TOWARDS A MORE HOLISTIC APPROACH ON ORGANIZATIONAL INNOVATION ADOPTION

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Abstract

The increased turbulence, complexity and competitiveness of business contexts have made identification, evaluation and implementation of new technological innovations critical determinants of organizational productivity, competition and survival. *The purpose of this study* is to scrutinize how the network and interaction approach of IMP could contribute innovation adoption and diffusion research in an organizational setting. The empirical part of the study investigates an adoption process in which a large food processing firm adopted a new microbiological quality assurance method to test microbiological safety and purity of final products. The internationalization of food processing industry combined with a growing amount of global raw material sourcing is posing increasing challenges for companies, authorities and governments in terms of guaranteeing food safety. Since improved food safety is both time consuming and expensive, food producers find it difficult to cover the resulting costs of testing. These circumstances offer an interesting and fruitful context in which to study organizational adoption of technological innovation. As a result of discussing the compatibilities and incompatibilities of the chosen approaches the paper presents an *activity based perspective* that is a new view to conceptualize and understand the organizational innovation adoption process as a holistic phenomenon. Activity based perspective consists of *primary and secondary adoption activities* that are identified on a *focal actor level* as well as on a *system level*.

Keywords: technological innovation, organizational innovation adoption and diffusion, network and interaction approach, activity based perspective

Why and how organizational innovation adoption revisited?

Decision-making is one of the most extensively studied fields within management disciplines. For example in business-to-business marketing organizational buying behavior literature embodies one application that has its grounds in decision-making adopted from general management literature. However single actor oriented decision-making as organizational buying behavior has got followers from approaches that can be applied to the buying phenomenon on a more general level, like the network and interaction approach of IMP (see e.g. Tanner, 1999). A lot of research has been conducted within IMP-tradition that demonstrates the fruitfulness of this shift in unit of analysis in generating more comprehensive understanding of a single actor's behavior with respect to its context. Regardless innovation adoption in the organizational context has continued the tradition of the focal actor perspective, and those studies have been and will still be widely published in quality journals (see e.g. Frambach & Schillewaert, 2002). Therefore *the purpose of this study* is to scrutinize how the network and interaction approach of IMP could contribute innovation adoption and diffusion research in an organizational setting.

In the theoretical framework the most attention has been paid to innovation adoption and diffusion approach in order to clearly specify what we mean by organizational innovation adoption as the literature on this field can be stated to be fragmented, contradictory and beyond interpretation. This review is of the essence for drawing on the interaction and network approach to conceptualize the phenomenon labeled as organizational innovation adoption and for establishing a basis for knowledge accumulation in the field of organizational innovation adoption in the future. After discussing and reviewing innovation adoption and diffusion we move on to network and interaction approach and consider and choose the most relevant aspects of it to conceptualize the phenomenon and structure the empirical study. Then we represent our case study, conducted by applying the both approaches, in a form of a brief description and analyze it by using the both approaches. Finally the work is put together and ideas for further research are fed in findings, discussion and conclusions section. To do this we aim to harmonize the terminology on organizational innovation adoption and show how knowledge generated within the IMP approach can be applied to understand this phenomenon.

In this study technological innovation refers to a thing that exploits technology and is perceived new and beneficial by the potential adopter (e.g. Damanpour & Evans, 1984; Cumming, 1998, 22). The term organizational here means that the unit of adoption is an organization not an individual. The empirical part of the study investigates an adoption process in which a food processing firm adopted a new microbiological quality assurance method to test microbiological safety and purity of final products. The adopted quality assurance method is an innovation from the adopter's point of view. It changed the analyzing procedure dramatically bringing in evident benefits. Although the technology platform was not new the application of this technology was clearly perceived new by the participants of the decision-making unit at the adopter firm. In the empirical context instead of innovation the informants used terms, investment, product or quality assurance method to refer to the adopted innovation and therefore we use these terms synonymously in this study. For the same reason an investment project, or simply a project, refers here to the innovation adoption process.

Innovation adoption and diffusion research

Adoption and diffusion of innovations has been studied within various disciplines for example economics (e.g. Stoneman & Ireland, 1983; Mansfield, 1961), sociology (e.g. Rogers, 1962), geography (e.g. Brown, 1981), medical sociology (e.g. Coleman, Katz & Menzel, 1957), cultural anthropology (e.g. Barnett, 1953) and marketing (Bass, 1969; Gatignon & Robertson, 1985; Robertson & Gatignon, 1986; Gatignon & Robertson, 1989). According to Grønhaug and Kauffmann (1988, 4) "researchers preoccupied with innovation are partly unaware of the research done and conceptualizations used by colleagues from other disciplines". However Rogers' (1962) seminal work brought closer together diffusion traditions from many fields and is still the most cited piece of work within this research area.

The idea of Rogers' theory is twofold. Single adoption decisions are meaningful in a sense that they can be aggregated on a macro level as cumulative pattern of adoption. On the other hand macro level is meaningful to facilitate understanding of single adoption decisions. Innovation adoption and diffusion is a

theory of communication and sees these two perspectives as information spread on a market level and information processing within a single adopter firm. Despite its popularity the diffusion theory by Rogers is a difficult one for this reason. The theory adopts a focal adopter's point of view and also tries to capture the system view at the same time or vice versa. Conceptually this leads to confusion. Especially the term adoption is very difficult within this theory in an organizational context. Next we consider more carefully this conceptual dilemma and make a distinction between adoption and diffusion as they are used in this study to structure the empirical part.

Innovation diffusion as a context of adoption

Diffusion as a social process of formal and informal information exchange among members of a social system is a core idea of Rogers' (1962) diffusion theory. He (1962, 5) defines diffusion as a process in which innovation "is communicated through certain channels over time among the members of a social system". His diffusion theory consists of four major interrelated constructs influencing the diffusion process: an innovation, relevant social systems, time and communication about the innovation. This approach accentuates importance of interpersonal networks within the social system during the diffusion process. Mahajan, Muller and Bass (1990, 1) extend further this idea of communication. They propose that as being a theory of communication the main focus of diffusion theory lies in the communication channels and their use to transmit information about innovation within and into a certain social system.

Communication channels both personal and impersonal are crucial for innovation diffusion and adoption. Communication channels spread information that makes a potential adopter aware of an innovation and influence on a potential adopter's innovation adoption. Basically two concepts have a key position in this communication; *opinion leaders* and *change agents*. Opinion leaders are members of a social community in which an innovation diffuses and change agents are actors outside this community promoting change in terms of innovation adoption (Rogers 1962).

Distinguishing between adoption as choice and adoption as process

Ozanne and Churchill (1971, 322) state that "the industrial adoption process is nothing more than a decision process leading to the purchase of an industrial innovation." Similarly Woodside and Biemans (2005, 384–385) define adoption as "the decision-making process of an individual unit of adoption…" Becker and Whisler (1967, 466) reviewed literature on organizational processes of innovative behavior and reported "a substantial degree of agreement" as the literature visualized the process of four stages: stimulus, conception, proposal and adoption (or rejection). In the first edition of the seminal book Diffusion of Innovations (1962) Rogers conceptualized the adoption process as awareness, interest, evaluation, trial and adoption. Basing on these statements we could state that innovation adoption equals decision process to acquire innovation. In the same book Rogers' (1962, 17) define adoption as "a decision to continue full-scale use of an innovation". According Klein and Sorra (1996, 1055) adoption is "a decision, typically made by senior organizational managers, that employees within the organization will use the innovation in their work." As well Klein, Conn and Sorra (2001, 811) define adoption as "an organization's decision to install an innovation within the organization... adoption is a decision point, a plan, or a purchase." In this respect the definition of adoption is at least two-fold. Adoption can be seen both a decision-making *process* from it's outset until the decision as well as this final decision *choice* as an outcome of this process (for a classification of hierarchical levels of decisions see Kriger & Barnes, 1992, 446–450). The both conceptualizations, choice and process, can be found to describe the literature.

The distinction between *choice* and *process* conceptualizations of adoption is supported by Choffray and Lilien (1980) as they distinguish research on new-product purchasing in industrial markets into *adoption research* (choice) and *behavior research* (process). Also Mohr (1982) presents a categorization of *variance* (comparable to choice here) and *process* approaches into organizational phenomena and demonstrates this by taking examples from innovation adoption and diffusion literature. Traditionally innovation adoption has been studied within diffusion research. In this context it is understood as choice. This perspective has dominated the field as research has been typically carried out with a large sample of organizations and focusing on correlations between groups of factors and a specific outcome of the adoption proc-

ess. The research has yielded organizational, environmental and managerial factors that separate adopters from non-adopters or different variables such as sources of information used (see e.g. Rogers, 1983) or a role of a CEO (Meyer & Goes, 1988) as predictors of adoption. These models are incapable to explain how these factors evolve and interact with other factors during the process finally producing adoption or rejection (see Langley & Truax, 1994, 620). As process, innovation adoption is not seen only a means producing innovation adoption or rejection that is interesting only as a part of an aggregate level cumulative pattern. Rather the process of adoption is considered meaningful itself. As Damanpour and Schneider (2006, 215) present that even though the process of adoption has been conceptualized as a multiphase process most large sample empirical studies of organizational innovation have operationalized adoption as a dichotomous decision of adoption or rejection (see also Frambach & Schillewaert, 2002, 164). Need for the process perspective has been manifested for example by Frambach and Schillewaert (2002, 172) who argue basing on their review of earlier studies that further research should concentrate on "the factors influencing different pre-adoption stages within the adoption process, rather than the adoption or non-adoption decision itself." (see also Pennings, 1987, 6–7; Drury and Farhoomand, 1999.)

Mohr (1982, 37) took the innovation adoption and diffusion research as an example of a field of research that mix up process theory and variance theory (choice here). We state that the situation has not improved from 1982 as most of the researchers do not recognize that innovation adoption as choice and innovation adoption as process are different fields of research. Figure 1 illustrates the current adoption research. Dashed line between these two research streams and arrows crossing the line illustrates that current research on innovation adoption mix up the terminology and results from these separate fields. Most alarming is that we tend to believe that this is mostly done unconsciously as clear distinction between choice and process approach has not been widely recognized in the previous literature on innovation adoption.

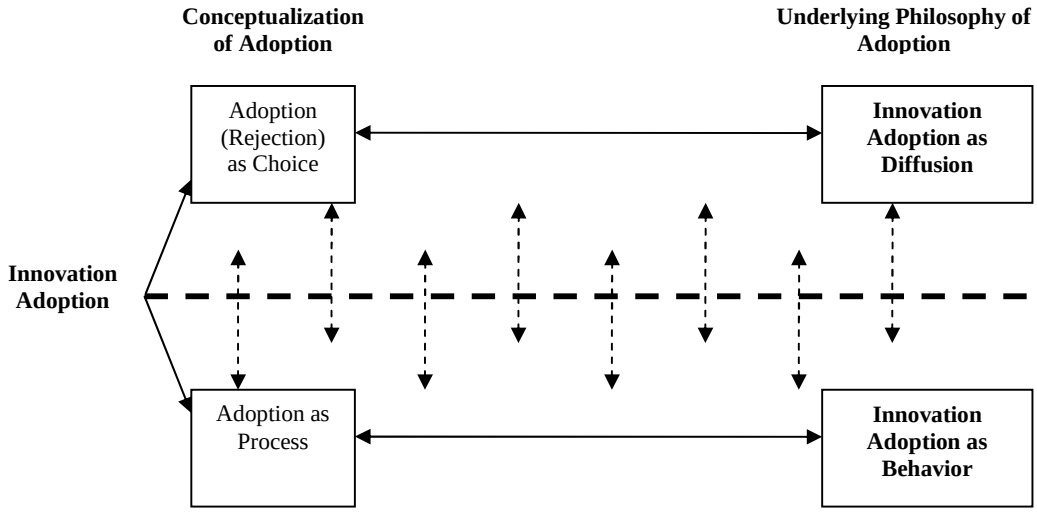

Figure 1 Innovation Adoption Research as Choice and Process

Even though the concept of innovation adoption is shared the underlying ideas are greatly different as adoption is considered as behavior or as diffusion. Mohr (1982, 37) states that attempts to mix between process and variance theory will lead to "significant impediment". He (1982, 69) continues that "lending back and forth between variance theory and process theory leads to a situation in which neither is as well served as it truly deserves, although further work along either track by itself, more purely conceived, might well pay handsome dividends." The research results from these two different fields are like "intermingled pieces of two different jigsaw puzzles. When one realizes that one is dealing with a mixed collection, the two types of bits must first be sorted out; then assembly can go forward in earnest." (Mohr, 1982, 70.) This means that application of results found within studies having a choice as a unit of analysis to

process studies and vice versa should done carefully. By stating this we mean that for example the influence of different factors that have been found in studies considering innovation adoption as choice and generating results through quantitative surveys might be only weak reflections of some other elements more critical during the process making us to believe them being meaningful by themselves. Without recognition of a clear boundary between these separate fields the research labeled under innovation adoption will continue to be inharmonious and dissonant.

As embodiment of this blurred boundary between process and choice adoption we may consider the widely recognized meta-analysis of relation between innovation characteristics and innovation adoption-implementation by Tornatzky and Klein (1982). In their analysis they have included both studies that consider adoption as yes/no decision (70 studies) and studies that take into account adoption decision and post adoption phases (5 studies). The results of the meta-analysis were not presented according this coding but were mixed up together. The study did neither make distinction between individual adopters or organizational adopters nor between different types of innovations, but was rather a general insight on characteristics of innovation and their influence on adoption-implementation.

Concepts related to adoption as process

As we scrutinize adoption as process, we notice that there is disagreement in literature which phases to include to innovation adoption. On the third edition (1983, as well in the fourth 1995) Rogers revised the original model consisting of phases of awareness, interest, evaluation, trial and adoption as the revised model constitutes of knowledge, persuasion, decision (adoption), implementation and confirmation. In this latter version adoption includes also phases that follow the adoption decision and in this respect is more comprehensively conceptualized. Divergence characterizes the process of adoption in the literature as adoption has been put into a variety of phases. Hage and Aiken (1970): evaluation, initiation, implementation and routinization. Zaltman, Duncan and Holbek (1973): knowledge awareness, attitudes formation, (adoption) decision, initial implementation and sustained implementation. Rogers (1995) and Zmud (1982): initiation, adoption and post-adoption. Most of the definitions agree with a classification of *pre-adoption* and *adoption* but in addition some definitions extend the adoption to cover *post adoption* activities as well (see Damanpour & Schneider, 2006, 217).

The models that recognize *post adoption* describe organizational adoption as two-stage process. Firstly innovation is adopted on an organizational level, *primary adoption*, and then on an employee level, *secondary adoption* (see Zaltman et al., 1973). Leonard-Barton and Deschamps (1988, 1253) call these phases similarly as *authority decision* and *end-users' adoption decision*. Klein and Sorra (1996, 1055) define *implementation* as "the process of gaining targeted employees' appropriate and committed use of an innovation." *Intra-firm diffusion* and *individual level acceptance* posses the same meaning as implementation and generally they refer to actions and process that are taken in order to take the adopted innovation in full use among employees at the adopter firm. (cf. Kim & Srivastava, 1998, 231). The idea is that for some type of innovations an organizational adoption process is followed by implementation and employee level adoptions within an adopter firm. The process of adoption, seen as pre adoption, adoption and post adoption, is comparable to assimilation. Meyer and Goes (1988, 897) define *assimilation* as "an organizational process that (1) is set in motion when individual organization members first hear of an innovation's development, (2) can lead to the acquisition of the innovation, and (3) sometimes comes to fruition in the innovation's full acceptance, utilization, and institutionalization." The process of assimilation is divided further into three sub-processes (a knowledge-awareness stage, an evaluation-choice stage and an adoption-implementation stage) each consisting of three episodes. This term covers widely an adoption decision process, its outcome as innovation adoption choice and a phase of intra-organizational diffusion after that. Woodside and Biemans (2005, 387) have described comprehensiveness of assimilation using terms breadth (cumulative number of users) of use and depth of use (extent of use and its impact on the firm).

Interesting is that in the literature implementation, as far as we noticed, hardly ever referred to installation of a capital investment innovation but always to employee level adoption. This tells that the type of the innovations studied under label "innovation adoption" in organizational setting represent a type of

innovation (software, computers etc.) that is targeted to be used by single employees in their personal work.

A model of organizational innovation adoption

Frambach and Schillewaert (2002) reviewed organizational innovation adoption studies and integrated the main findings within a framework (Figure 2). They mention in their paper that classical organizational buying behavior models (Choffray & Lilien, 1980; Sheth, 1973; Webster & Wind, 1972) are "largely reflected" in their framework (Frambach & Schillewaert, 2002, 164). The model consists of phases of *awareness*, *consideration*, *intention*, *adoption* and *continued use*.

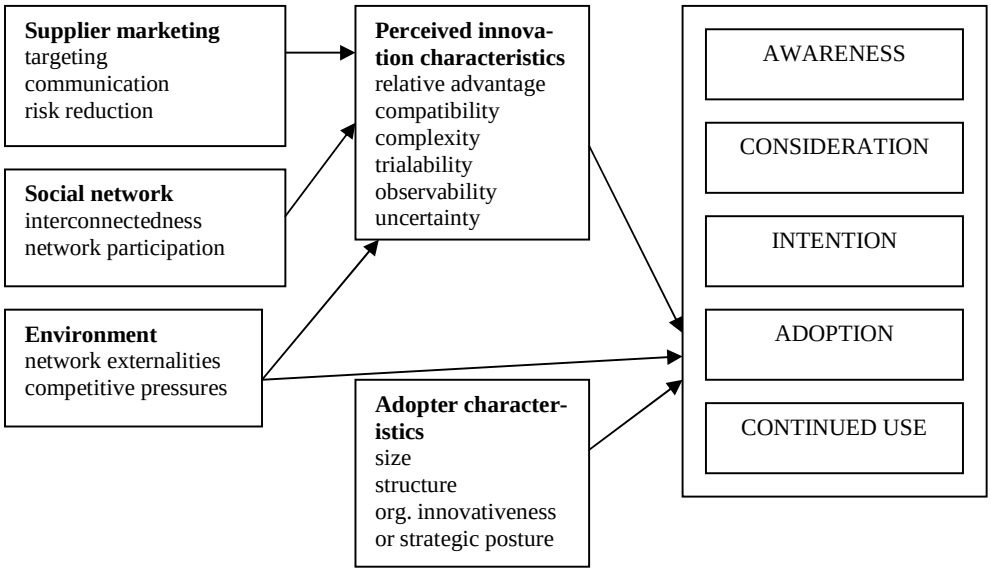

Figure 2 A sequential innovation adoption model (based on Frambach & Schillewaert 2002, 165)

Basing on a literature review Frambach and Schillewaert (2002) propose a set of relations between the presented variable categories and their relations to the adoption decision process that has been put at the heart of the model. However the authors do not clearly argument all their propositions or the influence mechanisms. *Adopter characteristics* have been attached to affect the adoption decision directly. Size affects positively adoption as larger companies feel the greater need to improve and support their performance by adopting an innovation. Organization structure may inhibit or advance adoption. More formalized and centralized organizations (usually large firms) are less likely to initiate adoption but are more capable in implementing innovations properly (see Damanpour, 1991). More or less self-evident is the organizational innovativeness affecting positively on adoption (e.g. Hurley & Hult, 1998). The more important and lucrative the perceived positive *innovation characteristics* (Rogers, 1995); relative advantage, compatibility, trialability, observability and the less important and pernicious the perceived negative innovation characteristics; complexity (Rogers, 1995) and uncertainty (Venkatraman, 1991) the more likely the innovation will be adopted. *Supplier marketing* is proposed to affect these perceived innovation characteristics but the mechanism is not reported. Targeting, communication and risk reduction is presented to have a positive impact on adoption via perceived innovation characteristics (e.g. Robertson and Gatignon, 1986). Participation in social networks and their interconnectedness (Zaltman et al., 1973) facilitates innovation adoption via perceived innovation characteristics as well. *Environment* may influence either positively or negatively on adoption both directly and via perceived innovation characteristics. The existence of external contingencies called *network externalities*, meaning that benefits of adoption for the adopter increases

as the cumulative number of adopters increases, facilitates adoption (see e.g. Katz & Shapiro 1994). Another variable in *environment* category, competitive pressures, have been reported to have both positive and negative affect on adoption. In marketing literature Gatignon and Robertson (1989) have reported competition to stimulate innovation adoption.

Network and interaction approach

Network and interaction approach brings marketing close to organization theory and more precisely to resource dependence view (e.g. Pfeffer & Salancik, 1978) that accentuates an interplay and mutual dependence of environment and organization. The industrial network perspective (see e.g. Axelsson & Easton, 1992) focuses on the space between organizations. The focus of the IMP research has evolved from dyadic relationships to networks of interrelated relationships. The underlying philosophy is the recognition of various actors that are engaged into continuous interaction that is shaped by interdependence, prior experiences and current expectations with other actors. (see e.g. Håkansson & Snehota 1989, 190, 196). The following discusses the key features and concepts of network and interaction approach of IMP that we assume to be applicable to organizational innovation adoption.

In the context of business-to-business marketing the concept of *embeddedness* has a key role. Halinen and Törnroos (1998, 189-190) have stated that the idea of firms being embedded in wider, far extending business networks is the major argument of the IMP approach and has been manifested by an expression "no business is an island" (Håkansson & Snehota, 1989). The concept refers to companies' dependence on and relations with different kinds of networks (Halinen & Törnroos, 1998, 187-188). Ritter (2000) consider the concept of *interconnectedness* that can be seen to relate actors' structural positions more closely whereas embeddedness describe dynamics in an overall context. Ritter (2000) illustrates a situation where two actors (A and B) are connected to the same focal actor F that mediates the effect of acts on relationship FB to FA and vice versa. Nine different kinds of effects are exposed having negative or positive effect on another or both of the actors A and B and one situation where the effect is neutral. The concept of *network position* results from a view of embedded and interconnected nature of business-to-business markets. Network position can be seen as relational setting between individual actors in network structure in terms of individual actor's function, role and identity defined by other actors within the network (see Johansson & Mattsson, 1992; Håkansson & Snehota, 1989, 196).

ARA-model (see Håkansson & Snehota, 1995) is constructed of three factors; actors, resources and activities that are closely related, and in a larger scale form a framework to conceptualize industrial networks. *Actors* control *resources* and are linked to another actors via different *activities* that they perform. The actor may be a single individual, group of individuals or a firm. Actors control the resources directly or indirectly. The indirect control refers to other companies' resources that can be reached by an actor through relationships and interdependencies that connect the actors. The activities are divided into *transformation activities* that are used to generate resources to new resources and *transfer activities* that transfer control over the resources within the network. Transfer activities enable transformation of other companies' resources through relationships.

Relationships can be seen as interrelated acts and episodes taken place in the past shaping and forming the relationship (see e.g. Håkansson, 1982). *Acts* are the smallest ingredients of interaction and relationships (e.g. phone call) and as linked they form coherent *episodes* (negotiation process for example). Håkansson and Gadde (1997) have considered episodes in terms of complexity and in relation to the history of the relationship between the parties. This basis they form a matrix consisting of four situations; a simple episode or a complex episode taking place within a well-developed relationship or in a context lacking of a previous relationship. A relationship can be seen as different kinds of bonds between the interacting organizations. Turnbull and Wilson (1988) argue for complementary needs of organizations to lead to social and structural bonding. Social bonds refer to strength of the relationship in terms of soft measures and structural bonds to social and economic factors that develop to tie the parties together. Halinen (1997) has studied dyadic dynamics and presented three types of bonds: attraction, trust and commitment. Of these, *trust* can be separated further into specific and general trust. General trust is based on indirect information provided by other parties and known reputation of the other party. Specific trust is

generated within the dyadic interactions and is thus based on direct experiences of the other. *Attraction* is attached on the early phases of the relationship development and *commitment* refers to continuity dimension of the relationship based on mutual attraction.

Analytical framework of the study

The discussed approaches fall into two categories in Figure 3. Innovation adoption represents a focal actor perspective and innovation diffusion approach, and network and interaction approach form a system perspective. The arrows connecting the boxes refer to the aim to discuss the compatibility of different approaches to understand our empirical case that embodies organizational innovation adoption here. The classification is based on the connection between innovation adoption and innovation diffusion that was discussed in the theoretical framework and defined that innovation diffusion forms a wider context for innovation adoption as innovation diffusion focuses on information spread on a market level and timing of a single adoption and innovation adoption concentrates on information processing and adoption decision-making within a single adopter firm.

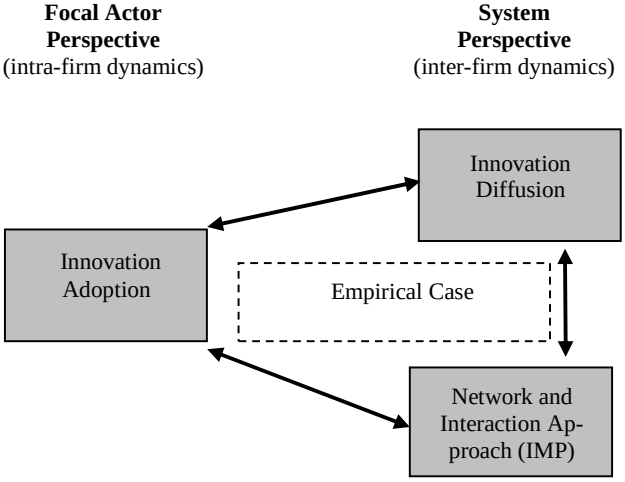

Figure 3 The Analytical framework of the study

In the empirical part we scrutinize the compatibility of network and interaction approach with innovation adoption and innovation diffusion to contribute our understanding on organizational innovation adoption. Although network and interaction approach has been put under a system perspective, where it traditionally belongs, we apply the contextual ideology of this approach to innovation adoption on a focal actor context as well in order to gain a more holistic understanding on different activities and their interplay between different contexts during the adoption process. The following will present the case and methodology and then discuss the approaches against conducted empirical case.

Empirical case study

The adoption process took place during 2002-2003 at one production plant of FoodCo that is one of the biggest food processing concerns in Finland. To respect the wish of anonymity of the supplier and the adopter in this case we name the adopter firm as FoodCo and the supplier firm as TestCo. The adopted product was a microbiological quality assurance method to test microbiological safety and purity of final products. The method consists of a testing machine and chemical reagents that are needed to perform tests by the machine. These reagents are supplied only by TestCo in Finland. This continuous need for reagents and a need for maintenance and service for the machine mean that interaction between TestCo and FoodCo continued after the adoption process.

The methodology used was thematic interviews with the participants of the adoption process at FoodCo and at TestCo. The project was formally based and those individuals were named to the project

which made them easily identifiable. Themes of the interviews have arisen from the chosen theoretical fields but their role has been more supportive than compulsive or restrictive in order to structure the interviews but also to leave room for new topics to be arisen. All the interviews were transcribed in order to facilitate analysis in comprehensive fashion.

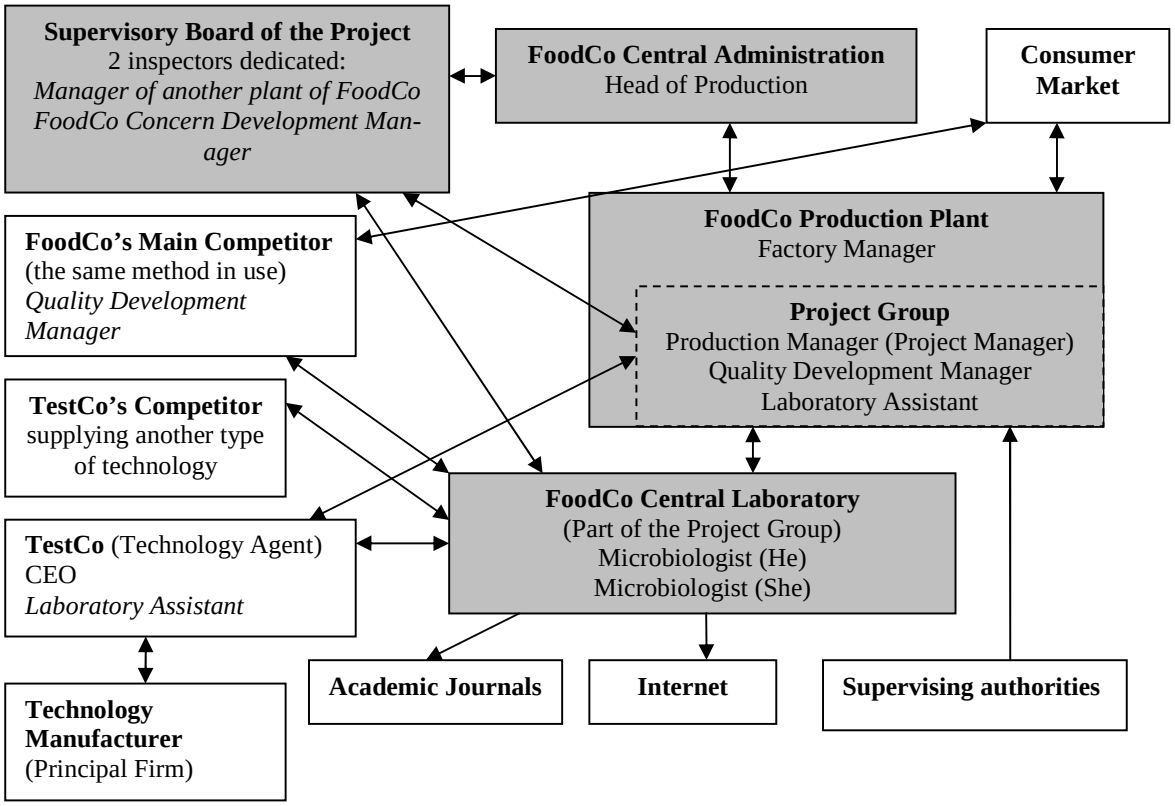

Figure 4 Actors and their relations in the adoption process

The data consists of 10 interviews that have been collected between 27th September 2005 and 18th April 2007. Total number of informants was 8. Five of the informants composed the project group at FoodCo and the sixth informant was the CEO of TestCo, the person who sold the method and did the project together with FoodCo (see Figure 4). These interviews were done between 27th September and 17th March 2006. The rest 2 informants were the head of production from the central administration and the factory manager, who were interviewed later (13th and 18th April 2007) as their attendance in the project came out during the discussion concerning the confirmation of the analysis with the production manager who was the contact person in this research. The role of these two additional interviews was mostly confirmatory supporting and strengthening the already got view of the project as the persons were not directly engaged into the project on a concrete level. The shaded boxes represent the internal parts of FoodCo and the arrows represent different links between these actors in the project. Figure 4 is presented here in order to form a rough idea of the context and the actors of the project for the reader but will be discussed in more detail on page 11 after outlining the project first.

Two individuals of the project group at FoodCo were specialized in microbiology and worked at the central R&D laboratory of the concern. Both of them were phone interviewed twice. The rest three of the project group at FoodCo worked at the production plant. The laboratory assistant, who did all the practical testing, and the project manager were interviewed together at the plant. The third person who worked as quality development manager was phone interviewed as he had left the organization. The CEO of TestCo

was face to face interviewed twice. The factory manager and the head of production were both phone interviewed. TestCo's laboratory assistant's role was a very minor one in the project as she demonstrated the method in practice in couple of first meetings in which the CEO was always present and had the main role. The laboratory assistant had left TestCo already during the project and could not get reached for the interview. The other persons' roles in the project (quality development manager of FoodCo's main competitor and two inspectors) were so minor ones that therefore they were not interviewed.

Outline of the adoption process

The examined project was a half part of a bigger project that aimed developing the production plant's microbiological analytic procedures. This part under scrutiny here included a concrete investment and was particularly a part in which a firm searched a solution to cut down storage time that was required due to microbiological quality assurance. That was done in order to avoid constructing a new storage. The production at this plant was known to rise due to a FoodCo concern level decision to shut down the other one of FoodCo's two special production plants and concentrate all this type of production to this examined site. The production plant needed to find a solution to adapt to increasing production. The microbiological analytics of final products to assure their quality was especially a bottleneck in this new situation.

At the production plant they were aware of faster microbiological quality analyzing methods already since 2000 mainly because of active providers who had approached the plant. Before this shut down decision these methods were not considered seriously even though it might have been a beneficial investment. Due to the known rise in production the factory was more sensitive to respond as the CEO of TestCo contacted the production manager who agreed to meet him at autumn 2001. The method felt promising from the very beginning and the benefits it could bring in sounded lucrative. After some weeks of preliminary investigation they agreed to get into a more serious testing that required a formal establishment of a project. The production manager made a project plan which specified him as project manager, the aims of the project, project personnel, the supervisory board and the schedule. The project outline derived partly from the requirements for an internal technology development process as which this project was specified according ISO 9001 quality system the firm has. The plan was proposed to FoodCo central administration and then a license to start the project was given (see Figure 5).

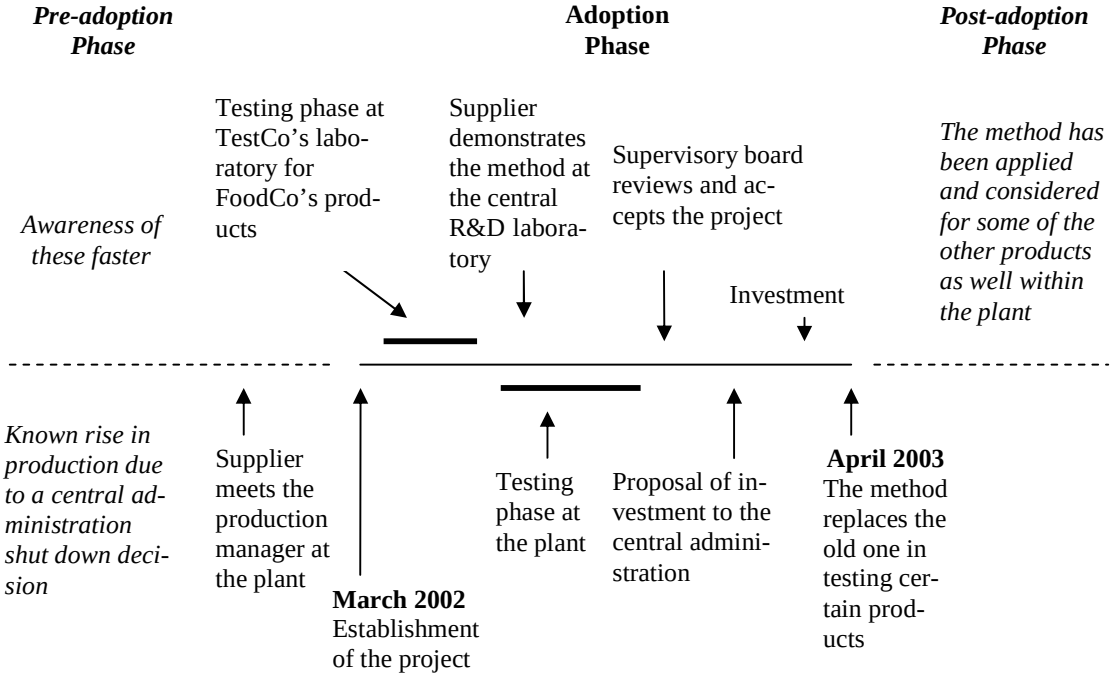

Figure 5 The main incidents of the process

The both microbiologists had known the technology platform since late 1970's. The central laboratory had tested another application of this technology already in the beginning of 1980's for another purpose but results then were not satisfying. After that the central laboratory had not examined any solutions based on this technology and in the beginning they were doubtful about it. The other (he) said that in the beginning of the project he used to put this suspiciousness into a phrase that *"Do we try again a long forthcoming, promising new method."*

After the establishment of the project at FoodCo in March 2002 TestCo performed a testing period in order to adapt and fine tune the method for the products to be tested at the production plant (see Figure 5). During TestCo's testing period FoodCo sent them their products to be analyzed. In parallel with this testing at TestCo FoodCo found out other possibilities and suppliers. In addition to TestCo another supplier whose product was based on a different technology platform was considered preliminary, but never tested due to a high price and lack of references. After TestCo method was adjusted for the FoodCo's products the testing period started at the production plant in August 2002. In the beginning of this testing period at the plant TestCo had to assure the microbiologists that it is worthwhile to engage into a deeper testing phase. For that purpose TestCo visited the central laboratory in September 2002 and performed a set of tests to demonstrate the method and got microbiologists' blessing to continue.

The new method was run in parallel with the old one in order to do comparisons until January 2003. The number of tests being as high as 10 000 was sufficient for statistical analyzing. After the testing period it seemed that the method is enough specific and sensitive for the purpose. The results were then presented to the supervisory board of the project that made sure that the project was done following the formal internal guidelines and the results are satisfying for that purpose. Supervisory board accepted the project and then the production plant was capable to do a proposal of investment to FoodCo central administration. After the approval the machine that was leased until this far was bought and then started to be used in analyzing some product groups without the older method as backup since April 2003. The older method is still currently used to analyze contract manufacturing products and products for children as experiences of the new method are still scarce due to a short time of usage.

The roles of the different actors during the process

The project group at the production plant formed a core for this project (see Figure 4 on page 9). As this project was initiated at the plant in order to meet the need to adapt to increasing production the project group was highly motivated to find a solution to avoid constructing a new storage and to gain the possible benefits of the fast analyzing methods. The project manager and the quality development manager did the project in parallel to other responsibilities but the laboratory assistant was dedicated on full time basis to this project only. The quality development manager made a calculation comparing the method by TestCo with the method currently in use and with the other fast analyzing method provided by the other supplier. He was also mostly in contact with TestCo. The project manager had established the project and was a communication link to microbiologists on issues concerning the project on a more general level. The laboratory assistant did the practical testing and in these issues was in contact with the other microbiologist (she).

The microbiologists acquired and refined information facilitating the evaluation of the method and the adoption process. They brought in expertise needed to arrange the testing and implementation procedures to make sure that they qualify for the restrictions set up by the authorities and interpreted the test results. Their role was also crucial in the final examination by supervisory board to give credence to the project. In addition to the success of this project the microbiologists were interested in the method as they wanted to inspect that whether it could also be used somewhere else within FoodCo concern.

In addition to a traditional role of seller, TestCo possessed also co-operative and expert roles. They brought in their contribution to validation and implementation in terms of expertise and experiences they have gained through earlier customer validation and implementation processes and also through their own use of the method as it had been used in TestCo's own laboratory to produce commercial laboratory testing services. The CEO of the firm was the key person who possessed various roles in this case as TestCo is a quite small firm. In addition to him the laboratory staff at TestCo was involved on practical testing

and user training. TestCo gave user training for the machine, installed it and supplied the needed chemicals.

Sources of information

The microbiologists were the main communication links occupying information about different methods outside the firm. The main channels they used were academic community (journal publications of the method), FoodCo's main competitor, TestCo and the other technology supplier whose product was under consideration (see Figure 4 on page 11).

The method was not validated by any specific validation organization but it was widely used for similar purposes around Europe. According EU principles this whole range of references legitimized the use of the method but still implementation validation was needed to assure internally that the method is reliable to be used and also in order to learn how to use it. The other function of the references in addition for the governmental bodies' approval was to demonstrate to FoodCo that it seems promising and worthwhile to inspect it more carefully. According to the other microbiologist (he) a condition for considering closely a new method is that it has to be validated by an official validation organization or then it has to be used for the same purpose by others trustworthy companies. Also already before the project started the R&D laboratory knew that these methods have been developed further since they last tried them. This knowledge was based on information the suppliers provided and also on international academic journals on the field. This information made an impression that the method might work or at least is worth testing. The lack of references of the other supplier and also the much higher price gave a feeling that it is not even worth testing.

The main competitor of FoodCo at this area was consulted by the other of the microbiologists (she). She knew the quality development manager there at the competitor firm and contacted him during the testing process at the production plant. She characterized that it was mostly due to her curiosity and kind of confirmation she asked but also she got some of their testing results. According to the other microbiologist (he) this was also important in a sense that authorities have accepted this testing method already in Finland for the same purpose and this way facilitates the validation process at FoodCo.

The benefits of the adoption

After implementing the method the production plant was able to cut down the microbiological quality assurance storage time from 6-5 days to 3 days for the products analyzed by this method. This tremendous spare of time saved the plant from constructing a new storage or recruiting new personnel and cut down storage costs. This spare of time also improved certainty of delivery because time span to react and start replacement production shortens if some problems would arise. The new method is less labor intensive and reduces the amount of work at the quality assurance laboratory as well.

These benefits were clearly recognized in the beginning of the project making it very attractive but the in-depth testing period was necessity to assure that there is not trade-off between a level of quality and these gained benefits. The method was considered an important tool to help the production plant to meet the settled goals. It was a totally different way to do the analysis compared to the older method.

Assessing the case through the theoretical approaches

Focal actor perspective

Innovation adoption approach

The following model (Figure 6) has been revised from the model presented by Frambach and Schillewaert (2002, 165) that was presented in Figure 2 in this study. We renamed the phases as *awareness & pre-consideration,* and *time gap* that took place during the pre-adoption stage, *intention, reconsideration & implementation* and *adoption choice* forming the adoption stage and finally *normal use* and *confirmation* that are located to the post adoption stage that was still ongoing at the moment of the data gathering as the method has not been applied to all the products yet due to a lack of sufficient experiences. The arrows be-

tween normal use and confirmation refer that confirmation happens through normal use if FoodCo gets more positive experiences on the method it becomes more confirmed. Different from Frambach and Schillewaert (2002, 165) model we do not propose links between the factor categories in a form of arrows but rather discuss in the text how different factors are interlinked in this case. This is due to a fact that our model is more generous as the affect of different factors has been discussed separately on each level.

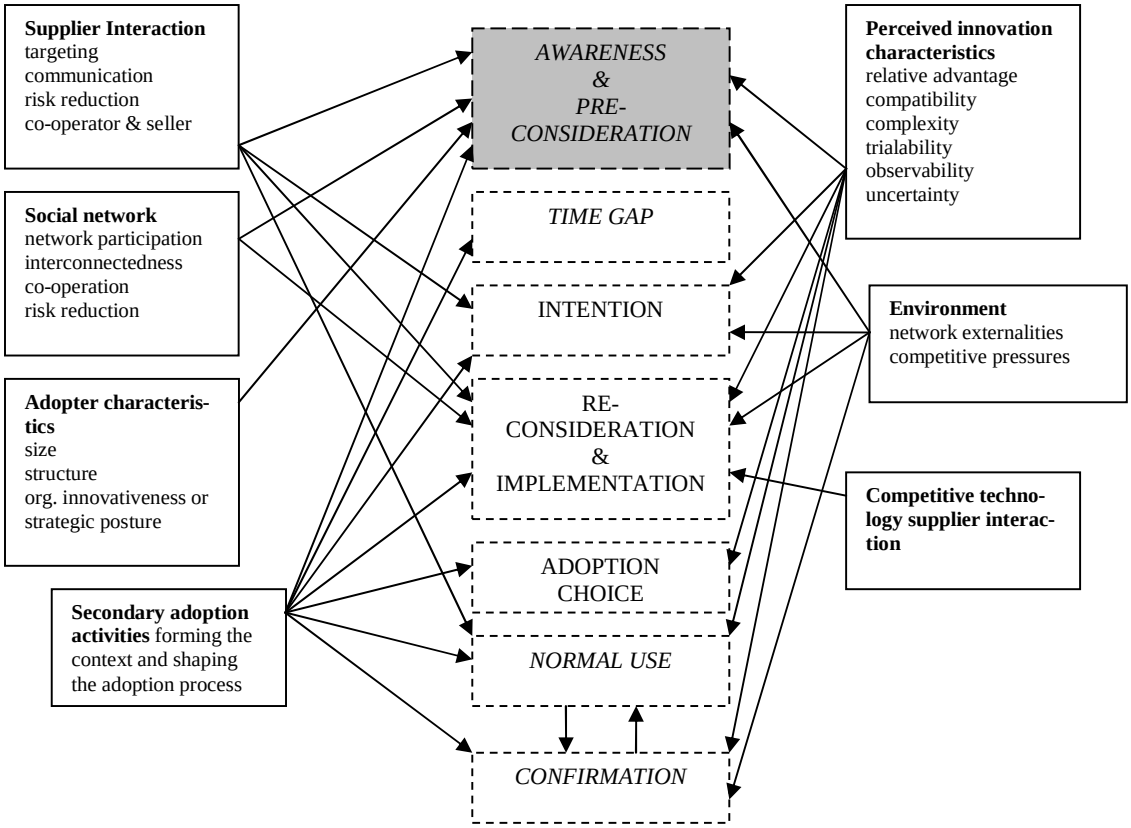

Figure 6 The revised model of case firm's adoption process

The interaction between the *supplier* and the adopter was fairly continuous during the adoption process. TestCo had a great role in advancing awareness and pre-consideration of this adopted innovation by marketing the method. This was done already before this acute adoption process as TestCo had actively taken part in different kinds of exhibitions and built knowledge of its products through different channels. In the beginning of this adoption process the TestCo *targeted* FoodCo and demonstrated the method. During the reconsideration & implementation stage TestCo co-operated tightly with FoodCo in order to adjust and fine tune the method to meet the FoodCo's needs. In addition to this *co-operator* role TestCo had the role of *seller* and therefore could not attend FoodCo's internal meetings concerning this project and was not fully aware of all the things concerning adoption choice and the factors affecting it. The characterizing feature of the interaction between TestCo and FoodCo was *risk reduction*. Thus the method was fairly ready solution, except for the need for fine tuning by TestCo, the main reason for the project was to get certainty of the method's reliability and applicability to the targeted task.

The social network had a role in the very beginning of the process in advancing the general awareness of these faster methods but the social network performed its main role during the reconsideration & implementation phase. The main competitor of FoodCo was an actor from FoodCo's *social network* and the other microbiologist (she) knew the quality development manager from this firm. The both of these firms included in an informal network consisted of key players of this industry on Nordic countries level that has seminars once or twice a year. Hence *interconnectedness* of this network is quite solid. The com-

petitor had acquired exactly the same method from TestCo earlier and had experiences on it. TestCo had provided FoodCo with a list of references which included this contact. However TestCo was not aware of that FoodCo had consulted the competitor in this case. The purpose to consult the main competitor was to reduce the risk associated with this method.

FoodCo being a *large firm* in Finland it is bombarded by suppliers, which facilitates a good level of general awareness of options available in markets. Being a centrally lead organization the *firm structure* affected the shape of the adoption process as a certain protocol needed to be followed. The references had a crucial role to convince FoodCo that it is worth to take a closer look on this method and test it. All of the project group members at FoodCo said that an idea to consider a product that is totally new and do not have references is not a very tempting one. According to the project manager the general problem is the generosity of promising methods and potential projects but the problem is that how to screen effectively what are the most promising ones. The reference list in this case facilitated this screening process evoking trustworthiness and reducing risk. TestCo's CEO put it as "I think that in this case, and especially in the beginning to convince the microbiologists, the role of the international references was a remarkable, without them this could have been easily a dead end." Thus it is clear that FoodCo's *innovativeness* was not a powerful driving force in this case.

Innovation characteristics were evaluated throughout during the process. In this case the method was not very expensive one but the role it has is very important. The method has a *relative advantage* over the former one if it works properly. The spare of time is evident but the method is still under surveillance as FoodCo is not yet fully confirmed that there is not a tradeoff between spare of time and quality of analysis. As the method is not put into a certain system but operates individually *compatibility* here refers instead of technical compatibility to mental compatibility. The perceived relative advantage in the beginning was enough high to beat the suspicious attitudes and in this sense mental incompatibility. This was facilitated by the ease of use (*low complexity*) and *trialability* of the method. TestCo demonstrated the method and its benefits that made them *observable* as well as did the list of references. *Uncertainty* was and still is attached to the method but the other perceived innovation attributes reduced this uncertainty.

Competitive pressures affected the adoption process during various stages. Competitive pressures stimulate FoodCo to improve performance constantly, and due that FoodCo is open for new ideas and willing to be aware of and pre-consider other options in markets. For the same reason FoodCo screened the other method by a *competitive technology supplier* during the re-consideration & implementation phase. This openness may mean that now adopted method could be replaced by a novel solution already in the near future and hence competitive pressures affect on the confirmation stage as well. As the method was already used in Finland by a competitor and the authorities had accepted it in this use it facilitated adoption (called *network externalities* in the model) and eased the re-consideration & implementation phase.

Network and interaction approach

We have added a category in to the model (Figure 6) called *secondary adoption activities* that form the context and shape the adoption process. By adding this and proposing it to affect through out the process we try to draw attention to the embeddedness of the adoption process as it is embedded to the adopter firm's other prior, current and future processes and activities. We can apply the underlying idea of network and interaction approach of various actors that are engaged into continuous interaction that is shaped by interdependence, prior experiences and current expectations with other actors (see e.g. Håkansson & Snehota 1989, 190, 196) to innovation adoption on a focal actor level too. The adoption process can be understood as an actor itself floating in a general business context of FoodCo and being in continuous interaction with the other elements and activities of FoodCo's business operations. For example the decision to shutdown the other plant, the earlier awareness of these methods and suspicious attitudes against them represent results of activity sets that have already taken place. But in respect to purely adoption related activities or activity sets, like planning the evaluation and implementation procedures, testing the machine, co-operating with the supplier, etc., they form a context with which these directly adoption related activities are in interplay.

This interplay between different activities shapes the process and generates various kinds of dynamics in it. Both the central R&D laboratory and the production plant had been aware of these faster methods for analyzing microbiological quality but a concrete starting shot for the project was the production redesign on FoodCo concern level and then the active marketing by TestCo at the same time. In this sense the interplay and randomness resulting from that interplay is emphasized over a linear process with a clear defined beginning and an end. Although the benefits were known already before the redesign decision, the adoption was not considered seriously even though it would have brought in benefits in terms of time and labor saving in any case even without an increase in production. Another example of the interplay between the directly adoption related activities and the secondary adoption activities was social interaction and power hierarchy that characterized the adoption process. As FoodCo is a centrally administrated concern the examined adoption process at the production plant followed strictly the formal procedures for that kind of project. These guidelines for different types of projects are defined in FoodCo's certificated ISO 9001 quality management system. The power relationships were shown particularly on the role of the central R&D laboratory in the project as it had a power to kill the project already before the testing phase if it would have seemed unpromising. In this sense the microbiologists were approvers of technology here having a lot of potential power that they did not exercise in a full scale. Also a need to establish formally the project, specify the details in the project plan and name a supervisory board for the project as well as a need to make a formal proposition of the final investment to the central administration represented certain power structures that shaped the process.

In addition to this view of activities as actors we can clearly recognize an intra-firm network in this adoption process. Different actors (the central administration, the supervisory board, the production plant and the central R&D laboratory) were linked to each others resources via different activities during the adoption process. The production plant was a focal actor in this adoption process as the innovation was to be adopted there. Although the production plant was eager to consider the method in more detail, the limited resources of the plant, as there did not work any microbiologist at the plant, hindered the changes to move on to the reconsideration & implementation stage without support by the R&D laboratory. The microbiologists brought in expertise that was recruited in various ways during the adoption process. Their expertise was needed to arrange the testing and implementation procedures to make sure that they qualify for the restrictions set up by the authorities and to interpret the test results. The microbiologists were also approvers of the technology as they centrally coordinated the microbiological quality assurance within FoodCo. The central administration controlled the financial resources. The central administration had empowered the supervisory board to control the adoption process as an independent and unbiased committee. The supervisory board had surveillance resources and power to affect the adoption process. The microbiologists' role was also crucial in the final examination by the supervisory board in giving credence to the project and hence convincing the board of the quality of the project and its possible results if to be adopted.

System perspective

Innovation diffusion approach

We considered and defined diffusion as a context of adoption in the theoretical framework. Innovation diffusion approach understands single adoption decisions with reference to other adoption units' (opinion leaders) adoption decisions within the social system and change agents' influence on these adoption decisions from outside the community. In this case the main competitor was an opinion-leader for FoodCo as it was a part of FoodCo's social system and horizontally at the same level. TestCo represented a change-agent promoting the change from the old method to the one it supplies. On the other hand TestCo was also an opinion leader in a sense that it was a user of the method as the method was in use in TestCo's laboratory to produce commercial analytical services. The other competing technology supplier was a change-agent pro the innovation it supplied.

In addition to these actors FoodCo occupied information from impersonal media like Internet and academic journals. Internet and academic journals are only forums to provide information and according

to who is a sender the distinction between opinion-leaders and change-agents can be made. In this sense these forums cannot be considered as sources of information according diffusion theory as they do not fall into the presented dichotomy. This approach being a theory of communication is powerless to understand reasons for communication and other types of interactions between the actors related to the adoption process.

Network and interaction approach

By applying the network and interaction approach of IMP we get a wider view to understand the adoption process as *embedded* into its inter-organizational context. This perspective understands better also other types of interaction in addition to communication. The idea of embeddedness is shown in various links and dynamics between FoodCo and its environment. The motivation for the competitor to share experiences and give hints to FoodCo was based on informal personal links but also on the firms' mutual interest to avoid quality problems that would harm the both companies in terms of bad reputation and consumers' tendency to associate single actor's quality problems to the whole industry. In this sense the both companies are embedded into a certain environment and their actions are interlinked together causing direct and indirect effects for another one or both of them. This can be understood as discussed interconnectedness (Ritter 2000) consumer markets being a factor mediating the effects between FoodCo and the competitor (FoodCo < > Consumer market < > Competitor firm).

Due to these interrelations the other one of the microbiologists (she) participates regularly in meetings of an informal consortium of the industry on Nordic countries level. This exchange of experiences derives from an idea that product safety is not an area under competition but rather a prerequisite for the whole industry's welfare. These networking activities connect the actors together and to each others resources as ARA-model illustrates and as the other of the microbiologists (he) put it: *"Networking is a good thing because you can't do everything on your own. It is cheaper to all that we listen to the others' experiences and ideas and exchange them instead of everybody would try on their own. "*

The importance of references in this case can be understood through the concept of network position. The reference list of TestCo gave to FoodCo a concrete hint or proof of TestCo's prestigious network position within different networks performing similar activities (in this case TestCo had references from cosmetic and pharmaceutical industries in addition to food processing industry) or on the same industry as FoodCo. On the other hand the TestCo's high commitment to the project derived partly from the reference value i.e. FoodCo as a reference would facilitate selling the method in Finland in the future.

The adoption process was a relationship establishment process between FoodCo and TestCo and afterwards can be seen as an initiating episode within this relationship. The companies did not have anything to do together before this project (see Håkansson and Gadde 1997). The relational bond *attraction* developed during the early phases of the project. The project manager understood the potential benefits of the method and got along well with the CEO of TestCo. The CEO of TestCo considered a certain discussion important between him and the project manager concerning microbiological analyzing procedures in the very beginning of the project. The CEO assumed that the project manager found his views, based on his wide experience, useful and applicable. The project manager thought that during the testing period at TestCo the adjustment of the reagents and the influence TestCo had in this issue on the principal firm, which tailored the reagents to better fit with the FoodCo's products was a proof showing that TestCo although being a little firm is capable to meet the needs of FoodCo and also willing to adapt to meet them. In addition to this social bonding the companies *committed* to each other through different structural bonds during the process (machine leasing contract, testing phase at TestCo) and after the implementation (continuous need for TestCo's chemical reagents in order to analyze).

Trust refers here mostly to the method and can be put in subjective and objective trust here. The laboratory assistant started to trust the method (having been quite suspicious first) after a certain test in which the method recognized a failure in a test product but she did not recognize that by tasting and smelling. The objective trust was evolved through the testing period in which the method was run in parallel with the older one and 10 000 samples was gathered and analyzed. Because the method is not in full-scale use yet, rather confirmation is still ongoing; the product specific trust could be higher.

Findings, discussion and conclusions

The *purpose of this study* was to scrutinize how the network and interaction approach of IMP could contribute innovation adoption and diffusion research in an organizational setting. First we needed to review and define organizational innovation adoption as the literature on this field is fragmented, contradictory and beyond interpretation. We defined innovation diffusion as a context of innovation adoption and made a distinction between adoption as a *choice* and adoption as a *process*. This categorization has not been illustrated enough explicitly in the previous literature, and therefore the current research on innovation adoption mix up the terminology and results from these separate fields, which leads to conceptual and theoretical confusion. We clarified also the terminology on the adoption process and noticed that implementation hardly ever referred to installation of a capital investment innovation but always to employee level adoption. On the basis of this study organizational innovation adoption can be seen highly relational and embedded activity involving different actors and dynamics between these actors and thus should be considered by acknowledging these interconnections both on a focal actor level and on a system level.

On a focal actor level innovation adoption literature considers an innovation, which initiates a certain pattern of behavior finally leading to adoption as a point of departure for the theory. However the original stimulus-reaction pattern of behavior underlying the innovation adoption that it is more or less a matter of time when a new innovation becomes adopted (or rejected) by a certain unit of adoption and a linear path to this adoption decision cannot be so straightforwardly confirmed. As FoodCo was aware of these faster methods since 2000 this awareness did not initiate a clear decision-process immediately. FoodCo also considered another option supplied by another technology supplier to meet the need. Thus the process was more about to find a solution to a problem not to decide on this specific and finally chosen product. Or as the other of the microbiologists (he) said: "If it would not have worked the ongoing search process would have continued." Instead of this innovation centricity, in which a particular innovation and the path to its adoption is in focus, an organizational need or a problem to be solved could be a more relevant starting point because we may easily imagine a situation in which a firm considers different options and ends up adopting only one of them, like in this case happened. Thus in addition to one adoption process, there can be found one or more rejection processes. In this point innovation adoption approach on a focal actor level could be enriched by the tools created within organizational buying behavior literature. The described adoption process characterized as decision-making in Figure 6 presents a quite limited and forced combination of activities that were relevant to result the adoption because this model focuses heavily on the innovation that became finally adopted. The interplay between different activities and different contexts resulting to this adoption can be very limitedly understood in this kind of presentation in which we illustrate the phenomenon as a decision-making on a finally chosen innovation and factors affecting that process. Instead of this very restricted way to view the adoption process we suggest an *activity based perspective,* consisting of *primary* and *secondary adoption activities* to understand better the problem solving behavior of a focal actor during the adoption process leading to innovation adoption. Primary adoption activities are temporary activities or sets of activities that are performed to solve a current organizational problem. Hence in addition to activities related to adoption of a certain innovation the primary adoption activities include also the rejection processes of the other options considered during the problem solving process. Secondary adoption activities are activities that are not directly attached to problem solving but affect indirectly on it having a facilitating, inhibiting or neutral influence. This view accentuates the embeddeness of the adoption process into a wider problem solving process including the rejection processes and the structural dynamics due to the continuous interaction of the adoption process with the other elements and activities of the adopter's past and present business operations and future visions.

In addition to a focal actor perspective we scrutinized organizational innovation adoption on a *system level* by applying innovation diffusion approach and the network and interaction approach of IMP. The diffusion approach understands the communication flow between the different actors but fails to capture the other interactions and deeper motives for this interaction. Also there are problems to transfer these diffusion related concepts as opinion leadership and change agency and this cumulative pattern of adoption to an industrial context. Problematic is to define the relevant social system in industrial markets as it is not so easy to define the group of potential adopters. We must first define a relevant adopter unit, is it a

single firm or a dyad, maybe a value-chain? The problem to define a relevant unit of adoption means that we cannot define what actually a social system is in an industrial context. Does it have to be an industry?

To briefly conclude we strongly feel that the network and interaction approach of IMP could evidently contribute the current research on organizational innovation adoption, both to understand the phenomenon on its context on a system level and on a focal actor level. The diffusion theory captures perhaps the idea of the information spread and cumulative adoptions in some more stable contexts but is obviously too mechanistic and static to be applied to a modern networked business-to-business markets due to the discussed problems. In order to understand diffusion in this complex context we find a network and interaction approach applicable here as the attention should be paid to identify different actors affecting the process from different networks and concentrate on activities these actors perform. These activities can be classified similarly to *primary adoption activities* and *secondary adoption activities* as on a focal actor level. Primary adoption activities on a system level refers to activities that are directly related to a temporary problem solving as secondary adoption activities mean the past or other current activities or future expectations forming the context and structure for the temporary problem solving in a dynamic network context. Robertson et al. (1996, 336) propose that collaboration based informal relationships between companies in an industry and universities, government agencies and professional associations might well represent the building blocks of diffusion networks. This combining with network and interaction approach enhances the context-specificity of the diffusion ideology to cope with industrial markets. Although a role of a more holistic approach provided by the network and interaction approach has been emphasized in our discussion here, this is not to be interpreted that we ignore the relevancy of current intra-firm oriented approaches. Nonetheless we only suggest that the intra-firm problem solving behavior should be still in focus but not to be assumed to take place in a vacuum but rather in a complex and dynamic environment. There is still a huge gap in our understanding of what happens within a firm when it adopts an innovation and the organizational innovation adoption literature has not shed a bright light on this issue until this far. The underlying stimulus-reaction idea of current adoption models seems to capture some features of the process but the models are still too mechanistic and general to explain how different factors evolve and interact with each other during the process due to the facts discussed in this paper. Therefore we believe that a more holistic perspective of the network and interaction approach would contribute this field on the both separated levels. The idea of primary and secondary innovation adoption activities forms a fruitful base for future research avenues basing on this presented holistic approach.

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