

Deciding on a New Technological Investment

Hannu S. E. Makkonen

Turku School of Economics
Department of Marketing
Rehtorinpellonkatu 3
20500 Turku
Finland
e-mail: hannu.makkonen@tukkk.fi

Abstract

One constant variable in today's management environment is change. The increased turbulence, complexity and competitiveness of organizational environments have made the identification, evaluation and adoption of technological innovations critical determinants of organizational productivity, competition and survival. The role of decision-making in successful technology investment projects is crucial and deserves a closer look.

The current body of knowledge in this area is much less than the sum of its parts. In order to yield cumulative knowledge of technological investment decision-making, an integrative work is needed. This paper focuses on technological investment decision-making seeking alternative theoretical approaches for the innovation adoption and diffusion approach in order to understand more deeply this complex phenomenon. A possibility to enrich *intra-firm* oriented decision-making view of traditional innovation adoption research with organizational buying behavior research is examined. On *inter-firm* level, the paper targets to contribute the innovation diffusion perspective by drawing from the current network and interaction approach of IMP. An integrative nature of the research purpose asks for an intuitive approach that enables us to consider chosen theoretical fields in generative and inventive manner. This has led us to adopt purely conceptual approach. The presented comprehensive approach, including *micro*- and *macro*- level analysis, finally challenges the traditional, one-sided innovation adoption approach in business-to-business context and feeds ideas for empirical research in the future.

Keywords: technological innovation, innovation adoption and diffusion, network approach, organizational buying behavior, technological investment

Introduction

A Research Gap – Demand for a Comprehensive Approach

The statement by Cyert, Simon and Trow (1956, 237) that “Decision-Making – choosing one course of action rather than another, finding an appropriate solution to a new problem posed by a changing world – is commonly asserted to be the heart of executive activity in business.” holds true still after fifty years. Relating to the theme of the 22nd annual IMP-conference “opening the network” this paper discusses technological investment decision-making drawing conceptualizations from four different approaches aiming to cross-fertilize them successfully by each other. Due to the decision-making context we suggest *the innovation adoption approach* to be accompanied with *the organizational buying behavior approach* in order to capture the nature of intra-firm activities better during decision-making. On a macro-level we propose *the network and interaction approach* to be relevant partner for *the innovation diffusion approach* in order to understand inter-firm dynamics of the process.

The choice of the topic was influenced highly by a current disorder in the field of innovation adoption and diffusion literature. After an extensive review on the field we strongly argue that the literature on innovation adoption and diffusion in organizational settings can be described fragmented and contradictory. The current body of knowledge is much less than the sum of its parts. In order to yield cumulative knowledge of innovation adoption and diffusion in business-to-business markets an integrative work is needed. However, we do not want to stick ourselves firmly into a one restricted and emerging perspective, but rather to study a more general level phenomenon, namely technological investment decision-making, in order to draw conceptualizations and ideas, even more important, to share them between the chosen different approaches.

The Purpose and the Structure of the Paper

The purpose of this study is to examine technological investment decision-making conceptually. This purpose will be achieved by applying four different approaches: the innovation adoption, the innovation diffusion, the organizational buying behavior and the network and interaction approach of IMP. In addition to our research purpose, we have a general level objective to clarify and integrate the innovation adoption approach, specifically in the context of technological innovation, more tightly with current understanding of complex business networks and interaction.

At first, we consider these approaches forming basic understanding of them. This is done in order to use them to conceptualize technological investment decision-making later in the discussion section of this paper. Finally the work is put together in the final discussion and some suggestions for further research are given. We address our research mostly as an attempt or framework to initiate integrative and comprehensive approach for empirical studies on technological investment decision-making.

The Innovation Diffusion and Adoption Approaches

A Technological Investment as an Innovation

Not all products, ideas or processes adopted are innovations. To be an innovation, there must be some newness or novelty involved or as Cumming (1998, 22) 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. (Damanpour & Evans 1984; Lyytinen & Rose 2003, 559.) These new products and processes can be separated into different categories. The dual-core model of innovation (Daft 1978) divides organizational innovations into technical innovations and administrative innovations. *Technical innovations* relate to a technical nature of an organization or a primary work activity in which an organization converts raw materials into final products. These activities may or may not exploit technology. *Administrative innovations* [sometimes synonym for organizational innovations (e.g. Mouzas & Araujo 2000, 294) but here organizational innovations refer only to an industrial context] refer to behavioral or managerial side of an organization, a social system of rules, roles, procedures and structures. (Daft 1978; Grover, Fiedler & Teng 1997, 274; Knight 1967.)

The distinction between technical and administrative categories is not clear sometimes (see e.g. Mouzas & Araujo 2000, 294) and thus the classification has been developed further. Swanson (1994,

1076) added a third category (called IS core in his model due to a context of information technology of the study) between these two in order to describe innovations that have characteristics of both technical and administrative categories. A technological investment can be seen as an innovation if it agrees with the definition meaning that it is new from an adopter's point of view (perceived newness) and brings in added value for the adopter (successfulness). (for newness and utility see also Hurmerinta-Peltomäki 2001, 48.) Following the presented logic technological innovations may be included in any of these three categories depending on their final purpose. The terms technical, technology, technological innovations and technological investments and products are considered as synonyms in this paper.

The Innovation Diffusion Approach

Swanson (1994, 1071) 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. (Sinha & Chandrashekar 1992; Frambach, Barkema, Nooteboom and Wedel 1998, 161.) 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 e.g. Mahajan, Muller & Bass 1990 for a review). The purpose in these research attempts has been to identify factors quantitatively that affect positively or negatively on a shape, rate and potential of a diffusion process (see e.g. Puumalainen 2002, 5). 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). The idea of cumulative individual decision processes and factors affecting them, producing finally adoption or rejection decision, is presented in Appendix 1 (p. 15).

To inspect in more detail this communication flow, central in diffusion process, we can draw a distinction between different approaches. Rogers (1983, 5) 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 (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. This crucial link between the social system and the outsider environment is missing in a definition offered by Rogers (1983) in his early work, even though it is considered by him. 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" see e.g. Rogers 1983). Similarly *external effect models* concentrate only on outsider sources of information (these are generally called "change agents" in the diffusion literature see e.g. Rogers 1983), denying opportunity for internal communication within a social system. Finally *combination models* take the both sources of communication in the account and are also the most widely used of these models. (Dos Santos & Peffers 1998, 178; Mahajan & Peterson 1985, 15–22.) The information-based diffusion models ignore widely the active seek of information by a potential adopter rather considering the potential adopter as a passive recipient of information. The more sophisticated approaches take into account an active search for information according some basic rules and producing some cost for a searcher. (Karshenas & Stoneman 1995, 273; see also Midgley et al. 1992.) Basing on this classification the widely referred work done by Rogers (1962) can be put into the category of internal effect models. Diffusion as a social process of formal and informal information exchange among members of a social system is a core idea in Rogers' (1983) diffusion theory. This idea of

communication within a social system as a flow between potential adopters and those who already have adopted the innovation as well as change-agents attempts to influence on potential adopters from outside the social system are demonstrated in Appendix 1. Opinion-leadership may be based on various factors for example on early adoption of the innovation (see e.g. Turnbull & Meenaghan 1980). The bolded line between early adopters and early majority in Appendix 1 accentuates the chasm between these two groups due to their differences hindering the diffusion process (Moore 1995, 19). The presented categories are based on Rogers (1962).

Based on Mohr's (1982) distinction between variance and process approaches into organizational phenomena Langley and Truax (1994) 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 (see Mohr 1982) 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 (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 e.g. Woodside 1996). (Langley & Truax 1994, 620.) 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 the diffusion process. In the latter sense the adoption seems to refer the decision-making process of a potential adopter. Due to this duality we consider next adoption from this process perspective.

Innovation Adoption Approach

Langley and Truax (1994) reviewed technology adoption models and placed process-oriented 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 (see Mintzberg et al. 1976 and Nutt 1984) and was put forward in the innovation adoption context by Rogers (1962) establishing a permanent approach and followed by a stream of research (see e.g. Rogers & Shoemaker 1971, 102; Rogers 1983, 164; Hubbard & Hayashi 2003, 53; Robertson & Gatignon 1987, 180 and Frambach & Schillewaert 2002). A number and order of stages of different models varies but the basic idea remains the same.

Serendipitous models understand the 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. (see Mohr 1987 and Langley & Truax 1994.) Langley and Truax (1994, 622) give the well-established garbage can model by Cohen, March and Olsen (1972) 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." (Cohen, March & Olsen 1972, 2).

Political models consider adoption 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. The reasons for adopting the 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. (Langley & Truax 1994, 622.)

Summing Up 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 Kunreuther & Bowman

1997). 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 meaningless itself. This perspective brings innovation adoption close to organizational behavior and innovation adoption can be seen as an organizational action taken to change the relationship between the organization and its environment somehow (Damanpour and Gopalakrishnan 2001, 47; Damanpour and Evan 1984, 406–407). This process perspective has been manifested for example by Drury and Farhoomand (1999) 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 Pennings 1987, 6–7).

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 senses 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.

Here we briefly present the concepts commonly used within the context of organizational innovation adoption as a process, to form the basis for the general level discussion later on this paper. *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. Kim & Srivastava 1998, 231). 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 Dorothy-Barton and Deschamps (1988, 1253). 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 (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 an innovation adoption choice decision and a phase of implementation and 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) To conclude this 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. Klein & Sorra 1996, 1055; Woodside & Biemans 2005, 385). The processes that follow this organizational adoption decision process are not included into our definition, but should be named rather as suggested above (see Zaltman et al. 1973). 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.

Research findings suggest that factors affecting an adoption decision (Tornatzky & Klein 1982; Damanpour & Evan 1984, 393) and an adoption process (Daft 1978; Daft & Becker 1978, 121; Kimberly & Evanisko 1981; Swanson 1994, 1071; Drury & Farhoomand 1999, 135) may vary between different innovation types. Thus factors that have been pointed out to have a certain influence on a consumer or other organizational innovation context cannot be directly applied to technological innovations. Technology related attributes are perhaps not rigid and fixed but rather socially constructed (Newell, Swan, & Galliers 2000, 245). The process approach to innovation adoption challenges also direct application of results found within studies having a choice as a unit of analysis to process studies of innovation adoption. By stating this we mean that the influence of different factors that have been found

in studies (see e.g. Tornatzky & Klein 1982 for a meta-analysis of an innovation related adoption factors) considering innovation adoption process as a “black-box” and generating results through quantitative surveys might be only weak reflection of some other elements more critical during a process making us to believe them being meaningful by themselves.

Organizational Buying Behavior Approach

The more complex a product is the lengthier a buying process is likely to be due to difficulty of risk evaluation. A risk can be divided into a performance risk and a psychological risk. The former refers to an extent to which the purchase meets the expectations and the latter to how other people in the organization react to decision. Low involvement buying situations are likely to be handled autonomously by an individual decision-maker according specific buying criteria. Due to a higher risk and higher organizational involvement for complex products a buying center makes the buying decision. (Tidd, Besant & Pavitt 1997, 181.) The former captures three critical concepts (underlined) of organizational buying. The following section starts a discussion from a buying process and then moves on to consider different buying situations or tasks as one factor affecting the buying process and finally zoom into a concept of buying center. The buying task has been chosen among other process influencing factors due to the context of technology buying and because it has been suggested to bridge the innovation adoption and organizational buying approaches (see Wilson 1987). This structure of consideration is in harmony with a classification of organizational buying behavior research offered by Möller and Wilson (1989). They propose that the traditional research of organizational buying can be classified into studies focusing on (1) the phases or sub-processes of the buying process, (2) the characteristics and composition of and interaction within the buying center and (3) factors influencing (like buying situation) the process and buying center.

Buying process

Organizational buying behavior has been approached from several different viewpoints. The three main approaches are task models, nontask models and complex models. (Johnston & Spekman 1987; Lichtenthal 1988, 124.) Task models concentrate on closely task-related variables (e.g. price) whereas nontask models consider a set of variables that are not closely linked to the specific problem to be solved, but function in the background perhaps influencing the final decision (e.g. buyer motives). Complex models combine task and nontask models. (Webster and Wind 1972, 12.) According to Webster and Wind (1972, 15–16), *task models* often focus on economic aspects of organizational buying behavior such as price or related costs (see also Johnston & Spekman 1987, 93–94). These models ignore the influence of the characteristics of the individual decision maker, interaction among members of the buying organization and the nature of the formal organization on the decision process outcome. These models lack behavioral explanations and consider the individual as a rational decision maker synonymous with the firm. *Nontask models* introduce nonrational/noneconomic factors affecting the decision process and concentrate on the psychological aspects of an individual. These models, being more holistic and understanding the circumstances of the decision process more widely than task models, lose the point that the organizational decision process is problem solving with specific objectives and goals. The decision maker is also considered synonymous with the firm but interested primarily in self-gain. (Webster & Wind 1972, 20; Johnston & Spekman 1987, 94–95.)

The problem with the task and nontask models is that they both emphasize some set of factors while excluding the others. An attempt has been made to overcome these problems by presenting *complex models* combining the best features of both types of model (Johnston & Spekman 1987, 95). Johnston (1981, 82) argues that the buygrid model (Robinson, Faris & Wind 1967), the general model for understanding organizational buying behavior (Webster & Wind 1972), the model of industrial buyer behavior (Sheth 1973) and the industrial market response model (Choffray & Lilien 1978) are four of the most well developed and comprehensive complex models presented.

Johnston and Lewin (1996) analyzed and summarized the 25 years of research of organizational buying behavior initiated by Robinson, Faris and Wind (1967), Webster and Wind (1972) and Sheth (1973), by reviewing 165 articles on the topic. Since the presentation of these models, they have established the conceptual foundation for the study of organizational buying behavior to this day and followed by hundreds of articles extending or testing them. (Johnston & Lewin 1996, 1–2 see also Wilson 1996, 7.) The idea of seeing organizational buying behavior as a process composed of a se-

quence of phases or stages is common to the three models. Although the number of stages in the process varies between the models (buygrid: 8, general model for understanding organizational buying behavior: 5 and model of industrial buyer behavior: 4), the nature and sequence of events are quite similar. In addition to the process nature of the models, they all present variable categories influencing the buying behavior (buying process). Of the total nine different categories three are shared between the models, namely the category of *environmental influences* (physical, political, economic, suppliers, competitors, technological, legal, cultural and global), category of *organizational influences* (size, structure, orientation, technology, rewards, tasks and goals), and the *individual participants' characteristics* (education, motivation, perceptions, personality, risk reduction and experience). In addition to these the Robinson, Faris and Wind model and the Sheth model have *purchase characteristics* (buy task, product type, perceived risk, prior experience, product complexity and time pressure) and *seller characteristics* (price, ability to meet specifications, product quality, delivery time and after-sales service) in common.

The sixth category, *group characteristics* (size, structure, authority, membership, experiences, expectations, leadership, objectives and backgrounds) is presented in Webster and Wind's general model for understanding organizational buying behavior, and two final categories in Sheth's model: *informational characteristics* (salespeople, conferences, trade shows, word-of-mouth, trade news, direct mail and advertising) and *conflict negotiation characteristics* (problem solving, persuasion, bargaining and politicking). After 25 years of empirical testing, these nine fundamental concepts (the process nature of buying and the presented eight influencing factors) of the models still hold valid. But on the basis of an extensive review of articles in the field, four constructs needed to be added: on an intra-firm level *decision rules* and *role stress* and on an inter-firm level: *buyer seller relationships* and *communication networks*. The latter operates also on an intra-firm level. Decision rules refer to the rules used by the buyer to handle different buying situations. These rules vary in their degree of formality. The second intra-firm level concept, role stress, means ambiguity or conflict in buying objectives (cost reduction and concurrent quality improvement). An inter-firm level concept, buyer seller relationship, refers widely to a dyadic and network perspective of organizational buying. The implicit view in this addition is that factors affecting buying behavior also combine to affect a firm's supply relationships. The other added concept, communication networks, refers to an intra-firm level to communication in buying center and on an inter-firm level to communication between different actors. (see Johnston & Lewin 1996, 2-5.)

Buying task

Möller (1983, 5) states that attempts to generate generalizable results on the structure and elements of the buying process face an essential problem caused by "the complex idiosyncratic nature of organizational buying". This is due to variance in buying situations, people, departments and organizations involved and a context or an environment. The situational variance led to the classification of Robinson, Faris and Wind 1967: new buying task, modified rebuy and straight rebuy. This classification is closely linked with an information level of the buyers, a risk perceived and search behaviour, but is insufficient to provide a definition for product complexity or significance in a situation at hand. Möller (1983, 6-7) suggests replacing this paradigm with extensive problem solving, limited problem solving and routinized response behaviour categorisation of decision processes (see e.g. Howard & Sheth 1969 and Howard, Hulbert and Farley 1975).

This categorisation however does neither explicitly take into account a relative importance of the buying situation or the product. To offer a more comprehensive conceptual framework Möller (1983, 8) superimpose an organizational commitment dimension on the presented categorization. Here organizational commitment refers to a degree of the organization's perceived commitment to the product. The commitment dimension together with the categorisation of decision processes offers potential for developing time and organisational buying policy based hypotheses about movements of products and buying situations in a two dimensional buying (high commitment-low commitment) space. The transition can be initiated from an internal (buying policy) or external context of a company. (Möller 1983, 9; cf. Wilson et al. 2001.)

Buying center

The notion of a buying center has been the most important conceptual contribution within the research on organizational buying behavior (Johnston & Bonoma 1981). Finding an answer to the question

“who does the buying” has been a primary attempt within the organizational buying behavior research. From a marketer’s point of view this kind of knowledge is an essence to approach a customer. Since 1970’s the idea of buying as a multi-person process culminated in the concept of “buying center” (Webster & Wind 1972, 77) that became the prevailing framework to conceptualize industrial buying. (King, Patton & Puto 1988, 95–96.) The buying center concept refers to all those members of the organization involved in the buying decision process with responsibility for buying. (Webster & Wind 1972, 77; Dadzie, Johnston, Dadzie & Yoo 1999, 434; Pae, Kim, Han & Yip 2002, 720.) It can be stated therefore that to understand organizational buying behavior one must understand group behavior. (Morris, Berthon and Pitt 1999, 264.)

There have been various attempts to find a covering solution to questions that when the buying decision is done by a single person and when it calls for multi-person commitment (see e.g. Hutt & Speh 1981 and King, Patton & Puto 1988, 96), what is the relevance of the different members in different buying situations (Doyle, Woodside & Mitchell 1979; Hill & Hillier 1977) and what are the stages of buying (Bonoma & Shapiro 1984) but common answers covering all buying situations has not been found. The studies of the buying center have their theoretical backbone mostly in the social influence/interaction theory and organizational psychology (Möller 1983, 10).

Understanding how influence is distributed within a buying center is critical but still a fuzzy area in the organizational buying research. McQuiston (1989, 69) defines influence in the buying center as “the extent to which the communication offered by an individual for consideration is perceived to affect the actions of other participants in the decision-making unit.” Research of personal influence within the buying center can be put in two: the research examining the influence of people in certain positions during the different phases of the decision process and the research concentrating on how some individuals influence and change the opinions and actions of others. Despite the contribution of both approaches during the long research tradition there are still gaps in understanding influence within the buying center especially in a case of new task buying situation in which typically new knowledge is generated during the process. (Daves, Lee & Dowling 1998.) Posses of information may be affected by a position in the organization or personal needs and characteristics. Control of information was found to be important base of influence within organizational buying decisions by Pettigrew (1972) and after that a critical role of information with limited access has been confirmed by various researchers (Conrad 1990; Pfeffer 1981).

Lichtenthal (1988, 119) suggests definitions of buying center roles to be the most permanent concepts in the organizational buying behavior research. Roles allow members of a buying center to be studied as individuals as well as a part of the group. The roles are in a key point when attempting to find a solution to the question “who does the buying?”. Lichtenthal (1988, 121) propose that neither an individual nor an organization resolves a buying situation but rather the decision will come up as a result of a small group task process, which consists of outcomes from individual task processes. Concentrating on behavior results that identification of different stages of the decision-making process and the organizational positions of the members become less important in understanding the buying process. In other words, rather than the positions the distribution of complementary role behaviors, which members execute, form a structure for a buying center. On the other hand adopting a group behavioral view on buying, the documented variance of number of stages during the process (see e.g. Johnston 1981) is easy to understand. The stages identified in different studies reflect rather a few acts in the buying process or major behavioral events during it consisting of hundreds of behavioral acts (Lichtenthal 1988, 138).

Webster and Wind (1972, 17) have proposed five roles for the buying center participants: users, buyers, influencers, deciders and gatekeepers. *Users* are those who use the product to be bought. *Buyers* and *influencers* are those who influence the process directly or indirectly by providing information and evaluative criteria. *Deciders* are capable of making the choice among alternatives. *Gatekeepers* filter incoming information to the buying center. This classification is very intra-firm oriented and gives an idea of the organization as a passive information seeker. The role of active outward orientation is captured in the boundary spanning role suggested by Tushman and Scanlan (1981) and defined as an individual who actively participates in various types of inter-organizational networks. It has been proposed that different persons may hold the same role or one person can perform various roles (Lichtenthal 1988, 123).

Rogers and Kincaid (1981) presented an information network approach that can be well applied on an intra-firm or inter-firm level to describe communication processes among certain systems. The network approach adopts communication links rather than isolated individuals as units of analysis and aims to make visible, understandable and manageable the communication structure that people live within. Instead of restricting a unit of analysis to individuals, communication network analysis conceptualizes human communication as a process of mutual information-exchange. Rogers and Kincaid (1981, 63) define communication as “a process in which the participants create and share information with one another in order to reach a mutual understanding.” This means that communication is always a joint activity, a mutual process of information sharing between two or more parties and involves always a relationship. These interrelated relationships form communication networks of interconnected individuals “who are linked by patterned flows of information”. As a result of information-sharing, individuals converge or diverge from each other in terms of their mutual understanding of reality. (Rogers & Kincaid 1981, 63.)

At individual level information processing involves perceiving, interpreting, understanding, believing and action, which results to new information for further processing perhaps. Collective action, mutual agreement and finally mutual understanding may be achieved through a combination of the individual level actions. The other possible results in addition to mutual understanding with mutual agreement are: mutual understanding with disagreement, mutual misunderstanding with agreement and mutual misunderstanding with disagreement. The prerequisite for these collective results is that individual information processing becomes human communication among two or more persons who hold the common purpose of understanding one another. (Rogers & Kincaid 1981, 56-57 cf. conflict negotiation characteristics in Sheth model.)

Network and Interaction Approach of IMP

The network 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 transfer from a focal firm approach, represented by organizational buying behavior, to a dyadic approach was suggested by various scholars (see e.g. Johnston 1981). This was due to an aim to widen understanding of the interdependencies of two organizations. This relativity was ignored by the focal firm approach. The dyadic approach was although not enough to conceptualize the complex nature of organizational interdependencies and a multidyadic view was suggested for example by Johnston and McQuiston (1984). 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. Håkansson & Snehota 1989, 190, 196). Here we first start our discussion of interdependence and related construct embeddedness, after that moving on to other central concepts and approaches of the network and interaction perspective in the context and scope of this paper.

Embedded and Interrelated Nature of Business Markets

Granovetter (1985, 481) states, “How behavior and institutions are affected by social relations is one of the classic questions of social theory.” The solution to deal with these relations can be separated in two. Because these relations interplay constantly with behavior and institutions we can purely reach targeted phenomenon only through a thought experiment by using our imagination. At the other extreme end is an argument that because these relations are always present an attempt to ignore them would lead to total misunderstanding. (Granovetter 1985, 481-482). 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 to industrial markets 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 kind 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 overall context. Ritter (2000) illustrates a situation where two actors (A and B) are connected to the same focal actor F that medi-

ates 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.

Network Position and ARA-model

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 (see Johansson & Mattsson 1992; Håkansson & Snehota 1989, 196). This position is a result of resource development through interactions with other actors within the network (Low 1996, 479).

ARA-model (see Håkansson & Snehota 1995) 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 Kock 1992, 6). 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.

Different Types of Networks

Grandori and Soda (1995) distinguish between different types of networks in terms of formalization, centralization and coordination mechanisms. They suggest three different types of networks: social networks, bureaucratic networks and proprietary networks. *The social networks* are not coupled with formal agreements, they may be based on parity or not (decentralized or centralized) and they are coordinated by social control mechanisms (e.g. personal and confidential contacts) or more institutionalized measures (e.g. interlocking directorate). The centralized networks are most often coordinated by vertical or transactional interdependencies between firms, whereas decentralized or parity-based networks are connected with horizontal interdependencies. The view adopted here supports the idea that even though the relationship between the firms is based on vertical interdependencies the possible contract between the parties only specifies the terms of exchange not the structure of relationship or interaction patterns between the firms i.e. the network as the coordination measure is not determined in the contract. (Grandori & Soda 1995, 199-201.) *The bureaucratic networks* are coordination modes that are formalized in agreements specifying the organizational relationship between the parties. Due to the incompleteness of contracts and contracting the bureaucratic network never fully covers the relationship as a coordination mode but is rather complemented by social network. Also the bureaucratic networks can be separated into the classes of symmetric and asymmetric coordination structures. The third category, *proprietary networks*, covers bureaucratic forms of formalized networks that in addition are founded on some proprietary commitment. (Grandori & Soda 1995, 201-203.)

Melo Brito (1999, 93) defines the concept of issue-based net as "a form of association mainly based on cooperative relationships amongst actors who aim to cope with a collectively recognized issue by influencing the structure and evolution of the system(s) to which they belong through an increased control over activities, resources and/or other factors". He continues that if the net has been legitimated by an explicit contract and it takes a form of formal structure and organization it is called formalized issue-based net and at the other hand lack of this formality means non-formalized issue-based net.

The IMP Model and Relationships between Actors

The IMP model is constructed by four concepts: *interaction process*, (short-term exchange episodes and long term relationships) between the *interacting parties*, affects and is affected by *atmosphere* (power/dependence, cooperation, closeness and expectations) and takes place in a certain *environment* (market structure, dynamism, internationalization, position in the manufacturing channel and social system) that forms a context for it (Håkansson 1982). This is much overlapping with the relationship marketing perspective, if we adopt a view offered by Morgan and Hunt (1994, 21-22) that

“relationship marketing refers to all marketing activities directed towards establishing, developing, and maintaining successful relational exchange” and widely consider this to happen at a level of complex interrelated networks.

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 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 also 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 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.

Discussion

Cross-fertilizing Innovation Adoption and Organizational Buying Behavior Approaches

Innovation adoption, seen as a process, is highly comparable to organizational buying behavior approach that promotes also process view. Both consider technological investment decision-making as an intra-firm information processing activity. In the context of organizational buying behavior an investment decision on new technology falls into the category of new task buying situation and involves high risk. Seen as problem solving, it represents extensive problem solving situation as well pose a high risk, uncertainty and high commitment.

The three types of models, presented in the context of innovation adoption sequential, serendipitous and political models, are connected to buying models' philosophy. The perspective advocated by sequential adoption models is similar to underlying idea of problem solving in task models. Also as kind of generic presentation of a sequential process affected by various factors, sequential models shares ideology with nontask models. Serendipitous models, being more relaxed from ideas of linear process and specific well defined problem solving, are comparable to nontask models to some extent. However the idea of serendipity does not fit very well with the underlying problem-solving approach describing the buying models in general. We may think that as long as a buying task will be considered by a buying center an outcome is not serendipitous unless the process is highly affected by a single member of the buying center advocating his own interests. Political models capture the idea of a multi-person decision process involving different roles, hierarchy and thus perhaps conflicts and is in this sense in harmony with nontask models and with the general idea of OBB that complex and new task buying situations are decided by a buying center with multiple roles and influences. Otherwise the concept of the buying center was not recognized in the adoption literature. Organizational buying behavior can be characterized in some degree as a problem solving process whereas innovation adoption can be seen perhaps more as a reaction to an exposed new innovation.

Cross-fertilizing Innovation Diffusion and Network and Interaction Approaches

The second interesting cross-fertilization opportunity arises when we consider the innovation diffusion approach and the network and interaction approach by IMP in parallel. The both can be seen to capture the nature of information spread and consider a decision-making context in which a focal decision-maker firm is embedded. The innovation diffusion approach is a kind of memory that draws together the individual adoption choices and presents them in a form of certain historical curve that is specific for the innovation examined. The concepts of opinion leadership and change agency and this

cumulative pattern of adoption are not however so easily transferred to an industrial context. Due to the context of consumer markets and time perspective the diffusion approach based on the early work of Rogers (1962) is as such incapable to capture the idea of a similar process in complex business-to-business markets. The idea of applying the networks and interaction approach into the diffusion process in the industrial context has been suggested already by Robertson, Swan & Newell (1996). This approach bridges diffusion ideology closer to the inter-organization relationships and network studies of IMP-group and enhances their context-specificity to cope with a different area of application (see e.g. Axelsson & Easton 1992). Of the presented types of networks (Grandori & Soda 1995, 201-203) a social network as a less formal type of network by its nature might be better comparable to diffusion networks than the two more formal ones presented.

Thinking the concept of the social system more carefully we notice that it is not so evident in an industrial context. The group of potential adopters is not so easy to define. First we must define the relevant adopter unit, is it a single company or a dyad, maybe a value-chain? The problem to define the relevant unit of adoption implicates that we cannot define what actually is a social system in an industrial context. Does it have to be an industry? Robertson et al. (1996, 336) 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. This assumption is supported by the relevance of weak ties (Granovetter 1973). Weak ties can mean e.g. relationships between former colleagues. These links and informal information exchange between individuals are important in yielding new knowledge and ideas because information is asymmetrically diffused between persons from different contexts. This channel of information is a crucial in the diffusion process even when the flow of knowledge is occasional (Rogers 1983, 297). This is consistent with the idea of the combination models in the diffusion context. Tushman and Scanlan (1981) name the individuals who operate between different networks as boundary spanners. These individuals are involved both in the construction and also into diffusion of innovations (Robertson et al. 1996, 336).

Complex relations of business markets (demonstrated in Figure 1) is an area that needs closer attention when speaking about technological decision-making in the industrial context. Scrutiny of technology adoption decisions in relation to a context of constraints and forces they are embedded on was suggested by Hultman (2003).

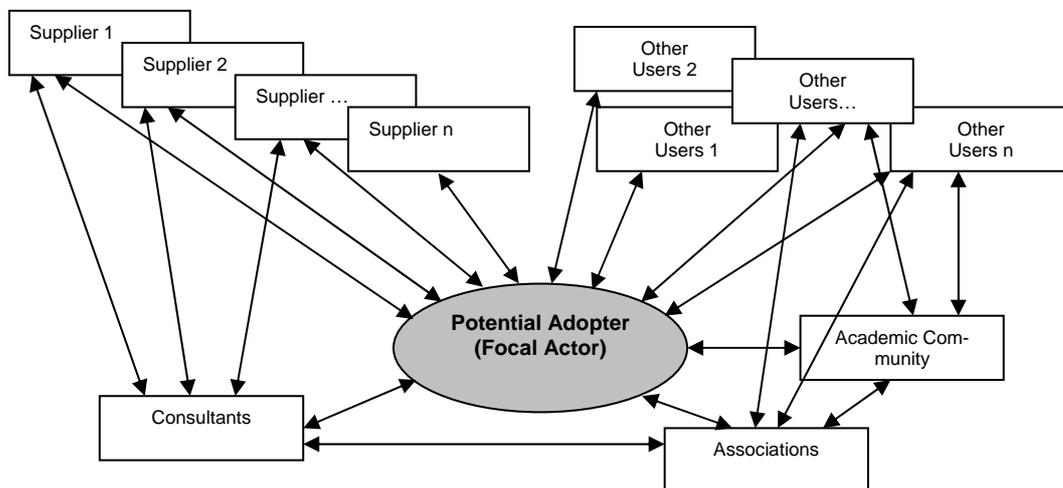


Figure 1 Hypothesized connections and actors related to a potential adopter

For example successful innovation adoption may improve both the supplier's and the adopter's (buyer's) network position. For the adopter a new technology brings benefits in terms of better quality or cost effectiveness (e.g. McDonald 2004) or opens up totally new business opportunities that has not been reached before, which may directly or indirectly (or both) affect the adopter's network position. The supplier's network position improves for example due to a reference value of a successful case [Anderson, Håkansson and Johansson (1994, 3) call this effect as "secondary function" or "network function"]. As typical in the context of technology adoption references are critical means for a supplier to reduce potential adopter's perceived risk (see e.g. Robertson, Swan, Newell 1996). References give a concrete hint of the supplier's well-established network position within a network relevant for the

potential adopter in the current decision-making situation. Figure 1, based on Robertson, Swan and Newell (1996), illustrates the potential actors in a technology investment situation and the actors' hypothesized relationships.

The potential adopter performs a focal actor in the presented network (Figure 1). The parties of the network have various interrelations between them, both direct and indirect (Ritter 2000; see Robertson, Swan & Newell 1996). This relativity has not been, in its full scale, demonstrated by the diffusion approach. This is partly because of the diffusion approach has been originally developed to describe the spread of radical, new to the world innovations, but commonly stretched to cover minor innovations, demanding only newness for the adopter as a qualification basis for an innovation. This has been affected by rarity of radical new innovations in a business market context, innovations being more or less variations on known themes which may occur as a translation of an idea or a product from one field of market or application to another. (Cobbenhagen 2000, 26.) For radically new innovations lack of substitutes would remove the alternative objectives and the other suppliers from the picture and return the investment decision-making process closer to the diffusion and adoption ideology.

Towards a Two-Level Approach to Technological Investment Decisions

After a review of the four chosen theoretical fields it seems that we can put the presented approaches into the framework proposed below (Figure 2). Similarity between the innovation adoption process approach and organizational buying behavior has been already suggested by some researchers (see e.g. Woodside & Biemans 2005) and studies have mixed terminology of both these fields (e.g. Woodside 1994). A concrete attempt, as far as we know, to consider this overlapping has been although taken only by Wilson (1987) but in a very brief form and with no remarkable impact. His main point was that adoption should be seen as a new task buying situation. This connection is demonstrated by link A in Figure 2.

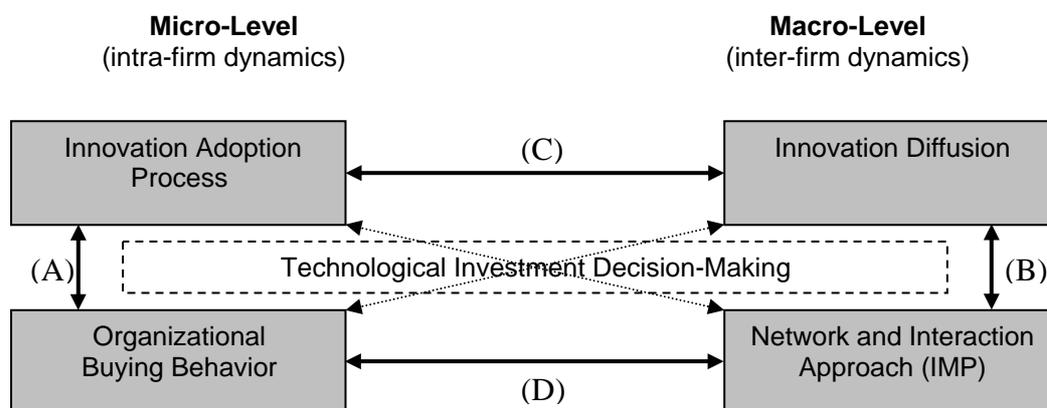


Figure 2 The two-level framework to study technological investment decision-making

Similarly, innovation adoption and organizational buying behavior being conceptualizations on a micro-level there can be found congruencies as well on a macro-level between the innovation diffusion approach and the network and interaction approach by IMP. Although the link between innovation diffusion and the huge body of knowledge of industrial networks and interaction produced within IMP-group (e.g. Ford 1997, Håkansson & Snehota 1995, Axelsson & Easton 1992) (link B in Figure 2) is also quite weakly established in the previous literature. However the work done by Robertson, Swan and Newell (1996) makes an exception in this. The relation between innovation adoption and diffusion (link C in Figure 2) is very tight, and in consequence of that, terminology is ambiguous in this area. Historically there can be seen a movement from the focal firm approach (OBB) towards the network and interaction approach (see Tanner 1999). In this sense there is an evolutionary link between these two complementary approaches in the context of technology investment decision-making. The following considers the role and use of these four theoretical approaches in an integrative manner in order to understand and conceptualize decision-making on a new technology better.

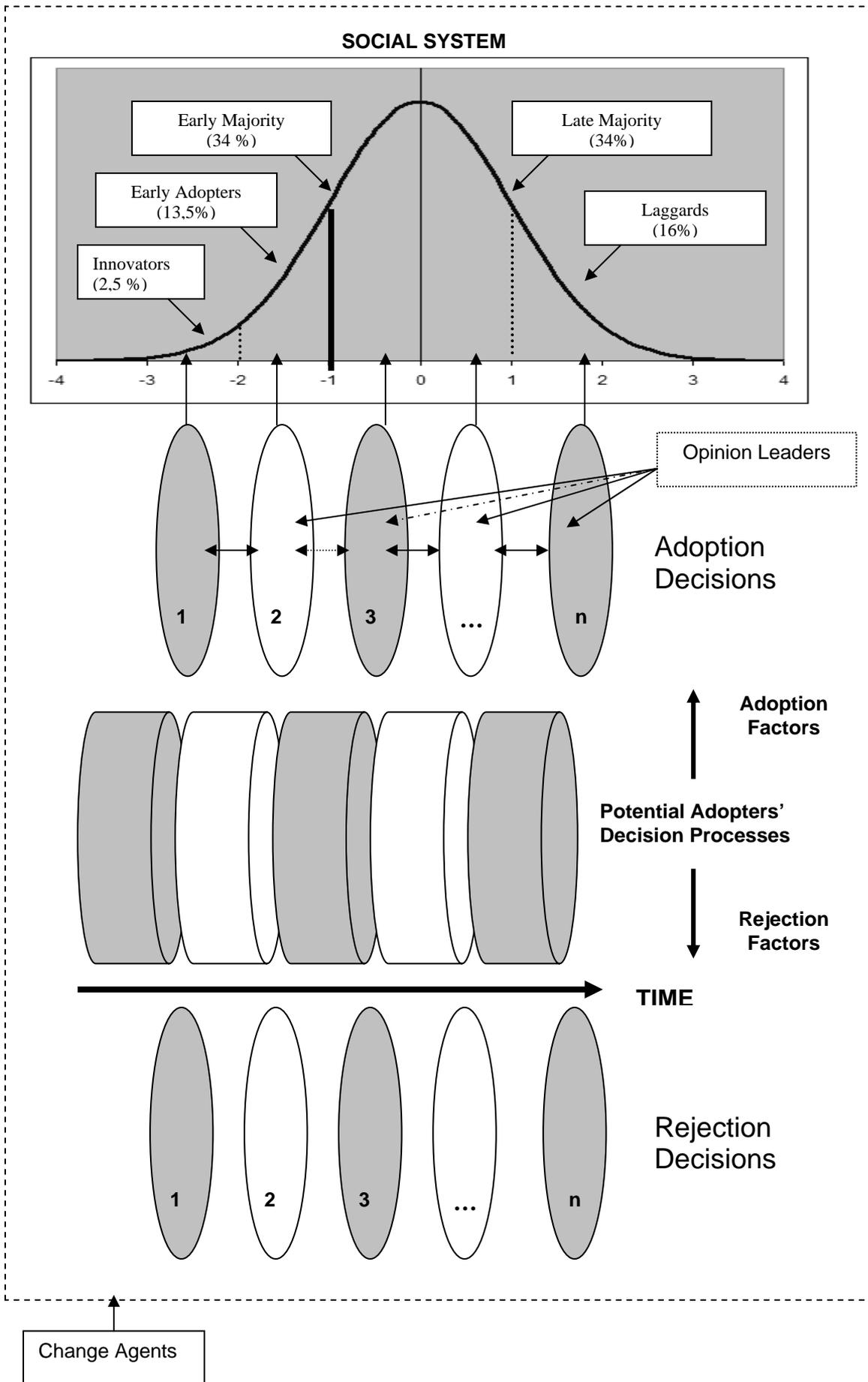
Cross Fertilizing Micro and Macro Levels and Ideas for Future Studies

The discussion above illustrates that in an industrial context social and informal relationships are vehicles to exchange information about innovations that generates cumulative adoptions on a macro-level, but similarly as in the original context of consumer markets we are not able to define diffusion and the relevant adoption unit and population so clearly. This gives us a reason to reconsider the relevancy of the innovation adoption approach. The adoption approach as basing on the idea of an organizational reaction to a certain new innovation does not feel so convincing in an industrial context and is perhaps only a very narrow part of organizational buying behavior. Only in a sense that awareness of a new innovation may set up a decision-making process to change the status quo (see Kunreuther & Bowman 1997, 406.) this perspective sounds justifiable. This is in harmony with Minzberg (1978) who has studied an organization's response to its environment and argues that patterns of strategic change are never steady, regular or foreseeable. Tushman and Romanelli (1985) describe organizational activity as "punctuated equilibrium" in which stability and change alternate with each other, sometimes triggered externally and sometimes internally. This idea of an organization drifting in its environment is not although penetratingly established in organizational buying behavior that sees the process being initiated more internally.

There are some issues that reveal not being so simple if we apply this kind of two-level approach. A new task buying situation does not seem to be so unambiguous if we take networks into account. Considering newness only a product related dimension, we ignore the newness related to the supplier. If we look at decision-making on new technology in a way Håkansson and Gadde (1997) proposed, taking into account a relational dimension, the newness related to the product might be compensated by the familiar supplier from some other area. Interesting here is that how much buyers value a prevailing relationship and how it appears during a decision-making process. Technology decision-making can be seen highly relational and embedded activity. As have been pointed out, especially technological innovations need tailoring before they are ready to use (Robertson et al. 1996, 336; Pinch & Bijker 1989; Clark 1987; Fleck et al. 1990; von Hippell 1982). This post-adoption phase means that the supplier and the buyer will engage into some sort of relationship at last in a point when adoption decision has been done and implementation begins. Presented relational bonds (Halinen 1997; Turnbull & Wilson 1988) sound a fitting conceptualization into technology investment decision-making if the more comprehensive view is adopted also in a sense that these technology attributes evaluated by a buyer are not rigid and fixed but rather socially constructed (Newell, Swan, & Galliers 2000, 245) in a process that might be highly affected by the supplier. Due to this learning process during an evaluation phase the role of the supplier may differ greatly from traditional context being more co-operative. Also interesting is what are the roles of the other suppliers in a situation where there is an established relationship between buyer and one of the suppliers and why these other suppliers are taken involved by the buyer: is it due to a learning process or to put a rivalry setting between the suppliers.

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. On the contrary we suggest approaching decision-making on a new technology from a more holistic point of view and encouraging empirical studies in the field. That kind of integrative framework might contribute the areas that have been under one-sided scrutiny only. For example bases of individual influence in the buying center has been examined mostly on an intra-firm context even though it has been proposed by Davies et al. (1998, 65) that external information provided by a seller or other outsider sources may act a base of influence for some member of the buying center, the clear research attempts to clarify this individual boundary spanning process and link between influence from more holistic point of view are still missing. The discussion presented in this paper is based on earlier studies and due to their technological context we cannot directly generalize this discussion on a level of other types of products (low involvement – transactional) although discussion was aimed to be on a more abstract and general level in order to feed ideas for empirical research widely.

APPENDIX 1



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