

THE INNOVATION ADOPTION/DIFFUSION AND THE INDUSTRIAL NETWORK APPROACHES

A CONCEPTUAL AND EMPIRICAL COMPARISON

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Introduction

Innovation adoption and diffusion as a construct has been studied within various disciplines for several decades (for a review see e.g., Greenhalgh, Robert, MacFarlane, Bate & Kyriakidou 2004; Rogers 2003, 43–91). According to Everdingen and Wierenga (2002, 649), the theory was introduced into the *marketing discipline* in the 1960s (see e.g., Robertson 1967, Bass 1969), at a time when organizational buying behavior (OBB) was arousing more and more interest among marketing scholars. Meanwhile, Webster and Wind (1972, 19–20) incorporated innovation adoption and diffusion into non-task buying models, and Sheth (1977, 21–25) positioned the paradigm within the behavioral approach to buying. Thus the newly adopted approach was closely integrated into the current research on marketing.

The development of theoretical understanding in the field of business marketing has been vast since those days, and the research interest that was once focused on OBB spread to other areas of industrial marketing. One of these new emergent fields concerned dyadic interaction between companies, and the IMP school of thought started to evolve (see e.g., Håkansson 1982). Later the perspective broadened to incorporate a multi-dyadic view of interconnected relationships (see e.g., Håkansson 1987; Mattsson 1987; Anderson, Håkansson & Johanson 1994), which was called the *industrial network approach* (see Axelsson & Easton 1992). Nowadays the IMP school comprises an informal network of scholars aiming to conceptualize and enhance understanding of industrial marketing in terms of inter-organizational interaction, relationships and networks, and has an established position within business-to-business marketing research (see e.g., LaPlaca 2009, Baraldi, Brennan, Harrison, Tunisini & Zolkiewski 2007, Ford & Håkansson 2006, Gadde, Huemer & Håkansson 2003, Ford 1997, Håkansson & Snehota 1995, Anderson et al., 1994, Axelsson & Easton 1992).

During the shift in theoretical focus away from organizational buying behavior the tight connection between innovation adoption/diffusion and industrial marketing was lost. For example, the industrial network and the adoption/diffusion approaches are not closely linked or considered jointly in the literature, with the rare exception of Robertson, Swan and Newell (1996). This seems odd, as both place strong emphasis on network dynamics. The network concept is inherent in the very name of the industrial network approach, and as Everett Rogers, the most cited researcher in the field of adoption and diffusion, states (2003, 331): “We must understand the nature of networks in order to understand the diffusion process”.

In order to bridge the gap in the current understanding *this study compares the innovation adoption/diffusion and the industrial network approaches*. The aim is to investigate and

update the potential contribution of the former to the discourse on industrial marketing, and to broaden its context-specificity to cope with this area of application.

The comparative approach brings the study onto the meta-theoretical level. According to Möller (1994, 366), “The basic function of any meta-theoretical description of research traditions is to reveal the key assumptions on which those traditions are based. Identifying these assumptions and the primary goals of the tradition provides an abstract summary of the tradition and helps to position it among other traditions that focus on the same empirical domain.” Complementing the conceptual review of the two approaches, therefore, is an empirical investigation. Thus the study also falls into the category of *multi-paradigm research*, which involves applying different paradigms or theories in collecting and analyzing data, and cultivating their diverse representations of the studied phenomenon (see Lewis & Grimes 1999).

The following section begins with a review of the theoretical approaches. Through a discussion of the methodological stances the study moves on to apply both to five cases from the food-processing industry. The industry is currently facing its greatest upheaval in modern times, fuelled by increasing international competition, structural and technological change, global warming, shifting consumer habits (Lagnevik, Sjöholm, Lareke & Östberg 2003, 3–9), and animal diseases. These dynamic circumstances offer an interesting and fruitful context for the study. The findings and discussion section highlights the main similarities and differences between the approaches as reflected in the cases. This establishes a basis for drawing more general-level conclusions, discussing the managerial implications, and giving suggestions for future research.

Theoretical background

The adoption/diffusion approach

Because of the variety of disciplinary roots in the research there is no clearly established conceptual difference between organizational and individual (e.g., consumer) adoption and diffusion - the organization and the individual are simply treated as different units of adoption (see Rogers 2003). Therefore the definitions generated and the studies conducted in the context of the individual adopter are equally valid in defining the meaning of adoption and diffusion despite the lack of direct transferability in the two fields.

Robertson (1971, 20) defines diffusion as a “process by which something spreads”, whereas Rogers (2003, 5) defines it as “the process in which an innovation is communicated through certain channels over time among the members of a social system.” Referring particularly to the industrial context, Swanson (1994, 1071) describes innovation diffusion as “the pattern of its adoption by an organizational population over time.” It could thus be concluded that innovation diffusion is an ongoing macro-level social process that occurs over time within a certain social system.

The adoption process could be defined as an adopter’s decision-making process that ends up with taking the innovation into use with the intention of using it now and in the future (Woodside & Biemans 2005; Klein, Conn & Sorra 2001; Ozanne & Churchill 1971). The relationship between adoption and diffusion is twofold. Firstly, single adoption decisions accumulate and form a pattern of market-level diffusion, thus the adoptions cause the diffusion pattern. Secondly, market-level diffusion forms a context for single adoption decisions; an adopter experiences risk and uncertainty and is therefore willing to turn to others, such as those who have already adopted the innovation, to gain more information and reassurance (Valente 1995, 5). It can be assumed that all adoption decisions are made in a certain social context, and that decision makers are never alone or beyond the reach of social influences (see e.g., Montgomery, Lipshitz & Brehmer 2005, 5).

The social process of formal and informal information exchange among members of a social system is a core idea in Rogers' (2003) diffusion theory. According to Mahajan, Muller and Bass (1990, 1), as a theory of communication the main focus in the adoption/diffusion approach is on the communication channels and their use to transmit information about the innovation within and also *into* a certain social system. Thus, it could be concluded that a *social system* sets boundaries for adoption and diffusion. Gatignon and Robertson (1991, 319) define a social system as "a set of people with a shared sense of commonality who tend to interact over time". Coleman, Katz and Menzel (1957) took a local community of doctors and Ryan and Gross (1943) two communities of farmers as social systems in their studies. In the industrial context Mansfield (1961) applied the concept to the iron and steel, railroad, bituminous coal, and brewing industries. In general, the social system refers to the population over which the innovation diffuses and whose members are in a reciprocal relationship, both subjects and objects of actions.

The communication within social systems is characterized by *homophily*, which means a high degree of similarity among pairs of communicating individuals. It speeds up the diffusion process in that it facilitates effective communication and understanding between the parties (Rogers 2003, 305-308.). However some heterophily is necessary in order to facilitate communication between different homophilous cliques (see e.g., Granovetter 1973). *Heterophily* is the opposite of homophily, and implies distance between a pair of communicating individuals.

The concepts of change agent and opinion leader can be incorporated into this homophily–heterophily categorization, and are central in understanding the communication flow in the adoption/diffusion approach. A *change agent* is an individual or an organization that influences clients' adoption decisions in a direction deemed desirable by the change agency, whereas an *opinion leader* is an individual or organization that has an informal influence on other individuals' or organizations' adoption behavior with relative frequency. A notable distinction between the constructs is that an opinion leader is part of the social system whereas a change agent is an outsider (Rogers 2003, 300, 365; Lancaster & White 2001, 288; Kautz & Larsen 2000, 14; Katz & Lazarsfeld 1955). Figure 1 illustrates the key concepts of the adoption/diffusion approach, and the relations between them.

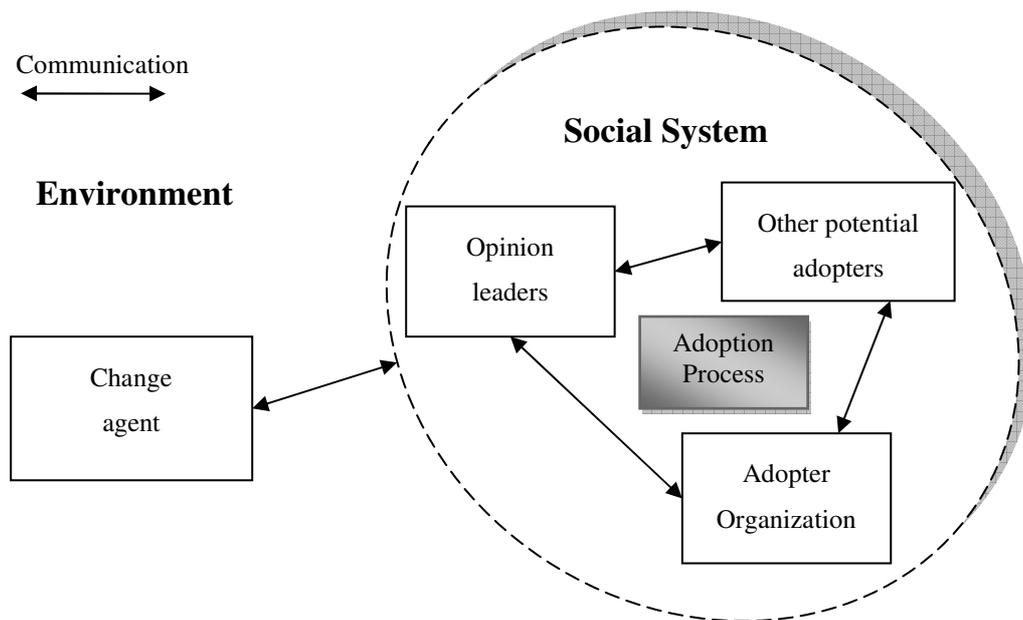


Figure 1 The key concepts of adoption/diffusion approach and the relations between them

An ideal change agent is a balanced mixture of competence (heterophily) and safety credibility (homophily) (Rogers 2003, 385). Opinion leadership is based on various factors, such as early adoption of the innovation (see e.g., Turnbull & Meenaghan 1980), which differentiates the opinion leader from the potential adopter and enhances heterophily between them.

The Industrial Network Approach

The idea of firms being embedded in wider, far-reaching business networks is at the heart of the industrial network approach (see Halinen & Törnroos 1998, 189-190), and is reflected in the expression, “No business is an island” (Håkansson & Snehota, 1989). The approach is built on the notion that business actors are in continuous interaction with other identified counterparts, and that the interaction is shaped by interdependence, prior experiences, and current expectations of other actors (see e.g., Anderson et al., 1994; Håkansson & Snehota 1989, 190, 196). Thus the connection between *past*, *present* and *future* is clearly recognized.

The space between organizations and the system they comprise is the key focus (see e.g., Axelsson & Easton 1992). The concept of *embeddedness* refers to companies’ dependence on and relations with different kinds of networks in this wide system (Halinen & Törnroos, 1998, 187-188). According to Ritter (2000), *interconnectedness* relates more to actors’ structural positions whereas embeddedness describes the dynamics in an overall context. The *network position* reflects the embedded and interconnected nature of business-to-business markets. It could be described as a relational setting between individual actors in the network structure in terms of their function, role and identity as defined by other participating actors (see Mattsson & Johansson, 1992; Håkansson & Snehota, 1989, 196).

Networks could be described as aggregations of interlinked relationships (Anderson et al., 1994; Easton 1992, 8). *Relationships*, in turn, are the means by which a firm can control its counterparts in the network (see Håkansson & Snehota 1989; Anderson & Narus 1990), and a channel to the external resources they possess. This access refers to the indirect control of

resources in addition to the direct control of those that are internal to the company (see Ford & Håkansson 2006).

Relationships can be further broken down into interrelated *acts* and *episodes* that have taken place in the past thereby shaping and forming them (see e.g., Håkansson, 1982). Temporal interaction episodes are affected by and affect a relationship in terms of *norms* and *rules* developed and learnt over time (Håkansson & Snehota 1995, 25; Håkansson & Ford 2002, 133). If no previous relationship exists between companies, an adoption episode may initiate one (see Håkansson & Gadde 1997).

The *substance of a relationship* could be described in terms of *actor bonds*; attraction, trust and commitment, *resource ties* and *activity links* (Håkansson & Snehota 1995). Strong bonds and resource dependency provide a more solid structure, bringing in stability and predictability. Activities may be *internal*, not crossing company boundaries, or *external*, directed towards and involving others. In a relationship they take place within exchange episodes and are undertaken by either of the actors. Activity links connect the activities of the two actors. Figure 2 illustrates the concepts discussed in the context of innovation adoption and diffusion.

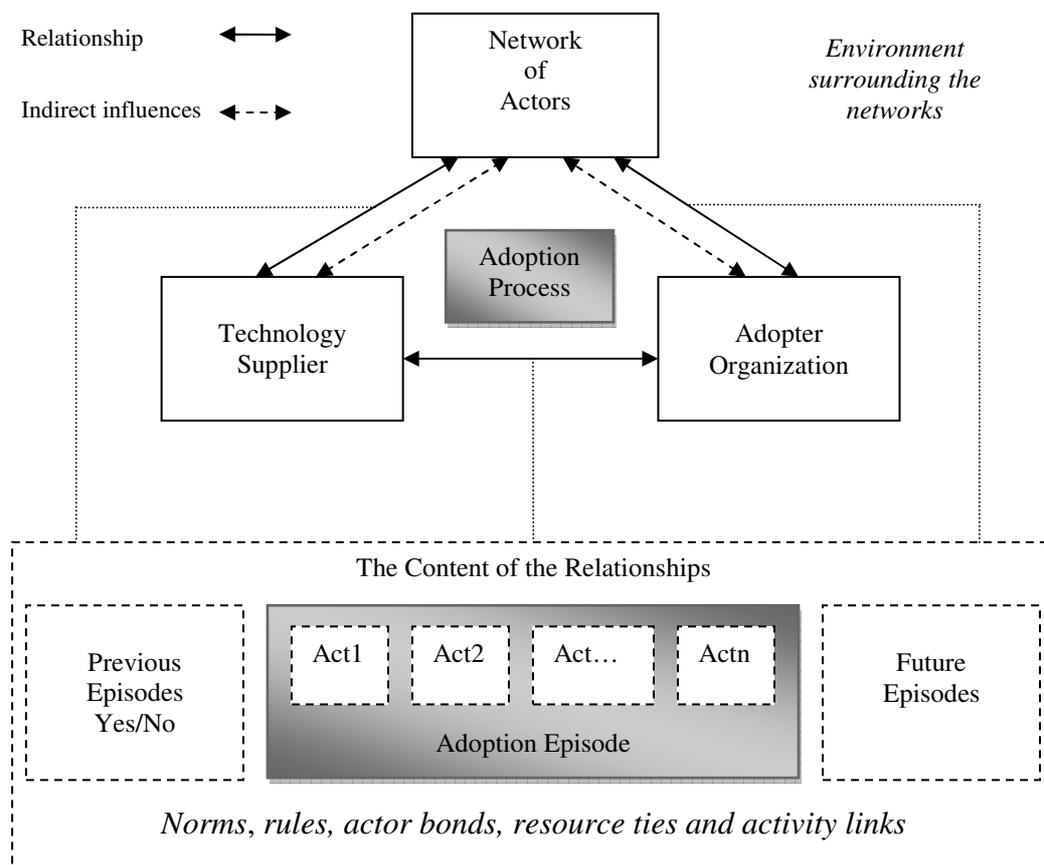


Figure 2 A synthesis model of the industrial network approach to organizational innovation adoption/diffusion

Both the technology supplier and the adopter organization are part of a network of connected relationships (Anderson et al., 1994; Easton 1992). In this respect they and the other actors and their networks may influence the adoption process through the network. The arrows in the model refer to *relationships* and the dashed arrows refer to the *indirect*

influences the actors may have on each other without being in a direct relationship. For example, another organization's use of an innovation and demonstration of this through supplier references is a critical way of reducing a potential adopter's perceived risk (see Robertson, Swan & Newell 1996). *References* give a concrete hint of the supplier's well-established position within a network that is relevant to the adopter (see Salminen & Möller 2006). Networks exist in an *environment* that is characterized by features related to market structure and dynamism, internationalization, and the actors' social systems and positions in the distribution channels (Anderson et al., 1994; see also Håkansson 1982 on the environment of the interaction process).

The methodological approach

The empirical application of different theoretical views in a *multi-paradigm approach* may occur in parallel or sequentially (see Gioia & Pitre 1990). In this study the innovation adoption/diffusion and the industrial network approaches were applied in parallel to the empirical reality. Parallel studies reveal and preserve theoretical conflicts in depicting the different aspects of the phenomenon in the light of opposing theoretical views.

This study adopts a *case-research strategy*, which goes hand in hand with the multi-paradigm approach (see Lewis & Grimes 1999) and the aim of understanding the dynamics of a complex unbounded research phenomenon (see Eisenhardt 1989, 534; Yin 2003, 5–9, 13; Pihlanto 1994, 373). Given that the goal is to enhance *understanding* rather than to seek a causal explanation, a *qualitative approach* (Stake 1995, 37) is taken.

The empirical part of the study investigates the adoption process in five food-processing companies in Finland. In line with their wishes, the companies remain anonymous here and are labeled Foodsmall1, Foodsmall2, Foodmedium, Foodconcern1, and Foodconcern2. The innovation to be adopted was used to rank the suitable cases. The basic condition was that it had to meet the major innovation criterion, namely being perceived as new and beneficial from the adopter company's point of view (see e.g., Cummings 1998). Further, they were all technological innovations taken into the production processes of the companies. Table 1 presents the key details of the cases.

Table 1 The cases

Company	Number of employees	Process type	Risks	Cost of Innovation	Interviews
Foodsmall1	ca. 15	Production development	Financial	MEUR 0.4	Total: 3 Adopter:2 Seller:1
Foodsmall2	ca. 15	Production development	Not notable	EUR 20,000	Total: 9 Adopter:5 Seller:2 3 rd parties:2
Foodmedium	ca. 150	Production development	Financial	MEUR 0.4	Total: 10 Adopter:8 Seller:1 3 rd parties:1
Foodconcern1	over 4,500	Production development	Microbiological quality hazard	EUR 80,000	Total: 10 Adopter:8 Seller:2
Foodconcern2	over 5,000	Production development	Variety of production challenges	MEUR 8	Total: 8 Adopter:7 3 rd parties:1

In total: 40

There was high risk associated with the processes in all the cases except Foodsmall2, and therefore the role of external information and networks was assumed to be critical. This was confirmed prior to the interviews in the preliminary discussions with the company representatives. The cases are presented below.

Foodsmall1 is a small family business established in 1977. The business idea is to develop, produce and market healthy and health-supporting high-quality vegetarian and organic food supplies for consumers who value wellness and well-being. The adoption process in question concerned the packing function for a certain product range. The adopted innovation was a packing machine with a disinfection function comprising the largest single machine investment in the firm's history, and accounting for around 20 percent of its annual turnover. This feature was new and highly beneficial to the adopter company.

Foodsmall2 is a small family business whose business idea is to produce traditional products applying tomorrow's technology. This means additive- and preservative-free high-technology production in which the company has invested heavily. A supplier had invented a cover for UVC lights that makes the use of UVC lighting feasible in washable production facilities. The cover and a disinfection solution based thereon comprise the innovation in this case. The disinfection system was co-developed by the supplier and Foodsmall2.

Foodmedium is again a family business, established in 1959. The innovation in this case was a new packing machine for a certain production line. It cost around 400,000 euro and constituted the largest single machine investment in the company's history.

Foodconcern1 is one of the biggest food-processing companies in Finland and has a long tradition in Finnish food processing. The case concerns the adoption of a new quality-assurance system to analyze the end products. The investment was not large in financial

terms, but was potentially dramatically hazardous in microbiological terms if it had not worked properly.

Foodconcern2 is another of the largest food-processing concerns in Finland. The innovation in this case was a new production line at one of its plants. The line comprised three machines of which the company had no prior experience, and other equipment such as conveyors that facilitated production flow and processing. The implementation had to take place partially during the production breaks in the evenings and at weekends. Given the huge production volume, if this line or its implementation had failed it would have caused severe problems in the production and more widely in the whole raw-material chain, as the company uses live raw material. The animals in question might have grown too large for processing during any delays.

The *interview method* was chosen as the primary data-collection technique. It is especially well suited to highly episodic and infrequent phenomena (Eisenhardt & Graebner 2007, 28) such as adoption and diffusion. The interview framework comprised themes covering both theoretical approaches in two separate sections covered with every interviewee in the same interview. The theory-driven questions were not meant to be compulsive or restrictive; rather, the discussions were guided by the themes derived from the theory and the pre-formed questions were only there to help generate and initiate discussion. The discussion was so rich in some interviews that the questions were used only to a marginal extent, and vice versa - some interviews were more or less driven by them. Documents were used when available as secondary data to support the interview material (see e.g., Glueck & Willis 1979). In all of the cases the companies' web pages and general information from the Internet were used as sources of information on their finances, staff, and firm characteristics.

Eisenhardt and Graebner (2007, 28) suggest choosing numerous and highly knowledgeable informants who view the studied phenomenon from different perspectives in order to increase reliability and reduce the bias in the interview data. The *snowballing technique* (see e.g., Moriarty & Bateson 1982, Johnston & Bonoma 1981) was used to identify the informants. This was considered relevant as the individuals in the adopter organizations did not necessarily comprise a formal structural unit, and it was more likely that various individuals from different organizational units were engaged in the processes. The strategy was to interview all the individuals at the adopter company and at the other actor organizations who had a certain role in the adoption processes. All the informants were asked who else had been involved or would otherwise be worth interviewing. In order to acquire data on the adopters' external information-gathering patterns other external actors were interviewed, too. The interviews were conducted between 27th September 2005 and 26th June 2007. They were all recorded and transcribed in order to facilitate comprehensive analysis.

The cases interpreted in accordance with the approaches

Foodsmall1 – a new packing machine

The adoption/diffusion approach

The change agent (supplier) provided the first information about the innovation when the company contacted it to hear about the potential solutions it had to offer for fixing the problem of insufficient packing volume. The adopted machine was the first of its type in Finland. Hence, there were no earlier adopters or opinion leaders with relevant information with whom to discuss experiences of functionality and practical issues within Foodsmall1's social system, which was quite restricted locally.

Foodsmall1 did have some discussions about the machine's adoption with a couple of food-processing companies with which it had good relations and frequent informal

communication, however. This increased the likelihood of adopting the innovation in that the discussions and the brief search for alternative solutions did not reveal anything better.

The adoption decision was also facilitated by the fact that the machine was already in use in other European countries, even if only in small numbers, according to the change agent this was the 36th machine to be sold up to that point. Hence the diffusion that had already occurred did have an impact on the Foodsmall1 adoption. Information about the diffusion and the innovation was obtained from a reference list provided by the change agent, whose reputation was another significant factor.

The industrial network approach

Sales had risen strongly and there was clear pressure to make sure that Foodsmall1's production capacity was sufficient to meet retailers' needs. Hence the company faced a problem that forced it to look for solutions. It knew the supplier, from which it had previously obtained production machinery. There was an existing relationship between the companies in terms of regular maintenance of the previously supplied machines, one of which was similar to the newly acquired packing machine, but without the innovative disinfection feature. The adoption process was an episode within the ongoing relationship between Foodsmall1 and the technology supplier, which in turn influenced and structured the process. The focus was not on the intentional development of actor bonds (attraction, trust, and commitment) as these already existed and positively affected the adoption episode.

Embeddedness in terms of technological compatibility with the older packing machine and the strong actor bonds with the chosen supplier meant that Foodsmall1 did not consider other suppliers to any great extent. However, given the high price and the importance of the machine it asked for and received advice from another food-processing firm, which passed on information about a Danish technology manufacturer that had a much cheaper aseptic packing machine. This gave rise to some consideration that lengthened the process. However, the Danish machine proved to be very different and lacked a disinfection function. Foodsmall1 was never in direct contact with the supplier.

Foodsmall2 – a new disinfection method

The adoption/diffusion approach

Foodsmall2 became aware of a cover that allowed UVC lights to be installed in its washable production facilities when the CEO and owner of a change agent (technology supplier) came to meet the production manager. No social system played a role in the adoption process because Foodsmall2 was the first adopter and co-developer of the innovation. No other external information was gathered, and no other communication channels were used in the evaluation and consideration of the innovation.

The industrial network approach

The supplier visited Foodsmall2 for two reasons. Firstly, Foodsmall2 had been profiled as developing its production process towards becoming additive and preservative free. This was a core statement about its business and differentiated it from bulk manufacturers in the competition for consumers. It had already invested in sterile production and a culture supporting this idea had evolved. Secondly, Foodsmall2, as a small family business, was thought to be more approachable and likely to engage in this kind of project, even though the supplier did not have a proven track record.

This supplier's belief in Foodsmall2's innovativeness proved to be justified, and the companies began to co-operate in developing, installing and modifying a disinfection solution

based on UVC lights. The adoption episode was thus the initiation of a relationship between these companies.

Foodmedium – a new packing machine

The adoption/diffusion approach

Foodmedium became aware of the innovation when it contacted the change agent (supplier). It already had general knowledge about different packing machines, but then it became aware of the possible specific solution it was seeking.

The change agent presented a plan for developing the packing machine, which was not a standard product but needed to be purpose built according to Foodmedium's requirements. It then organized a reference visit for representatives of Foodmedium to a plant that produced a similar product and used a similar type of packing machine to the one under consideration. The reference site was significantly bigger than Foodmedium and the capacity of the machine was much higher than required. The Foodmedium representatives had an opportunity to talk to and ask questions of the other company's employees, and thus the reference company could be considered an *opinion leader* in this case, providing homophilious information. This visit made the innovation observable to Foodmedium and eased the complexity and uncertainty related to it. No other external information was gathered, and no other communication channels were used in the evaluation and consideration of the innovation.

The industrial network approach

Due to the standardization of automatic packing in modern food processing, and the activeness of the company in the field, Foodmedium was well aware of other suppliers of packing machines prior to the adoption process.

The adoption of the new machine was an *episode* within an established relationship between Foodmedium and the technology supplier, and an episode between Foodmedium and the three other suppliers considered. Foodmedium had known the chosen supplier for years and had acquired machinery from it for other production areas. Given this joint history it was naturally included in the project as a potential supplier. Foodmedium also contacted and had interaction with three other suppliers, one of which had provided it with machines previously. In this respect there were established relationships with all the potential suppliers prior to the adoption process. The two that had not been used before were invited in order to provide information and to give reassurance about the performance and price of the adopted solution compared to other options.

All the suppliers under consideration had an agency in Finland, and one of them was also manufacturing the machinery in the country. However, this spatial distance did not play any role in the process, but the social relationships with all four were perhaps a prerequisite for being considered a potential supplier. The two that had previously provided Foodmedium with machinery were considered to offer the most potential. The unsuccessful one had supplied machinery for the packing section and had slight technological embeddedness on its side, but the brand was not competitive enough.

The rivalry aspect does not reflect the very close joint-development relationship between Foodmedium and the potential suppliers with which it had already co-operated. This could be attributed to the *low resource dependency* in this specific task: a packing machine is a rather individual unit and can be acquired from any capable supplier.

The chosen supplier had supplied other food-processing companies in the past and thus had a relationship with the industry. It recruited these third actors and organized a reference visit in order to facilitate the adoption process. The Foodmedium representatives saw a similar but larger machine in action at the reference plant and had a chance to discuss it with the workers

there. The reference visit convinced them about the technical issues, but the *network position* of the supplier was equally important. The reference company was a much bigger actor and a significant player in various markets. The reasoning was that if this large a company had similar machines it was likely that the supplier would be a reliable partner in carrying out this specific task.

Foodconcern1 – a new quality-assurance method

The adoption/diffusion approach

Foodconcern1 became aware of the innovation when the technology supplier contacted it. The supplier represented a *change agent* promoting change from the old method to the one it offered. The interviewees also perceived it as an *opinion leader* in the sense that the method was in use in its laboratory in the production of commercial analytical services.

The *social system* facilitated the acquisition of information about the existence of new technologies. Foodconcern1 was well represented in informal communities through its employees and their social networks, through which much *homophilious* information passed. During the testing it was in contact with another food-processing company that had adopted the same method for a similar purpose. This company was an *opinion leader* in this case. It provided detailed information about the use and functionality of the innovation, which implied that it was favorable for adoption.

The industrial network approach

Competitive pressures mean that Foodconcern1 is constantly willing to improve its performance, is open to new ideas, and is aware of technological opportunities. It had general knowledge about new quality-assurance techniques before beginning the adoption process scrutinized here, mostly on account of active suppliers seeking business and its own activity in monitoring the environment. Its general knowledge, and the very brief informal consideration related to it, did not lead to any further action until the supplier of the adopted innovation made contact in order to demonstrate the method.

Foodconcern1 was aware of the supplier, who had actively taken part in different kinds of exhibitions, and built up knowledge about its products through different channels. However there was no relationship before the adoption process, which was thus an *initiation episode*.

Foodconcern1 also discussed using *another technology supplier* and contacted one company. Given the complexity and importance of the product the company wanted to find out about other possible technologies and how they performed. The two on offer were formally compared at Foodconcern1 before the supplier was selected for the testing period.

Some other actors in addition to the two suppliers and the adopter were engaged in the adoption process. Foodconcern1's main competitor was an actor in its social network in that one of its microbiologists was a member of the adoption project group and knew the quality-development manager of this competitor firm. Both firms were members of an informal self-organizing network consisting of key industry players in the Nordic countries who attended seminars once or twice a year. Hence, the interconnectedness of this network was quite solid, and more specifically the interconnectedness between Foodconcern1 and its main competitor was high.

Co-operation in terms of the joint coordination of quality analysis builds on the idea that the actors are *interconnected* through consumer markets. According to the interviewees, a consumer does not distinguish between different brands if there is a significant quality hazard in some product category, but is likely to extend the problems of one brand to others. The competitor had acquired exactly the same method from the supplier earlier and had experience

of it. The purpose of consulting this company was to reduce the risk associated with this method. These networking activities linked the actors' and their resources.

The other food-processing companies' use of the innovation also indirectly affected the adoption process, as communicated through *references*. The references had two functions in this case. Firstly they helped in the very first evaluation. According to the project manager a general problem is that the methods do not always deliver what they promise. Thus, the problem is that how to screen out effectively the least promising ones. The *reference list* in this case facilitated this screening process, evoked trust, and reduced risk. Secondly, the references facilitated the governmental bodies' approval of the method for use at Foodconcern1.

Foodconcern2 – a new production line

The adoption/diffusion approach

Foodconcern2 had general knowledge about these new production technologies before the adoption process started. It had acquired information via social-system communication including company visits and informal discussions, and from change agents at exhibition visits. As a large player its social system was not locally restricted. The adopted production line was the first of its type in Finland, and the company had become aware of this specific innovation when it approached the change agent (supplier).

Deliberation about the innovation was based on intra-firm evaluation but also on external information acquired for that purpose. The most significant source of information was a reference visit organized by the change agent. The opportunity to talk to the production staff at the plant facilitated homophilious communication about the innovation, and thus the reference company could be considered an *opinion leader* in this case. This visit made the innovation visible to Foodmedium and eased the complexity and uncertainty related to it.

Further to the visit the supplier gave Foodconcern2 a written report in which an earlier adopter reflected on his experiences of using the innovation. The evaluative processing of this information led to the adoption.

The industrial network approach

The key people in the company already had a vision of an automated process, and had been developing the idea of an ideal production process since the mid-1990s. They acquired their general knowledge about the relevant technologies by visiting different production plants and being in close contact with the key suppliers in the field. Contacts within the industry, and with technology suppliers and consultancies, were well established and yielded knowledge about new innovations. Foodconcern2 knew of four key technology suppliers in the world specialized in automation projects related to this issue, three of them were Danish and one was Dutch. As a larger food-processing firm, it was naturally interested in technology development and wanted to be a part of it. Its representatives said that they wanted to have good relationships with all these key players because of their clear *resource dependency* on them. This was motivated by the competitive pressures that were forcing it to seek new ways of improving quality and cost efficiency.

At the beginning of the year 2000 the company began seriously to consider introducing new production technologies similar to the production line it eventually adopted, but the time was not ripe. The firm realized that the machines did not work effectively, and companies that had taken early versions into use had struggled with them. This information was gleaned through the close relationships with other food-processing firms and suppliers. Given its long-term interest in and positive attitude towards these technologies the company was willing to embark on a project to consider the options in more detail once it knew that the new

generation of technologies was a reality. This knowledge was, again, gleaned from various company visits, informal discussions, and exhibition visits in which this positive view of the current developmental status of the technology was strengthened.

The adoption process was part of the continuous technological development and *an episode in the relationships* that Foodconcern2 had with the eventual supplier and the other one it had considered. *Reference-site* visits were made to both, during which its representatives saw the machines in action. These visits were significant in the sense that before them the preferred supplier was not the one that was eventually chosen. Having made the visits, and especially after receiving a written report from the eventual supplier in which both machines were evaluated by a firm that had them in use in its production facility and expressed a preference for the one finally chosen, Foodconcern2 decided on the one it had been favored least initially. After the adoption the co-operation strengthened and resulted in the building of the production line that is currently in use.

Findings and discussion

Both the adoption/diffusion and the industrial network approaches clearly capture the context in which an adoption process is embedded. The perspective of the former is on the innovation to be diffused and the related communication flows between the adopter and opinion leaders as well as the change agent. The emphasis is on the time variable and the diffusion is considered a cumulative process in which the innovation sweeps through the social system. It provides the context for the individual adoption process in that already adopted companies are potential sources of information. The industrial network approach, on the other hand, considers a single adoption as an organizational activity in a wider relational setting of actors. The temporal adoption process is linked to both the history and the future of the adopter and other influential actors and their activities. Account is taken of the direct and indirect influences affecting the adoption process. Figure 3 compares the two approaches in parallel.

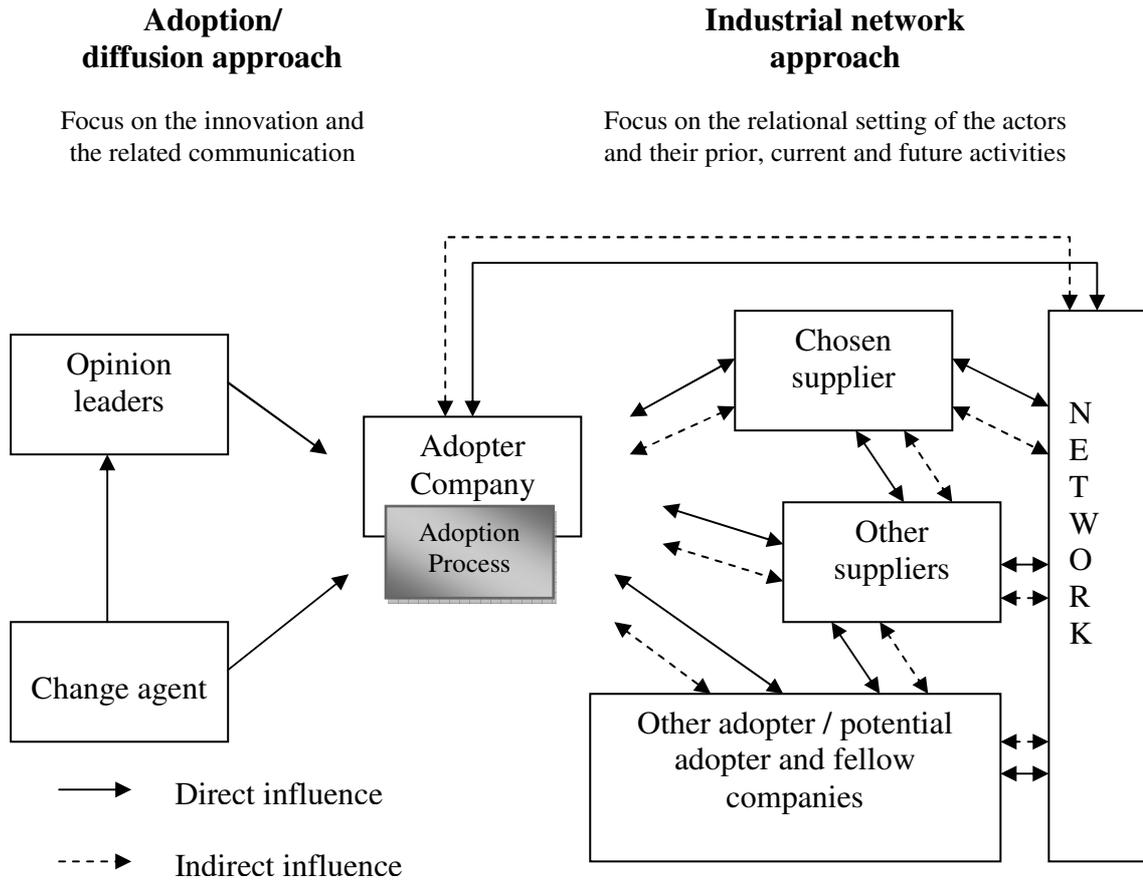


Figure 3 The relationship between the adoption/diffusion and the industrial network approaches

The industrial network approach emphasizes the relational setting of the actors. The adoption process activates the adopter's established relationships with the supplier, fellow companies and other potential suppliers, or initiates new relationships with them. In the Foodsmall1, Foodmedium, and Foodconcern2 cases the processes happened in the context of established relationships. These relationships structured the interaction as the norms and rules had already developed through earlier interaction. This was evident in that much of the focus in the cases was on concrete action rather than the development of actor bonds, adaptation or mutual learning. The adoption episode established a new relationship between the companies in the Foodsmall2 and Foodconcern1 cases, and especially in the latter one trust in the supplier and the method had to be developed before the formal project phase began. The lack of a previous company-level formal relationship was compensated in Foodsmall2 case by the fact that the persons concerned knew each other already.

Complementing these direct relationships and their related influences, the adoption process indirectly influences and is influenced by other actors in the suppliers' networks through interlinked relationships. In the cases this refers to the suppliers' earlier references and relationships that influenced the focal adoption process, which in turn will probably influence upcoming adoptions by customers of the chosen supplier as a reference. For example, in the Foodconcern1 case earlier references affected the adoption process and the choice of supplier, and the adoption is also likely to play a referential role in future selling attempts of the supplier.

Concepts related to the adoption/diffusion approach, including the notions of opinion leaders, change agents, and social systems, were not unambiguously identified in the cases. They were rather related to the actors only as minor reflections at the time, not as dominant or permanent features. For example, although Foodconcern1 approached a fellow company that had adopted the technology earlier, it did not consider it to be an opinion leader. The focus was on information gathering and the other company was only a source of specific knowledge about the innovation.

It was problematic to define the relevant social system in the contexts of the case companies. Some of the firms consulted had not yet adopted the innovation, and may or may not have been future adopters of this specific innovation from this supplier or of some related innovation from the same or another supplier. Hence, the idea of diffusion as a static process related to some specific innovation and linked to a social system is problematic and restrictive. It is not so easy to define a group of potential adopters. It is necessary first to define a relevant unit of adoption, and to determine whether it is a single company or a dyad, or possibly a value chain. If we do define a relevant unit of adoption, the question remains whether we can then define a social system as a group of potential adopters in an industrial context. It does not necessarily have to be an industry, however. For example, the supplier in the Foodconcern1 case used references from the cosmetics industry in convincing the adopter. Webster and Wind (1972, 7) hypothesized long ago that buying organizations are likely to differ from each other to the extent that each one might need to be viewed as a separate market segment. This difference between industrial markets and consumer markets derives from the different objectives, resources, people, and abilities in the companies.

No evidence was found of the concept of change agent in this rather stiff form. Both the chosen suppliers and the group of suppliers were more likely to be familiar from other contexts, and the “change” in the form of the innovation did not take place overnight, nor was it advocated only by these suppliers. For example, in the Foodconcern2 case the adopter company had been promoting change and cooperating with suppliers. The need for this type of development was constant in all the case companies, and the suppliers were aware of it, and were part of the evolutionary process or would have liked to be.

The cooperative role of the change agents or suppliers was identified not only prior to but also during the adoption processes due to the complex nature of the technological innovations in question. They were not ready solutions and had to be purpose built and redesigned in situ (on similar notions see e.g., Robertson et al. 1996, 336; Clark 1987; Fleck, Webster & Williams 1990; von Hippell 1982). The change agent/supplier cooperation also affected the adopters’ evaluations of the innovations in that the attributes evaluated were not only rigid and fixed but also *socially constructed* in a process that was affected by the supplier (see also Newell, Swan, & Galliers 2000, 245).

Partly on account of its emphasis on a specific innovation, the innovation adoption/diffusion approach ignores competing change agents. The lack of substitutes for radically new innovations would remove alternative options and other change agents from the picture and bring the adoption process closer to the major-change and single-change-agent ideology inherent in the approach. Most of the studied cases involved competing change agents/suppliers and solutions. This is logical as it is natural to assume that various potential solutions will meet the defined organizational needs, and equally hard to imagine a unique need to which there is only one solution. Multiple suppliers were taken into the process by the adopter in order to enhance understanding of the innovation and to add an element of rivalry.

Conclusions

The adoption/diffusion approach gives little indication of the effects on adoption of previous development, relationships, or other structural elements of the relational setting of actors and

their activities. It is rather the innovation to be diffused and the related communication that are in focus. As a result, the phenomenon is considered unique and actors are assigned the static roles of opinion leaders and change agents. This fits poorly with the empirical data. The weaknesses are linked to the fact that the approach was originally developed to describe the spread of new-to-the-world innovations but usually, as in this study, it extended to the adoption and diffusion of new-to-the-adopter innovations (see also Cobbenhagen 2000, 26).

The industrial network approach, on the other hand, represents a wider and perhaps more realistic view of adoption and diffusion. In taking into account the relational setting between actors and their activities in the context of the past, present and future it provides a solid framework for a single, temporary adoption process. In this respect the process could be seen as a temporal reflection of wider context-bound organizational activities. The different actors affecting the adoption process directly or indirectly are identified, and light is shed on the specific drivers in terms of actor bonds, interconnectedness, and resource dependency. This eases the pressure on identifying the different actors only in terms of this temporal innovation adoption, and allows each process to be set against a wider developmental path and a network comprising various actors who directly and indirectly influence it.

There were differences in adoption patterns between the small and large case companies. It was more a question of a continual process in the larger firms, which tended to possess general knowledge about the product category or technology platform related to the innovation. They therefore knew about the future adoption long before it happened. The smaller firms were more serendipitously introduced to the innovations. There were also differences in terms of the information channels used and emphasized. The information provided by the supplier (change agent) was more important to the smaller companies, whereas the bigger ones tended to use other sources, consulted for a specific purpose (Foodconcern1 even consulted its main competitor), or already had direct or indirect knowledge or experience of the innovation in question.

Future research avenues

This study establishes a point of departure for further research on organizational innovation adoption/diffusion processes. The focus was on technology innovations in manufacturing organizations. The applicability of the ideas presented to other types of innovation could be scrutinized in future studies. Organizational contexts other than business operations could also be considered. More specifically, further research could focus sharply on particular aspects of the small, medium-sized and large companies used in this study, and in a small-business context could shed light on some factor that has been ignored in studies concentrating primarily on big businesses.

Given the relatively sparse academic discussion on the topic of applying multiple theories simultaneously and comparing them, there are various themes that are neglected in the literature. In this respect the current study provides guidance and an example of how to conduct this type of research. However, there is a need for further investigation into how to conduct this type of research in a methodologically sound manner.

Further research could continue the practice of borrowing from other fields, as explicitly adopted in this study. The phenomenon of organizational innovation adoption and diffusion was approached from the industrial network perspective. Given the fact that research on adoption and diffusion has been conducted within a variety of disciplines, there must be interconnections between the adoption/diffusion approach and other relevant theoretical approaches within other disciplines. Borrowing from other fields and presenting the results to others engaged in research on adoption and diffusion would greatly contribute to and open up this field of study.

Managerial implications

Continuous improvements are essential in gaining and maintaining competitive positioning. Improvement in manufacturing effectiveness refers largely to adopting new technology (see e.g., Winch 1997, 318). The identification and explicit discussion of the structure of information gathering and processing in adoption situations could provide examples for management in terms of managing these activities and structures in their companies. Mapping the sources of information and the types of information they convey reveal patterns of behavior in such situations and make them manageable. This knowledge would facilitate resource allocation and reveal potential bottlenecks in the company's resources and know-how.

From the perspective of technology suppliers the study offers insights into the behavior of industrial customers, as emphasized by LaPlaca (1997, 184), for example: "The foundation for all successful marketing is a firm understanding of customers and their needs, how they make buying decisions, and how purchasing is actually implemented." This understanding will enable suppliers to adapt their actions to satisfy their customers in terms of supplying the required product offerings. Knowledge of information-gathering and processing patterns will make it easier to influence the potential information sources that the buyers consult so as to stimulate positive statements about the product and the supplier.

Suppliers viewing the adoption process as a temporary episode should aim at a co-operative role, and at transferring the positive experiences to the level of the relationship with the customer. This would probably pay dividends in terms of future projects or through positive statements made by the customer to other potential adopters.

An alarming finding relates to the capabilities and resources in small companies to gather and process information on innovations. For example, the owners of Foodsmall1 said it was difficult or even impossible to know about different technologies and to compare them. The situation is even worse for small firms if the partner companies are also small, as was the case in Foodsmall1. These partner firms do not possess any more knowledge that could help the focal adopter firm. The hints given in the Foodsmall1 case actually hindered the information-gathering and processing activities. In this respect the use of technology consultants would perhaps be useful for small firms.

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