative signaling mechanisms. The choice of one mechanism over another results in the firm differentially signaling upstream suppliers and downstream customers.

Add to this mix the decreased costs of information flow attributable to advances in information technology and the liberalization of trade and financial flows. The totality of these events is shifting the basis of rivalry away from tangible assets, the traditional basis for rivalry among competitors, to a new fundamental core for rivalry based on value added and wealth creation through knowledge management (Sporleder, 2001). The management of the information and knowledge of the firm includes brands, reputations, and customer and supplier relationships. Thus, exploiting existing knowledge combined with

knowledge that is created by the firm provides a new and contemporary foundation for competitive advantage.

Fortunately these events coincide with rapid developments in the field of knowledge management. The emergence of this specialization may provide the basis for a more sophisticated understanding of the characteristics of interfirm vertical relationships within the global food system. Because knowledge is becoming recognized as a strategic asset of a firm, knowledge and the management of it is emerging in contemporary analyses as a potential source of competitive advantage (Nonaka and Takeuchi; Winter; Quinn). When knowledge becomes the basis for rivalry among firms the focus for managers turns to creating and nurturing knowledge and shielding the knowledge from imitation by rivals in an effort to gain a sustainable competitive advantage for the firm (Teece; Bontis, 2002).

Scant attention has been paid to the application of knowledge management logic to food supply chains. More typical is the analytic focus on the food supply chain or networks within the chain, for example Lazzarini, et al. This focus provides only an implicit recognition of the broader foundations for knowledge management and the expanse of the firm's intellectual capital. The next section provides a thumbnail sketch of the emergence of knowledge management as a new source of logic, capable of fostering hypotheses and analytic insights, transcending the more mechanistic view of conventional supply chain analysis.

The Emergence of Knowledge Management

Especially within the last decade there is an increasing recognition by analysts that managers of all organizations face a very general and generic issue of managing knowledge (Seemann, et al). Knowledge management is defined as a field that advances an integrated approach to identifying, creating, managing, sharing, and exploiting all of the information and knowledge assets of an organization. Knowledge management is emerging in contemporary business strategy literature as a foundation for the analysis of competition (Morey et al). The importance of skill acquisition, learning, and the accumulation of capability over time is the core of knowledge management within an organization (Nonaka; Teece).

One rather simple view of organizational knowledge management is as a process of knowledge creation and the organizational performance outcomes that result from that knowledge, Figure 1 (Soo, et al). The sources of information include networks, for both the organization and its employees, for acquiring information from internal and external sources. The model posits that networking improves the flow of information. The absorptive capacity of an individual or organization is the ability to recognize, assimilate, and incorporate information, either internal or external to the organization (Cohen and Levinthal). Absorptive capacity partially determines the use of knowledge and the quality and comprehensiveness of decision-making based on it. The model suggests that as absorptive capacity of an organization or an individual improves the more new knowledge is created (Powell et al). Finally, the model is based on the construct that knowledge creation is positively correlated with both

innovation (Nonaka) and with financial performance (Nelson and Winter). Thus, over time, innovation and improved performance are the end results of new knowledge within the organization.

In the context of a for-profit firm, managers must recognize the stock and flow aspects of information and knowledge. Organizational knowledge is composed of both intellectual capital stocks and organizational learning flows. Thus, some intellectual capital is cumulative over time. To illustrate, brands may be a portion of the intangible assets and therefore the intellectual capital of a firm. The value of brand equity at any point in time is cumulative and indeed may appreciate or depreciate in value over time.

The field of knowledge management offers a unique perspective of the firm and some analysts even advocate knowledge management as a comprehensive approach to the theory of a firm (Teece; Grant). The development of knowledge management as a field of specialization dates back only to the early 1990s. The emergence was propelled by the work of Nonaka and Takeuchi. The notion of defining a firm as a repository of resources and capabilities is a development at the core of knowledge management (Reinhardt). The most closely related prior theories of the firm include transaction cost economics and the resource-based theory of the firm, the latter attributable especially to the works of Teece. Some recent analyses have highlighted knowledge management as a part of the resource-based theory of the firm (Conner and Prahalad). In some respects, knowledge management is not so much a new theory of the firm as an expedient for highlighting knowledge as a distinct factor of production (Grant, p. 133; von Krogh and Grand).

Intellectual Capital Within the Firm

Contemporary thought is that the intellectual capital of a firm is composed of social capital, human capital, and structural capital (Seemann, et al). Some analysts include other types such as customer capital and relational capital as distinct components of intellectual capital (De Carolis). There is accord among contemporary writings that human capital and structural capital are clearly included in intellectual capital, but less harmony about other components. For purposes of this article, intellectual capital is defined broadly to include social capital, human capital, and structural capital. This definition of intellectual capital includes human and structural capital that are predominantly internal to the firm, while the inclusion of social capital adds an important external dimension to the mix. This is consistent with the increasing importance placed on networks as sources of social “knowledge” capital (Adler & Kwon; Dyer and Singh; Gulati et al). Another aspect of the differences among these types of capital is in ownership rights. Managers must recognize the ownership right differences. Structural capital is the only one of the three owned entirely by the firm. Individuals, not the firm, own human capital. Individuals may earn income from “renting” their capacity to an organization. Ownership of social capital is different from either structural or human capital. Social capital is built upon connections among individuals where none of the individuals have exclusive rights over the capital yet all share some authority, control, or influence over it.

Human capital embraces the acquired knowledge, skills, and capabilities of the individuals within a firm. Human capital has been defined as the

combination of an individual's genetic inheritance, education, experience, and attitudes about life and business (Hudson).

Structural capital reflects the systems, procedures, and processes that reside within the firm (Morey, Maybury, and Thuraisingham). As such, it includes intangibles such as intellectual property and brand names. Intellectual property can include process and product technology or know-how, licenses, trade secrets, or other agreements that have commercial value. Intellectual property is a distinct subset of the broader category of intellectual capital. Intellectual property is the intangible asset portion of a firm's balance sheet and is only a portion of the totality of intellectual capital that a firm possesses.

Social capital lacks a precise definition but unmistakably embraces the notion that a web of relationships by individuals within the firm and the firm itself is a valuable resource. Much of this capital may be entrenched in networks or other acquaintance and recognition relationships. The measurement of social capital is difficult, although some contemporary analyses devote effort toward defining metrics of social capital (Bontis). For purposes of this article, social capital is viewed broadly as the capacity to collaborate (Morey, Maybury, and Thuraisingham). It is explored in more depth in the next section.

Social Capital

The recent management literature concerning social capital centers upon the characteristics of relationships and networks, the influence of these characteristics on information flow and exchange, and the implications for competitive dynamics.

Within the evolving definition of intellectual capital relationships is the foundation for the collaborative capacity viewed as social capital.

This paradigm generates a new theory of the firm as a social community or knowledge system capable of generating information. As such, firms have unique advantages over other forms of institutional arrangement in their capability for creating value through new intellectual capital (Nahapiet and Ghoshal). Nahapiet and Ghoshal further suggest that social capital facilitates the creation of intellectual capital in that social capital influences the conditions necessary for the combination and exchange of existing explicit or tacit knowledge resources. This is because access and use to the diversity of knowledge provides for experimentation of novel recombinations of asset use to which Schumpeterian innovations of “new ways of doing things” are introduced (Ng). The creation process has a structural dimension (e.g., network ties which provide access to resources, and “who you know” influences what you know), a cognitive dimension (e.g., shared language, metaphors and paradigms), and a relational dimension (e.g., trust, social norms, and group identification).

The study of networks has likewise evolved to consider the influence of cooperative relationships among firms on competitive behavior. First, the dimensions of the knowledge creation process explained above expand to analysis of business and social networks through the concepts of relational and structural embeddedness (Gulati; Rowley, Behrens and Krackhardt). In the network view, a firm’s external resources are fundamentally important for strategy (i) as external conduits for internal capabilities, (ii) for generating external economies from the complementarities of internal resources and network-derived capabilities, (iii)

because the return on internal resources may be mitigated or enhanced by network structure, and (iv) a firm's participation or position in a network may facilitate development or acquisition of new capabilities (Gnyawali and Madhavan).

Network embeddedness, encompassing both structural or relational, can in turn influence the “net” result of a firm's interfirm relationships and can affect the design and implementation of strategy relating to quality signaling in supply chains (Sporleder and Goldsmith, 2001). Analysts agree that firms better connected in their networks have a competitive advantage over firms that are not; however, debate continues over the precise meaning of “better connected” (e.g., Rowley, Behrens, and Krackhardt).

Furthermore, the type of social capital that best generates competitive advantage may depend fundamentally on the competitive environment. For example, firms engaging in knowledge exploitation, versus exploration, may require more specific know-how that is best procured from dense network structures (Rowley, Behrens, and Krackhardt). In contrast dense networks may cause firms to be “collectively blind” to new information and alternatives (Nahapiet and Ghoshal).

Contemporary agricultural economics literature indicates that relationships among firms or individuals who transact are fundamental to industrialization in the food system (Robison, Schmid and Barry). As such, understanding the roles of trust and social capital is requisite to the economic interpretation of industrialization and its implications. Social capital is thought to possess capital-like properties not unlike the physical, financial, and human

capital typically modeled by economists. Further, it satisfies our human need for socio-economic goods. For example, some current consumers care about animal welfare in the production of a food product in addition to the product's sensory attributes in consumption. These situations challenge analysts to explore more sophisticated models that are necessarily divergent from the self-interest oriented neoclassical paradigm.

Hybrid forms of governing transactions in the food system (such as strategic alliances, joint ventures, and contracting) remain as influential as Williamson's (1985) pure forms of market and hierarchy. All forms use individual incentives, authority or monitoring mechanisms, or a combination of both to ensure the minimization of transaction costs. However, social capital can be viewed as another means of assuring transaction cost efficiency in that actual mutual interests mitigate or eliminate opportunistic behavior (Peterson, Robison and Siles). In other words, investments in social capital may be an appropriate response to risk in an increasingly coordinated food system (Robison, Schmid and Barry).

Social capital "premiums" are measured by agricultural and applied economists in the reservation price for a used car (Robison and Schmid), sales of farmland (Siles et al), employee acceptance of catastrophic risk (Schmid and Robison), farmland lease preferences (Gwilliam), farm loan approvals by banks (Siles, Hanson and Robison), and customer retention by commercial banks (Schmid and Robison). Empirical evidence suggests unequivocally that relationships matter in that they significantly alter the terms of trade.

The current status of social capital research suggests a shift away from theories of the firm that derive from human opportunism and market failure to a more positive framework in which the capabilities of firms in creating and sharing knowledge are central. Within this new framework, the co-evolution of social and intellectual capital is the driver of organizational advantage. Performance differences among firms may derive from differences in capabilities to generate and exploit social capital. However, the link to innovation, where innovation is defined as invention plus exploitation (Roberts), remains tenuous. Current models admittedly concentrate on knowledge creation and rarely extend to the exploitation of new intellectual capital.

Network Embeddedness

Business networks are interfirm relationships developed by agents of a firm. Granovetter introduced the concept of embeddedness within a social context. However, business analysts quickly recognized the broad applicability of the concept and utility to business relationships as well. Embeddedness is the interdependency that develops over time from a myriad of interfirm relationships. Such networks exhibit both social and historical dependence (Halinen and Tornroos). Networks also are thought to cause asymmetric information and asymmetric resource availability among firms within a supply chain (Granovetter; Burt). The concept of temporal dependence as a factor in managerial decisions enriches the understanding of the firm decision process. In a sense, embeddedness has potential explanatory power for the development and the dynamics of business networks.

Two types of network embeddedness commonly cited by analysts include structural and relational (Gulati). Structural embeddedness is based on interfirm vertical linkages within a supply chain (Baum and Dutton; Darcin, et al). Structural embeddedness captures the impersonal relationships and linkages among people and businesses. The aspects of structural embeddedness include network ties across agents in terms of the density, connectivity, and hierarchy. Structural embeddedness influences the choice set of managers because firms are embedded in a web of relationships within a vertical network. This dynamically influences competitive behavior of the firm and its rivals (Gnyawali and Madhavan).

Relational embeddedness captures the more personal relationships that people have with one another that typically are developed over a long period of time. Characteristics such as respect, friendship, and sociability are cited as aspects of this dimension (Nahapiet and Goshal). Relational embeddedness is a dimension of the larger stock of social capital enjoyed by individuals or an organization. Some argue that strong ties among vertically allied firms, such as vertical strategic alliances, produce trust-based governance and lead to mutual gain in a comparatively efficient manner (Sporleder, 1994). Of course, there are costs in forming and maintaining strong ties so the optimal configuration for a firm is a provocative and open question. To complicate matters, some analysts argue that the interaction between structural and relational embeddedness is an important predictor of firm performance outcomes (Rowley, Behrens, and Krackhardt).

Implications for Food Supply Chains

The application of the logic underlying network embeddedness and the performance of supply chains and food firms within the global food system is challenging. Stylized facts suggest a domestic food system characterized by a plethora of new food products, about 9,700 in 2001 alone, competing for limited retail shelf space. Other aspects of the food supply chain include a relatively large number of transactions, significant exploitive innovation, and a high degree of new product failure. In fact, U.S. information suggests a new food product success of only about 1 in 3 (Harris). How firms should be embedded in vertical networks to optimize on these environmental characteristics to achieve a knowledge-based sustainable competitive advantage remains a complex management challenge.

The closure and structural hole forms of social capital suggest different relationships between network embeddedness and firm performance (Rowley, Behrens, and Krackhardt). The closure argument suggests that firms situated in dense networks have a competitive advantage over firms in less dense ones due primarily to collective social capital. The structural hole view would counsel managers to embed firms in a sparse network of unconnected agents. Network analysts attempt to reconcile these apparently divergent perspectives by suggesting that the true prescription depends fundamentally on the nature of the competitive environment and the firm's strategic purpose within it. Specifically, the extent of environmental and/or industry uncertainty influences the degree to which the firm is necessarily engaged in exploration of new innovations versus exploitation of existing knowledge (Rowley, Behrens, and Krackhardt).

These relationships have been explored in industries such as steel production and semiconductor manufacturing, where the steel industry is characterized as one of exploitation and semiconductors as one of exploration. Despite the theoretical implications, empirical results demonstrate little support for the influence of network density (i.e., structural embeddedness) and firm performance suggested by either the closure or structural hole arguments (Rowley and Baum). However, the effect of interconnectedness is dependent on industry context and may provide useful insight for food industry analysts.

Using reasoning based on knowledge management, the food industry in the United States arguably could be characterized as consisting primarily of weak ties-- the relational embeddedness dimension, and sparse networks-- the structural embeddedness dimension. As such, the typical characteristics of the supply chain would be firms that have relatively low embeddedness, low social capital, have low redundancy, relatively low levels of trust, and tacit knowledge that is difficult to exchange. The relatively less dense networks in food supply chain suggest an industry paradigm resembling the steel industry.

An intriguing part of this is the intellectual capital, particularly in the form of brand equity, and the potential difference it makes to a firm in terms of relational and structural embeddedness. As a firm gains food product category-leader brand names, usually recognized globally (known in the trade as 'category killers') such as Coca-Cola or Nescafé, the relational and structural embeddedness dimensions are likely to be quite different compared with similar firms lacking such brand equity. This appears true particularly of the relationships among food manufacturers and food retailers. A Forbes magazine

article reports that the chief executive at Kraft dedicates two days per month for discussions with top-level executives in Wal-Mart and Albertson's (Forbes, April 15, 2002, p. 138). Access to and face time with top management of large retailers increases dramatically when the food processors possess significant brand equity, enhancing both structural and relational embeddedness. The same Forbes article reports that a "buddy relationship" began in 1985 between Procter & Gamble (P&G) and Wal-Mart. This relational embeddedness eventually developed into food product category management, so that over time P&G was trusted by the retailer to manage retail shelf space for *all* brands in a particular category, not just their own.

These stylized facts suggest that accumulated intangible assets, in the form of category-leading brands, change the fundamental characteristics of the supply chain to strong ties and close networks. Some of the specific characteristics would be high embeddedness, high social capital, more easily exchanged tacit knowledge, and higher levels of trust, and thus, may mitigate opportunistic behavior in supply chains.

Consolidation has been experienced in both food manufacturing and food retailing in the United States over the past several decades. Consolidation facilitates the transition from weak ties with sparse networks to strong ties and close networks. Much research remains before the stylized facts presented here are tested and before implications for food firm performance become clear.

Summary and Conclusions

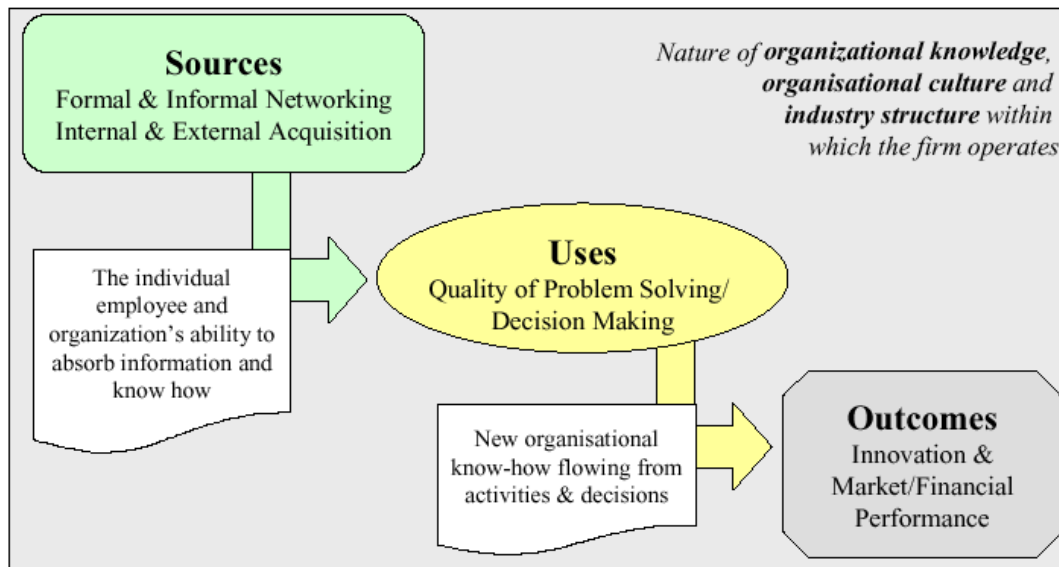
The paramount conclusion may be that the food supply chain can be analyzed using the conceptual foundations of knowledge management to enrich our understanding of the food system and how it operates. There are numerous novel constructs in the emerging field of knowledge management that may prove useful in the quest for an improved understanding. Events are buffeting the food supply chain that demand increased vertical flow of information. As these demands are met, comprehension of knowledge management, embeddedness, and social capital may become valuable foundations that enhance our analysis and provide new means of assessing vertical relationships and supply chains that simply would not be cogent to more traditional approaches.

Because knowledge is becoming recognized as a strategic asset of a firm, knowledge and the management of it is emerging in contemporary analyses as a potential source of competitive advantage. This analysis focused on the relationships among social capital and both structural embeddedness and relational embeddedness. The first issue was to define knowledge management and a general approach to the subject. Knowledge management as an emerging area also is related to two other more mature theories of the firm—transaction cost and resource-based theories of the firm.

The analysis here also relies on a clear distinction between the broader concept of intellectual capital and the narrower concept of intellectual property. Firm strategy may involve exploitation and exploration. Managing innovation implies the creation and commercialization of new knowledge. The majority of firms in the food industry supply chain in the United States arguably could be

characterized as having weak ties-- the relational embeddedness dimension, and sparse networks-- the structural embeddedness dimension. As such, the typical characteristics of such a supply chain would be firms with relatively low embeddedness, low social capital, low redundancy, low levels of trust, and tacit knowledge that is difficult to exchange. However, significant brand equity may change the fundamental characteristics of the supply chain to strong ties and close networks. Some specific characteristics would be relatively high embeddedness, high social capital, more easily exchanged tacit knowledge, and higher levels of trust, and thus, may moderate opportunistic behavior in supply chains.

Figure 1. A Model of Organizational Knowledge Creation and Performance



Source: Soo et al, 2001, p. 4

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