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***Abstract* — The increased turbulence, complexity and competitiveness of organizational environments have made identification, evaluation and implementation of new technological investments critical determinants of organizational productivity, competition and survival. This paper examines new technology investment decision-making process on two levels combining traditional innovation adoption and diffusion approaches by network and interaction approach of IMP-Group. Conducting this we aim to cross-fertilize the chosen approaches and produce more comprehensive and integrated understanding to conceptualize investment decision-making processes on new technology. The empirical part of the study investigates an investment process in which a food processing company invested in a new microbiological quality assurance method. 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 the safety of food. 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 investment decision-making process on new technology.**

***Keywords*— technological innovation, investment decision-making, innovation adoption and diffusion, network approach, food processing industry**

I. Introduction

Decision-making on new technological investment has been closely related to an innovation adoption and diffusion approach in the recent literature. But the literature on innovation can be described as fragmented, contradictory and beyond interpretation. From both theoretical and practical perspectives, our cumulative knowledge of why and how organizations adopt innovations is considerably less than the sum of its parts. Originally the adoption perspective derives from consumer markets particularly how consumers react to new innovations (see e.g. [1]). Studies in which organizational adoption has been scrutinized have concentrated on decision-making outcomes and factors affecting decision-making process not to a decision-making process itself.

As an attempt to fill this research gap and to consider and understand inter-firm dynamics and interactions during the investment decision-making process we combine *network and interaction approach of IMP-group* with this original innovation perspective. IMP stands for Industrial Marketing and Purchasing that is an informal group of scholars interested to study industrial marketing, especially from a perspective of networks and interaction (see e.g. [2]). This idea of applying the network and interaction approach on a diffusion process in an industrial context has been suggested already by Robertson, Swan & Newell [3] which is a starting point for a deeper discussion about the issue for us here. This paper examines new technology investment decision-making process on two levels combining traditional innovation adoption and diffusion approaches by network and interaction approach of IMP-Group. Conducting this we aim to cross-fertilize the chosen approaches and produce more comprehensive and integrated understanding to conceptualize investment decision-making processes on new technology. In order to execute this we first briefly discuss these approaches, present the conducted case and methodology and then interpret the case through these chosen approaches. Finally findings and discussion are presented and ideas for further research are fed. Next we zoom into these approaches to understand the ideology they advocate.

II. Two levels – Three Approaches

A. Innovation diffusion approach

Not all products, ideas or processes adopted are innovations. To be an innovation, there must be some newness or novelty involved or as Cumming [4] points out, it must be "the first successful application of a product or process" for a potential adopter. A perception of newness matters, not the absolute newness of a product [5], [6]. The terms technology, technological innovations, technological investments and products are considered as synonyms in this paper.

Swanson [7] sees innovation diffusion to refer to "the pattern of its adoption by an organizational population over time." Following this general idea diffusion models can be divided into those considering a diffusion process as a whole on an aggregate level and models concentrating on determinants of individual adoption decisions. The former are known as diffusion models and the latter as adoption models [8], [9]. Innovation adoption is a part of an innovation diffusion process that refers to antecedents and timing of an individual adoption decision by an adoption unit and factors affecting that adoption decision. As a part of the innovation diffusion approach an individual adoption decision is interesting only in a sense that factors affecting it can be generalized also to cover other adoption decisions on that specific innovation within the same social system

and this way it gives insights of an aggregate level diffusion phenomenon that recruits mathematical modeling usually (see [10] for a review). The purpose in these research attempts within the field of diffusion has been to identify factors quantitatively that affect positively or negatively on a shape, rate and potential of a diffusion process (see e.g. [11]). These factors have been identified on a *micro-level* (what factors correlate with adoption decisions on an individual adopter level) as well as on a *macro-level* (what other than adopter related factors influence a diffusion process).

To inspect in more detail this communication flow, central in diffusion process, we can draw a distinction between different approaches. Rogers [12] define 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 [10] extended further this idea of communication. They proposed 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. This crucial link between the social system and an environment is missing in a definition offered by Rogers [12] in his early work, even though it is considered by him implicitly. On the basis of information sources used by and available for a potential adopter, models can be put on categories of internal effect models, external effect models and combination models, each established well empirically. *Internal effect models* concentrate only on communication within a social system ignoring outsider sources of information. This means that only earlier innovation adopted organizations or some other units within the social system are able to share information and affect a decision of a potential adopter. Social system internal communication source that affects a decision of a potential adopter is called an "opinion leader" [12]. Similarly *external effect models* concentrate only on outside sources of information denying opportunity for internal communication within a social system. These sources are generally called "change agents" in the diffusion literature [12]. Finally *combination models* take the both sources of communication in the account and are also the most widely used of these models [13], [14].

B. Innovation adoption approach

Based on Mohr's [15] distinction between variance and process approaches into organizational phenomena Langley and Truax [16] discuss technology adoption research. Variance models, carried out with a large sample of organizations and focusing on correlations between groups of variables and a specific outcome [15] have dominated the field of technology adoption research. The research has yielded organizational, environmental and managerial factors that separate technology adopters from non-adopters or different variables such as sources of information used [12] or a role of a CEO [17] 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 [18], [16]. On this basis we can recognize that the concept of innovation adoption is at least dual-meaning. The adoption as variance refers to the meaning as we considered adoption in the previous section it being a part of a diffusion process. In the latter sense the adoption seems to refer the decision-making process of a potential adopter.

Langley and Truax [16] put process-oriented technology adoption models into three classes: sequential models, serendipitous models and political models. In *sequential models* adoption is seen as a multilevel decision process composed of series of sequential phases involving different activities. This process approach is supported by an extensive empirical literature on strategic decision-making in general [19], [20] and was put forward in the innovation adoption context by Rogers [1] establishing a permanent approach and followed by a stream of research (see e.g. [21], [12], [22], [23] and [24]). A number and order of stages of different models varies but the basic idea remains the same.

S*erendipitous models* understand adoption as an outcome of a wide variety of organizational routines. Innovation adoption is included in these standard operating routines that are basically organizational responses to an environment. Under some conditions interplay between an organization and an environment produce innovation adoption [25], [16]. Langley and Truax [16] give the well-established garbage can model by Cohen, March and Olsen [26] of decision-making as an example of ideology advocated by serendipitous decision-making models in general. The garbage can model promotes an idea that organizational decision-making is not in reality as linear, mechanistic and sequential than the sequential models describe it to be: "Although it may be convenient to imagine that choice opportunities lead first to the generation of decision alternatives, then to an evaluation of those consequences in terms of objectives, and finally to a decision, this type of model is often a poor description of what actually happens." [26].

Political models consider adoption as a political process where adoption decisions are fostered by technology advocates who have an influence on managerial level decision-makers. These models emphasize social interaction during the process. The participants of the adoption process can be grouped into champions, boosters and approvers of technology. Reasons for adopting a technology can be based, for example, on financial or strategic components, the credibility of advocates or political pressure. Political models take into account the different influences on adoption from outside and inside the organization during the process. Decision-making and the power of the organization are considered to be centralized and open to influences [16].

C. Bringing clarity to innovation diffusion and adoption approaches

It seems that innovation adoption has at least two different meanings. In a context of diffusion it is understood as a *choice* type decision and in a context of intra-firm decision-making it refers to a whole decision-making *process* (for a hierarchical classification of decisions see [27]). As a process, innovation adoption is not seen only a vehicle producing innovation adoption or rejection that is interesting only as a part of an aggregate level cumulative pattern. Rather it is considered meaningful itself. This perspective brings innovation adoption close to organizational behavior and innovation adoption can be seen as an organizational action taken to change somehow the relationship between the organization and its environment [28], [5]. This process perspective has been manifested for example by Drury and Farhoomand [29] who claim that innovation adoption should not be treated as dichotomous organizational choice decision but rather there is a need for integrative theories considering adoption as a chronological process (see also [30]).

In addition to duality of a phrase "innovation adoption" recognition of a process nature of industrial innovation adoption has led to various interpretations for the term adoption in this process context. Consumer adoption decisions differ in many ways from industrial market adoption decisions. Unlike consumer durables, organizational innovations need to be implemented as a part of value adding activities of an adopter organization. This lack of a concrete implementation phase or a process in a consumer innovation adoption context has led to difficulties and various interpretations when researchers have tried to apply conceptualizations into the organizational innovation adoption context. Sometimes these terminological pitfalls has been tried to avoid by using other, in common language quite similar meaning possessing concepts for adoption in order to distinguish a piece of research from the fuzzy innovation adoption approach, even though the underlying idea has been drawn from the innovation adoption context. This has created even more disorder.

Intra-firm diffusion, *implementation* and organizational *acceptance* are closely related concepts that generally refer to actions that are taken in order to take the adopted innovation in full use at the adopter company and after that to use it by the employees (cf. [31]). The concepts of *authority decision* as organizational adoption decision on an innovation that is targeted to be used by individual employees and that following *end-user's adoption decision* as a decision taken by an end user to take the innovation in his use have been used by Leonard-Barton and Deschamps [32]. Both these approaches advocate an idea that for some type of innovations an organizational adoption decision process is followed by implementation and individual decision processes within an adopter company. Meyer and Goes [17] 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 an innovation adoption choice decision and a phase of implementation and intra-organizational diffusion after that. Woodside and Biemans [33] have described comprehensiveness of assimilation using terms breadth of use (cumulative number of users) and depth of use (extent of use and its impact on the firm).

To conclude we state that adoption as a process refers to an organizational decision process from its outset until the decision to adopt an innovation (see e.g. [34], [33]). The processes that follow this organizational adoption decision process are not included into our definition, but should be named rather as suggested above (see [35]). This ideology has its roots on an idea that underlies the whole adoption and diffusion literature that originally adoption refers to acceptance of change and episodes before this acceptance and is finished when the decision has been made. Episodes and processes that follow the adoption process are seen as concrete conduct of this accepted change.

D. Network and interaction approach of IMP

The network approach brings marketing close to organization theory and more precisely to resource dependence view (e.g. [36]) that accentuates an interplay and mutual dependence of environment and organization. The industrial network perspective (see e.g. [2]) focuses on the space between organizations. The focus of 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. [37]). The following discusses the key features and concepts of network and interaction approach of IMP.

In the context of business-to-business marketing the concept of *embeddedness* has a key role. Halinen and Törnroos [38] have stated that the idea of firms being embedded in wider, far extending business networks is the major argument of the IMP approach to industrial markets and has been manifested by an expression "no business is an island" [37]. The concept refers to companies' dependence on and relations with different kind of networks [38]. Ritter [39] consider the concept of *interconnectedness* that can be seen to relate actors' structural positions more closely whereas embeddedness describe dynamics in overall context. Ritter [39] 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 a

relational setting between individual actors in a network structure in terms of individual actor's function, role and identity defined by other actors within the network [40], [37].

ARA-model [41] is constructed of three factors; actors, resources and activities that are closely related and in a large scale form a framework to conceptualize industrial networks. *Actors* control *resources* and are linked to another actors via different *activities* they perform. The actor may be a single individual, group of individuals or a company. 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 (see also [42]). 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. [43]). *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 [44] have considered episodes in terms of complexity and in relation to history of the relationship between parties. This basis they form a matrix consisting four situations; simple episode or complex episode taking place within 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 [45] 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 [46] 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 another. 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.

E. Analytical framework of the study

The discussed approaches on technological investment decision-making are presented in Figure 1. The innovation adoption approach is named more specifically as *innovation adoption process* to accentuate the approach distinguished from the adoption as a part of the diffusion approach.

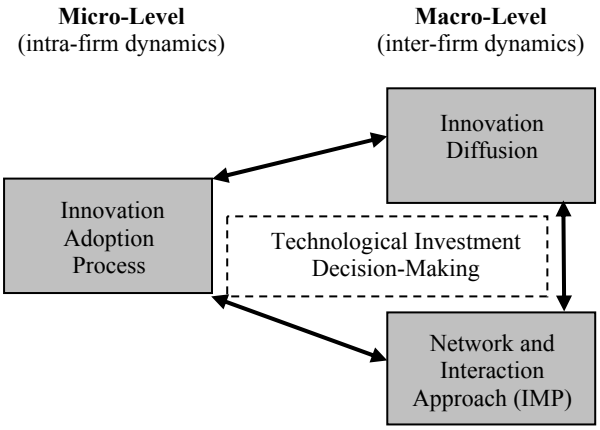

Figure 1. The Analytical framework of the study

Perspectives are classified into micro- and macro-levels on a basis of focus on intra-firm or inter-firm dynamics during the process. The following will present the case and methodology and then discuss the approaches with reference to conducted empirical case.

III. EMPIRICAL CASE STUDY AND METHODOLOGY

The investment decision-making 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 seller and the buyer in this case we name the buying company as FoodCo and the selling company as TestCo. The product to be invested in was a quality testing method to assure the microbiological safety and purity of final products. The method consists of a testing machine and chemical reagents that are used to perform test by the machine.

The methodology used was thematic interviews with the participants of the investment decision-process at FoodCo and at TestCo. The project was formally based and those individuals 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 interviews but also to leave room for new topics to be arisen. The interviews were transcribed in order to facilitate comprehensive analysis.

The data consists of eight interviews that have been collected between 27.9.05-17.3.06. Length of the interviews varies between thirty minutes to two and half hours. Total number of informants was six. Five of the informants composed a project group at FoodCo and the sixth informant was the CEO of TestCo and the person who sold the method and did the project together with FoodCo. Two (He and She) of the informants 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 at FoodCo worked at the production plant. The laboratory worker who did all the practical testing and the project manager were interviewed together. The third

person who worked as quality development manager was phone interviewed. The CEO of TestCo was interviewed twice.

A. Antecedents of the investment project

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 company searched a solution to cut down storage time before products are sent to markets in order to avoid constructing a new storage. The production at this plant was known to rise due to FoodCo concern level decision to close down the other one of concern'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 of the other production plant this option was not considered seriously even though it might have been beneficial investment. Due to the expected rise in production amounts 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 a project manager, the aims of the project, project personnel, the supervisory body and schedule. The project outline derived from the requirements of the internal technology development process as which this project was specified according the ISO 9001 quality system the company has. The plan was proposed to FoodCo central administration and then a license to start the project was given.

Two microbiologists (He and She) possessing high organizational status at central R&D laboratory was specified in the project plan as participants. Also these persons 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 to another purpose but results then was not satisfying. After that the central lab had not examined this technology and in the beginning they were doubtful about it. The other of the microbiologists (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."*

B. The testing phase and decision to invest

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. 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 technological platform was considered preliminary, but never tested due to a high price and lack of references. After TestCo method was adjusted for the FoodCo 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 lab in September 2002 and performed a set of tests to demonstrate the method.

The new method was run in parallel with the old one in order to do comparisons until January 2003. The number of tests as being 10 000 was so high that the results could be statistically generalized and analyzed. 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 body 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 the FoodCo central administration. After the approval the machine that was leased until this far was bought and then started to be used in analyzing final products without the older method as a backup since April 2003.

C. The Role of different actors during the project

The project group at production plant formed a core for this project. As this project was initiated there 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 faster analyzing method. 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. The quality development manager made calculation comparing the method by TestCo with the method currently in use and another fast analyzing method provided by another 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) at central R&D lab.

The microbiologists at the central R&D possessed an expert role. They brought in expertise needed to arrange the testing and implementation procedures, to make sure they qualify for the restrictions set up by authorities. Another task was to interpret the test results of the method. Their role was also crucial in the final examination by advisory board as they were asked to confirm that the interpretations of the results are correct and the method performs as it has been claimed.

In addition to 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 testing method as it had been used by the own laboratory of TestCo to produce commercial laboratory testing services. The CEO of TestCo was the key person who possessed various roles in this case as TestCo is a quite small company. 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.

D. The results of the project

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

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 totally different way to do the analysis compared to the older method. However the method has not fully replaced the older one as it is still being used to analyze some but not all production lines. A wider use has been considered but the plant wants to evaluate and use the method longer before they are ready to replace the older one fully.

E. Sources of information

The microbiologists were the main communication links to occupy information about the different methods outside the company. The main channels used were academic community (journal publications of the technology), main competitor, TestCo and another technology supplier whose product was under consideration.

The method was not validated by any specific validation organization but it was widely used for similar purpose 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 to use it. The other function of references in addition for governmental bodies' approval was to demonstrate to FoodCo that it seems promising and worthwhile to be inspected more carefully. According to the other one of the microbiologists (He) a condition for considering more 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 other trustworthy companies. Also already before the project started the R&D laboratory knew that these methods have been developed since they last tried them. This knowledge was based on the information the supplier provided and also on the international academic journals on the field. This information made an impression that the method might work or at least is worth testing. The project manager thought that 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 as evoking trustworthiness. 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 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.

IV. ASSESSING THE CASE THROUGH THE THEORETICAL APPROACHES

A. Innovation adoption approach

The adopted microbiological testing method is an innovation from FoodCo's point of view. It changed the analyzing procedure dramatically bringing in clear benefits. Although the technological platform was not concerned as new the application of this technology was clearly perceived new by all participants in the process. The innovation adoption approach can be then applied in order to exam and understand the investment project. There are clearly characters of presented types of different process models of adoption to be recognized here.

The adoption process followed a certain sequences or phases that can be recognized afterwards. *Sequential models* accentuating these stages are not although perhaps the best option to describe the occurred process. These models usually describe adoption as terms of phases of decision-making process. The original idea that it is more or less a matter of time when a new innovation become adopted (or rejected) by a certain unit of adoption and a linear path to this 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. FoodCo also considered other option supplied by another supplier to meet their need. Thus the process was more to find a solution to a problem not to decide on this specific product. Or as the other microbiologist (He) said: "If it would not have worked the ongoing search process would have continued. "

Serendipitous models highlighting interplay between organization and its environment producing adoption as a result of this fits well with the empirical evidence here. Both the central R&D laboratory of FoodCo and this production plant had been aware of these faster methods for

analyzing microbiological quality but a concrete starting shot for the project was this production redesign decision on FoodCo concern level and then active marketing by TestCo at the same time. In this sense also the randomness typical for serendipitous models is accentuated over rationality. Although the benefits were known already before the redesign decision, the adoption was not concerned seriously even though it would have brought benefits in terms of time and labor saving in any case even without an increase in production.

Some characteristics of *political models* emphasizing the social interaction and power hierarchy during the adoption process can be found from the empirical evidence here. As FoodCo being 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 certificated ISO 9001 quality management system. The power relations 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. Also the limited resources of the production plant hindered their changes to start the evaluation-implementation process without support by the R&D laboratory. In this sense the microbiologists had a lot of potential power but they did not exercise it in a full scale. Also a need to establish formally the project and specify the details in project plan and name a supervisory body for the project and propose for the final investment represented certain power structures that shaped the process. In addition to the microbiologists as approvers of technology the roles within the plant also structured partly as these models suggest. The project manager can be characterized as a champion who in the very beginning understood the benefits and then started to lead the project. He was a kind of intra-firm sales representative of TestCo at FoodCo. An example of an outside influence is contacting to the main competitor whose role can perhaps be characterized as a technology booster.

B. Innovation diffusion approach and network and interaction approach of IMP

The innovation diffusion approach understands single adoption decisions with reference to other adoption units' adoption decisions within the social system and change agents' influence on these decisions from outside the community and finally demonstrates these cumulative adoptions retrospectively in a form of S-curve and Gauss-curve. Depending on the source of information the information sources can be put in social system internal sources (opinion leaders) and external sources (change-agents). In this case the main competitor was an opinion-leader for FoodCo as it was part of the social system and horizontally at the same level with FoodCo. TestCo represented a change-agent as promoting the change from the older 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 machine in the field of their commercial analytical services and so earlier adopter than FoodCo. The other supplier was a change-agent pro another innovation. The information occupied through Internet and academic journals can be classified on the basis of their content. The internet or academic community is only a forum to provide information and according to who is a sender depends the classification to opinion-leaders or change-agents. In this sense these forums cannot be considered as sources of information and does not fall into the presented dichotomy. This approach being a theory of communication is powerless to understand reasons for communication and other type of interaction between the actors related to the investment process at FoodCo.

By applying the network and interaction approach of IMP we get a wider perspective to understand the investment decision process as embedded into its context. This perspective understands better the 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 their mutual benefit to avoid quality problems that would damage them both in terms of bad reputation and consumers' tendency to associate single actor's quality problems to the whole industry. In this sense the both firms are embedded into the certain environment and their actions are interlinked together causing direct and indirect effects for themselves, for another one or both of them. This can be understood as discussed interconnectedness [39] consumer markets being a factor mediating the effects between FoodCo and the competitor (FoodCo <> Customer <> Competitor).

Due to these interrelations the other one of the microbiologists (She) participates regularly in the meetings of an informal consortium of the industry on Nordic countries level. This exchange of experiences derives from an idea that quality is not an area where to compete 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 explains 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 share them instead of everybody would try on their own. "

The importance of references in this case can be understood through a concept of network position within IMP approach. The reference list gave to FoodCo a concrete hint or proof of TestCo's prestigious network position within different networks performing similar activities 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 a future.

The investment process was a relationship establishment process between FoodCo and TestCo. The companies did not have anything to do together before this project (see [44]). The relational bond *attraction* formed during the early phases of the project. The project manager understood

the benefits of the method and they seemed attractive. During the project the firms committed to each other through different ties (machine leasing contract, testing phase at TestCo) and that deepened after the implementation (continuous need for TestCo chemical reagents in order to do analyzing).

Both TestCo and FoodCo named couple of critical incidences during the process. The CEO of TestCo considered a general level discussion important in the very beginning of the project between him and the project manager about microbiological analyzing procedures. The CEO thinks that the project manager found his views based on wide experience useful and applicable and that way he's role as an expert was recognized. The project manager thought that during the testing period at TestCo the adjustment of reagents and the influence of TestCo on the principal company who produces the method to tailor 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 to adapt to meet them. These incidences facilitated the trust development between the parties.

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

V. Findings, Discussion and Conclusions

On the basis of this study technological investment decision-making can be seen highly relational and embedded activity involving different actors and dynamics between them and thus should be considered by acknowledging these interconnections. As in this case and pointed out already by some other authors as well [3], [47], [48], [49], [50] technological investments need tailoring before they are ready to be used. This means that a supplier and a buyer will engage into some sort of relationship in order to adjust the product. Presented relational bonds [46], [45] sound a fitting conceptualization to capture this development of a relationship between a buyer and a seller. However in addition to the buyer and the seller there were also other actors who involved the process in this case. The main competitor of FoodCo delivered information about the product that facilitated the decision. On the other hand another competing supplier offered their method to be considered by FoodCo. Information was also acquired to be processed from academic journals and Internet. Process itself was shaped by restrictions of authorities.

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. It is not so easy to define a group of potential adopters. We must define a relevant unit of adoption, is it a single company or a dyad, maybe a value-chain? The problem to define a relevant unit of adoption implicates that we cannot define what actually a social system is in an industrial context. Does it have to be an industry? To relieve this difficulty we could adopt a network view and try to identify different actors affecting the process from different networks. Robertson et al. [3] propose that collaboration based informal relationships between firms in an industry and universities, government agencies and professional associations might well represent the building blocks of diffusion networks. The collaboration over traditional industrial boundaries might yield surprising forms of cooperation and it could be interesting field of empirical research to identify what composes these diffusion networks and who participate them. This combining enhances a context-specificity of diffusion ideology to cope with a different area from the original field of application.

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 relevancy of intra-firm oriented approaches. There is a huge gap in our understanding of what happens within a firm when they decide on a new technological investment. The underlying stimulus-reaction idea of current adoption models seems to capture some features of the process but they are still too mechanistic or general to capture the complex nature of investment decision-making. In these models a starting point is an innovation that initiates a certain pattern of behavior. Instead of that a need or a problem to be solved in an organization could be a more relevant starting point. The lack of knowledge of what happens within a firm during an investment decision-making process hinders suppliers to influence on the process and also prevents them to include in the products certain attributes that are the most beneficial and valuable for the customer. On the other hand it reduces customer chances to enhance effectiveness and efficiency of the process as it is not understood explicitly.

In addition to empirical findings our discussion aimed to clarify the link between the innovation adoption approach (a word *process* is added to accentuate the approach distinguished from the adoption as a part of the diffusion approach) and the innovation diffusion approach as it has been unclear in the previous literature. We suggest the term *adoption process* to be used to describe an organizational decision process from its outset until the decision to adopt an innovation [34], [33]. The processes that follow this organizational adoption decision process are not included into our definition of adoption.

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