Knowledge Sharing in an Emerging Network of Practice

The Role of a Knowledge Portal

van Baalen, P.J.; Bloemhof-Ruwaard, Jacqueline; van Heck, Eric

Publication date
2005

Published in
European Management Journal

Pergamon

European Management Journal Vol. 23, No. 3, pp. 300–314, 2005

Printed in Great Britain
0263-2373 $30.00

doi:10.1016/j.emj.2005.04.008

Knowledge Sharing in an Emerging Network of Practice: The Role of a Knowledge Portal

PETER VAN BAALEN, *Erasmus University, Rotterdam*
JACQUELINE BLOEMHOF-RUWAARD, *Erasmus University, Rotterdam*
ERIC VAN HECK, *Erasmus University, Rotterdam*

This article addresses the emergence of networks of practice and the role of knowledge sharing via knowledge portals. Its focus is on factors that stimulate the successful emergence of networks of practice. Literature on knowledge management and communities of practice suggest the pre-existence of shared knowledge or a shared belief system as a condition *sine qua non* for the networks of practice to emerge. We challenge this assumption and argue and demonstrate that common knowledge and belief systems are rather a result of knowledge sharing rather than a pre-condition. The central question is how a knowledge portal facilitates the diffusion of knowledge among rather loosely coupled and often disconnected innovation projects. Research is carried out in the agricultural industry in The Netherlands. In this industry there is a need to change from a product-oriented to a problem-oriented innovation structure. The set up of a platform and knowledge portal around agro-logistics – crossing different product-oriented production clusters – was therefore a logical result. It gave the opportunity to analyze what the impact of a knowledge portal is in a situation where people and projects come from different organizations and do not know each other. Do they start to share knowledge and what are the conditions? With regard to the case study of the knowledge portal in the agricultural industry we conclude that a knowledge portal will have an impact on how projects are sharing knowledge and on the emergence of a network of practice. The results show that pre-conditions for the emergence of a network of practice are a sense of urgency and fragmented awareness. These results also indicate the important role of a knowledge broker. The developed knowledge portal seems to lead to overcoming structural holes and a closer cognitive distance among the projects. However, we did not find a direct effect of the knowledge portal on sharing tacit knowledge. In the initial phase of a network of practice the knowledge exchange seems to focus on general, non-project specific and explicit knowledge. There was also no direct effect of the knowledge portal on the reciprocity of knowledge exchange among the projects. However, knowledge was shared between the project level and the platform and public level. Conclusions and directions for future research are formulated.

Keywords: Agro-logistics, Innovation projects, Knowledge portal, Knowledge sharing, Network of practice, Social networks

Introduction

The diffusion of innovative knowledge is considered to be one of the main challenges in the emerging

knowledge society. As this innovative knowledge is distributed and fragmented, Internet-based information and communication technologies can help to leverage the knowledge diffusion. These technologies can easily connect distributed and loosely coupled 'pockets of innovation' and diffuse relevant information at high speed and at relatively low costs, see Tuomi (2002).

For this reason a platform of representatives of government, industry, and knowledge institutes in The Netherlands, the so-called *Platform Agro-logistics*, initiated the setting up of a knowledge portal in order to facilitate and speed up the diffusion of innovative knowledge in the agricultural industry. The set-up of this knowledge portal in the Dutch agricultural industry should be considered as an innovation itself. For many years this industry was characterized by a closed and hierarchical knowledge infrastructure in which the government dictated the research themes to the agricultural knowledge institutes. The research results were disseminated and communicated to the agricultural companies who were expected to apply this new knowledge in practice. But recent disasters such as the outbreak of animal diseases such as BSE showed the limits of this approach and new ways of innovations were explored.

In this paper we consider the diffusion of innovative knowledge as a form of collective action that requires social (collective) organization. It implies that the knowledge diffusion is viewed as an interactive process including the involvement of different collective actors.

The research question we address here is how a knowledge portal facilitates the diffusion of knowledge among rather loosely coupled and often disconnected innovation projects. Although the knowledge portal can easily connect these disconnected projects and thereby facilitate knowledge diffusion we will argue that a minimal social organization is needed to initiate this diffusion process. Literature on knowledge management and communities of practice suggest the pre-existence of shared knowledge or a shared believe system as a condition *sine qua non* for the networks of practice to emerge, see for example Cohen and Levinthal (1990), Nonaka (1994), and Grant (1996). We challenge this assumption and argue and demonstrate that common knowledge and common belief systems are rather the result of knowledge sharing instead of a pre-condition. The aim of this article is twofold. The first objective is to conceptually describe the emergence of a network of people and groups that do not share knowledge and beliefs at the initial situation. The second objective is to empirically show how this network emerges and evolves and what factors contribute to the successful emergence. It implies that we do not assume the existence of a particular form of a social network (e.g. community of practice) in advance, but will view this as the outcome of network evolution.

Research was carried out in the agricultural industry in The Netherlands in particular the set up of innovation projects around themes related to agro-logistics, see Ministries of LNV and V&W (2001). Agro-logistics deals with the logistics e.g. transportation, storage, and distribution of agricultural products. The answer to the above question was sought in a case study approach. The case study provides a basis upon which theoretical propositions are formulated and generalized (so called analytic generalization), see Yin (2003). The choice of the case setting made it possible to analyze how a network emerges and how people and groups – that did not know each other – started to share knowledge. The case study let us closely track the design and use of a knowledge portal that could facilitate knowledge sharing among different innovation projects.

This article is divided into three main sections. First, a literature review of knowledge sharing in networks and the role of knowledge portals is developed into a conceptual framework, complemented with six propositions. Second, the empirical setting in the agricultural industry with research method and data will be explained. Third, an empirical analysis of the case of the knowledge portal in the agricultural industry will be presented. Lessons learned, conclusions, and suggestions for further research are formulated.

Literature Review and Conceptual Framework

Knowledge Sharing

The diffusion of innovative knowledge has become one of the major research interests in management science and economics. A huge body of literature focuses on innovation as a ''thing'' about which information needs to be provided to potential adopters and users in order to implement this innovation successfully (Swan *et al*., 1999: 262). As knowledge has become to be seen as an innovation in itself new, critical questions arise how to define knowledge and how innovative knowledge can be diffused. Since the former question has been discussed extensively in the recent management literatures it suffices to discuss it briefly here. Since the publication of Nonaka's seminal paper ''A dynamic theory of organizational knowledge creation'' the complex distinction between explicit and tacit knowledge has been widely accepted (Nonaka, 1994). The issue is not if there exists such a distinction but how to understand the complex relationship between explicit and tacit knowledge. Roughly, two different views can be distinguished in this debate: the 'near tangible view' and the distributed view on knowledge (Tsoukas, 2003). In the former view it is assumed that explicit and tacit knowledge can be converted to each other (Nonaka, 1994; Nonaka and Takeuchi, 1995). This view suggests that knowledge, by means of articulation,

can be called upon for use in reasoning and can be translated into language and other media (Winograd and Flores, 1986: 73). In the distributed view it is believed that tacit knowledge is a component of all knowledge and as such cannot be converted into explicit knowledge. Tacit knowledge is not internalised explicit knowledge, nor is explicit knowledge externalised tacit knowledge. In viewing ideas as objects that can be extracted from people and transmitted to others over a conduit, Nonaka and Takeuchi reduce practical knowledge to technical knowledge. According to Tsoukas (2003) tacit and explicit knowledge are complementary, in the sense that explicit knowledge is always grounded on a tacit component and *vice versa*. Tsoukas further criticizes the notion of knowledge as a given or something that is to be discovered. The organization is a distributed knowledge system and cannot be surveyed as a whole; it is lacking an ''overseeing mind''. Similarly, Winograd and Flores argue that articulation of the unspoken is a never-ending process, as we must do it in a language and a background that itself reflects a pre-understanding. ''Knowledge'', as they put it, ''is always a result of the interpreter, which depends on the entire previous situation and on its position in a tradition (1986: 75). Thus knowledge has an important tacit component, which resides in individual skills, understanding, collaborative social arrangements, but also in tools, documents, and processes that embody aspects of knowledge (Wenger *et al*., 2002: 11). As these skills and social arrangements are related to work activities we will call them *practices* (Szulanski, 2003). This view contrasts the 'near tangible view' as it suggests that any form of explicit knowledge assumes the existence of tacit knowledge that cannot be articulated. As a consequence, the transfer of innovative knowledge from one practice to another will become problematic. Disembedding knowledge from one practice and re-embedding this knowledge into another practice does not go without any costs. Von Hippel has coined the concept of ''stickiness'' of knowledge to refer to the incremental costs to transfer knowledge from one practice to another (Von Hippel, 1994: 430, see also Szulanski, 2003). When transfer costs are low, knowledge stickiness is low; when it is high, knowledge stickiness is high. Both Von Hippel (1994) and Szulanski (2003) point to the fact that the stickiness of knowledge involves not only the complex epistemology of knowledge, but also attributes of the knowledge source, the knowledge recipient, and of the context. When the knowledge source and the knowledge recipient share the same context and are engaged in the same practice, the stickiness will be relatively low, whereas the transfer cost will increase when the knowledge source and the knowledge recipient operate in different contexts and are engaged in different practices.

Knowledge transfer within and between organisations is not a one-way activity, but a process of trial and error, feedback, and mutual adjustment of both the source and the recipient of knowledge (Von Krogh, 2003: 373). This mutuality in the knowledge transfer suggests that the process can be construed as a sequence of collective action in which the source and the recipient are involved (Von Krogh, 2003: 373). For this reason we will use the term *knowledge sharing*, instead of diffusion and transfer, as it succinctly refers to the social processes that are involved. Sharing knowledge is not giving a full representative account of what is known by the source about a particular practice to the recipient. Because of the tacit component, knowledge contains an ineffable element; it is based on an act of personal insight that is essentially inarticulable. Tsoukas argues that this does not mean that we cannot share knowledge about a practice, but it should be viewed as re-punctuation of distinctions underlying the practice, as drawing attention to unnoticed aspects and as making people aware of new connections (Tsoukas, 2003). The stickiness of knowledge sharing does not only refer to the epistemological but also to the relational problems. According to Szulanski (2003) people on the source side may be reluctant to share their knowledge with others for fear of losing ownership, a position of privilege, superiority, for the lack of insufficient rewards, for lacking time to communicate about an innovative practice. Another reason can be that people are unaware of the fact that their knowledge might be of interest to others. On the recipient side important factors like the reluctance to accept new knowledge from an external source ('not invented here'-syndrome), the inability to exploit outside sources of knowledge (absorptive capacity), an inability to retain the newly acquired knowledge in the organization, increase the stickiness of knowledge sharing.

Emergence of Networks of Practice

The sharing of knowledge requires social organization and governance. Traditional organizational forms (markets and hierarchies) show serious deficits in organizing the complex nature of knowledge (Jones *et al*., 1997). For this reason new organizational forms are introduced to deal effectively with the sharing of explicit and implicit knowledge. The community of practice concept, introduced by Lave and Wenger (1991) and transferred to the management domain by Brown and Duguid (2000), represents probably one of the potentially most useful and enduring concepts in this respect. Most definitions of communities of practice (CoP) stress the importance of *shared* practice, repertoire, interests, knowledge, on informality, and on the self-organizing character of the community. Recently, Brown and Duguid (2000) have distinguished two types of networks, networks of practice (NoPs) and communities of practice (CoPs). In the former, people have practice and knowledge in common but are mostly unknown to each other. The links between the networks are mostly indirect (e.g. databases, newsletters, info bulletins) and members coordinate and communicate normally explicit. NoPs can have an

enormous reach. There is relatively little reciprocity across NoPs as the members do not interact directly. NoPs are loosely coupled systems that hardly initiate collective action and produce little knowledge.

CoPs on the other hand represent relatively tight-knit groups of people who know each other well and work together directly. Online communication is often supported by face-to-face interactions, which enable them to coordinate and communicate to a high degree on implicit knowledge. Due to these face-to-face relationships the communication reach is bounded. CoPs are characterized by strong reciprocity norms which help to sustain the community.

Although the distinction between CoPs and NoPs seems to be clear at the surface level, it is hard to determine precisely in advance if the social collective should be conceived as a CoP or a NoP. We suggest that both, CoP and NoP, are particular forms and therefore suggest taking the social network as the starting point for our analysis and conceive CoPs and NoPs as particular forms of social networks. A social network can be defined as a patterned organization of a collection of actors and their relationships (Jones *et al*., 1997). It is important to note that in this minimal definition no specifications are given about the nature of the actors and their relationships. According to Wellman and Gulia (1999) this implies that even when people are only connected through a computer network, they should be conceived as a social network. We don't agree with this minimal definition because if no interaction takes place one cannot speak of a social network. The collection of actors should contain more than two actors to be defined as a network. Triadic relationships differ fundamentally from dyadic relationships because in the former 1) individuality is reduced; 2) the individual power is reduced; 3) and conflicts are moderated by the presence of a third party. We can add to this definition two other characteristics (Podolny and Page, 1998). The first is that the collection of actors pursue repeated, *enduring exchange relations* with one another. If exchanges are not enduring but episodic - engaging in an incidental transfer of goods, services or information - there is no social network but a market situation. The second is that social networks lack a *legitimate organizational authority* to arbitrate and resolve disputes that may arise during the exchange (as is the case in hierarchies). Based on these characteristics a network can be viewed as a social exchange structure with its own governance structure and patterns of interaction in which flows of resources between independent units (or individuals) take place.

> *"The collection of actors should contain more than two... to be defined as a network"*

Most research on social networks focuses on existing social structures. Less attention is paid to the way these networks emerge and evolve. In their study of CoPs Wenger *et al*. (2002) made a first attempt to sketch the evolution of CoPs by identifying five stages of community development. According to the authors, CoPs typically start as loose networks that hold the potential of becoming more connected and develop towards a tightly-knit community. However, loose connectedness presumes the existence of particular ties between the members of a potential network. This might make sense within the context of one organization or CoPs where homogeneity of interests and knowledge can be presumed. Our question, however, focuses on the emergence of those initial ties between actors that come from different organizations and who do not or hardly know each other. Many authors state that the coordination and sharing of knowledge cannot take place without assuming a vast amount of mutual knowledge, mutual beliefs, and mutual assumptions. This is what is called common ground. Similarly, Grant (1996: 115) argues that common knowledge (language, other forms of symbolic communications, shared meanings, commonality of specialized knowledge etc.), defined as the intersection of individual knowledge sets, should be conceived as a precondition for the knowledge integration. Cohen and Levinthal (1990) point to the importance of overlapping knowledge in organizations in order to assimilate external knowledge, whereas Nonaka (1994) views redundancy of knowledge as a necessary precondition for knowledge creation and the building of trust. Nooteboom (2000) has coined the concept of cognitive distance and cognitive proximity to refer to cognitive closeness and similarity between people. It does not only refer to the cognitive variety but also to the differences in abilities of perception, interpretation, and different views on the world that develop out active interaction with the physical and social environment (Nooteboom, 2000). Cognitive distance yields both a problem and an opportunity (Nooteboom and Bogenrieder, 2003). When the cognitive distance is too short or is absent for people to share the same knowledge, there is no incentive to share knowledge. This might be the case when people interact frequently and consequently establish strong networks like CoPs. However when cognitive distances are too great, the more difficult it becomes to cross the distance, i.e. to mutually understand the actions and expression in the network. The notion of cognitive distance is relevant here as it succinctly points to the potential for a network to emerge. The question however is still how much cognitive similarity is needed to initiate knowledge sharing. In order to find out what is minimally needed to initiate enduring interaction we briefly discuss Weick's (1979) theory on the emergence of collective structure. Weick (1979) argues that people initially don't

have to agree on goals to act collectively. In any potential collective, people have different interests, preferences etc. and want to accomplish different things. In order to achieve these ends they have to initiate action towards others by which they create mutual commitment (interlocked behaviours) to collectively pursue diverse ends through common means. Once people are engaged in mutual commitments a subtle shift takes place from diverse to common ends. As Weick argues, diverse ends remain, but they become subordinated to an emerging set of shared ends. This part of Weick's evolutionary theory contrasts conventional thinking about the preconditions for the emergence of collective structures. The second part of Weick's theory addresses the question of how coordination can take place even though ties between people are minimal. To this end he discusses the notion of a mutual equivalence structure (MES). The MES is like an implicit contract between people that can be built and sustained without knowing the motives of another, and without people having to share goals. Weick points to three preconditions for an MES to emerge. The first is that a person must perceive that his ability to perform his consummatory act depends on the instrumental act of the other. The second is that a person must perceive that his own instrumental act serves to elicit the instrumental act of the other. Third, a MES only emerges when a person repeats his instrumental act. A fourth precondition can be added, that is that a person must have some knowledge (expectations) about another person that can fulfil his instrumental acts. From this perspective we may conclude that the common ground, needed to initiate a MES, does not refer to common knowledge or a common belief system but from a mutual expectation structure.

The issue of reciprocity in online networks is widely debated among researchers. Especially the motivation for people to contribute to an online connected group of people who do not or hardly know each other have been subject to extensive research. Wellman and Gulia (1999) point to different types of explanations. The first refers to the fact that online contributions are a means of expressing one's identity. Helping others might increase self-esteem, reputation, respect from others etc. The second one is generalized reciprocity and organizational citizenship. In their recent research on three online communities McLure Wasko and Faraj (2000) concluded that sharing knowledge and helping others is 'the right thing to do' and that people also have a desire to advance the community as a whole. Participants did not expect to be reciprocated by the same person with whom they shared knowledge (direct exchange) but did expect to receive future help from someone in the network. Wellman and Gulia (1999) argue that the logistic and social costs involved in online contribution are relatively low. The easy access to online social networks allows and enables people to contribute at low participation costs. Discussing the economies of online cooperation Kollock (1999) points to the limitations of online cooperation and collective action. Although it is quite easy to produce and share digital information, it requires coordinated activities from the beginning. Another weakness is that if active knowledge producers withdraw from the online network, the network will cease to exist. The basic features for an online network are: ongoing interaction, identity persistence, and knowledge of the previous interactions. (Kollock, 1999: 235). The notion of online generalized exchange demonstrates how fragile the minimal social situation of emergent social network is.

Design of Knowledge Portals

The question then is what the design and the management of an interactive information and communication system should look like for the online (generalized) exchange of knowledge in a minimal social situation. The agro-logistic projects are geographically dispersed and the participants hardly know each other and have rarely communicated. In the literature three dominant perspectives on the role of information and communication technologies on knowledge sharing are distinguished: deterministic view on technology, medium choice theory, emergent process perspective. We believe that the three perspectives are not mutually exclusive. It is now widely accepted that user involvement is essential in the process of design and implementation. However the user is just one node in the potential network of knowledge sharing. It is not only important to know if user A prefers to use a particular application of the intranet for the transfer of a particular type of knowledge but also if persons B and C have similar preferences and expectations. The implication of our argument here is that the design of an interactive information system should not reflect the needs of individual users but the social structure (triadic relationships) of the emerging network. We therefore call for a *relational* and *rich* information system design. That design will have the following three characteristics:

- It should be relational as it should not only address the needs of individual users but also the triadic expectations of a potential social network. It means that in the initial stage of the development of the knowledge portal the potential network actors should be informed about these expectations (e.g. by organizing meetings, providing information about the projects, advertising, see Damsgaard, 2002).
- It should also be rich as it is impossible to predict how the actors in the network will communicate. Social networks are complex social systems that cannot be simply founded. They develop and transform over time (Wenger *et al.*, 2002). To allow the online social network to take different shapes and to evolve in different directions the

design of the knowledge portal should dynamically match different social profiles of the network. It implies that the knowledge portal should provide different spaces of knowledge sharing, synchronous and asynchronous communications media, document storage and retrieval etc.

- Perhaps the most important requirement for the design in the minimal social situation is that people converge on the *means*, in our case the knowledge portal. Following Weick's theory on the emergence of collective structures we consider the knowledge portal as a *means* to facilitate the sharing of knowledge between different groups.

Markus *et al*. (2002) argue that traditional information system design theories are badly equipped to deal with emergent knowledge processes (EKPs). EKPs are defined as organizational activity patterns that exhibit three characteristics in combination: deliberations with no best structure or sequence; highly unpredictable potential users and work contexts; and information requirements that include general, specific, and tacit knowledge distributed across experts and non-experts. We believe that the set up of a knowledge portal in agro-logistics in order to facilitate the diffusion of knowledge between the distributed projects fits pretty well the situation as described by Markus *et al*. (2002). However, the portal is only the 'front door' of an intranet or an extranet (Chaffey and Wood, 2004). Intranets and extranets are called decentralized, general purpose- and open-ended technologies which mean they can be designed for different purposes and can potentially be constructed and modified by those who are involved in the design and use of these information systems (Damsgaard, 2002).

Conceptual Framework

The following conceptual framework depicts the role and impact of knowledge portals and how networks of practice emerge, see Figure 1. Based on the literature review we formulate the following propositions:

As discussed by Brown and Duguid (2000), in networks of practice people have practice and knowledge in common but are mostly unknown to each other. The links between the networks are mostly indirect (e.g. databases, newsletters, info bulletins) and members coordinate and communicate and these are normally explicit. There are two factors that seem to be a pre-condition for the emergence of networks of practice: sense of urgency and fragmented awareness.

Proposition 1. A higher sense of urgency to tackle specific problems of practice will lead to the emergence of a network of practice.

People are tackling specific problems of practice and one way to do that is to coordinate and communicate. However, there has to be a high sense of urgency that people will coordinate and communicate with people they hardly know (and also from other organizations). Without that level of urgency ''out of the box'' thinking seems a strategy people will not follow.

Proposition 2. Fragmented awareness in a dispersed industry will lead to the emergence of a network of practice.

A second pre-condition is that there has to be a fragmented awareness in a dispersed industry. People need to have the expectation that somewhere out

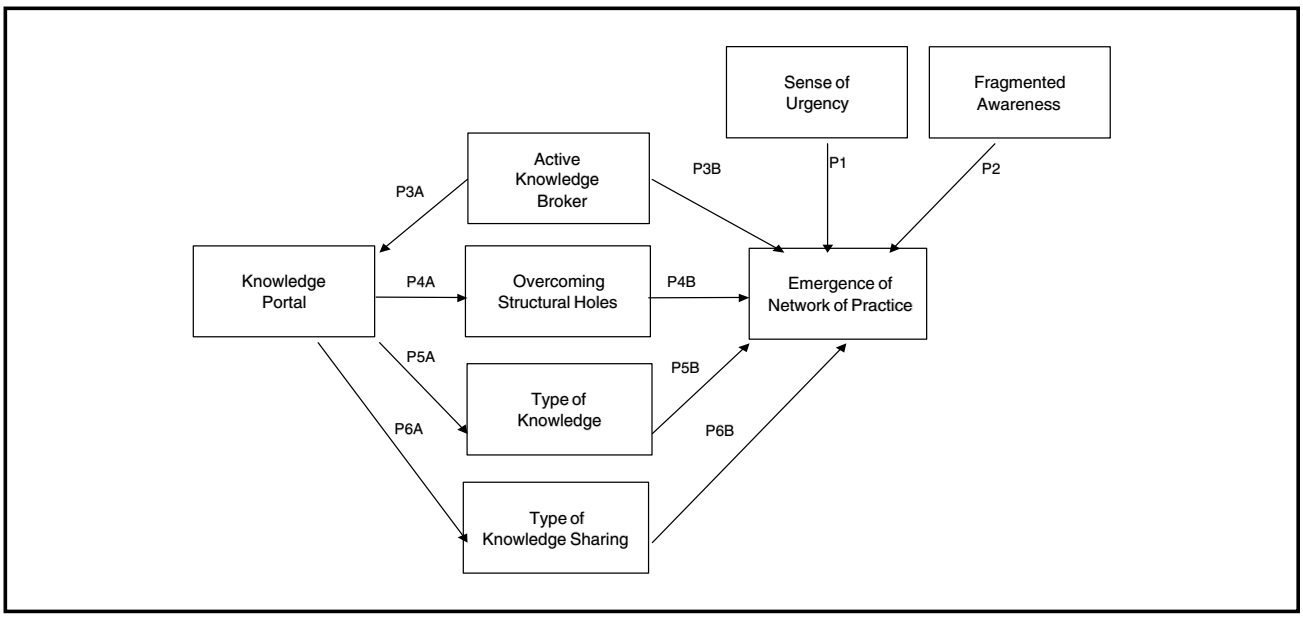

Figure 1 The Conceptual Framework

there solutions are available. They know what they don't know and they know that somebody else might know (about similar problems and potential solutions). Without that fragmented awareness there seems to be no logical reason to strengthen ties among people.

Next to these two basic factors we think there are more specific factors that stimulate or hamper the emergence of Networks of Practice (NoPs). The following factors will be taken into account: action by broker, role structural holes, type of knowledge, and type of knowledge sharing.

Proposition 3. An active knowledge broker will lead to the development of a knowledge portal and the emergence of a network of practice.

The links in a network are mostly indirect. Therefore in the initial phase there has to be an active broker bringing people together who did not know each other before. Previous research has shown that an active broker (in a coordinated or spontaneous way) helps to create the indirect linkages among members of an emerging network. The role of a knowledge broker is identified by, for example, Davenport and Prusak (1998).

Proposition 4. A knowledge portal will bridge structural holes and contribute to the emergence of a network of practice.

Potential knowledge portals have the ability to create direct linkages (between the portal and the knowledge sender/receiver) in such a way that direct linkages between the sender and receiver are not necessary. In such a case structural holes are overcome (Burt, 1992). As we have seen there is a paradox in the sense that overcoming structural holes will lead to effective knowledge exchange because as Nooteboom and Bogenrieder (2003) indicated cognitive distance yields both a problem and an opportunity. It is still unclear how much cognitive similarity is needed to initiate knowledge sharing.

Proposition 5. A knowledge portal will lead to the exchange of project-domain knowledge and therefore contribute to the emergence of a network of practice.

A knowledge portal will make it easier and less costly to transfer and exchange knowledge. However, as we have seen, related to the stickiness of knowledge both Von Hippel (1994) and Szulanski (2003) indicate the transfer cost will increase when the knowledge source and the knowledge recipient operate in different contexts and are engaged in different practices.

Proposition 6. A knowledge portal will lead to reciprocity in knowledge sharing and therefore contribute to the emergence of a network of practice.

As Kollock (1999) argues, the generalized exchange system of sharing is both more generous and riskier. It is more generous because the person who gives provides the network with a benefit without the expectation of immediate return. However generalized exchange is also more risky because actors are easily temped to a free ride (taking without contributing). However, the basic features for an online network are: ongoing interaction, identity persistence, and knowledge of the previous interactions. (Kollock, 1999: 235). Therefore a knowledge portal has to lead to a certain level of reciprocity in knowledge sharing to sustain the emergence of a network of practice.

Research Methods and Data

Case Study Background

The role and impact of knowledge portals for the emergence of networks of practice is illustrated here by a case study of a knowledge portal for agro-logistic innovation projects in The Netherlands. For a detailed description of case study research, see Yin (2003). Agro-logistics deals with the transport, storage, and distribution of the agricultural flows of food and non-food goods in the entire supply chain. Agro-logistics is an important sector. In The Netherlands, more than 20% of good transportation (including import and export) includes agro products. The agribusiness has recently dealt with a number of bottlenecks such as animal diseases leading to trade embargos, congestion on the Dutch highways, international competition, and stronger legislation regarding food safety and animal well-being. Recently, a number of developments in society have taken place, influencing the management of agro-logistic flows. These developments are: higher consumer awareness, pull strategy (market) instead of push strategy (producers), fragmentation, scaling-up in retail and agro-distribution, globalisation and liberalisation, sustainable entrepreneurship, sharpened legislation, and more attention to tracing and food safety.

The agricultural community has a product-related cluster structure. This can be illustrated by the names of the Product Boards (regulatory organizations for businesses in the agricultural supply chains): Animal Feed, Beer and Wine, Cattle, Meat and Eggs, Dairy, Farming, Grains and Seeds, Horticulture. These sectors are highly independent of each other with weak ties between each other. They often are called the Pillars of Agriculture. Within these pillars, knowledge is available and people have regular contacts with each other. Between the pillars, the information sharing and communication is quite low. Recent developments and bottlenecks encouraged the community to change

from a product-related structure towards a problem-related one. These problems occur in the area of spatial planning, EU legislation, high scale infrastructure, and optimizing logistic networks. In order to develop a vision on the sustainable coherent future of the agro-logistics sector, a platform of representatives of government, industry, and knowledge institutes was set up, the so-called Platform Agro-logistics (Ministries of LNV and V&W, 2001). The *Vision Agro-logistics* aims to reach a sustainable, innovating and transport-efficient sector and is based on three keywords, i.e. Clustering, Binding, and Directing. The national government, cooperating with the Platform, invited the sector to propose innovative projects in the area of agro-logistics to improve sustainable development. The innovative character can be related to Clustering (realisation of large scale agri-business areas), Binding (innovative logistical concepts) and Directing (towards virtual livestock markets or worldwide plant cultivation networks). The Platform Agro-logistics focuses on coordinating between parties, tuning with governmental organizations, and creating support. The goals of the platform are (i) to advise, cooperate and coach pilot projects to succeed in system innovations and (ii) to attract attention and share information on threats and opportunities in the agro-logistics sector. In 2003, 20 innovative pilot projects were selected by the Dutch government to be supported in their development by the Platform Agro-logistics. The project proposals came from almost all pillars in the agricultural industry like vegetable products, chicken, plant cultivation, cheese, and pig farming. The innovations are not essentially product based, but had to fit into the themes of Clustering, Binding, and Directing.

Knowledge Portal: Stages and Data

It is important that knowledge on how to innovate and the innovation itself are exchanged in an efficient and effective way among the projects and potential new projects. The Platform Agro-logistics suggested setting up a (virtual) place to meet each other, share information and knowledge, deal with governmental and policy issues, and seek financial resources, in other words, to be a network of practice. A knowledge portal, a platform based on Internet-technology, can support the forming of a network or community. The knowledge portal should open the door to innovative knowledge in the various pilot projects, regardless of time, place, and existing relations of knowledge exchange.

The development of a knowledge portal took place in three stages. In the *first* stage (March 2003–June 2003) objectives, requirements, and design rules were determined. Structured interviews were held with all project leaders of the different innovation projects, see Van Baalen *et al*. (2003). The aim of these interviews was to answer the following questions:

- Do the selected innovative projects have a need for a knowledge portal?
- Is there a need for specific knowledge and information (both in content as in type of knowledge/information)?
- Is there a willingness to share?
- If there is a need, what is the main design of the portal, and what are critical success factors for the design, building, and implementation of the knowledge portal?

The interview results showed there was a high sense of urgency to tackle specific problems of practice exists. About 80% of the project leaders stated a need to exchange knowledge by means of a knowledge portal. The knowledge portal was also seen as an effective medium to reach the public in general, creating a basis for innovative projects, making projects known to the public, and finding new partners. The interviews also show that knowledge and information need is very diverse between projects. It is unusual that these groups are not divided by the central Platform themes Clustering, Binding and Directing, neither by the pillars of the Agro Sector. The Projects can be divided as follows:

- *Entrepreneurs* who want to share knowledge on legislation, best practices, subsidiaries, and lobbying;
- *Knowledge institutes* with no need for a social knowledge network, interested in European subsidiaries;
- *Umbrella projects* with a need to share knowledge in the field of project management and regional scaling-up.

All interviewees showed willingness to share information with each other and with the public space. With respect to the design of the knowledge portal, a layered structure was suggested in such a way that it reflected the current community structure, i.e. a project level, a platform level, and a public level. Each level gives entrance to specific types of information. Being present in the public space was one of the priorities of the project leaders (visibility).

In the *second* stage (July 2003–August 2003) the knowledge portal was designed, built, and tested. It was decided to structure the knowledge portal in three levels. The first level deals with the innovation projects, the second level with the platform, the third level with the public space. At the project level knowledge sharing among the members of the project is facilitated. The members of a project share a common practice in which knowledge primarily related to the project is developed and shared. Relations are direct and tightly coupled and implicit

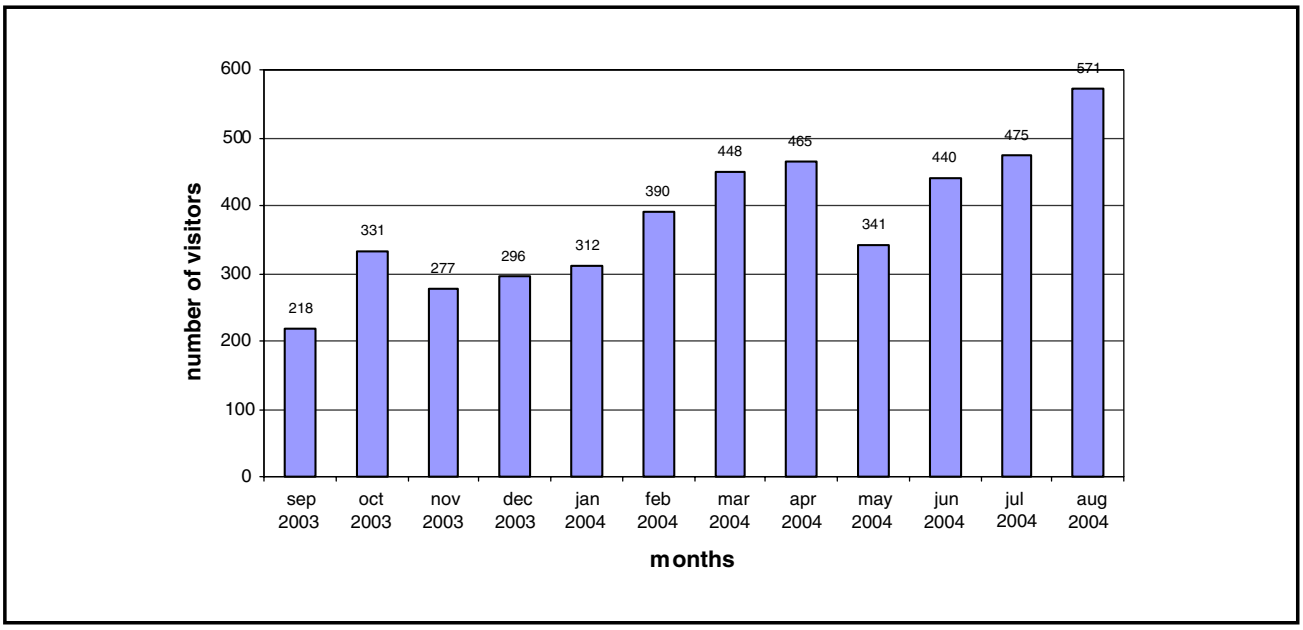

Figure 2 Overview of the Number of Visitors Since the Start of the Knowledge Portal

knowledge sharing (learning by doing) possible. At the platform level knowledge can be shared among the different projects and the members of the Platform Agro-logistics. The platform level is only accessible by the members of the different projects and the platform. The knowledge exchange at this level is worthwhile for the community as a whole, as it gives a base for sharing experiences and best practices among the sectors and therefore from moving from a product-related innovation structure towards a problem-related structure. Finally, at the public level knowledge can be exchanged between the innovation projects and the actors outside (public, innovation projects outside agro-logistics, other industries). Here information is available for everybody and free of charge.

In the *third* stage (September 2003–until now) the knowledge portal was used. A web master was taking care of the functioning of the portal and of the instruction of users. In that period we were able to monitor the use of the knowledge portal and therefore could analyze who was using it and how it was used. The use of the knowledge portal in the first year (September 2003–August 2004) will be presented in this article. Detailed statistics were available on the profile of visitors, the amount of hits and page views, and details about visitor sessions. A visit is defined as a hit originating from the same IP-address with a maximum time between the hits of 20 minutes. A monitoring tool was developed and linked to a social network analysis software program called UCINET 5 (Borgatti *et al*., 2004). With the help of this program a general analysis of relationships among the projects in the emerging network of practice could be identified. For a more thorough explanation of the research methods and techniques used, we refer to Van Baalen *et al*. (2003).

Analysis of Empirical Data

Knowledge Portal Statistics

The knowledge portal (www.agrologistiek.nl) went live in September 2003. For one year, we analyzed the knowledge portal statistics. In one year the total number of hits was about 275,000. The results indicate the knowledge portal had between 15,000 and 20,000 hits per month in the period December 2003–May 2004. In the summer of 2004 the number of hits increased. Figure 2 shows the monthly number of unique visitors to the knowledge portal.

The data of the number of visitors show there was a steady increase in visitor numbers due to the fact that the public was more aware of the existence of the knowledge portal. The total number of visitors to public level varied from 218 in the first month to 571 one year later. Figure 2 shows that the number of visitors grew steadily over the year, with two exceptions: the second month (October) had a relative high number of visitors, caused by the novelty of the site and the month of May had a relative low number of visitors, probably due to the Spring holidays. The number of visits suggest there is a need for information sharing within and outside the agricultural community.

In one year more than 7,500 documents were downloaded. Table 1 presents the top 10 downloaded files. Original titles of the documents were in Dutch.

From this list, we conclude that the need for information focuses on the existence of the Platform Agrologistics and its vision (1,6,8,9), and less on the content and urgency of the innovative projects. Only one of the themes of the Platform Agro-logistics is in

Table 1 Top 10 of Downloaded Files from September 2003 to September 2004

	Document	Number of downloads
1	Brochure_Platform_Agro-logistics.pdf	2786
2	Agro-Logistic Invitation Letter.pdf	1252
3	Final report_Agro-chains and Clusters.pdf	960
4	Agro-logistics_ Examples.MPG	697
5	Pre-announcement_Agro-logistics.pdf	600
6	Vision_Agro-Logistics.pdf (Platform)	514
7	Bundling of Agro-streams.pdf (Clustering)	476
8	Conference_registration_Aro-logistics.pdf (Platform)	465
9	Letter_MinistersLNVandVenWto Second Chamber.pdf (Platform)	316
10	Examples Agri-parcs.pdf (Clustering)	278

the top 10, namely Clustering logistics flows in Agribusiness centers (3,7,10).

Apart from a statistical analysis at the Public level, it was possible to monitor the communication between projects themselves, at the Platform and Project level. Some functionalities were hardly or never used. For example, the discussion forum was hardly ever used. Also, the use of the bulletin board was negligible. These features were pointed out as potentially useful features in the interviews. The feature of sharing information by downloading documents was frequently used, as indicated by Table 1. For each downloaded document, data was available with respect to the supplier of the document (providing information) and the client (receiving information). Table 2 provides information on who shared documents with whom. In Table 2 the providers are represented in the rows (between brackets the number of posted documents), the columns represent the receivers. Providers and receivers are innovation projects. In total there were 25 innovation projects indicated by P01, P02, ..., P23, P26, and P27. P24 and P25 were projects for general and project management purposes. Not all projects come back in Table 2 due to the fact that these projects were stopped or merged with others. The values in the matrix represent the number of times that, for example, project 01 downloads information from project 02 in the Platform or Project space. These spaces were restricted to members only and can be visited through a login name and a password.

Table 2 shows mixed results: some projects were active providers of documents, some projects were active consumers of documents, and some projects were not very active at all in sharing documents. A more detailed analysis of knowledge sharing among projects will be discussed in the next section.

Lessons Learned

Based on interviews of the project leaders, the design and use of the knowledge portal, the knowledge portal statistics, and monitoring of the document exchange among the projects the proposition – as defined in Section 2 – were validated. A network of practice will emerge if there is a sense of urgency (Proposition 1) and fragmented awareness in a dispersed community (Proposition 2). Proposition 3 states that active action of a broker will lead to the development of a knowledge portal. The broker in this case is the Platform Agro-logistics. For testing Propositions 4–6, we carried out interviews with all innovative pilot projects (Van Baalen *et al.*, 2003) and analyzed for one year (September 2003–August 2004) the actual use of the knowledge portal. The purpose of the interviews is to find data on the network situation before the start of the knowledge portal (Proposition 4, Structural Holes), to investigate the

Table 2 Document Sharing among the Projects in the Knowledge Portal

Supply	Demand														
	P01	P02	P03	P04	P11	P12	P13	P15	P17	P20	P21	P23	P25	P26	P27
P01(12)	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P02(5)	0	0	0	0	2	0	0	0	0	1	0	0	1	0	0
P03(9)	1	0	12	0	0	0	0	0	0	2	0	0	1	0	0
P04(7)	1	0	0	1	0	0	0	0	0	6	0	0	3	0	0
P11(14)	9	0	0	0	12	0	0	0	0	0	0	0	4	0	0
P12(10)	4	0	4	0	4	0	0	0	0	15	0	0	18	0	0
P13(1)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
P15(9)	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0
P17(11)	0	0	0	0	0	0	0	0	1	6	0	0	2	0	0
P20(45)	0	0	3	0	0	0	0	0	0	559	0	0	2	0	0
P21(9)	2	0	0	0	0	0	0	0	0	3	1	0	2	0	0
P23(1)	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0
P25(6)	1	0	0	0	0	0	0	0	0	16	0	0	141	0	0
P26(5)	0	0	0	0	0	0	0	0	0	13	0	0	21	0	0
P27(5)	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0

need for knowledge and the type of knowledge needed (Proposition 5, Types of knowledge), and the willingness to share knowledge (Proposition 6, Reciprocity in knowledge sharing). The analysis provides the following lessons learned.

Proposition 1. A higher sense of urgency to tackle specific problems of practice will lead to the emergence of a network of practice.

In the former, people have practice and knowledge in common but are mostly unknown to each other. The links between the networks are mostly indirect (e.g. databases, newsletters, info bulletins) and members coordinate and communicate in a normally explicit fashion. NoPs can have an enormous reach. There is relatively little reciprocity across NoPs as the members do not interact directly to one another. NoPs are loosely coupled systems that barely initiate collective action and produce little knowledge.

The Agro-logistics case shows that there was on the one hand a high sense of urgency in the agricultural sector to start the Platform Agro-logistics. Several reasons were mentioned during the initial phase of the set up of the platform. These reasons were related to the outbreak of animal diseases, transportation problems, and more strict legislation for food safety. Also during the interviews with the project leaders at the start it turned out that most of them indicated an urgent need for collective action with regard to transport and distribution problems related to agro-products in The Netherlands. On the other hand in analyzing objectives, incentives, and the lack of direct subsidies for projects to participate in there was not a high level of urgency. Projects could not be pushed to deliver results in a fast way, subsidies were not directly given to projects, the platform was installed to facilitate the different innovation projects. Overall, there was a shared level of urgency to innovate to keep The Netherlands competitive in the field of agro-logistics. Proposition 1 is accepted.

Proposition 2. Fragmented awareness in a dispersed industry will lead to the emergence of a network of practice.

The Agro-logistics case shows there was a fragmented awareness in a dispersed agricultural industry. Traditionally, the agricultural community is structured in a product-oriented way (meat, milk & cheese, flowers, fruit & vegetables). Agro-logistical problems and solutions are endemic in these different product units. Therefore there was a need for agro-logistical experts to learn from innovations in different product-oriented communities. In these different communities there was awareness that the agro-logistics community is highly dispersed and a lack of coordinated action was hampering solutions to agro-logistical problems. Proposition 2 is accepted.

Proposition 3. An active knowledge broker will lead to the development of a knowledge portal and the emergence of a network of practice.

The set up of the Platform Agro-logistics including representatives of different stakeholders in the different product-related communities together with representatives of local and national authorities encouraged a broking role in an emerging network of practice. In particular, the chairman and secretary of the platform acted as active brokers – they took the initiative to develop a knowledge portal. In the initial phase of the knowledge portal most documents and initiatives were posted by the web master. Proposition 3 is accepted.

Proposition 4. A knowledge portal will bridge structural holes and contribute to the emergence of a network of practice.

To look at the impact of the knowledge portal in overcoming structural holes and decreasing cognitive distance among projects we examined which projects were known to each other before the platform and knowledge portal were implemented. The different project leaders were interviewed and asked if they knew the other projects (Van Baalen *et al.*, 2003). Based on these interview results relationships among the different projects were measured and drawn with the help of UCINET software (Borgatti *et al.*, 2004). On the left side of Figure 3 the initial network is sketched. As one can see, there are seven projects that have no relationship with other projects and some projects have very weak ties with others. None of the projects regularly exchanged information and knowledge. After one year of using the knowledge portal we examined which documents were exchanged among the different projects. The right side of Figure 3 presents the network after the introduction and use of the knowledge portal. As Figure 3 indicates, projects are exchanging documents and therefore could learn from each other. One can see a network of practice is emerging. The knowledge portal overcomes some structural holes and there are indications that the cognitive distances between the actors are not too short e.g. that there is no incentive to share knowledge. Proposition 4 is accepted.

Proposition 5. A knowledge portal will lead to the exchange of project-domain knowledge and therefore contribute to the emergence of a network of practice.

We distinguish three types of knowledge:

- Type I – This type of knowledge is project-domain knowledge and developed by one of the innovation projects.
- Type II – This type of knowledge is platform-domain knowledge and developed by one of the innovation projects.

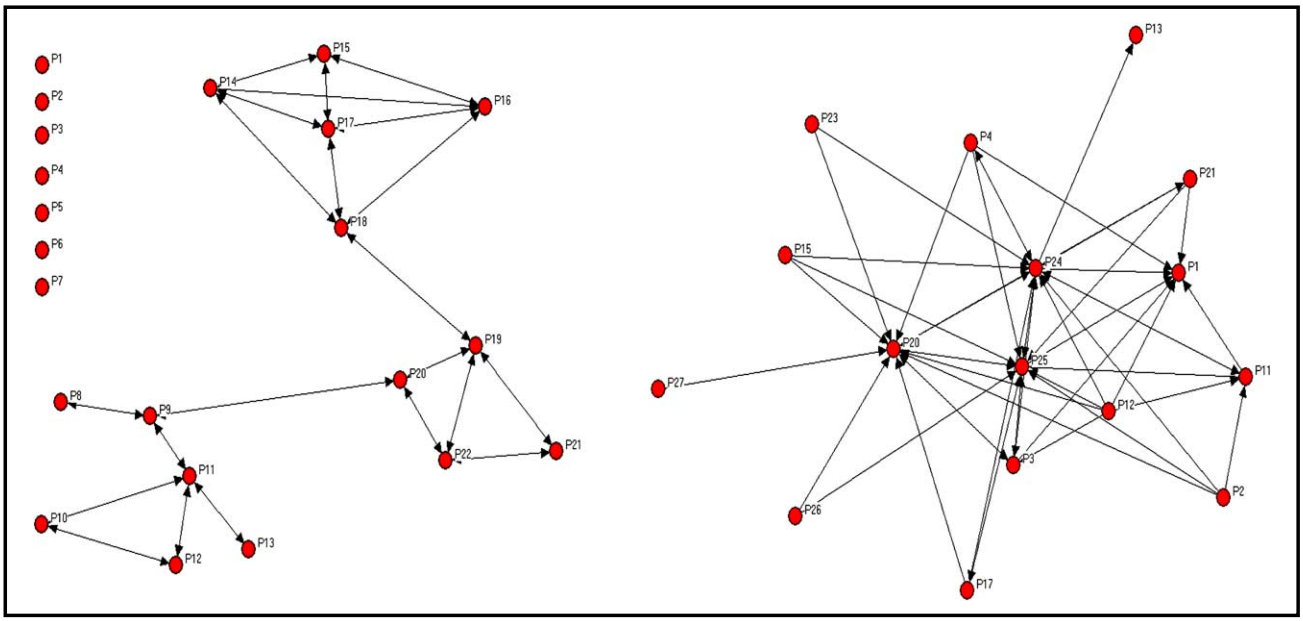

Figure 3 Information Exchange Among Projects Before the Introduction (left side) and One Year After the Introduction (right side) of the Knowledge Portal

- Type III – This type of knowledge is public-domain knowledge and developed by one of the innovation projects.

As discussed, the knowledge portal was developed with three levels or spaces: project, platform and public. By analyzing the use of the knowledge portal (documents, web pages, bulletin board) we conclude that information exchange among the different projects (Type I) was rather limited. The analysis also shows that some documents were exchanged at the platform level (Type II) and most documents were exchanged at the public level (Type III). There seem to be two potential explanations. The first one relates to the stickiness of knowledge – see Von Hippel (1994) and Szulanski (2003). The different innovation projects did not exchange because transfer costs were too high due to the fact that the knowledge source and the knowledge recipient operate in different contexts and are engaged in different practices. The decreased transfer costs of the knowledge portal did not overcome the high level of transfer costs related to the stickiness of the knowledge. The second one relates to the concept of cognitive distance – see Nooteboom and Bogenrieder (2003). The cognitive distance between the innovation projects seems to be too high and therefore it is more difficult to cross the distance between the projects. It seems to be logical that at the emergence of a network of practice knowledge exchange will start with knowledge with low transaction costs and a low cognitive distance (such as general project knowledge). The analysis also indicates there is information exchange *within* some of the projects. This can be considered as a new type of knowledge (knowledge exchange within project). In particular, large projects (with around 50 project members) were eager to exchange information within the project. Proposition 5 is not accepted. However, the empirical results indicate a *revised* Proposition 5: In the initial phase of a network of practice knowledge exchange will be focused on general, non-project specific and explicit knowledge. It is expected that after this phase the exchange will be directed to project-specific and tacit knowledge.

Proposition 6. A knowledge portal will lead to reciprocity in knowledge sharing and therefore contribute to the emergence of a network of practice.

Reciprocity in a network means that projects are posting and demanding knowledge from other projects. This is different from market relationships where a specific activity (an indication to buy something) will automatically lead to an offer by the other party. In a network of practice one can post knowledge but one does not automatically and directly get something in return. However, in the longer term one expects that if one posts a question to the network – or rather, to a member, (in our case projects) – that it will react with an offer. We analyzed the knowledge exchange among the projects and distinguished four type of projects. These four types are labeled:

- Individualistic Projects: These projects do not post or demand information and knowledge.
- Altruistic Projects: These types of project post a lot, but make no demand.
- Free rider Projects: These projects show no posting, but demand a lot.
- Reciprocity Projects: These project post and make demands.

It is interesting to analyze how projects developed during the use of the knowledge portal. Figure 4 identifies the typology of the projects after one year

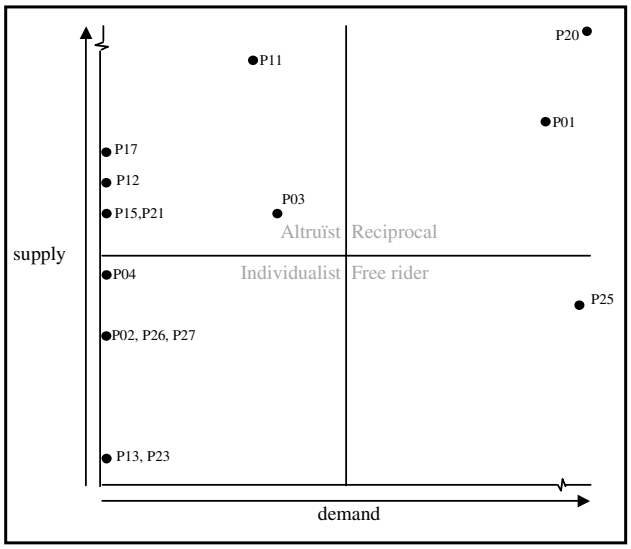

Figure 4 Reciprocity in Knowledge Sharing Among Projects After One Year of Using the Knowledge Portal

of using the knowledge portal based on document exchanges.

Figure 4 indicates there is not much reciprocity with regard to explicit innovative knowledge sharing among the projects. The empirical analysis shows there is high reciprocity related to two projects (P01, P20). There is one project (P25) – which is not one of the core innovation projects but a cooperation project among project leaders of the innovation projects that has a free rider characteristic. In general, there was no free rider behavior among the innovation projects. The question remains if – given the objectives of the knowledge portal e.g. exchanging innovative knowledge – the knowledge portal stimulated the exchange of knowledge. Given the empirical results the answer is that there was no direct and strong relationship between the impact of the knowledge portal on reciprocity of knowledge sharing. Proposition 6 is not accepted. Several explanations could be given for this result. The first one is that the innovation projects started with a long cognitive distance among the projects. Therefore it is not easy to develop mutual understanding and trust. The second explanation is that reciprocity is not executed via the knowledge portal but via other channels (direct contact, telephone). A third potential explanation is that the level of urgency – although indicated as high at the start of the platform – to share knowledge projects was not that high. It seems there was a high level of urgency within the projects to execute them (deliver to deadlines, secure financial resources, link to relevant partners), but a lower level of urgency to directly help other projects. The empirical results indicate that, as argued by Kollock (1999) the generalized exchange system of sharing is both more generous and riskier. It is more generous because the person who gives provides the network with a benefit without the expectation of immediate return. However, generalized exchange is also more risky because actors are easily tempted to free ride (taking without contributing). For this reason the generalized exchange has the structure of a social dilemma in which individually reasonable behavior might lead to collective disaster (Kollock, 1999). In our case there was no free-rider behavior among the projects, but also no balanced knowledge supply and demand. In the longer term there is the potential risk that the knowledge portal runs dry and that the network of practice will dissolve.

Conclusions

Research Problem

The central research question of this article is how a knowledge portal facilitates the diffusion of knowledge among rather loosely coupled and often disconnected innovation projects. With regard to the case study of the knowledge portal in the agricultural industry we conclude that a knowledge portal will have an impact on how projects share knowledge and on the emergence of a network of practice. The results show that pre-conditions for the emergence of a network of practice are a sense of urgency and a fragmented awareness. The results also indicate the important role of a knowledge broker. The developed knowledge portal seems to lead to overcoming structural holes and a closer cognitive distance among the projects. However, we did not find a direct effect of the knowledge portal on sharing tacit knowledge. In the initial phase of a network of practice the knowledge exchange seems to focus on general, non-project specific and explicit knowledge. There was also no direct effect of the knowledge portal on the reciprocity of knowledge exchange among the projects. However, knowledge was shared between the project level and the platform and public level.

This paper makes three key contributions to the literature of knowledge management, networks of practice, and innovation policy. First, it identifies critical factors in explaining how networks of practice emerge. It focuses on the situation where people and projects in different organisations are previously unaware of each other and start to share knowledge and use a knowledge portal. It shows that even in this type of situation networks of practice can emerge. Second, it provides a conceptual framework that explains critical factors for the development of common knowledge and the emergence of networks of practice. We think that the typology of knowledge related to project, platform, and public will be useful in the design of future knowledge portals. Also, the typology of projects in terms of supply and demand of knowledge is a useful tool to analyze (potential) reciprocity in knowledge exchange relationships. Third, it provides a detailed analysis of the emergence of a network of practice around agro-logistical innovation projects in The Netherlands.

This study has some limitations and the results need to be interpreted with care. These limitations are:

- The use of the knowledge portal could not be isolated from other knowledge exchanges among the projects. Telephone contact and physical meetings also stimulated the sharing of information and knowledge and this impact is not taken into account.
- There was no detailed analysis done on the impact of shared documents on the practice of the receiving project. Did it lead to active use of the knowledge gathered?
- The knowledge portal is analyzed before and after one year of use. The period might be too short to see a sustainable effect and impact.

Suggestions for Further Research

There are at least two directions for further research on the impact of knowledge portal on the emergence of networks of practice.

Our research propositions need to be tested by large-scale statistical inquiry.

We concentrated on document exchange as a first indicator of knowledge exchange. A broader analysis is required.

Acknowledgement

The research in this article was carried out in the KLICT project Kennisportal Agrologistiek HR-185. We thank the Platform Agrologistiek for their support during the project and thank Mathijs van der Vlis for his assistance in analyzing the data.

References

Baalen, van P., J. Bloemhof, E. van Heck, P. van de Veire. (2003), *Analyse kennisportal Agrologistiek* (in Dutch), report Erasmus University Rotterdam, 40 pp.

Borgatti, S., M. Everett and L. Freeman. (2004). *UCINET 5 for Windows: User's Guide*. Harvard: Analytic Technologies, 7 June 2004.

Brown, J.S. and Duguid, P. (2000) *The Social Life of Information*. Harvard Business School Press, Boston.

Burt, R.S. (1992) *Structural Holes: The Social Structure of Competition*. Harvard University Press, Cambridge, London.

Chaffey, D. and Wood, S. (2004) *Business Information Management: Improving Performance Using Information Systems*. Prentice-Hall, Essex.

Cohen, W.M. and Levinthal, D.A. (1990) Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly* **35**, 128–152.

Damsgaard, J. (2002) Managing an Internet Portal. *Communications of the Association for Information Systems* **9**, 408–420.

Davenport, T.H. and Prusak, L. (1998) *Working Knowledge: How Organizations Manage What They Know*. Harvard Business School Press, Boston MA.

Grant, R.M. (1996) Toward a knowledge-based theory of the firm. *Strategic Management Journal* **17** (winter special issue), 109–122.

Hippel, von E. (1994) Sticky Information and the locus of problem solving: implications for innovation. *Management Science* **40**(4), 429–439.

Jones, C., Hesterly, W.S. and Borgatti, S.P. (1997) A general theory of network governance: exchange conditions and social mechanisms. *Academy of Management Review* **22**(4), 911–945.

Kollock, P. (1999) The economies of online cooperation: gifts and public goods in cyberspace. In *Communities in Cyberspace*, eds M.A. Smit and P. Kollock, pp. 220–239. Routledge, London etc.

Krogh, von G. (2003) Knowledge Sharing and the Communal Resource. In *Handbook of Organizational Learning and Knowledge Management*, eds M. Easterby-Smith and M.A. Lyles, pp. 372–392. Blackwell Publishing, Malden, Oxford, Melbourne, Berlin.

Lave, J. and Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press, Cambridge, New York, Melbourne.

Markus, M.L., Majchrzak, A. and Gasser, L. (2002) A design theory for systems that support emergent knowledge processes. *MIS Quarterly* **26**(3), 179–210.

McLure Wasko, M. and Faraj, S. (2000) ''It is what one does'': why people participate and help others in electronic communities of practice. *Journal of Strategic Information Systems* **9**, 155–173.

Ministries of LNV and V&W. (2001). *Visie Agrologistiek: Clusteren, Verbinden, Regisseren* (in Dutch), Rapport aan de Tweede Kamer, Den Haag, 30 p., 14 November 2001 (www.agrologistiek.nl).

Nonaka, I. (1994) A dynamic theory of organizational knowledge creation. *Organization Science* **5**(1), 14–37.

Nonaka, I. and Takeuchi, H. (1995) *The Knowledge-Creating Company*. Oxford University Press, Oxford etc.

Nooteboom, B. (2000) Learning by interaction, absorptive capacity, cognitive distance, and governance. *Journal of Management and Governance* **4**, 69–92.

Nooteboom, B. and I. Bogenrieder. 2003. *Change of Routines: a Multi-Level Analysis*, Rotterdam: ERIM report (www.erim.nl).

Podolny, J.M. and Page, K.L. (1998) Network forms of organization. *Annual Review Sociology* **24**, 57–76.

Swan, J., Newell, S., Scarbrough, H. and Hislop, D. (1999) Knowledge management and innovation: networks and networking. *Journal of Knowledge Management* **3**(4), 262–275.

Szulanski, G. (2003) *Sticky Knowledge. Barriers to Knowing in the Firm*. Sage Publications, London, Thousand Oaks, New Delhi.

Tuomi, I. (2002) *Networks of Innovation: Change and Meaning in the Age of the Internet*. Oxford University Press, Oxford.

Tsoukas, H. (2003) Do we really understand tacit knowledge? In *Handbook of Organizational Learning and Knowledge Management*, eds M. Easterby-Smith and M. Lyles, pp. 410–427. Blackwell Publishing, Malden etc.

Weick, K. (1979) *The Social Psychology of Organizing*. (second ed.), New York.

Wellman, B. and Gulia, M. (1999) Virtual communities as communities: Net surfers don't ride alone. In *Communities in Cyberspace*, eds M.A. Smith and P. Kollock, pp. 167–194. Routlegde, London and New York.

Wenger, E., McDermott, R. and Snyder, W.M. (2002) *Cultivating Communities of Practice*. Harvard Business School Press, Boston.

Winograd, F. and Flores, F. (1986) *Understanding Computers and Cognition: A new Foundation for Design*. Ablex Publishing Corporation, New Jersey.

Yin, R.K. (2003) *Case Study Research: Design and Methods*. (Third ed.). Sage, Thousand Oaks.

PETER VAN BAALEN, *RSM Erasmus University, Department of Decision and Information Sciences, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands. E-mail: pbaalen@rsm.nl*

Peter van Baalen is Associate Professor in the Department of Decision and Information Sciences at RSM Erasmus University. His main fields of research interests are knowledge management, knowledge networks, e-communities, e-learning, ICT adoption and diffusion, and management education.

JACQUELINE BLOEMHOF-RUWAARD, *RSM Erasmus University, Department of RSM Decision and Information Sciences, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands. E-mail: jbloemhof@rsm.nl*

Jacqueline Bloemhof-Ruwaard is Assistant Professor in the Department of Decision and Information Sciences at the RSM Erasmus University Rotterdam. Her main fields of research interests are supply chain management, closed loop supply chains, logistics networks, agricultural distribution networks, and sustainability.

ERIC VAN HECK, *RSM Erasmus University, Department of Decision and Information Sciences, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands. E-mail: evanheck@rsm.nl*

Eric van Heck is Professor of Electronic Markets at Erasmus University's Rotterdam School of Management. His research concentrates on electronic markets and IT-enabled business networks. His recent book Smart Business Networks *– co-edited with Peter Vervest, Kenneth Preiss, and Louis-François Pau – was published in January 2005 (Springer).*