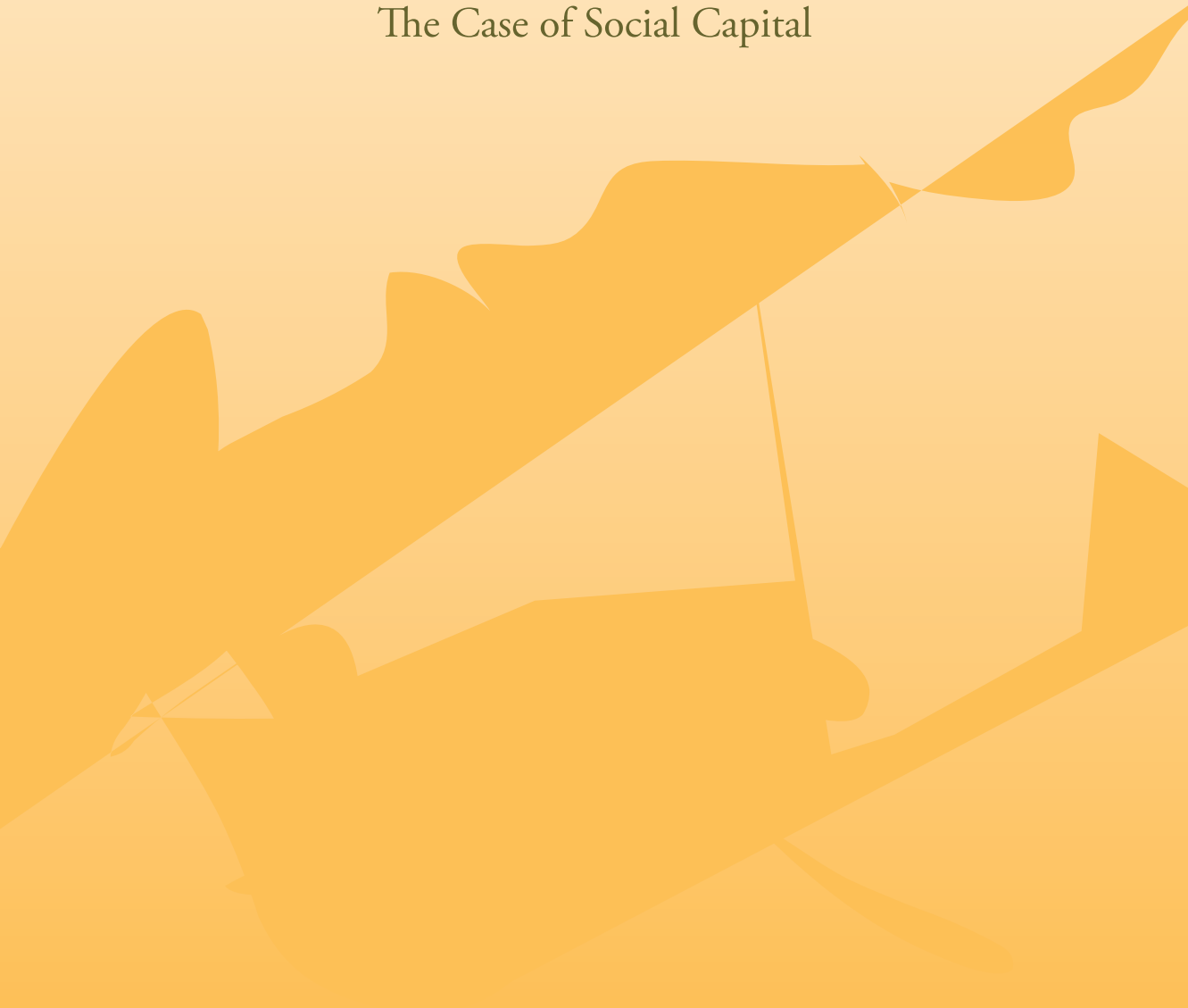
Maria Forsman

Development of Research Networks

The Case of Social Capital



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DEVELOPMENT OF RESEARCH NETWORKS

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Maria Forsman

Abstract

The aim of this study is to explore how a new concept appears in scientific discussion and research, how it diffuses to other fields and out of the scientific communities, and how the networks are formed around the concept. Text and terminology take the interest of a reader in the digital environment. Texts create networks where the terminology used is dependent on the ideas, views and paradigms of the field.

This study is based mainly on bibliographic data. Materials for bibliometric studies have been collected from different databases. The databases are also evaluated and their quality and coverage are discussed. The thesauri of those databases that have been selected for a more in-depth study have also been evaluated. The material selected has been used to study how long and in which ways an innovative publication, which can be seen as a milestone in a specific field, influences the research. The concept that has been chosen as a topic for this research is *Social Capital*, because it has been a popular concept in different scientific fields as well as in everyday speech and the media. It seemed to be a 'fashion concept' that appeared in different situations at the Millennium.

The growth and diffusion of social capital publications has been studied. The terms connected with social capital in different fields and different stages of the development have also been analyzed. The methods that have been used in this study are growth and diffusion analysis, content analysis, citation analysis, co-word analysis and co-citation analysis.

One method that can be used to understand and to interpret results of these bibliometric studies is to interview some key persons, who are known to have a gatekeeper position in the diffusion of the concept. Thematic interviews with some Finnish researchers and specialists that have influenced the diffusion of social capital into Finnish scientific and social discussions provide background information.

The Milestone Publications on social capital have been chosen and studied. They give answers to the question "What is *Social Capital*?" By comparing citations to Milestone Publications with the growth of all social capital publications in a database, we can draw conclusions about the point at which social capital became generally approved 'tacit knowledge'.

The contribution of the present study lies foremost in understanding the development of network structures around a new concept that has diffused in scientific communities and also outside them. The network means both networks of researchers, networks of publications and networks of concepts that describe the research field. The emphasis has been on the digital environment and on the so-called information society that we are now living in, but in this transitional stage, the printed publications are still important and widely used in social sciences and humanities. The network formation is affected by social relations and informal contacts that push new ideas.

This study also gives new information about using different research methods, like bibliometric methods supported by interviews and content analyses. It is evident that interpretation of bibliometric maps presupposes qualitative information and understanding of the phenomena under study.

Keywords: bibliometrics; diffusion of knowledge; growth of knowledge; information studies; scientific communities; social capital; social networks; social studies of science.

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1 Introduction

> "The surest sign that a society has entered into possession of a new concept is that a new vocabulary will be developed, in terms of which the concept can then be publicly articulated and discussed."
>
> Quentin Skinner: *The Foundations of Modern Political Thought (1978)*

It is a common slogan that we are living in an information society or in the digital era. The information professionals notice every day that in this digital environment information is produced, retrieved and exchanged fast both on a local and global level. This results also in fast changes in the contents and views of disciplines and subject fields. New subject fields develop, paradigms change in old subject fields and the terminology changes rapidly.

In this situation the signal words become more important as entrances to whole fields. Signal words persuade readers and attract them to new fields. Relevant signal words in an information retrieval strategy give much the most important and actual information in the subject field. In this study we are interested in how the signal words are created in a field. How does a text catch the interest of a reader? These are research questions, and these are also important practical questions, the answers to which will promote the building of information systems and the development of controlled vocabularies, and also indexing practice.

The aim of this project is to study how a new concept appears in scientific discussion and research, how it diffuses to other fields and out of the scientific communities, and how the networks are formed around the concept. Text and terminology take the interest of a reader in the digital environment. Texts create networks where the terminology used is dependent on the ideas, views and paradigms of the field.

This study is a sub-project of the research project "Cultural and linguistic differences in digital storage and retrieval of information" that focuses broadly on the production, management, and use of digital information resources. From the user's point of view, it taps many fundamental questions of efficiency and accuracy of information retrieval. Additionally, it analyses and develops useful instruments for accomplishing high quality digital documentation in a multicultural context. The

entire research project is closely connected to the new language dependent challenges of the Internet, and the outcome will promote successful development of more sustainable digital documents (Ungern-Sternberg et al. 2003).

This study belongs to the field of information studies. It is also, because of my academic background, written from the sociology of science perspectives. The works and ideas of Robert K. Merton, Thomas S. Kuhn, Derek J. de Solla Price, Diana Crane, Everett M. Rogers and Michel Polanyi have influenced on my thinking during years. New ideas have come during this research process from Michel Callon, John Law and their collaborators in the Paris-Keele School (models of translation and the funnel of interest), Leah Lievrouw (communication in science), as well as Bryce Allen, Jian Qin and F.W. Lancaster (persuasion in science). It has been methodologically very important to know about the latest trends of bibliometrics, as well as to realize the need for a qualitative aspect of bibliometric studies.

This study is based mainly on bibliographic data. Materials for bibliometric studies have been collected from the DIALOG information system, Web of Science databases, several international subject databases, as well as Finnish databases FENNICA, ARTO and ALEKSI. The databases are also evaluated and their quality and coverage are discussed. The thesauri of those databases that have been selected for a more in-depth study have also been evaluated.

The material selected has been used to study how long and in which ways an innovative publication, which can be seen as a milestone in a specific field, influences the research. The concept that has been chosen as a topic for this research is *Social Capital*, because it has been a popular concept in different scientific fields as well as in everyday speech and the media. At the beginning of this study, there were no exact statistical numbers or any clear picture of the diffusion of the concept. It seemed to be a 'fashion concept' that appeared in different situations in 2001, and this drew my attention to it.

The growth and diffusion of social capital publications has been studied. The terms connected with social capital in different fields and at different stages of the development have also been analyzed. The methods that have been used in this study are growth and diffusion analysis, content analysis, citation analysis, co-word analysis and co-citation analysis. (Bibliometric methods, see e.g. Borgman 1990; Borgman 2000; Glänzel 2003; Gläzer & Laudel 2001; Kärki & Kortelainen 1996 and 1998; Lancaster & Lee 1985; Law & al. 1988; Whittager 1989.)

One method that can be used to understand and to interpret results of these bibliometric studies is to interview some key persons, who are known to have a gatekeeper position in the diffusion of the concept. Thematic interviews with some Finnish researchers and specialists that have influenced the diffusion of social capital into Finnish scientific and social discussions provide background information. Those interviewed have been e.g. the first ones to publish articles, to arrange seminars and workshops or in writing reports for public authorities. Some of them have been chosen for interview on the basis of recommendations of those previously interviewed - the snowball method. The researchers present several fields. Most of them are also interdisciplinarists or persons who have influence both in science and in some other fields, such as politics, or social life.

The Milestone Publications on social capital have been chosen and studied. The first criterion for selection is based on the citation analysis. What or which are the most cited and long-lasting publications? A supportive criterion is based on review articles of social capital. The third criterion is based on the interviews, i.e. on those publications that have been mentioned as impressive publications by the interviewed persons.

Milestone Publications give answers to the question "What is *Social Capital*?" They also give other answers. By comparing citations to Milestone Publications with the growth of all social capital publications in a database, we can draw conclusions about the point at which social capital became generally approved 'tacit knowledge'; i.e. authors no longer cite the Milestone Publications nor cite them as often as in the early years.

2 Concepts and theory

2.1 Word, term, concept and idea

Research on authors' terminology or assigned terminology is often used to trace the flow of ideas within and across disciplines. This kind of research is closely related to content analysis (see e.g. Paisley 1990, 290; Borgman 2000b, 146). Concepts may be applied to define scholarly communities (Borgman 1990, 18; Lievrouw 1990; Borgman 2000).

There are different definitions of word, term, concept and idea. In this study the dictionary definitions have been chosen and presented.

A *word* is defined in many ways. In this research we understand a word as a combination of vocal sounds, or one such sound, used in a language to express an idea (e.g. to denote a thing, attribute, or relation), and constituting an ultimate minimal element of speech having a meaning as such (Oxford English Dictionary).

A *term* is also defined and understood in many ways. It can mean, for example, a time period. In this study a term means a word or phrase used in a definite or precise sense in some particular subject, as a science or art (Oxford English Dictionary).

Paisley (1990, 295) states that *concepts* are what the information product embodies. It may not be immediately obvious that concepts include not only words or themes in the text, but also citations and presentation details such as the inclusion of statistical tables. Each decision of the author to include a word, theme, citation, or presentation detail is a concept for analysis. In this study, the chosen definition of concept is the product of the faculty of conception; an idea of a class of objects, a general notion or idea (Oxford English Dictionary).

An *idea*, too, is defined in many ways. In this study, idea is understood as any product of mental apprehension or activity, existing in the mind as an object of knowledge or thought; an item of knowledge or belief; a thought, conception, notion; a way of thinking (Oxford English Dictionary).

2.2 What is science?

When we study the development of science, scientific publications and scientific communication, we have to explain in some way, what we mean by science. There are different ways of defining science, sciences and scientific activities which vary from one country to another (national differences) and from one culture or language to another. The differences in interpreting the word have also had an influence on international communication: both on the contents of a book or journal, and on the organizational differences in science, such as scientific societies (Meadows 1998, 39-43).

There are different terms that refer to a person who is a professional in science and research. A *scientist* is a general term, but it has a connotation with the natural sciences. A *scholar* is a term that is used in the humanities. A *researcher* is a neutral and general term that refers to a person who is doing research work. In this study I prefer the term "researcher" where there is no reason to emphasize the disciplines and also to use either "scientist" or "scholar".

2.2.1 Science as a social system

In the sociology of science, the common way of thinking that science is a social system is based on Merton's functional viewpoint. Merton (1973) sees science as a social system, which has a normative structure. Pierre Bourdieu claims that the social system of science is a competitive struggle between scientists for scientific authority. He perceives science as a result of social negotiation. The concept of scientific capital explains scientific authority as a result of accumulation of symbolic goods through individual competition between scientists. The scientific elite is seen as accrued scientific capital, thus having the power to make decisions as to what constitutes scientific orthodoxy, current consensus, disciplinary boundaries, and other issues of authority (Bourdieu 1975; see also Lindholm-Romantschuk 1998).

Kuhn presented a view of science as a collective effort by the scientific community, one in which scientific development follows a cyclical pattern. Periods of normal science are interrupted by scientific revolutions that affect paradigm changes (Kuhn 1970).

Science as a social system has also been studied as work in scientific communities, such as laboratories (Latour & Woolgar 1979; Law 1986; Maglaughlin & Sonnenwald & Whitton 2004). This kind of research could be classified as the anthropological approach.

Rogers (1995, 23) defines a social system as a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal. The members or units of a social system may be individuals, informal groups, organizations, and/or subsystems.

2.2.2 Norms in science

Norms are the established behavior patterns for the members of a social system. They define a range of tolerable behavior and serve as a guide or a standard for the members' behavior in a social system. The norms of a system tell an individual what behavior is expected. Norms can operate at the level of a nation, a religious community, an organization, or a local system like a village (Rogers 1995, 26).

In science as a social system there are common norms. This is basically a question of rules of conduct - social norms. Merton (1973), who identifies four basic norms, has postulated the definitions of norms for the scientific community: universalism, communality, disinterestedness, and organized skepticism.

"Universalism" means that the scientific community assesses new work on the basis of pre-established, impersonal criteria, independent of such personal factors as sex, race, nationality, religion, and so on. New results must be made available to scientific community. "Communality/communism" reflects the requirement that scientific knowledge should be made common property. "Disinterestedness" instructs scientists that their prime concern should be the advancement of knowledge. "Organized skepticism" means that the scientific community should continually be subjecting the knowledge they accept to critical scrutiny looking for possible errors, whether of omission or commission (Merton 1973, 267-278).

The existence and acceptance of norms can affect the process of communication. There have been different criticisms on these rules of conduct (Meadows 1998, 50-51), so it is reasonable to discuss

those criticisms of the norms. One such is that they are not true. It is difficult to follow these rules. These are not the only rules, either. A fifth norm, "originality", has also been suggested.

Meadows (1998, 50) states that these norms at least reflect what scientists would regard as a perfect research world. These norms apply to the academic research world, not to research in industry, nor even to all academic disciplines and communities that receive money from, for example, military sources. Marketing research may also have difficulties in following these rules, as well as applied social research.

"Universalism" is often difficult to fulfill in the publication of articles in scientific journals. However, editors are usually anxious to ensure that articles are accepted on their merit and not on the author's name, nationality or gender. On the other hand, in small countries or narrow fields of sciences, the researchers often know each other well: their research problems, their style of writing, their signal words. There is also the Matthew Principle, as Price (1986, 226) states, "success breeds further success". So, it is certainly difficult for the referees to fulfill the idea of universalism.

"Communality/communism" is also well-illustrated by journals. Authors cannot lay down conditions for further use and development of their article. Communality is also connected with the work of public data archives that make the common use of collected research data possible. To emphasize the communality, some scientific journals presume that the author of an article that is based on empirical research, mentions where the data is archived and available for public use. This information gives other researchers the possibility of repeating the research and maybe also checking the results, or trying to find some new interpretations on the earlier collected data. (See for example Lievesley 1999.) In social sciences, however, it is not always possible to repeat research and achieve same results exactly. A researcher's social position or disciplinary background may affect interpretation of results and choice of methodological approaches.

"Disinterestedness" presumes that the authors do not expect to be paid for having their research work published in (scientific) journals. Nowadays, it is even possible that – on the contrary - the authors pay publishers in order to get their articles published in a "high impact journal" (see for example Open Access seminar http://www.lib.helsinki.fi/finnoa/seminaari_2004.htm). A good example of disinterestedness in the digital era is Open Access journals that are available freely on the Internet. They promote diffusion of scientific information and create possibilities of creating new scientific knowledge faster than before.

The refereeing of research articles is an excellent example of "organized skepticism" that works. Meadows (1998) states that the same critical function can be found in informal communication, as speakers in seminars are cross-examined. The speakers have to answer critical questions in front of an academic audience, and defend their research results.

If "originality" is accepted as a basic rule, it appears in the article review process, where it is a basic requirement for acceptance – or sometimes rejection. "Originality" is, however, something that might create something new: viewpoints, ideas, and concepts. On the other hand, "originality" is not always acceptable in normal science. If a research report is too original or has new kinds of results or viewpoints, it may not suit the paradigm. So, research like this may be a risk to the career of a researcher or the beginning of a paradigm change (Meadows 1998).

According to Meadows (1998, 51) two conceptual factors have significant influence on the process of communicating science - the basic assumptions that scientists make about the work they do and the beliefs they hold concerning the research community and the way it should operate.

The Mertonian norms of science are not necessarily applicable to research communities in social sciences and humanities. Meadows (1998, 56) notices that social sciences and humanities differ from “hard” sciences. Some researchers in these disciplines would reject the idea of universalism for at least some types of research, claiming that a whole range of personal factors can affect the approach, and therefore the acceptability of the results. Similarly, disinterestedness, with its criticism of emotional involvement in the results of one's work, would not be seen as a worthwhile ideal by many researchers in the humanities and social sciences. In sum, both the basic assumptions made regarding research and the rules of conduct tacitly approved by the research community may differ between science and other disciplines. This can lead to differences in the nature of communication in these fields.

2.2.3 Scientific change

Kuhn has built a model of scientific change that has generated much discussion both in favor and against (see for example Kuhn 1974, 293-294). He argues that growth and development of scientific knowledge occur as a result of the development of a paradigm or model of scientific achievement

that sets guidelines for research. After a period of "normal science" during which the implications of the paradigm are explored, facts that the paradigm cannot explain become inescapable. The field then goes through a period of "crisis" during which a new paradigm is proposed and eventually accepted (Kuhn 1962).

The term "paradigm" has been interpreted in different ways. In his article Kuhn (1974) tries to explain what he really means by a paradigm. At the same time, he ironically states that the term has started to live its own life (Kuhn 1974, 293-294; 318-319). According to Kuhn, paradigm is closely related to the phrase "scientific community". A paradigm is what the members of a scientific community, and they alone, share. Conversely, it is their possession of a common paradigm that constitutes a scientific community of a group of otherwise disparate people.

Kuhn uses the concept of "disciplinary matrix", when he tries to explain, what he means by the word "paradigm". A scientific community consists of the practitioners of a scientific specialty. The members of a specialty share four main elements of the disciplinary matrix: symbolic generations, commitments to certain beliefs, values and exemplars (concrete models for problem solving). These and some other elements comprise together a kind of taken-for-granted set of understandings among the specialty's membership (Lievrouw 1992).

Fleck (according to Lievrouw 1992), who has had an impact on Kuhn's thinking, was speaking in the 1930's of "thought collectives", "thought structures" and "thought styles". A thought collective exists wherever two or more people are actually exchanging thoughts. He is a poor observer who does not notice that a stimulating conversation between two persons soon creates a condition in which each utters thoughts he would not have been able to produce either by himself or in different company. A special mood arises, which would not otherwise affect either partner of the conversation but almost always returns whenever these persons meet again. Prolonged duration of this state produces, from common understanding and mutual understanding, a thought structure that belongs to neither of them alone but nevertheless is not at all without meaning. Who is its carrier and who its originator? It is neither more nor less than the small collective of two persons. If a third person joins in, a new collective arises ... One individual belongs to several thought collectives at once (Fleck 1979, 44-45; cit. Lievrouw 1992).

Moreover, Fleck maintains, certain shared beliefs of the thought collective - thought styles - constrain individual scientists' new ideas in the process of establishing new "facts" and overturning

older ones. Such stylized ideas are candidates to become new facts. Fleck also divides a thought collective into several forms of science, which range from the extremely specialized (esoteric) to the extremely general (exoteric). Trenn and Merton describe them (cit. Lievrouw 1992):

- *journal science* for the special experts,
- *vademecum or handbook science* for the general experts,
- *popular science* for the exoteric circle, and
- *textbook science* for initiation into the esoteric circle.

As Lievrouw (1992) states, this typology is echoed in the flow of information among scientists as they engage in conceptual communication, documentary communication, and eventually popularizing communication. It can also give a frame of reference for the study of scientific concepts and their diffusion, when a concept is moving from scientific discussion to specialist conversations and sometimes also to everyday speech.

The most characteristic operational feature is a democratic exchange of ideas and experience, going outward from the esoteric circle, permeating the exoteric circle, and then feeding back upon the esoteric circle. The work of the mind thus conveyed undergoes a process of social consolidation and becomes thereby a scientific fact (Fleck 1979, 161; cit. Lievrouw 1992).

2.2.4 Scientific communities and invisible colleges

Meadows (1998, 107-110) presents some research groups and their productivity. Different fields of sciences have different ways of developing groups. That is reasonable for the research problem, for example, laboratory research for practical research, and mathematical deduction in theoretical research. Social scientists have also several styles. Survey research has often been done in research groups, when expensively collected data can be utilized by several researchers from different viewpoints. Social problems, as drug abuse, have also often been studied in interdisciplinary groups.

Teamwork has a major impact on both formal and informal communication. In small groups, or in collaboration between equals, all the participants may have a reasonable overview of the research project. In large teams, ordinary members may be part of smaller groups within the overall structure and have a detailed knowledge of only part of the project. In such teams, the team leader has the job

of organizing and integrating all the activities (industry and government research). Their research is mission-related; academic research is interest-related. Meadows states that the person providing integration and co-ordination - the team leader - becomes the most visible researcher. It is an exact antithesis of the traditional lonely genius. (Meadows 1998, 109.)

Scientific collaboration and invisible colleges have often been seen as an important part of the information environment in several scientific specialties, but humanists have been thought to work in comparative isolation. Weedman (1993) studied scholars of children's literature, and found an invisible college in this field, too. More than 50% of 123 respondents indicated that at least half of the ideas for their work could be traced back to conversations with others. 80% listed people with whom they discussed their work at its early stages. 95.5% cited people with whom they sorted out and clarified their thinking. Their personal communications also established a loose but well-defined social structure in the field.

Weedman states that the humanities, the social sciences and the sciences are practiced within the same environment. The objects of study differ, and therefore the methods of study must differ, but the basic unit of knowledge is the same – the public presentation of the knowledge gained through study. (Weedman 1993.)

Crane states that there are two distinct types of subgroups in science. The first are groups of collaborators, the second is a communication network that she calls the invisible college (Crane 1975, 34-35). The invisible college links groups of collaborators. It is a way of recruiting new members to a field of science. When we talk about scientific networks or connections between scholars, we can find also other concepts, like grapevines, social networks and social circles (Van Rossum1973, 63-75). Scientists form communities in other ways than through their learned societies or the universities they work in. They are people linked together by their interest in particular scientific problems. Those who belong together in such a group have been called invisible college, because theirs is a fellowship of intellectual rather than of material institutions or building (Ziman 1976, 90).

The original meaning of invisible colleges dates back to 17th century London. It refers to an informal club of artisans and practitioners before the formal organization of the Royal Society (see e.g. Chen 2003, 138; Valle 1999). It has been said to mean an unofficial community of researchers, who have the same research interests, but who were working in different universities. The term was

re-invented by Price (1962), and then Crane (1972; 1975) made it more popular in her milestone book. To Price and Crane the invisible college means collaboration between people who can be working in different institutions. The Internet has given possibilities to fulfill the original idea of the term in a new environment. (See e.g. Lukesh 1999; Kling & McKim 1999; Brunn & Lear 1999; Talja & Maula 2002.)

The word 'grapevine' has nowadays about the same meaning as 'invisible college'. It is defined as a community of like-minded scientists. As an example, a Social Science Grapevine was developed in Britain by the Social Science Information Gateway (SOSIG) in 1998. It is a loose organization on the Internet that offers social scientists an opportunity to network. (Huxley 2000, 7-8) The Academy of Finland has also developed the same kind of possibility for researchers to get information on opportunities to find like-minded colleagues abroad. (www.aka.fi; 31.12.2004)

Originally 'grapevine' as a concept of communication had its roots in the American Civil War. As the battlefronts quickly changed, intelligence telegraph lines were loosely strung from tree to tree, appearing much like grapevines. Because of the haphazard method in which these lines were hung, the messages sent over them were frequently garbled. Eventually, any unofficial communication was said to be from the grapevine. Contemporary grapevine information is frequently perceived to be just unreliable, but in reality these messages are surprisingly accurate and informative. (Rakes & Cox 1993.)

In information science, we also use the term 'specialty' that refers to the perceived grouping of scientists who are specialized in the same or closely-related topics of research. Theories of how specialties evolve and change started to emerge in the 1970's. Researchers began to focus on the structure of scientific literature in order to identify and visualize specialties, although they did not use the term 'visualization' at that time (Chen 2002, 145).

A 'network' can be defined in many ways depending on the field of science, technology or knowledge. In this study, the network is understood as an interconnected group of people having certain connections (frequently as a result of attending a particular school or university) which may be exploited to gain preferment, information, etc., especially for professional advantage (Oxford English Dictionary).

Networks and graphs are studied in graph theory that is a branch of mathematics. A graph consists of vertices and edges. A network consists of nodes and links. Many important phenomena can be formulated as a graph problem, such as telecommunication networks, club membership networks, integrated electric circuits and scientific networks. Social networks, for example, are graphs on which vertices represent people and edges represent interrelationships between people. Acquaintanceship graphs, co-author graphs and collaboration graphs are examples of social networks (Chen 2003, 90).

A 'social circle' describes the social organization of the entire set of members of a research area. (Kadushin 1966, 1968; cit. Crane 1975.) The exact boundaries of a social circle are difficult to define. The boundaries of the group in terms of its total membership are also difficult to locate. Each member of a social circle is usually aware of some, but not all other members. Indirect interaction is an important aspect of the social circle. It is not necessary to know a particular member of a social circle in order to be influenced by him. Not only can a scientist be influenced by publications written by authors whom he has never met, but he can also receive information second-hand through conversation or correspondence with third parties. There is no formal leadership in a social circle although there are usually central figures. Members of a social circle come together on the basis of their interests, by their commitment to a particular approach toward a set of problems (Crane 1975, 13-15).

Meadows (1998, 37) noted in the 1990's that the new electronic world has changed the scientific communication. The distinction between formal and informal information channels sits uneasily with the use of computers and networks. The difference between a hand-written letter and a published journal is very clear; the distinction between an electronic mail message and an electronic journal article is not. Both can be sent to any size of audience from one individual upward; both are disseminated via the same channels and can be accessed by readers via the same computer screens. This blurring of function does not only apply to researchers' disseminating information to research audience. The growth of information technology is increasingly making it possible for computers to act as channels for the mass media, more especially television. In principle, and already sometimes in practice, researchers can provide information to a mass public via the same information technology they use for contacting fellow-researchers. This blurring of traditional divisions is a key factor in the transfer of information from traditional to electronic channels.

In our electronic era researchers can more easily become members of invisible colleges. One way is to subscribe to some mailing list of scientists or specialists and be active on it. Also just being a member of a list means that one obtains information and is 'up-to-date' more easily. Of course, researchers also send email straight to each other, and maybe they also choose from a discussion forum some partners with whom they have more detailed and specific discussions. Brunn and O'Lear (1999, 287-289) introduced the concept of 'electronic invisible college'. They introduced also the concept of 'electronic scholarly community' that includes subscribers of disciplinary and interdisciplinary listservs, who share information on a variety of topics of local and global interest and engage in discussions on methodological, instructional, technical, and policy questions. In the digital era the important thing is who is networked with whom; location and distance are not issues.

The emergence of a new scientific discipline or paradigm often includes a new communication circle, a new invisible college. (See Crane 1973, 34-40.) In the digital era and in the networked world it seems that it is faster and easier to create or find new circles than before. The emergence of an international and transdisciplinary invisible college affects scholarship in a number of ways, also members of traditional research institutes (Brunn & O'Lear 1999, 299).

Speech is common informal communication, whether it is face-to-face (seminars, conferences, meetings in the street) or by telephone. Meadows (1998, 115) says that informal communications are by definition 'ephemeral', especially communication by speech. Exceptions are speech captured on tape or disk.

Important vehicles for such informal communication are conferences and seminars. Conference proceedings are carriers of new knowledge and ideas. Nowadays they are often also on the Internet. The abstracts of conference papers are available on the net even before a conference, which can speeden the dissemination of new ideas. This also gives new opportunities to participate in conferences without traveling; by surfing on the net one is a member of informal networks. (See also Brunn & O'Lear 1999.)

A researcher has opportunities for oral communication with a colleague next door, as well as with foreign researchers at international conferences. The frequency varies across researchers. Eminent researchers act as important foci for informal information exchanges, just as they do for formal exchanges (Meadows 1998, 139). Price and Beaver noted already in the sixties that well-known senior researchers take leading roles in scientific communication.

"The people in such a group claim to be reasonably in touch with everyone else who is contributing materially to research in this subject, not merely on a national scale, but usually including all other countries in which that specialty is strong. The body of people meet in selected conferences (usually held in rather pleasant places), they commute between one centre and another, and they circulate pre-prints and reprints to each other and they collaborate in research" (Price & Beaver 1966).

Meadows (1998, 140) states that there are different pictures of invisible colleges. The most common picture envisages a two-stage process - informal communication between individuals and research groups, and informal communication within research groups. Information-active researchers are the central actors in research groups. Their contacts with other groups are with the leading researchers there. These are people who are usually meant, when an invisible college is mentioned.

Big research groups have more contacts inside the group; smaller groups must find contacts also outside the group. Invisible colleges have three basic principles:

1) Lower status researchers are more likely to seek information from higher status researchers than conversely.
2) Higher status researchers are more likely to seek information from other higher status researchers than lower status researchers. And,
3) higher status researchers are particularly active in information exchange (Cronin 1982).

However, nowadays it is possible that higher status researchers (old) rely on lower status researchers (young) for information-seeking on the Internet. An explanation is that younger researchers are more experienced in the use of information technology than older ones, and they know the possibilities of the Internet better (see e.g. Meadows 1998; Forsman 2002a).

2.2.5 Social sciences

In different countries and regions social sciences include different fields. Usually it is accepted that the basic ones are in sociology, political sciences and economics. There are, however, sciences that lie near or on the marginal. They might be multidisciplinary or interdisciplinary fields. The scope of social sciences may vary even in one country, when the social science faculties of different universities include different fields. Social sciences may include anthropology, psychology, archeology and history. Sometimes the borderline between social sciences and humanities is

blurred, as in the case of history. Sometimes the borderline stays between social sciences and natural sciences, like psychology. Sometimes a field has characteristics in common with all of these, like anthropology. All the time new fields develop. The process can begin with a viewpoint or aspect in some mother science, and soon perhaps there is a scientific school or a new paradigm. A new viewpoint may diffuse to several fields and finally form a new interdisciplinary field. These kinds of fields are e.g. women studies, environmental studies and science studies. We could state that social sciences deal with people that act together or in collectives. The description of social science has had a somewhat less varied career than science or humanities. (See e.g. Meadows1998, 42-43; Line 1999.)

When we claim that social sciences and humanities differ from sciences, we should to try to define social sciences. According to the definition of *IFLA (International Federation of Library Associations and Institutions) Social Science Libraries Section*, social sciences include anthropology, communication science, criminology, demography, economics, education, environmental planning, futurology, geography, history, labor science, law, library and information science, linguistics, management science, philosophy, political science, public administration, psychology, social policy, sociology, statistics, science of religion, science of science (http://www.ifla.org/VII/s5/sssl.htm; 21.1.2004).

As we noticed, some social sciences are often very close to humanities. The concept of "humanities" is also very difficult to define. Originally humanities referred to classical studies. Close to the meaning of humanities is the word "arts", although also it has unfortunately its ambiguities. Until the 20th century it was mostly employed when talking of the practical arts, which ranged from fine arts, such as painting, through various crafts, to activities related to engineering, often extending to music and the theater. Research on all these topics is distinctive from the creative world in them and can be separated for inclusion under the "humanities research" banner. The distinction has been blurred between research and creative work (Meadows 1998, 41-42).

There is also considerable diversity between different social sciences. Economics, one of the younger social sciences, has in econometrics a sub-discipline that is virtually a branch of mathematics, and might therefore be considered a “hard” science. Some social sciences are soft through-and-through: the probability that two social surveys carried out on the same subject in the same district within a few months of one another will agree at all closely is not high - one has only to look at political polls (Line 1999).

It follows that concepts and terms are not international or consistent over time; there is some agreement within certain regions and across similar political systems and cultures, but even then there tends to be a national bias. In consequence, subject control and access are far harder than in the sciences; by comparison, the humanities are far more amenable to control. And unlike the sciences, nearly all social scientists write in their native language; there is no de facto common language. These factors together mean that it is much harder to develop satisfactory international information services in social sciences than in science, technology and medicine. (Line 1999.)

2.2.6 Disciplines and interdisciplinarity

The concept of 'disciplinarity' is a product of the 19th century. During that period, the natural sciences evolved, knowledge underwent a process of "scientification", the industrial revolution took place, and technology advanced. The trend within individual disciplines toward specialization was connected with industrialization (Lindholm-Romantschuk 1998, 5).

Disciplines are twigging (like "local history" or "history of science" from history), and also making unions of two branches of research to form new combinations (like "biochemistry" from biology and chemistry). As Meadows (1998, 44) states, there has still to be some common area or ground for the new combination; a field like "molecular theology" seems impossible.

In social sciences interdisciplinarity can be seen in fields like "science studies", "youth studies" and "gender studies". "Social policy studies" also have roots in several fields of social sciences, originally in sociology and economics.

Lindholm-Romantschuk (1998, 13-16) approached the problem of interdisciplinary communication. She refers to Megill and McCloskey (1987, 235; cit. Lindholm-Romantschuk 1998), who ask "What point would there be in a … discipline unable to speak beyond its own boundaries?" A discipline not only has to be able to communicate its own findings outward, it also has to be able to stay in touch with and utilize developments in other fields of research in order to maintain its position within the epistemological hierarchy. So, interdisciplinary communication can be seen as a survival strategy for a discipline.

A discipline needs influences from other disciplines, new viewpoints that may give new visions, and perhaps can also cause new paradigms. It is not rare that scientific disciplines take ideas and concepts from everyday life and language. It has generally been assumed that the direction of the flow of knowledge is from hard to soft disciplines, or from the top down of scientific hierarchies. It has also been argued that growing sophistication and specialization in all scientific endeavors have made communication across disciplinary boundaries even more difficult (Lindholm-Romantschuk 1998, 14). Kuhn (1977) maintains that communication between individuals from different disciplines is difficult in the same way that communication between individuals from different paradigms is difficult.

Lindholm-Romantschuk (1998) studied the flow of information within and among academic disciplines, in social sciences and humanities. She came to the conclusion that there appears to be support for the notion that each academic discipline is dependent upon other disciplines, and academic disciplines therefore have a need to communicate across disciplinary boundaries. She found that at least on a general level, intellectual innovations in the social sciences and humanities are able to permeate disciplinary boundaries and find an audience outside the originating discipline, in many cases an audience that is bigger than within the discipline (Lindholm-Romantschuk 1998, 129-130). In this way, cross-disciplinary communication is possible, and there is an ongoing conversation and exchange of ideas among the academic disciplines.

However, the main disciplinary groups in the study tend to communicate mainly with disciplines within their own group. The main direction of the flow of information across disciplinary groups is from the social sciences to the humanities. A conclusion is that the boundaries between disciplines may be rather permeable. The study shows that a few disciplines are extremely isolated, but most of the humanities and social science disciplines display a brisk exchange of information across the discipline boundaries. Another finding is that the humanities and social sciences may be more open to information and influences from outside the discipline than the hard sciences, i.e. their boundaries are more fluid (Lindholm-Romantschuk 1998, 131).

2.3 Scientific knowledge

There are many views on scientific knowledge. One of them is that there is just one real world waiting to be explored, which implies that specific discoveries about it can be made only once.

Since several researchers may be working along similar lines at the same time, this means that the first to give public notification of a discovery pre-empts the work of the others. Consequently, the communication system must be able to establish clearly who has priority for each new step forward.

Another example is that the emphasis on impartial observation and quantitative analysis links in with the way in which research results are typically presented - an impersonal style often interlaced with mathematics. This form of presenting science is indigestible to non-scientists and so has led to the rise of the popularization of science. Even a belief in the uniqueness of science has implications for the diffusion and acceptance of research information internationally. It suggests that all countries should adopt the forms of communication developed in the leading science countries. All these beliefs about science imply that scientific research is bound up with social interaction. Communication is, by definition, a communal activity (Meadows 1998, 49).

2.3.1 Scientific communication

Scientific communication is the basis of science and a premise of the growth of scientific knowledge. Scientific knowledge is based on previous knowledge. According to Ziman (1976) also scientific revolutions, when a new paradigm compensates an old one or grows alongside it, are based on earlier knowledge and the flow of information between scientists.

Within the social system of science, communication can be viewed as the glue that holds the system together. Without an organized communication system, the scientific enterprise would most likely be a series of disparate, random and overlapping undertakings (Lindholm-Romantschuk 1998, 8).

The meaning of scientific communication has been discussed in different fields, especially in thesociology of science, science studies and information studies, and from different viewpoints. Lievrouw (1992) states that "most researchers tended to see communication as an intermediary step on the way to some other phenomenon of interest, a process that is only interesting insofar as it produces some other structural or functional product. Information scientists have seen scientific communication primarily as the generation of documents, which in turn represent the knowledge structures of science. Sociologists and historians of science have considered communication as an activity that allows scientists to construct and organize the social structures of science. Philosophers

of science have discussed the linguistic problems that arise in the process of developing theories, scientific facts, or even ‘truth’."

Scientific communication is the core of scientific activities. Doing research work is a communication process. It means information seeking, discussions between researchers, organizing information and producing new knowledge. Traditionally scientific communication has been divided in formal and informal communication, and as we have noted before, the digital information networks support both of these. The formal communication includes books, journals, papers, and articles. The informal communication includes networks and communication with researchers such as correspondence, conferences, unofficial discussions, mailing lists; things that are not under formal control or formal rules.

Meadows (1998, 24-29) states that scientific communication can also be seen according to the environment and target of the communication. Scholarly communication is targeted to 1) scholars of the same field; 2) scholars of other paradigms; 3) scholars of other fields: and 4) students (young scientists). All these groups could be called professionals in science (Meadows 1998).

Scientific communication can also be targeted to outside the scholarly communities (science for people). The groups are: 1) Specialists of different fields with scientific education (medical doctors, high-level specialists like librarians, teachers, lawyers etc.) and who may also have professional mobility between science and practical work. These groups could be called amateurs of science (Meadows 1998). 2) Specialists of different fields without scientific education (professional education) and who may need scientific information in their work. 3) The wider public, or ”men in the street”. Everyone can belong in this group, and the communication channels are newspapers, magazines, radio, TV, and the Internet.

The means of communication can be different for different groups, but in general we can say that both printed and digital media are used both in scholarly communication and in scientific communication in and outside the scholarly communities. People have different roles and different situations concerning their information needs.

Using the Internet is to a researcher one way to acquire, produce and communicate research information. In his information-seeking process, the researcher uses different information repositories of the Web. These may be bibliographic databases, full-text electronic publications,

databases or web pages of institutions or individual scholars. He can use digital data as research data, and produce new data for scientific communities.

There are different communication patterns across disciplines. Researchers in physical sciences, who generally deal with discrete objects, are able to structure a particular method of study and communicate the research results according to a model that is widely accepted in the discipline. In sciences, the object of the study is a physical entity that can be described in precise terms. Furthermore, the process of research has stages that are fairly discrete. The world of physical sciences is aimed steadfastly at progress, and since it is a competitive world, the process of communication encompasses the reporting of the stages of inquiry and the swift publication of results. There is the practical need for timely reporting and the need to stake intellectual claims. The resulting literature is large and growing, and claims to be providing precisely what the scientific community demands. It means increasing the number of journals and titles (Budd & Harloe 1997, 5-6).

The means of communicating is very different in the humanities. A particular focus of inquiry is not necessary discrete, but may be an installation in a larger, perhaps even a lifelong, effort at understanding a specific object of study. The object of a study is often a text or a set of texts. The humanities, by and large, do not depend upon measurement and observation, but on interpretation and exegesis. At all levels and at each stage of inquiry the humanities scholar delves into the formation of the object, asking how it came about and how to gain some grasp of the malleability of the object. Humanities are far more indeterminate than the sciences; for this reason, the humanities must eschew deterministic methods of inquiry (Budd & Harloe 1997, 6).

Lievrouw (1992) deals with the cycle of scientific communication. From the communication perspective, science can be seen as a communication cycle that has three progressive stages: conceptualization, documentation and popularization. Depending on the level of analysis, different units may go through the cycle, including research teams, sub-fields, specialties, or invisible colleges.

At the conceptualization stage, communication processes are typically interpersonal in nature, allowing individual scientists to refine and promote ideas within an immediate circle of colleagues and trusted assessors. The processes are ordinarily casual one-on-one or small group exchanges. Communication structures at the conceptualization stage are composed of individual scientists who

share a common set of substantive concerns, common methodologies, or a common discourse. Their personal friendships or acquaintanceships also link them. The structures are usually small – from two to perhaps a dozen people. (Lievrouw 1992)

At the documentation stage, communication processes are more organized. Researchers produce a documented record of a coherent body of research, such as the publication of scientific papers and books, or the presentation of research findings at professional meetings. Researchers at this stage in their work tend to communicate in a more stylized, rule-bound fashion to reach a larger audience than the original tightly knit group of colleagues that characterizes the conceptualization stage. Communication structures are correspondingly larger, and their members are linked more by common professional and intellectual concerns than by personal friendships. Structures are more orderly and more socially and culturally heterogeneous. (Lievrouw 1992) The concept of funnel of interest illustrates this. According to that theory scientists try to get other scientists to read their texts by using words that are common in a scientific community. (See e.g. Callon & Courtial & Turner & Bauin 1983.) The role of a journal editor is also important. He acts as a gatekeeper by funneling manuscripts in one direction or another or rejecting the material entirely (McGinty 1999, 1).

At the third stage of the cycle, popularization, ideas that have been developed by scientists at the conceptualization stage and then recorded at the documentation stage may be communicated further to the society at large. The communication processes at this stage tend to encourage the acculturation of ideas; they may accelerate the development of institutions or awards, the introduction of new words into the language, or encourage new social behavior as a result of scientific innovation or ideas. For example, new terms may become part of the everyday language of the general public (Lievrouw 1992). We can also assume that words from the everyday language will become part of the scientific terminology. Scientists may pick words from the speech of people in order to popularize research results and to make them more understandable to a wider public.

Lievrouw (1992) states that "conceptualization" and "documentation" may seem generally similar to ”informal” communication and ”formal” communication, respectively. She says that the latter terms have been used for many years by sociologists and information scientists (cit.: Paisley 1965; Menzel 1968; Crawford 1971; Compton 1973; Garvey 1979) to denote activities that are differentiated primarily according to whether they produce communication artefacts (e.g. books or journal articles). However, according to Lievrouw, formal and informal are not systematic

descriptions of communication behavior; this distinction places too great an emphasis on artefact (document) production as the primary communication behavior in science.

Lievrouw continues that it also echoes a conceptual distinction about communication behavior that is encountering increasing criticism among communication researchers (i.e., that communication is either "interpersonal" or "mediated"). The growing use of new electronic channels, such as specialized telephone services, fax machines, and electronic mail, poses a problem for this classical categorization because communication via these channels has both "interpersonal" and "mediated" characteristics. Therefore, the three stages (conceptualization, documentation, and popularization) were devised and named to play down the traditional primacy of document production (especially publishing) implied by the "formal versus informal" dichotomy, and to acknowledge the increasing overlap between "interpersonal" and "mediated" communication, either of which can occur in any of the three stages.

Lievrouw (1992) states that researchers must communicate their ideas to the larger culture that supports their research in a way that audiences outside the specialty can readily fit into a familiar pre-existing framework via the processes of objectifying and anchoring. That is, audiences should be able to convert the idea into an acceptable social representation. In everyday life, individuals formulate presentations of all kinds of new ideas as they confront them, including scientific ideas. People understand new ideas or events by accepting them into a context that is already well understood.

As we have noticed earlier, scholarly communication is communication between researchers within the scientific community. It can be either formal or informal (Lindholm-Romantschuk 1998, 13). The term is fairly recent, as the conception of scholarly communication as a system. It can be traced to the mid 1970's when the *American Council of Learned Societies* began to organize the National Enquiry into Scholarly Communication (Lindholm-Romantschuk 1998, 21).

Accoring to Borgman by scholarly communication, we mean the study how scholars in any field (e.g. physical, biological, social, and behavioral sciences, humanities, technology) use and disseminate information through formal and informal channels. The study of scholarly communication includes the growth of scholarly information, the relationships among research areas and disciplines, the information needs and uses of individual user groups, and the

relationships among formal and informal methods of communication (Borgman 1990, 13-14; Borgman 2000b, 144).

A basic idea in the growth of knowledge and in the development of science is that ideas, new research results and new information reach other researchers and contribute to the scientific thought. It may also have some influence on the social practice and also on political activities. If a scientist wants other scientists to read his or her texts and for their own part make on output in the science, it is important to write so that people want to read the texts (Callon & Courtial &Turner & Bauin 1983).

The research on scientific communication was intense throughout the 1960's and 1970's, with the massive growth in scientific enterprises, in scientific publishing and libraries, and the expansion of universities (e.g. Vickery 1999). Researchers sought to understand the processes involved in scientific communication by building models of information flows and by testing theories of behavior. The research on scientific communication, however, languished for nearly two decades from the late 1970's to the mid-1990's, except for the continuing work with bibliometrics. According to Borgman (2000, 412-413), now researchers are dusting off the old work on scientific communication and viewing it in a new light.

2.3.2 Researchers and information technology

The circumstances of scientific communication have changed considerably as a result of what has happened in telecommunications, computer networks and the Internet. Digital libraries give new possibilities for information searching. Electronic journals and books come to a researcher's desk in a few seconds. This is a remarkable development, compared with old-fashioned libraries with card catalogues and interlibrary lending when it took days or weeks to obtain a book or an article. Researchers have also an opportunity to obtain digital research data from computer-based data archives. They can exchange data with each other, and send research papers for comments to colleagues around the globe via email. Because of the Internet, they can find a like-minded colleague easier than before. Ways and forms of publishing have also changed so that it is possible to publish in digital form, use, for example, pictures, colors and sounds (Vickery 1999; Forsman 2002). The communication etiquette on the net (netiquette) is less formal than the etiquette concerning the "old-fashioned" sending of letters. Meadows (1998, 113) notes concerning

netiquettes that people can behave differently with the "semianonymity" and can also be more direct. The democratization effects of computer networks can represent a leveling-down of communication, as much as a leveling-up.

Although the possibilities have changed, people have not changed so much. Old habits and behaviour still prevail. “Old-fashioned” printed media and modern digital ways of communication will probably co-exist for a long time. Researchers use the ways and means to communicate that best suits them, and hybrid libraries support this trend (see Talja & Maula 2002).

Transmission via networks can also make research results and scientific knowledge available to a much wider audience more quickly than is possible via traditional channels. Meadows (1998) says that these differences combined with the greater computer skills of younger researchers tend to reduce the differentiation between levels of researchers. This may also help female researchers to participate more readily in scientific discussions.

Meadows (1998, 113) states that "one of the most widely recognized properties of communication via electronic networks is its tendency to even out differences between different levels of users. It is often difficult when exchanging information to detect the status of the person at the other end of the line. This can mean that research students, or junior researchers, are more on a par with senior staff than they are when using traditional modes of communication".

Access to networks encourages teamwork. Networking can help in integrating the group. It may also extend a group's influence in numbers and in geographical spread. Electronic communication networks can also offer researchers in developing countries the possibility to interact informally with other researchers on equal terms, as Meadows (1998, 114) points out. There are possibilities for a new kind of invisible colleges. It is an interesting philosophical question to pose: whether we are now close to the original invisible colleges of the 17th century.

2.3.3 Social scientists in their communication process

Social scientists traditionally publish mainly in books. Monographs are highly significant in terms of the intellectual development of a field in the humanities and social sciences (Lindholm-Romantschuk 1998, 130). A special trait that can be noticed, especially in Finland, is that social

scientists publish many anthologies, *Festschrifts*, or edited books with several articles that are often too long to be published in periodicals and too short to be published as separate books. These kinds of edited books could be seen as landmarks: this is the situation of our research field or discipline in this year or at that period.

On the map of disciplines, the social sciences are situated between the sciences and the humanities. The social science literature displays features of the other two. There has been growth in the periodical literature in most social science disciplines. There has also been vigorous publication activity in other formats, principally books. Social scientists have a bifurcated approach to their objects of study. Many researchers choose to adopt the stance that the object of study sufficiently emulates physical objects, so the methods of physical sciences can be applied to the social sciences (quantitative research). So, communication often resembles that of sciences. These researchers emphasize the word "science" in social sciences. On the other hand, there are researchers who would maintain that the object of study is human and not merely physical. They use more interpretative methods (qualitative research), and the journals and books through which they communicate publish works that are less discrete and involve methods akin to those of the humanities. For these scholars the "social" in the social sciences is emphasized (Budd & Harloe 1997, 6). It seems that there is a fresh tendency to evaluate different methodological approaches in social studies (see e.g. Räsänen & Anttila & Melin 2005).

At the beginning of 21st century, social scientists as web users have not been much studied. This can be affirmed by searches that were made on the LISA (Library and Information Science Abstracts) database. There were in February 2005 only 16 references concerning the web use of social scientists since 1994. At least seven of them only present the possibilities of networked information resources for social scientists. In the Sociological Abstracts database there were only two references about Internet use and social scientists. Most of the research on the information use of social scientists has been done earlier, in the 1970's (see Line 1999).

It seems, however, that social sciences are not exceptional; there is not much research on scientists as web users in other fields. In a recent study of the use of FinELib (The Finnish Electronic Library) it was found that researches of physical sciences, economics, health studies and technical sciences were "heavy users" of the digital web material, whereas researchers of the humanities, cultural studies and social sciences were "low users" (Törmä 2003, 74-75). There can be many explanations for this. It is possible that there is not enough interesting or useful material for social scientists on

the web, or perhaps social scientists are not as good at web surfing as scientists are. The information seeking culture is different in different fields, too. It is evident that these kinds of gaps will be crossed in the future, when the Internet is increasingly a routine tool of research work. (See also Robb & Janes 2003.)

Information needs and uses studies were popular in the 1960's and early 1970's, but they fell into decline shortly thereafter, largely because they were considered too ambitious, too contradictory in their findings, and of little practical use (Robb & Janes 2003). A classic study on social scientists as information users was a project in England, at the University of Bath, in 1971-1975. A practical goal of the project was to obtain information for planning library and information systems and services (Brittain 1970). Since these investigations, known as the "Bath studies" undertaken by Line and his collaborators, there has been very little new research or even replication of the former studies in the field (Hobohm 1999).

However, times have changed, and there is much interesting and useful material to be found and used on the Internet also for social scientists – books, journals, quantitative and qualitative research data sets, bibliographic data etc. Researchers have possibilities to do information searches themselves on the databases and evaluate them. The role of an information specialist or librarian has changed; he or she is not, as previously, a mediator and interpreter between a researcher and information, but mainly an indexer, a teacher and a guide.

In fact, the main studies on social science information behavior in the 1970's revealed that social scientists do not use formal information tools like bibliographies or reference databases, but rather they rely on personal recommendations, browsing in journals, and citations found in other publications (Line 1971). They rely on monographs as well as on periodical literature, but their own citations refer to a large extent to primary data. Social scientists often use literature outside their own discipline with the consequence that one may not always find relevant resources in just one database or information system. The data used in the social sciences does not always come from social science research, but is mainly taken from other contexts not indexed in social sciences information systems. It is worth noting that also practitioners, not only researchers, use and need social science information in their work (Hobohm 1999).

Lindholm-Romantschuk (1998, 135) obtained the same kind of results in her study of the flow of ideas within and among disciplines. Sociology seems to be a discipline with a great deal of appeal

outside its boundaries. It has high visibility in other disciplines, but it also imports ideas from outside. Sociology seems to produce a very small core of books that are interesting only to sociologists. Economics as a discipline follows the same pattern as sociology – high visibility, high interest, small core, but a relatively small proportion of the reviews in the economics journals are to books of other disciplines. Economists appear to have less interest in ideas produced in other disciplines than sociologists.

In the 1970's it was not possible for researchers to do information searches in bibliographic databases themselves because it was rather expensive to use computers and databases and there was no reason to waste time and money on this. They needed an information specialist as a mediator. Also, the databases that were most qualified and best developed belonged to medicine, science and technology. The best databases and information services of social sciences were in economics and education; they were so-called useful social sciences for the development of society. In other social sciences, information sources were mostly books or periodicals, that is bibliographies, abstract journals and index journals (Line 1999).

The database construction was mostly developed in medicine, science and technology. Scientists across the world can and do make their views clear, on information services as on other topics - witness the several congresses that have taken place on information problems and needs in the sciences. The net result of all this is that social scientists do not seem particularly concerned as a body about information services or deficiencies, nor apparently are they organized to say or do much about it (Line 1999).

The information world has changed dramatically "after Bath". The 1970's and 1980's mainly saw the development and spread of big databases. Online information systems were at first considered as big magic boxes where one could obtain all the relevant information just by pressing the button. This has turned out to be an illusion. Several studies revealed the limited effectiveness of online retrieval systems, and most of the studies on computer retrieval performance have been undertaken in natural sciences where conceptual and terminological problems are far less than in social sciences (Hobohm 1999).

Bath studies showed that social scientists do not act as systematically as information professionals and database service constructors would like them to do. Librarians and information specialists may overestimate their own influence or possibilities to support social scientists in information seeking.

Information professionals are often too far from “invisible colleges”, unofficial networks of researchers and unsystematic information flows, if they have not acted themselves as researchers and in that way had the possibility of being a member of scientific networks. Information specialists in social sciences are only one source of information to their clients (Hobohm 1999).

This viewpoint is supported also by Talja and Maula (2002). They studied the role of virtual libraries in the information search process of researchers. They interviewed 44 researchers from different fields: literature, history, environmental sciences and nursing science. There were no “pure social scientists”, but somehow it is possible to generalize the results also to the social sciences, because at least history, environmental sciences and partly nursing science include a social aspect and social science methodology. The study of literature may also have some common research areas with the social sciences.

According to this study the virtual library, e.g. information gateway, was not familiar to most of the informants. The virtual library was associated with the Finnish Electronic Library (FinELib), e-journals, bibliographic databases and link collections of individual scientists. Those who had used the Finnish Virtual Library had visited it only a couple of times. Reasons for the low use were, among others, that the service was confused, some links were out-of-date, and indexing was inconsistent. It is possible that the logic of virtual libraries or information gateways that have been collected by librarians is not consistent with the way of thinking of researchers (Talja & Maula 2002).

In 2000, the Internet was already the main channel in information seeking for most of the interviewees. Data and material were searched by the researchers’ personal computers that were connected to the web. They still borrowed books or ordered material in libraries (Talja & Maila 2002).

Many researchers have doubts about librarians’ ability to understand their fields of science. That is a reason why researchers appreciate link collections and web pages compiled by their colleagues. Although researchers did not use virtual libraries, they used web sites of other researchers and science organizations. An information gateway of Finnish historians, called *Agricola*, was highly ranked, because it was collected and updated by departments of history at Finnish universities. The Finnish Virtual Library was not as highly ranked; some researchers felt that “the links were

collected by 'someone'" (Talja & Maula 2002). Selden (1999) obtained similar results in his research when he studied social science researchers' relations to the acquisition of information.

A reason for the popularity of such web resources as *Agricola* is, according to Talja and Maula, the fact that it is a kind of extension of the traditional communication channels of scientists. *Agricola* is also a mailing list that offers book reviews via email. It offers possibilities for scientific discussion and informal networking between scientists. It also acts as a scientific periodical when it offers information about new research results, but it is faster and more flexible. As a digital library *Agricola* was created in the community of researchers of history promoting interaction and communication. According to their study, researchers of history share the opinion that the Internet has brought the Finnish research community closer together and increased the knowledge of each other's research work. As a conclusion, Talja and Maula (2002) emphasize that researchers have not yet understood what kind of information source the virtual library really is.

The preceding study was conducted at the Millennium. Since then virtual libraries and digital information resources have been and will be developed fast. It may be difficult to reconcile the scientists' culture and the librarians' culture, but it is useful to know and understand each other's special characteristics. Librarians cannot demand that researchers behave as they would like. If librarians and information specialists want researchers to use the databases, virtual libraries and other digital information services that have been built and developed with much financial and human resources, it makes some sense to build them to be easy to use. As Line states, information scientists' work is not to criticize people for being as they are, but to design services to them. "I have never been happy about trying to redesign human beings to fit information services" (Line 1999).

Heinström (2002) studied students' information-seeking behavior. She interviewed 305 students, who were in the process of writing their master thesis. 144 (32%) were students of social sciences. The aim of her study was to explore the influence of personality and approach to studies in their information seeking behavior. She found three information-seeking patterns: *Fast Surfers*, *Broad Scanners* and *Deep Divers*.

Broad scanning was shown to be particularly common among students of social sciences. Social sciences are soft disciplines, and information can be found in a wide range of sources. The holistic comparison and interpretation is typical for the soft sciences. Typical personality traits of *Broad*

Scanners are openness to new experiences, extroversion, and competitiveness. This combination of traits was also common among students of social sciences, who were outgoing and active. It implies, according to Heinström (2002, 223-224), that personality traits, choice of study area and information-seeking behavior all form a pattern where all parts are interrelated.

Preference for new ideas instead of confirmation of previous knowledge was characteristic for the *Broad Scanners*. A broad information attitude is manifest both in information-seeking behavior and in content preferences. Covering a wide range of documents thoroughly offers excellent opportunities to find new inspiring material. Interest in broadening information horizons with new thoughts was typical for conscientious, extraverted and open students (Heinström 2002, 234-235). It is also possible that *Broad Scanners* have an important role in diffusion of new ideas and concepts.

Different fields of disciplines also differ in their traditions of publishing. Meadows (1998, 66-69) shows that the general rule is that publishing is easiest in sciences, harder in social sciences and harder still in humanities. It is difficult to have an article published in an academic journal. This brings social scientists to publishing via outlets other than journals: books and research reports.

The focus of research in social sciences and also in humanities is often national or local. A common way of publishing research results is therefore national scientific journals, professional journals and even magazines and newspapers. Local or national research themes also do not usually interest international scientific journals as much as global themes or theoretical and methodological problems. This causes research publications concerning local or national problems not to be included in the international bibliographic databases that cover mostly international journals.

2.3.4 Social scientists and information seeking

When we talk about diffusion of new ideas and concepts in science, we should not limit ourselves to the production of information. As important in the whole communication process is information-seeking and the ability of scientists to find new information from different sources and in different ways. There are some problems that make information acquisition and use difficult to most social scientists.

First, there are conceptual and terminological problems. The same term or concept can be interpreted differently in different fields of sciences, scientific schools as well as in different countries and language areas. When information diffuses from one researcher to another, there are several possibilities of misunderstanding the contents of a concept (Line 1999). As Buckland (1999, 3-4) has stated, all selection systems involve multiple vocabularies. Even in the most primitive case, where unedited texts are searched with unedited queries, there are at least two vocabularies, the vocabulary (or vocabularies) of the author(s) of the documents searched, and the vocabulary of the searcher. In the case of bibliographic databases and library catalogues, there are still the vocabulary of the indexer(s), the vocabulary of thesauri and the vocabulary of the searcher as formulated as a search query.

When there is a multiplicity of vocabularies, there is always a possibility of mismatch in any transition between vocabularies, a dissonance in meaning. If the searcher asks for A and the author wrote B, they might be expressing the same meaning in different ways (synonyms), or they might both write A and be meaning different things (homographs). All the stages and situations of the information dissemination can cause different interpretation or misunderstanding (Buckland 1999).

As we noticed earlier, researchers do not behave as information specialists wish them to behave. Researchers build their own information resources that can contain web sources or photocopies, research reports, books or anything, often also "non-scientific" material. Both everyday knowledge and studies of the information-seeking process show that humanities researchers and social scientists in particular often start information-seeking for their research in their own private and personal collections. There are several reasons and one of them is ease. Another reason is that researchers often are so specialized in some narrow field of a research that they think that their own collections are the best starting point. In cases like this, libraries, information services and other formally organized information resources are the last means. They offer the possibility to obtain rarities and expensive material, like books and bibliographic databases on the web (Hobohm 1999; Selden 1999).

Information resources like databases and web collections have often been planned and collected so that scientists do not have a possibility to influence the contents or structure. There has been much discussion on this already since the Bath studies in the 1970's. (See Hobohm 1999; Line 1999.) Many organizations producing library and information resources have tried to include subject specialists like researchers in the work. There are, however, some positive examples. In Finland the

Bibliography of Finnish Sociology was collected for years in co-operation with sociologists and library specialists, when the association of Finnish sociologists, *The Westermarck Society*, was a very active participator (Allardt 1989). Another example of that kind of cooperation from the digital era is SOSIG (Social Science Information Gateway) in Britain (Place 2003).

Researchers often trust their own informal channels. Many social scientists do not care about sophisticated information systems if their colleagues do not recommend them. Information gatekeepers and informal co-operation is an essential part of scientific work. In our digital era, email is a way to support informal contacts and network formation. It is an everyday tool of researchers that often takes the place of informal coffee breaks and telephone conversations. It can diminish personal contacts, but can also support it. Via email one can contact ones colleague: "See you in Cafe at 2 p.m." (See Talja & Maula 2002.)

The Internet opens new gateways via homepages of scholars to their own web collections and in this way makes recommendations to good and reliable web pages. It builds a linked world on the web. It offers possibilities for scientific networking. A scientist with web pages allows others to contact him. In this way it is - at least in theory - easier than before to approach leading, famous scholars (Meadows 1998).

Hobohm (1999) states that in several aspects researchers have also taken over some roles formerly held by the information professionals. Cataloguing, for example, is supposed to be done by the authors themselves when they produce the metadata for their electronic publications.

2.3.5 Scientific communication outside scientific communities

When a researcher communicates with researchers of other fields, as well as outside scientific communities, the information is often popularized, written in a more digestible, understandable way. This is possible e.g. by avoiding specialist terminology. When one studies scientific communication, one can map networks and communication chains, but also one can concentrate on different ways to use language and text. When researchers of a scientific discipline communicate with each other, they need not explain every word and every concept. They can presume that their colleagues understand the terminology and exact phrases they use. A part of academic studies is to initiate young students – scientists of tomorrow – to the terminology of that field.

When a scientist wants to communicate his research results to researchers of other fields, he must use language in a different way. Scientific knowledge must be popularized for scientists of other fields, especially if they are not members of some neighboring disciplines (Wikgren 1998.). This is a core issue in interdisciplinary research and in the work of research collectives. This is also a key issue when we think of the diffusion of ideas, concepts and terms from one discipline to another. Researchers of different fields do not always understand new concepts in the same way.

Communication of scientific information outside the scientific communities might also mean that the target group includes specialists and decision-makers of different fields with an academic degree. It is possible that they have also done scientific research themselves. They may be also interested in the theoretical background of the study, although the main interest is in research results. The specialists with scientific education may also be interested in research methods, and have the ability to read tables and figures (Laaksovirta 1988, 9-12).

It is also possible that a specialist or professional with an academic degree is a “gatekeeper”, a disseminator of new knowledge, who popularizes scientific research and introduces new concepts or new viewpoints to a wider public. Professional journals can also be the media that diffuse scientific information from research communities to decision-makers, practical work, and finally to everyday life. (See e.g. Bucchi 1998; McGinty 1999; Meadows 1998, 24-29.)

It is clear that there are differences between fields of sciences in communicating research information to a wider public. Some research areas and issues are more interesting and closer to the interests of ordinary people. Meadows (1998, 70) states that they must be "newsworthy". This means that 1) they must have happened recently, or to be about to happen; 2) they should be in some way relevant to ordinary human life; 3) they should have an element of entertainment. None of these elements is always present in equal amounts.

Meadows (1998, 71-72) points that from the media viewpoint sciences are experimental or observational, and the last ones are those that interest people. Among others astronomy, geology and zoology are observational and interesting disciplines. Biomedical research as an experimental research is an exception; it is usually widely reported.

In humanities, the object of study is often more interesting than the research itself, like painting or literature (Meadows 1998, 72-73). In social sciences smoking, drugs and alcohol behavior seem to interest mass media (Piispa 1997). Research on themes like sex, health, family, age groups, and sports also receive much publicity. These are themes that can be anchored to the everyday life of ordinary people (see e.g. Bucchi 1998).

A researcher can reach a wider audience by presenting his or her research results personally. There are two main ways. A researcher can contribute articles to popular magazines or write books at the appropriate level. Some researchers also appear on radio and television. Here there are also differences between disciplines and between research topics. In some disciplines the scientific text is easily understandable by a wider public or at least by specialists and professionals (e.g. history or social policy research). In other disciplines a book or an article for a wider public has to be specially written - or it may even be impossible to translate to layperson's language (e.g. some theoretical research). It is also usual that research publications are rewritten for a wider audience.

Sometimes researchers feel that there are barriers in the popularization of science that belong to the culture of the scientific communities. It is not always valuable to write for popular magazines, newspapers or to be on TV. As Goodell (1990) remarked about the "visible scientists", successful popularization has often alieneated them from their original colleagues, who may view the researchers's public success as "selling out".

2.4. Diffusion of knowledge

The simplest model to analyze what happens when new information appears in a field of science, describes information transfer as a diffusion process. Meadows (1998, 144) gives an example: When a lump of sugar is dissolved in a cup of coffee, the sugar, as it dissolves, gradually diffuses outward through the coffee. The time taken to reach any point in the coffee depends on its distance from the sugar lump. The analogy for information is that when new information is generated, it will be picked up quickly by those researchers most immediately concerned, then more and more slowly by those whose research interests are increasingly different.

Diffusion has different meanings in different fields of science and in everyday life. From the communication viewpoint, diffusion means ”spreading abroad, dispersion, dissemination (of abstract things, as knowledge)”. The anthropological definition of diffusion is ”the spread of elements of a culture or language from one region or people to another” (Oxford English Dictionary).

Rogers (1995, 5 and 10) defines diffusion as a process by which an innovation is communicated through certain channels over time among the members of a social system. His model of diffusion of innovations was developed as early as 1962, and it has been widely used in diffusion studies. (See e.g. Kortelainen 1999, 46-53; Crane 1975.) In this study the theories of Rogers were influential both as background information for understanding the phenomenon, and as a tool to explain some results of the empirical investigations.

The four main elements of Rogers' theory are innovation, communication channels, time and the social system**.** These elements are identifiable in every diffusion research study. An innovation is an idea, practice, or object that is perceived as a novelty by an individual or other unit of adoption. It matters little, so far as human behavior is concerned, whether or not an idea is objectively new as measured by the lapse of time since its first use or discovery. The perceived newness of the idea for the individual determines his or her reaction to it. If the idea seems new to the individual, it is an innovation. Newness in an innovation need not just involve new knowledge. Someone may have known about an innovation for some time, but not yet developed a favorable or unfavorable attitude toward it, nor adopted or rejected it. Newness of an innovation may be expressed in terms of knowledge, persuasion, or a decision to adopt (Rogers 1995, 11).

Not all innovations are adapted as fast or as easily. The characteristics of innovations, as perceived by individuals, help to explain their different rate of adoption. According to Rogers (1995, 13-14), past research indicates that the following five qualities are the most important characteristics of innovations in explaining the rate of adoption.

1) Relative advantage is the degree to which an innovation is perceived as better than the idea it supercedes. The degree of relative advantage may be measured in economic terms, but social prestige, convenience, and satisfaction are also important factors. It does not matter so much if an innovation has a great deal of objective advantage. What does matter is whether an individual

perceives the innovation as advantageous. The greater the perceived relative advantage of an innovation, the more rapid adoption will be.

2) Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible. The adoption of an incompatible innovation often requires the prior adoption of a new value system, which is a relatively slow process.

3) Complexity is the degree to which an innovation is perceived as difficult to understand and use. New ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills and understanding.

4) Trialability is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the installment plan will generally be adopted more quickly than innovations that are not divisible. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing.

5) Observability is the degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. Such visibility stimulates peer discussion of a new idea, as friends and neighbors of an adopter often request innovation-evaluation information about it.

As Moscovici (1984) has stated, the anchoring of new information into a familiar universe is a key issue in the communication process.

Re-invention is an interesting concept in innovation research. Rogers (1995, 15) states that during the first decades of innovation research, it was assumed that an innovation was an invariant quality that did not change as it diffused. In the 1970's diffusion researchers began to study the concept of re-invention, defined as the degree to which an innovation is changed or modified by a user in the process of its adoption or implementation. When an innovation exists, communication must take place if the innovation is to spread.

Rogers defines communication as the process by which participants create and share information with one another in order to reach a mutual understanding. Diffusion is a particular type of communication in which the message content that is exchanged is concerned with a new idea. The essence of the diffusion process is the information exchange through which one individual communicates a new idea to one or several others. A communication channel is the means by which messages get from one individual to another. The nature of the information-exchange relationship between a pair of individuals determines the conditions, under which a source will or will not transmit the innovation to the receiver, and the effect of the transfer (Rogers 1995, 17-18).

Mass media channels are often the most rapid and efficient means to inform an audience of potential adopters about the existence of an innovation, that is, to create awareness-knowledge. Mass media channels are all those means of transmitting messages that involve a mass medium, such as radio, television, newspapers, and so on, which enable a source of one or a few individuals to reach an audience of many. On the other hand, interpersonal channels are more effective in persuading an individual to accept a new idea, especially if the interpersonal channel links two or more individuals, who are similar in socio-economic status, education, or other important ways. Interpersonal channels involve a face-to-face exchange between two or more individuals. (Rogers 1995, 18; Lievrouw 1992.) In the 21st century the Internet has become an important mass media channel, and understanding its importance in the diffusion of new ideas is one research question of this study.

Diffusion investigations show that most individuals do not evaluate an innovation on the basis of scientific studies of its consequences, although such objective evaluations are not entirely irrelevant, especially to the very first individuals who adopt it. Instead, most people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have previously adopted the innovation. This dependence on the experience of close peers suggests that the heart of the diffusion process consists of the modeling and imitation by potential adopters of their network partners who have adopted previously. Diffusion is a very social process (Rogers 1995, 18; Carley 1995).

This is comparable with results of several studies on the information behaviour of researchers. They used to read those books and articles recommended by colleagues or friends, not by librarians or other “outsiders”. New information resources are also adopted easier if someone they know has

used and had good experiences. (See e.g. Brittain 1970; Persson 1980; Line 1999; Talja & Maula 2002.)

The inclusion of time as a variable in diffusion research is one of its strengths, but the measurement of the time dimension can be criticized. The time dimension is involved in diffusion 1) in the innovation-decision process by which an individual passes from first knowledge of an innovation through its adoption or rejection, 2) in the innovativeness of an individual or other unit of adoption – that is, the relative earliness/lateness with which an innovation is adopted – compared with other members of a system, and 3) in an innovation's rate of adoption in a system, usually measured as the number of members of the system that adopt the innovation at a given time period (Rogers 1995, 20).

The innovation-decision process is the process through which an individual (or other decision-making unit) passes from first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision. Rogers (1995, 20) presents five main steps in the innovation decision process:

1) Knowledge occurs when an individual (or other decision-making unit) learns of the innovation's existence and gains some understanding of how it functions.
2) Persuasion occurs when an individual (or other decision-making unit) forms a favorable or unfavorable attitude toward the innovation.
3) Decision occurs when an individual (or other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation.
4) Implementation occurs when an individual (or other decision-making unit) puts an innovation to use. Re-invention is likely to occur at the implementation stage.
5) Confirmation occurs when an individual (or other decision-making unit) seeks reinforcement of an innovation-decision that has already been made, but the individual may reverse this previous decision if exposed to conflicting messages about the innovation.

At the knowledge stage, an individual mainly wants to know what the innovation is and how and why it works. Mass media channels can effectively transmit such software information. But increasingly at the persuasion stage, and especially at the decision stage, an individual seeks innovation-evaluation information in order to reduce uncertainty about an innovation's expected consequences. Here he wants to know the innovation's advantages and disadvantages in his own

situation. Interpersonal networks with close-peers are particularly likely to convey such evaluative information about an innovation. Subjective evaluations of a new idea from other individuals are especially likely to influence an individual at the decision stage, and perhaps at the confirmation stage (Rogers 1995, 20-21).

The innovation-decision process can lead to either adaptation, a decision to make full use of an innovation as the best course of action available, or to rejection, a decision not to adopt an innovation. Such decisions can be reversed at a later point; for example, discontinuance is a decision to reject an innovation after it has previously adopted. The reasons may be dissatisfaction, or a better idea. An individual may also adopt an innovation after a previous decision to reject it (Rogers 1995, 21). When a new concept appears in scientific discussions, it may at first receive rejection, or maybe it is not noticed at all. It may also take time until the new concept has diffused so broadly that it as accepted e.g. in database indexing (see e.g. Whittager 1989).

Innovativeness is the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than the other members of a system. Adopter categories, the classification of members of a social system on the basis of innovativeness, include 1) innovators, 2) early adopters, 3) early majority, 4) late majority, and 5) laggards (Rogers 1995, 22-23).

Innovators are active information-seekers of new ideas. They have a high degree of mass media exposure and their interpersonal networks extend over a wide area, reaching outside of their local system. Innovators are able to cope with high levels of uncertainty about an innovation than are other adopter categories. As the first to adopt a new idea in their system, they cannot depend upon the subjective evaluations of the innovation from other members of their system. The measure of innovativeness and their classification of a system's members into adopter categories are based upon the relative time at which an innovation is adopted (Rogers 1995, 22).

Diffusion occurs within a social system. The social structure of the system affects the diffusion of innovation in several ways. The social system constitutes a boundary within which an innovation diffuses. Here we are dealing with how the system's social structure affects diffusion, the effect of norms on diffusion, the roles of opinion leaders and change agents, types of innovation-decisions, and the consequences of innovation. These issues involve relationships between the social system and the diffusion process that occurs within it (Rogers 1995, 24).

Structure can be defined as the patterned arrangements of the units in a system. This structure gives regularity and stability to human behavior in a system; it allows one to predict behavior with some degree of accuracy. Thus, structure represents one type of information, in that it decreases uncertainty (Rogers 1995, 24).

The most innovative member of a system is very often perceived as a deviant from the social system, and is accorded a somewhat dubious status of low credibility by the average members of the system. This individual's role in diffusion is therefore likely to be limited. Other members of the system function as opinion leaders. They provide information and advice about innovations to many in the system (Rogers 1995, 26).

Opinion leadership is the degree to which an individual is able to influence other individuals' attitudes or overt behavior informally in a desired way with relative frequency. This informal leadership is not a function of the individual's formal position or status in the system. Opinion leadership is earned and maintained by the individual's technical competence, social accessibility, and conformity to the system's norms. When the social system is oriented to change, the opinion leaders are quite innovative; but when the system's norms are opposed to change, the behavior of the leaders also reflects this norm. By their close conformity to the system's norms, opinion leaders serve as an apt model for the innovation behavior of their followers. Opinion leaders thus exemplify and express the system's structure (Rogers 1995, 27).

Opinion leaders are members of the social system in which they exert their influence. In some instances individuals with influence in a social system are professionals who represent change agents external to the system. A change agent is an individual who influences clients' innovation-decisions in a direction deemed desirable by a change agency. The change agent usually seeks to obtain the adoption of new ideas, but may also attempt to slow down diffusion and prevent the adoption of undesirable innovations. Change agents use opinion leaders in a social system as their lieutenants in diffusion campaigns (Rogers 1995, 27-28).

Change agents are often professionals with a university degree. It often means that they are heterophilous from their typical clients. So there may be problems in effective communication. Many change agents have aides. An aide is a less than fully professional change agent who intensively contacts clients to influence their innovation-decisions. Aides are usually homophilous with the average client, which helps to bridge the heterophily gap (Rogers 1995, 28).

The social system has yet another important kind of influence in the diffusion of new ideas. Innovation can be adopted or rejected 1) by an individual member of a system, or 2) by the entire social system, which can decide to adopt the innovation by a collective or an authority decision (Rogers 1995, 28).

One common way of investigating communication within a group or organization is to examine who consults whom when they stand in need of information. Those people who are standing amid a flow of information are gatekeepers. As each enquirer comes along, the gatekeeper opens the gate to allow through those items of information that are relevant to the particular enquiry. A gatekeeper must obviously have access to a range of information sources both within and outside the employing institution or network. The sources may be both formal and informal, but the information transfer from a gatekeeper to an enquirer is via informal channels (Meadows 1998, 143).

Meadows (1998, 24-29) examines the development and change of scientific communication in connection with the amount of producers and users of scientific information, e.g. researchers, and their education. He makes a division between professionals and amateurs. Professionals have a scientific career and post, amateurs have an academic degree, they may be even postgraduates working as professionals (medical doctors, lawyers, librarians etc.), but not as researchers. They have the ability to read and understand scientific texts and utilize the information in their own work. It is possible that they are occasionally full-time researchers, but the main purpose for them is not a scientific career.

It might be possible that just the amateurs are mediators of scientific information between research and practice, between science and everyday life. They have their feet in both worlds – scientific and non-scientific. They know the rules, etiquette and language of both worlds. They have the possibility to diffuse knowledge and ideas in several directions. Many science editors also belong to this group (McGinty 1999). The amateurs might also act as mediators from the everyday life to science and research and give scientists new ideas, impulses and maybe also signal words that can help them to communicate their research results to a wider public.

The importance of journal editors as gatekeepers must also be noticed. A science journal editor with experiences in scholarship may have a kind of supra-gatekeeper position, as McGinty (1999, 115)

notes, transcending the confines of constituency members to bring them new material that otherwise would not have been presented. It is a position requiring the editor to have a view that extends outside the boundaries of the present paradigms. That vision has to assimilate what is being developed in other areas of research into material for his constituency. McGinty states that perhaps this is one way in which new paradigms are generated.

Latour (1986, 266-267) criticizes the "model of diffusion" or "diffusion theory" of Rogers that is often used in explaining spread of ideas. He thinks it is too mechanical a model. He writes about the power of associations. In his opinion, the model of diffusion has three important elements in the spread of a token through time and space: 1) the force that triggers the movements and which constitutes its only energy; 2) the inertia that conserves this energy; and 3) the medium through which the token circulates.

This model of diffusion may be contrasted with another, that of the model of translation. According to that theory, the spread of anything – ideas, artefacts, goods etc. – is in the hands of individuals. Each individual may act in many different ways, letting the token drop, or modifying it, or deflecting it, or betraying it, or adding to it, or appropriating it (Latour 1986, 267).

We can say that everything that has anything to do with an idea or a token in a chain does something to it. The chain is made of actors and since the token is in everyone's hands in turn, everyone shapes it according to their different projects. This is why Latour calls it a 'model of translation' (Latour 1986, 268). Translation stands for all the mechanisms and strategies through which an actor identifies other actors or elements, and places them in relation to one another (Callon & Courtial &Turner & Bauin 1983, 193). To translate is to displace. But to translate is also to express in one's own language what others say and want, why they act in the way they do and how they associate with each other (Callon 1986, 223).

The difference between the model of diffusion and the model of translation is that the first one is more mechanical, and the latter is a social model. People are affecting the development of some idea. Instead of transmission of a token one has the continuous transformation of the token (Latour 1986, 268).

2.5 Growth of scientific knowledge

Scientometric analysis shows that the growth of scientific knowledge takes the form of a exponential curve, but in many research fields it is logistic. The logistic curve has been fitted to the cumulative number of new publications appearing per year in scientific disciplines (Crane 1975, 2; Price 1986, 4, 18-25). Price (1986, 4) states that "… if any sufficiently large segment of science is measured in any reasonable way, the normal mode of growth is exponential. That is to say, science grows at compound interest, multiplying by some fixed amount in equal periods of time". Price suggests this is a fundamental law of any analysis of science.

According to Price the growth of numbers of new publications where the growth is logistic passes through the following stages: 1) a preliminary period of growth in which the absolute increments are small although the rate of increase is large but steadily increases; 2) a period of exponential growth when the number of publications in a field doubles at regular intervals as a result of constant rate of growth that produces increasing amounts of absolute growth; 3) a period when the rate of growth declines, but the annual increments remain approximately constant; and 4) a final period when both the rate of increase and the absolute increase decline and eventually approach zero (Crane 1972, 2).

Price has studied sciences, and especially 'Big Science', i.e. expensive scientific research especially in industry, and his thinking and conclusions are based on this. Crane (1975) has a thesis that the logistic growth of scientific knowledge is the result of the exploitation of intellectual innovations by a particular type of social community.

2.5.1 Characteristics of scientific knowledge

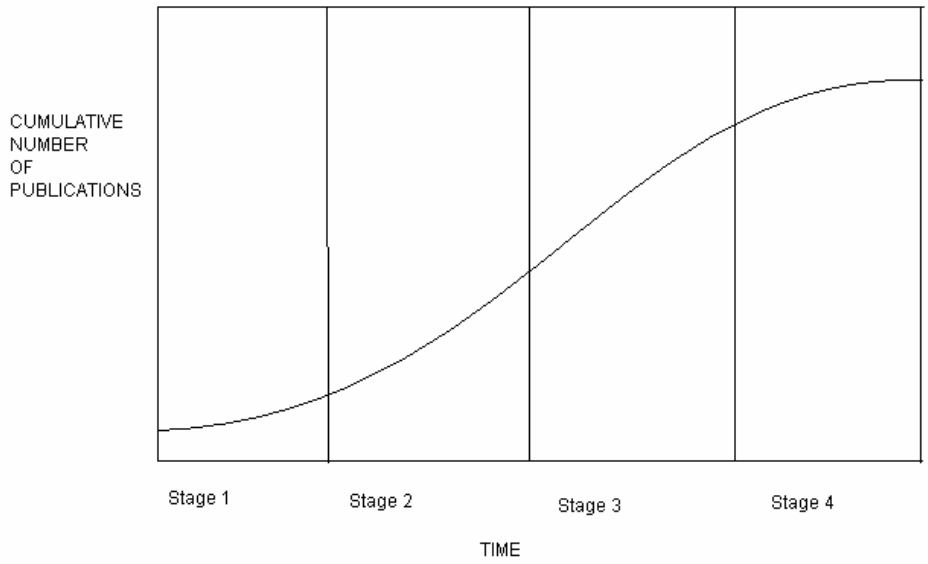
Crane (1975, 172) visualizes the characteristics of scientific knowledge and scientific communities at different stages of a logistic curve. The curve is built on the basis of database searches and annual growth of publications in selected fields. She has included social sciences in her studies; one example is rural sociology and the growth of knowledge in this area.

Crane (1974, 40) emphasizes the role of scientific communities in the process of growth of knowledge. She states that exponential growth of research areas in basic sciences is indicative of the

social process underlying scientific growth. The various stages of logistic growth of a research area are accompanied by a series of changes in the characteristics of scientific knowledge and of the scientific community working in the area.

Interesting discoveries that provide models for future work (paradigms) attract new scientists to the area during stage one. At stage two, a few highly productive scientists set priorities for research, recruit and train students who become their collaborators, and maintain informal contacts with other members of the area. As the implications of the seminal ideas are exhausted or become increasingly difficult to test due to the appearance of anomalies that cannot be explained by the original model (stages three and four), new scientists are less likely to enter the area and old members are more likely to drop out, thus leading to a gradual decline in the number of new publications and in overall membership in the area. Those who remain are likely to develop increasingly narrow and specialized interests as the possibilities for research dwindle or to be divided into fractions on the basis of theoretical controversies. In the latter case, acceptance of a new paradigm leads to a new cycle of growth (Crane 1975, 40).

Crane (1972, 172) includes in her figure an assumption of four stages or steps in the growth of knowledge and paradigm changes: 1) paradigm appears, 2) normal science, 3) solution of major problems/anomalies appear, and 4) exhaustion/crisis. Characteristics of scientific communities are at stage 1) little or no social organization, at stage 2) groups of collaborators and an invisible college, at stage 3) increasing speciality/increasing controversy, and at stage 4) decline in membership.



	Stage 1	Stage 2	Stage 3	Stage 4
CHARACTERISTICS OF KNOWLEDGE	Paradigm appears	Normal science	Solution of major problems Anomalies appear	Exhaustion _____ Crisis
CHARACTERISTICS OF SCIENTIFIC COMMUNITIES	Little or no social organization	Groups of collaborators and an invisible college	Increasing specialization Increasing controversy	Decline in membership Decline in membership

Figure 1: Characteristics of scientific knowledge and of scientific communities at different stages of the logistic curve (Crane 1975, 172).

Crane continues with the diffusion of ideas. She emphasizes that it ought to be possible to detect, first, which scientists are setting the standards for evaluating research in an area and, second, a contagion process that transmits important ideas to a steadily increasing population of ”adopters”

who explore their implications. The development of a paradigm is both an intellectual and a social process in which ideas are evaluated and norms for subsequent research are set. Analysis of the social organization of research areas has shown that a few scientists in each area played very important roles in recruiting and influencing other members. This suggests that consensus concerning a paradigm for an area may emerge among a small group of scientists who then transmit it to many others (Crane 1975, 66-67).

The factors affecting the diffusion of innovations in science appear to be similar to the factors affecting the diffusion of other types of innovations. There is some evidence that the diffusion of a scientific innovation is a fashion-like process in which influence is transmitted through steadily expanding networks of scientists. Science can be seen as an enormous cluster of innovations, of which the most successful are diffused by means of a contagion process that produces a logistic curve in all facets of scientific activity. Behind the seemingly impersonal structure of scientific knowledge, there is a vast interpersonal network that screens new ideas in terms of a central theme or paradigm, permitting some a wide audience and consigning many to oblivion (Crane 1975, 76).

2.5.2 Tacit knowledge, Milestone Publications and Sleeping Beauties

Explicit knowledge is knowledge that the knower can make explicit by means of a verbal statement: "Someone has explicit knowledge of something if a statement of it can be elicited from him by suitable enquiry or prompting" (Dummett 1991). Implicit knowledge can then be defined simply as knowledge that is not explicit. On this construal, implicit knowledge corresponds roughly to what Polanyi (1966) calls "tacit knowing" (Davies 2001).

'Tacit knowledge' has been explained as a particular kind of understanding which is so taken for granted by those who possess it that is never explicitly taught, but has instead to be acquired by sustained involvement in the relevant cultural milieu (Becher 2001).

Polanyi (1966, 4) states that the knowledge we can express in speech, writing, and other explicit forms is only the peak of the intellectual iceberg. Beneath the surface of conscious thought lies a vast sea of 'tacit knowledge' from a lifetime of experience, practice, perception and learning. He says, "we can know more than we can tell".

All fields of sciences have their visible scientists. This can be seen also in the communication systems. Meadows (1998, 101-102) refers to an analysis of physics articles published in the 1920's. He found that those which were considered to be classics were immediately cited very highly. However, this high citation rate lasted only for a short period of time. By way of contrast, articles that were cited equally highly, but over a longer period of time, are not now regarded as classics. The reason probably relates to the speed with which these major advances were incorporated into further research. Meadows states that a really epoch-making work was absorbed so quickly that it was soon unnecessary to refer to the original book or article. It has become 'tacit knowledge' of the field..

In this study those publications that are commonly agreed upon as classics or representatives of certain periods or paradigms in sciences are called "Milestone Publications".

Another phenomenon are the "Sleeping Beauties" of science. A Sleeping Beauty in science is a publication that is unnoticed ("sleeps") for a long time, and then, almost suddenly, attracts a lot of interest, i.e. "is awakened by a prince" (Van Raan 2004). These publications are ahead of their time. There may also be other reasons, why a publication becomes attractive after years.

A book or another scientific work is considered significant if it is highly cited, and vice versa. Citation rates are not, however, the best and only indicators of the growth of knowledge or diffusion of ideas. Citation is a social as well as an intellectual phenomenon (see e.g. Moravcsik & Murugesan 1975; Cronin 1984). The extent to which publications are cited is related to the stage of development of a research area and cannot be a simple measure of its growth (Crane 1975, 19-20). One can assume that when a research area is new, scientists cite publications they think that are milestones. It is also evident that scientists cite books and authors they believe one must cite in order to announce to which scientific school or network they belong. As an example, if a researcher wants to have an article published in an international journal, he must cite world-famous researchers. It is not enough to cite the top scholars of a small country who are local authorities. When a research area becomes more mature, researchers reduce citing to Milestone Publications. They use terms and concepts as known to all, evident – or 'tacit knowledge'.

Gerholm (1990, 263) uses concepts of 'implicit knowledge' and 'explicit knowledge'. The failure to acquire the implicit knowledge e.g. in some community is often taken as a sign of failure in the acquisition of the explicit knowledge itself. Implicit knowledge is the same as 'tacit knowledge'. He

divides ‘tacit knowledge’ into two main categories. One is the ‘tacit knowledge’ that is stored in the daily life of some community (like a university department) and that is being used to order its routines. The other category of ‘tacit knowledge’ is the similarly implicit knowledge generated among some group of people (like students) as a consequence of their encounter in the community (department) (Gerholm 1990, 263-264).

Bourdieu (1979) has a concept of ‘cultural capital’ by which he means a stock of knowledge, a frame of reference and a capacity to make the proper judgments which are called "taste". This is the ‘tacit knowledge’ that is "inherited" either in family ties or in certain circumstances by juniors from seniors.

Another way of adapting ‘tacit knowledge’ in a subculture or community is a kind of "hidden curriculum", in other words, the way children are taught at school. The children are trained not only in mathematics or history, but also in tolerating things that are not nice. This gives them abilities that are necessary in prisons, factories, offices and schools (Gerholm 1990, 269).

2.6 Persuasion in science

Most researchers want other researchers to read their texts. To be noticed and noted is a basic aim in scientific communication. On the other hand, the reading time of a researcher is limited. He does not want to read a paper of no significance. However, he should follow the development of his field and find from the information flow the books and articles that are worth reading. There are different signals used by researchers both in disseminating their own and scanning others’ research results and scientific information. Van Dalen and Henkens (2005, 209) mention the cover of book is not always the best sign of quality, better signals are the reputation of the publisher or the editorial board of a journal, the authors’s institution and the number of citations an article has received.

In this study, the signal words, i.e. the words that researchers use in their texts in order to gain attention for their ideas, is an issue. Signal words are also the words that indexers use in subject description of publications for a database. A reader is guided deeper into a topic by signal words.

2.6.1 Scientific texts and capturing interest

A scientific or technical text is a device for imputing, associating and capturing interest. Callon and his collaborators (1983) have explained the mechanisms by which a text exposes and at the same time imposes problems and how these problems are situated in relation to other problems.

The text can be reduced to a series of words, which they call translation operators. Translation stands for all the mechanisms and strategies through which an actor identifies other actors or elements, and places them in relation to one another. Each actor builds a universe around himself, which is a complex and changing network of varied elements that he tries to link together and make dependent upon himself. But this universe is not a separate world: other actors are building networks, other universes of which his own is a part. The never-ending process of translation/counter-translation is responsible for determining the social-cognitive nature of the elements to be associated in the networks, and how these associations are to be brought about (Callon & Courtial &Turner & Bauin 1983).

2.6.2 Language, concepts and terms

The language that scientists use is not unproblematic. Scientific words are necessarily laden with theory. Meadows (1998, 54) takes as an example the word "force" that seems simple enough, but its scientific meaning is much narrower than its use in everyday life and is best defined via a mathematical equation. The process of understanding words involves an interaction between the provider of information (a human being, a printed text, words on a screen) and the person receiving the information. From this viewpoint the transfer of information is not only a difficult activity, it also involves a considerable degree of subjectivity in affecting the transfer process.

Researchers use a specific language in order to show that they are researchers in a specific area. They have learned to use precise terms, and to avoid inexact interpretations and misunderstandings. Sometimes, especially in social sciences, researchers also take words from everyday language. Then they often want to popularize scientific knowledge and their research results. Using words from everyday language also means that researchers want to be more descriptive. A researcher writes texts because he wants other researchers to read them. A researcher needs a critical evaluation and approval of the scientific community of his research results.

A researcher may also write about his research results to a wider audience, and so popularize science. Sometimes scientific texts, research results and terms become so popular that they begin to live their own lives in non-scientific magazines, newspapers and everyday speech. Soon no one remembers the origin of a word or concept anymore. A concept has become widely approved, 'tacit knowledge'.

Some texts endure. They are 'charismatic documents' (Hargens 2000, 510-511). The texts of Greek philosophers are still popular. The founding fathers of the 19th century social sciences attract new generations. People recommend some texts to each other by writing reviews or citing these texts in their own publications. There must be something that the readers find interesting. However, sometimes a scientific book becomes a milestone that creates around itself a network, or even several networks, and attracts researchers across disciplinary boundaries.

2.6.3 Researchers, writing and readers

A scientific text can be compared to a detective story. Matti Virtanen, a Finnish social scientist and a science editor, writes about the aesthetics of scientific writing and asks how to write about such a difficult thing as science in an interesting and attractive way (Virtanen 2003, 98-101). He states five principles that he has applied in his own dissertation (Virtanen 2001).

The basis is the structure of a text. It is the theoretical and logical framework, as well as the manner of representation. A good structure means that a reader can see a text as a dynamic and harmonious entity. The second principle is the author's own voice. This does not mean subjectivity, but a way to understand different viewpoints and actors. One's own voice has a personal style. The third principle is the idea that bright thinking is short writing. A researcher writes the main lines and results. He does not describe the whole research process with all its false starts. A researcher starts to write a report when the research is ready at least in his mind, i.e. when he knows the whole story. Usually, when a text seems easy to read, it is a result of hard work and many drafts (Virtanen 2003).

The fourth principle is the concreteness of a text. This means details and examples, and also metaphors. Good metaphors are good means for thinking. They are also an excellent way of making abstract things or things that are strange in our culture concrete. It is possible that metaphors have

also seeds of new concepts in science. The fifth and last principle is the circle of the structure. In the end we come to the same point at which we started, but on higher level. At the beginning, a writer has some questions or assumptions, or maybe some clues. He knows how the book or the article will end. The text leads a reader to new results, new ideas, new concepts, maybe also to new ways of thinking (Virtanen 2003).

We can believe that every researcher wants other researchers to read his texts, write book reviews about them in core journals, cite them, use the same concepts and terms, and diffuse the ideas and research results. Printed pages, books and journals have a long-term existence and they rely on vision. Meadows (1998, 116-120) published an overview on design for reading, i.e. on the layout, types of text, structuring of texts, tables and pictures, as well as standardization of presentation in research communication.

What readers absorb from a book or article depends partly on the way it has been written, partly on the prior knowledge possessed by the reader. New information is anchored in old knowledge and experiences (Moscovici 1984). The style of the text is important. It is worth writing in a digestible way. Writing for scholars is different than writing for a wider public. According to Meadows (1998, 120), during the past hundred years or more, sentences in scientific publications have tended to become more difficult in length and complexity of words employed. Passive constructions also make reading difficult.

All fields of sciences develop their own vocabularies. They have their jargon. They also try to create shorter words rather than longer or acronyms like AIDS, DNA etc. Short words make reading easier, but, it may be a kind of “pig Latin” to outsiders. Researchers have also a tendency to create new nouns from existing verbs and adjectives in the English language (Meadows 1998, 121).

The more abstract or technical or special a piece of text is, the more difficult it is to follow. Scientific and technical articles are often more difficult for a reader than humanities articles. Meadows (1998, 122) states that the logical style of the former, with its tendency to refer to abstractions, contrasts with the narrative style of the latter, and its emphasis on concrete events and personalities. The difference is not, however, clear-cut.

Reading as a process and action is also interactive. Researchers bring their backgrounds with them to any text they read. They bring their own intentions to reading. They are looking for some

particular data or fact, or general interest, or for references to other works. They usually need and use a text for some purpose. A piece of work – an article, a book etc. - can satisfy different needs. Meadows (1998, 123) describes the common way in which researchers read. Most readers begin by scanning the content list. If they are dealing with a journal, they may then flick through the entire issue looking for anything that catches the eye or they may turn to a particular article and read the abstract. If this produces all the information they need, they may move to another article. If not, they may look at section headings, diagrams and tables of the article. Or they may settle down to read the article more thoroughly.

2.6.4 Text as a network

Texts are vital to many areas of social life, but nowhere more so than in science. Thus, a scientific text may be seen as an object which makes connections with other texts and literary inscriptions. The choice of a journal, a language and a title – these are methods by which an article or a book seeks to define and build an interested audience. The list of authors tells of collaboration and of the relative importance of each contribution. Here, then is the start of a network. But that network extends the cited texts, insert them into new relationships, and identify and link new actors together. Words, ideas, concepts and the phrases that organize themselves thus describe a whole population of human and non-human entities. Some may be well-established and other novel. But taken together they define, explore, stabilize, and test their identities against one another. A text may speak of many things, but their destinies are intertwined in the 'socio-technical dramas' described in scientific papers (Callon 1991, 135-136).

As Callon (1991, 155) says, "a scientific article tells a story that takes the reader by the hand and more or less successfully moves him or her".

The words in a text refer to other texts, and rework and extend the networks to be found in these. So whereas, traditionally we have assumed that texts are closed. Callon (1991, 136) states that texts have neither an inside or outside. Rather they are objects that define the skills, actions and relations of heterogeneous entities. Thus, the scientific article is a network whose description it creates.

Human beings try to construct classes that are as general as possible and seek to link those classes together by means of associations that are also as widespread as may be. There is, in other words, a

drive for generality and inclusiveness. People make classifications according to their experiences, their background, their ways of seeing the world and their environments (Law & Lodge 1984, 33-40).

2.6.5 Persuasive communities, citations and book reviews

According to Allen, Qin and Lancaster (1994, 281), the scientific community can be defined by the author-reader relationship. It consists of a network of formal communication links: people who read each other's papers. The development of a field is governed by these works. Another way to define scientific communities is by membership of formal institutions, or by less formal interactions such as informal communication.

The term 'persuasive communities' refers to the scientists (and other authorities) whose works are cited in a particular corpus of scientific writing (Allen & Qin & Lancaster 1994, 279). A persuasive community consists of researchers and colleagues whom scientists believe will persuade readers of the validity and importance of their knowledge claims. Authors cited in the same article may be presumed to have some mutual interests, or to be dealing with the same topic. Similarly, authors cited in an identifiable corpus of writings can be assumed to have some association with each other.

Allen, Qin and Lancaster (1994, 281-282) deal with the relationship between a scientific community and a persuasive community. The persuasive community is distinct from the scientific community that calls it into being. The persuasive community may contain some members of the scientific community: those regarded as having persuasive value because of their status or reputation. Some members of a persuasive community may be remote in time and space from the scientific community: the 'founding fathers' or authority figures.

Gilbert (1977) discusses the reasons, why scientists normally cite papers of other scientists, and why authors choose to cite particular papers rather than others. Scientific papers can be seen as "tools of persuasion". A scientist who has obtained results, which he believes to be true and important, has to persuade the scientific community, or certain parts of the community, to share his opinions of the value of his work. For it is only when some degree of consensus among his colleagues has been achieved that his research findings will become transformed into scientific knowledge.

Moravcsik and Murugesan (1975) found that negative references are quite rare in science. This supports the idea that references serve to create communities of supporting opinion. According to MacRoberts (1989), an author's main objective is not to cite other scientists influences but to present as authoritative an argument as possible, because papers are meant to sell a product. The scientific paper itself is a part or phase of ongoing science, not its end product. The formal paper presents a story and the citations present an array, but not the only array possible.

As we have noticed, social scientists frequently publish in books. Monographs are very significant in terms of the intellectual development of a field in the humanities and social sciences. Studying book reviews in scientific journals is one way to study the flow of information and ideas in these disciplines, as Lindholm-Romantschuk (1998) did. It is also a way to study, how the scientific community gives recognition to research publications.

Maybe this also gives some clues as to why some books become Milestone Publications. A consensus develops in a scientific community that one book is remarkable and worth reading. Many scientists want to write a review of such a book, and journal editors publish them. But still, it is fascinating that some books have some magic power to become Milestone Publications.

2.6.6 Reading as a social process

Reading a text is never only an interpretation, but it has also different uses. Texts are parts of their readers' life situations and experience. Even when we are focused on reading, there are many extra-textual questions that arise from life situations and inter-textual knowledge of readers (Lehtonen 1998, 197).

Ethnographic approaches remind us that readers are not atomic subjects. They belong to broader cultures and small groups or networks, which have their influence on the ways of reading. Readers are not only "consumers" or "recipients", but also "producers" of meanings (Lehtonen 1998, 198). In this way, we can say that every reader constructs a new work. Going further, every researcher who reads a book or an article and uses it or its ideas in his own text, is creating something new and giving a new interpretation to some idea, concept, or term.

Law and Williams (1982, 554) point out that the structure of scientific networks is not given in the speech or in the writing. It is the mistake of much discourse analysis to ascribe power to the words themselves. It is rather people who operate with, and alter, these networks. It is through their networks that they structure and give expression to their interests. Both persuasion and power depend on the capacity of whoever seeks to control, to align his array with that of the hearer at valued points.

2.7 Funnel of interest

A scientific text is an aid to guide and keep the interest of the reader, but terminology is the glue that connects the scientists in a specific field. Scientists identify the publications in their field through a common frame of accepted terminology. Law (1983) has introduced the concept of "funnel of interest". This concept describes the progression by which a reader is gradually obliged to consider the specific results of a paper. Law shows that when authors set up their arguments, they carefully determine which interests they want to capture, and how they wish to do this.

The authors of a document use so called macro-terms to guide a reader in the desired direction and take the reader into the funnel. To be able to do so, the authors have to use words that are accepted in the field. The funnel of interest organized around a few words depends on two mechanisms.

The first is by using the so-called macro-terms, which synthesize entire domains of reality. To mention these macro-words forces the reader whose interest lies within this field of activity to go on reading. This brings out the important role of macro-terms in funneling interests. The second mechanism is that these macro-terms are linked to other macro-terms in such a way that the associations postulated are consolidated in their turn. Funneling of interests is achieved through macro-terms fastened to other macro-words. These macro-terms are signal words, which point out and limit the way to a specific point. These signal words in a specific field develop slowly following the development of research (Callon & Courtial & Turner & Bauin 1983; von Ungern-Sternberg 1994, 121-122; von Ungern-Sternberg 2003, 11).

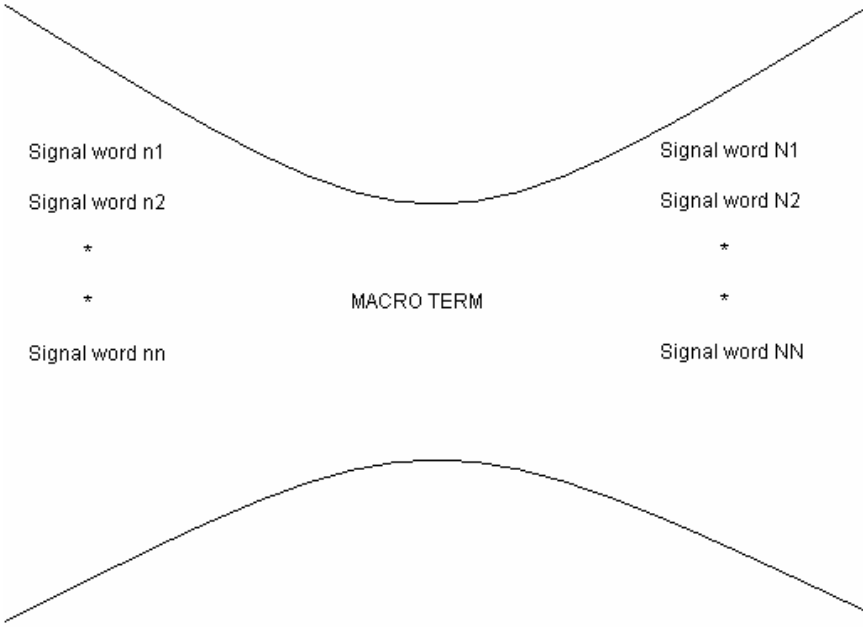


Figure 2: Funnel of interest

We can enlarge the concept of funnel of interest by looking closer at the function of the scientific paper. One important function is to persuade the reader of its knowledge claims and ideas (Gilbert 1977). The papers represent accounts supported by citations connected to other citations and pointing in a certain direction, exactly in the same way as signal words do. One can also call the bulk of accounts in a specific topic a funnel of interest. The texts in these papers use the terminology of a specific field with accepted signal-words in order to catch the interest of the audience and citations to literature, which support the results of the paper. There are many funnels of interest which represent ideas and views, but only a few of them lead to changes in paradigms (von Ungern-Sternberg 2000). The social system can be described in the following way (see figure 3):

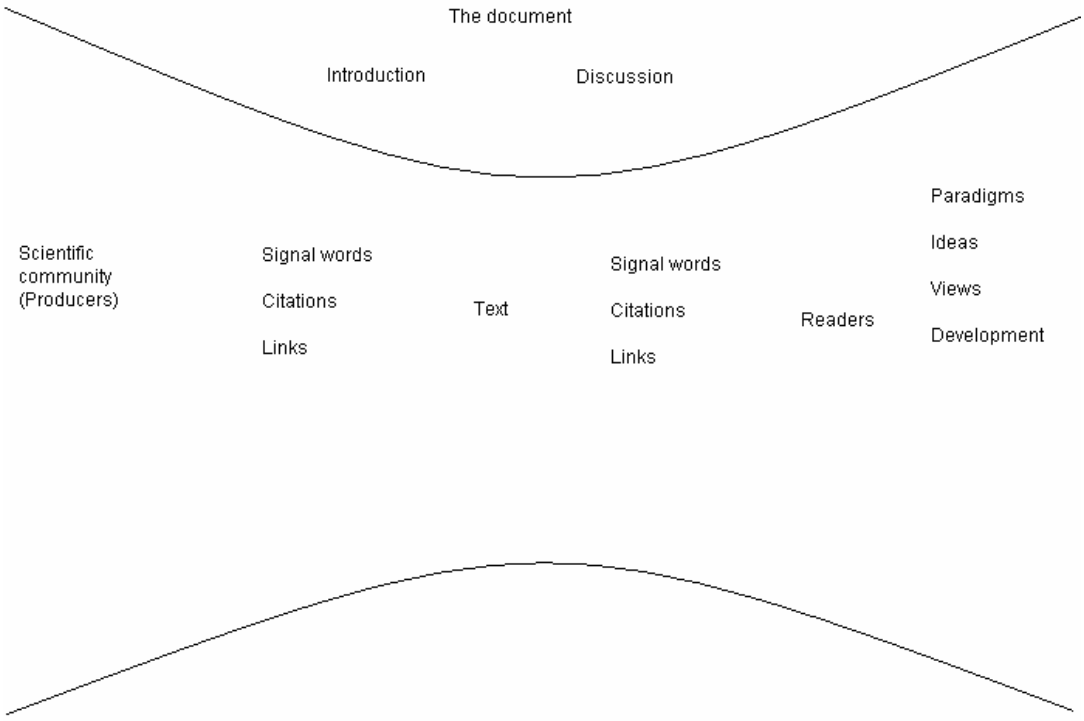


Figure 3: Social system of science and funnel of interest

2.8 New concepts, thesaurus construction and indexers

A library and information specialist is a gatekeeper (Meadows 1998, 143), a disseminator of new knowledge, who popularizes scientific research and introduces new concepts and new viewpoints to a wider public. It is, however, difficult to an indexer to choose the best possible terms, when a new concept appears. If a term is not in a thesaurus, an indexer has to decide, what the related terms are. It often takes time before a new term is approved in a thesaurus (Whittager 1989).

A thesaurus or a controlled vocabulary can function as guidelines to a field of science and knowledge. Thesauri are usually conservative, although nowadays when they are in digital form and available also on the Internet, it is possible to update them more often and more flexibly than earlier. It might take some years from the appearance of a term in a scientific text, before it is

included in a thesaurus. Also as Leydesdorff (1987, cit. Whittager 1989) states, “it is well known that keywords selected by an indexer who is not a practicing scientist tend to be conservative: the keywords reflect the world of the scientists of two years ago.“

2.9 Summary

In this chapter the conceptual and theoretical tools for analyzing and understanding the research problem have been presented. The main approaches include in the diffusion of new concepts to scientific communities and out of it by communication processes, where the texts are in focus. A key topic is network formation of terms, concepts and research fields.

The aim of these theoretical works is to give an understanding of the phenomenon that is studied. They have been important in constructing the structure of this study, selecting methodological approaches and designing questions both for the persons that have been interviewed and for the texts and datasets that have been gathered.

These works form the frame of reference of this study, and they have been most important in the interpretation of the empirical research results. It is difficult to say, in which way specific works have been influential, because over the course of this research process considerable ‘tacit knowledge’ has been accumulated.

It is always possible that some of those publications that have had an influence on the researchers own thinking during this research process have been forgotten. They become ‘tacit knowledge’.

3 The aim of the study

When this research project began in autumn 2001 there were some general and some specific research questions. During the process of the empirical study new questions arose, and the scope of the research also became broader. Originally the aim was to recover with bibliometric methods the network formation around a new concept that appeared to scientific discussion in the digital era. The idea was to use the co-word analysis as the main research method.

However, it seemed that some other bibliometric methods would also be useful when studying the development of a concept. Also other research methods, like content analysis and focused interviews of some selected gatekeepers would give more information about the target. The old fairytale about an elephant and seven blind men inspired me to study "The Elephant" of this research project from different viewpoints in order to obtain a more complete picture than just using bibliometric methods.

Gläser and Laude's article (2001) supported me in finding new viewpoints. They want to integrate scientometric indicators into sociological studies, and thus find the common area of scientometrics and sociology of science. The idea of qualitative scientometrics that Callon, Law and Rip (1986) have pointed out seemed fascinated. It meant that I had to collect different research data from different sources and use several research methods. This was, however, the only way to describe the elephant called Social Capital.

Preliminary results of this study have been presented in Nordic Bibliometric Workshops in 2002-2004 (Forsman 2001; Forsman 2002; Forsman 2004a) and some other international seminars in the field of information studies (Forsman 2001; Ungern-Sternberg et al. 2003; Forsman 2004).

3.1 Research questions

The research questions of this study were presented before the concept that was to be studied was chosen. The original idea of the research plan was to study closer a concept that has been popular in

scientific discussions in different fields of sciences around the Millennium. The concept of this case study was chosen to be Social Capital.

The general research questions include

- How is the interaction between ideas and paradigms built up in the digital environment?
- How does a scientist persuade the research community of his knowledge claims?
- At what point does the citing behavior change and when is the concept transferred to the 'tacit knowledge' of the field?
- When does the terminology in a field change so much that we can identify a change of paradigms?
- How does this changed terminology affect the storage and retrieval of information?

These are research questions, but they also try to find an answer to what implications a changed terminology in the texts of a subject field has on the development of controlled vocabularies for information retrieval.

The material selected has been used to study how long and in which ways an innovative publication, which can be seen as a milestone in a specific field, influences the research. The methods that have been used are diffusion studies, content analysis, co-word analysis, co-citation analysis, citation context analysis and focused interviews of gatekeepers.

There are also some specific research questions that try to gain more exact answers:

- When did the term occur the first time? Who introduced it?
- In what context and in what subject field did it occur?
- Which publications where important when the term was introduced?
- Were these publications cited or used as hyperlinks? How?
- How did the growth of publications based on the term proceed?
- Did the concept influence the development of the subject field?
- Did the term have an impact on the language?
- How was the concept defined?
- What other terms where used to describe the concept?
- How did the term diffuse into other fields?
- What fields where influenced?
- How was the concept introduced and defined in other fields?

- How did it change the terminology?
- What concepts does the term include and how does it change the controlled vocabularies used for indexing in the subject fields?

3.2 Research material

3.2.1 Bibliographic databases

Online bibliographic databases can be used to track the growth of the literature on a topic and to follow the diffusion of the topic through databases of various types. Lancaster and Lee (1985) studied the diffusion of acid rain, and found the usefulness of bibliometric methods.

The availability of reliable data is the most important condition for a valid bibliometric study. As Wormell (2000, 209) states, in order to answer the question 'what does this graphical presentation show', one should first answer the question 'what does the database cover'. Maps, graphical presentations and tables never show more than the data discloses. Therefore, in the selection of a particular database for a particular study, one has to answer to the question 'what do we want to show', in order to determine what kind of data is going to be used for the analysis.

The available databases can create limits for research. A researcher must be aware of limitations of databases when he makes conclusions based on the studies. It is necessary to know about the quality of the databases that are chosen for the study. Selection and indexing of material in databases are relevant for the empirical study. (von Ungern-Sternberg 1994, 83-98.) The databases as the material of bibliometric studies may have also weaknesses that are not foreseen. There may be errors in spelling or there may be duplicates. This means extra work to the harmonized material. In bibliometric research without that kind of intellectual and manual work the research results might be different.

The contents describing elements in the bibliographic databases are title, abstract, classification codes and thesaurus terms (Wormell 2000, 209). In this study thesaurus terms have been chosen for co-word analysis.

3.2.1.1 DIALOG information services

At the beginning of this study the first step was to browse the material that was available in databases. The DIALOG information services (see the description in Appendix 1) were used in order to find the core fields of sciences that most often include bibliographic records on social capital. On this basis the databases that would be useful for a closer study were chosen. A simple method was using the "rank" command that gives a list of the most often used keywords in a specific search, in this case a search concerning social capital (see more on the DIALOG web pages www.dialog.com). This is an essential part in the identification of core databases, as well as in getting an overview of possible access points and search terms.

3.2.1.2 Web of Science databases

The second step in the empirical research was to map a general international overview on the growth and diffusion of publications concerning social capital. A crucial question was, what are the Milestone Publications? The next question was, when did "social capital" become 'tacit knowledge', e.g. when did the citations to these Milestone Publications cease to grow or decrease?

The Web of Science databases (Science Citation Index, Social Sciences Citation Index, and Arts and Humanities Citation Index) produced by ISI (Institute of Scientific Information) are the best to answer to these questions on a global level (see Appendix 1). They include several fields of sciences, bibliographic references to core journals of many disciplines, and although the publications are mostly in English, other languages are also represented. It is also possible to find out the country of an author in order to map the cross-national diffusion and co-operation. The citations of publications can be detected, too. The persuasive communities and scientific fronts can also be mapped by co-citation analysis.

There have been critics of the ISI databases for years (see e.g. Persson 1988, 48-49). The criticism concerns mostly the international coverage of journals. Small countries and small language areas are not represented as well as big countries like USA, United Kingdom, Germany and France, or English language compared to other languages, including French and German. Also criticisms have concerned social sciences and humanities that often regard national or local research problems. In

small countries there have been concern in the academic communities about using citation analysis in research evaluation and funding of research (see e.g. Sipilä 2004).

The criticisms are valid. In January 2005 in the Web of Science of all the social capital publications (N=1606) 1543 (96.1%) were published in English. In French there were 24 (1.5%) and in German 23 (1.4%). The percentage of publications in any other languages was only 1%.

Some studies of the coverage of citation indexes have shown that most of the internationally important research is included in these Web of Science databases (Braun, Glänzel & Schubert 2000, 251-277). In the bibliographic databases that index international core journals, most of the articles are in English and most of the authors are from the USA, United Kingdom, Germany or other big countries. Braun, Glänzel & Schubert (2000) studied the Science Citation Index's journal coverage, and they also found that many so-called international journals are published in the USA, United Kingdom, Germany or Netherlands. Peripheral countries and language areas, like the Nordic countries, are in a minority.

The invisibility of peripheral countries in ISI databases is partly a myth. Ingwersen (2000) has studied the coverage of Social Science Citation Index database from this point of view. His research covers the period of 1989–1998. It investigates the results and meaningfulness of applying the Social Science Citation Index to publication and citation studies of nine selected social science research areas in Scandinavia by analyzing the international visibility, the research profiles, and relative citation impact. The study demonstrates that areas like economics, political science, sociology and anthropology, social policy, language and linguistics, and, for Denmark and Finland, information and library science as well as, for Sweden, management studies are well anchored internationally with a visibility in line with common scientific and technical domains. The journal article world share of the region is increasing rapidly. Other small European countries, like the Netherlands, are even more substantially represented as regard to citation analysis. His conclusion is that SSCI, although biased towards Anglo-American publications, actually makes room for valid bibliometric and scientometric analysis of research published by Scandinavian and other smaller countries with English as the second language in journals regarded as international by ISI (Ingwersen 2000). According to this study, the ISI databases are reliable research data for bibliometric studies. They have been chosen for the present study to give an overview of the international development and diffusion of the concept of social capital.

During this research project, the Web of Science databases were available on the Internet including references from 1986. In January 2005, there were more than 20 million references, 1606 of which dealt with social capital. In this study, the main period under review is 1986-2002, and includes 1010 references. It is supposed that all possible references of the year 2002 have been recorded in the database in 2004, when most of the bibliometric analyses was done, in spite of some delay in recording. However, in the first sub-studies of this project (e.g. authors by country) the last references were from 2001, and in the latest (e.g. the comparison with the Finnish databases) there are references also from 2003.

In summer 2005 the availability of the Web of Science databases in the Finnish universities has reached a new stage: the databases cover years from 1945 to the present. It is noteworthy that the use of the Web of Science databases as research material was in general possible because the Finnish libraries collaborate in consortiums with web resources. The Web of Science is a part of the Finnish Electronic library FinELib (http://www.lib.helsinki.fi/finelib), and it is possible to use these databases in the universities.

3.2.1.3 International subject databases

On the basis of the DIALOG searches several subject databases have been evaluated in order to see, if they include literature on social capital. As the term 'social capital' is not included in most of the thesauri, or it has been included only for some years, the free text searches ("social capital anywhere") have been made in order to detect the annual number of publications in the subject areas.

The first criterion for evaluation of the database was the subject field. The second criterion was that the database is internationally representative of that field. The third and practical criterion was that the database was available in Finnish university libraries at no extra charge.

The databases at the first stage of evaluation were *Sociological Abstracts* (sociology), *ERIC* (education), *EconLit* (economics), *PAIS* (political sciences), *Agricola* (agriculture), *LISA* (library and information studies), *PsycINFO* (psychology), *Business Information Sources* (business and administration studies), *Medline* (medicine) and *Helecon* (business and economics). The database descriptions are in Appendix 1. On the basis of coverage, time dimensions and growth rates two

databases were chosen that represent the first wave of the concept diffusion, two databases of the second wave and two databases that represent the third wave (see the empirical part of this study). The waves here are models that have been constructed in this study on the basis of empirical results in order to analyze time periods and changes.

The databases of the first wave cover social capital references as early as the 1970's; these fields of sciences adopted that concept early. The second wave databases cover occasional social capital references at the beginning of the 1990's, and the third wave databases have a strong growth rate at the Millennium. The databases that have been chosen are Sociological Abstracts, EconLit, ERIC, Medline, PsycInfo, and Business Information Sources. These databases have been analyzed in order to discover growth and diffusion of the concept of social capital in the fields as well as to find out terminological networks and their changes using co-word analysis as a research method.

3.2.1.4 The Finnish databases FENNICA, ARTO and ALEKSI

As we have noted earlier, in international databases small countries and language areas are not as well represented as e.g. USA, United Kingdom, Germany or France. That is why it seemed important to also study the diffusion of a new concept to and in a small country and a peripheral language. How long does it take to implement a new term? What are the early adopter disciplines? What kind of networks can be detected?

All publications that concern Finland or are written in Finnish ought to be included in the Finnish National Bibliographic Database *FENNICA*. A common assumption is that the diffusion of new ideas and concepts in science and in everyday discussion is visible first in newspapers and journals. That is why article databases have also been chosen for the bibliometric analysis. In Finland, there are two main general article databases; *ARTO* with articles published mostly in scientific journals and books, and *ALEKSI* with articles mostly in general journals and newspapers. Partly they index same articles. Both of them have their weaknesses in the coverage of material and harmonization of indexing, but together, however, they can give an overview of diffusion of new themes and concepts in Finnish scientific and everyday discussions. (Database descriptions are in Appendix 1.)

The research material of this study has been collected from all these databases. The material has been checked, duplicates removed and subject descriptors harmonized. A new dataset has been constructed for a closer analysis.

3.2.2 Web pages and mailing lists

When studying network formation and diffusion of concepts and ideas in the digital era, one has also to map the network of web pages. For this study both international and Finnish social capital web pages that appear at the top of the *Google* search have been chosen. Searches on the *SOSIG* information gateway and *Sociological Abstracts* have been used to confirm the solution.

Google has been chosen as the search engine because of its broad international coverage. Sociological Abstracts includes also web resources that has been evaluated and indexed for the database. SOSIG is a qualified information gateway that cooperates with other world-wide information gataways and virtual libraries. The material in SOSIG is also evaluated and indexed.

Discussion forums play an important role in network formation of researchers nowadays. Social capital mailing lists have been mapped on the Internet. Information about the background and foundation of mailing lists has also been gathered, where possible.

The web resources give researchers an opportunity to inform themselves on their own research interests and results, to seek information, form networks and invisible colleges and make connections to others easier than before as Brunn and O'Lear (1999) have noted.

3.2.3 Interviews in mapping the science

The interpretation of bibliometric studies is often difficult because the results have to be related to the complexity of human behavior. In a case like this, when a new concept is the topic of research, it seems especially important to gain some background information to understand the phenomenon. One way of understanding the results of bibliometric studies is to interview some key persons, who are known to have a gatekeeper position in the field. For this research, 11 Finnish researchers and specialists that have had influence on the diffusion of social capital into Finnish scientific and social discussions have been interviewed.

Some of them have been the first to publish articles, arrange seminars and workshops or write reports for public authorities. Some of them have been chosen on the basis of recommendations of those previously interviewed (snow-ball method). One selection criteria has also been that all those fields that are studied closer in the bibliometric analyzes should be represented. Most of the interviews were done in 2003, one in 2001 and one in 2005.

The researchers represent several fields. Most of them are also interdisciplinarists or persons that have influence both in science and some other fields like politics or social life. This is typical to innovators (Rogers 1995, 22). Some of them have also moved to different posts since the interview. It seems that at the same time they have diffused the concept and idea of social capital to the new organization with new research projects.

During this study it seemed that social capital would be a 'fashion term' in information studies and practical library and information work. That is the reason that there are two information scientists and two specialists of practical work. The information specialists are also interdisciplinarists and representatives of organization studies (see Huotari & Iivonen 2004; Ginman & Widén-Wulff 2004). The practical specialists gave information about the diffusion of a scientific concept outside scientific communities (Niinikangas & Näätsaari 2000).

All the interviewed persons gave permission to be mentioned by name.

All the researchers have a long research career. Niinikangas and Näätsaari are specialists who have also some scientific education, but who are more active in influencing practice and being change agents. Seven of the interviewed are men, four women.

Originally the idea of the interviews was to gain an understanding of the concept of social capital and its diffusion in Finland. They gave, however, more information, and most of the data is not possible to utilize in this study. They gave also ideas to 'make questions' to the bibliometric and textual data of this study. The semi-standardized interviews have been analyzed qualitatively, and in order to shed light on the quantitative research results.

3.2.4 Milestone Publications

For a closer content analysis three Milestone Publications on Social Capital have been chosen and studied. The first criteria of selection are citations. What or which are the most cited and long lasting publications? A supportive criterion is based on book reviews. The interviews have also influenced the selection of Milestone Publications.

Milestone Publications give answers to the question "What is social capital?" They give also other answers. By comparing the number of citations of social capital publications to the Milestone Publications with the number of all social capital publications one can draw conclusions as to when the concept of social capital became generally approved 'tacit knowledge' in scientific communities so that the authors no longer feel it necessary to cite the milestones in their publications.

The publications that have been chosen as the Milestone Publications of this study are Pierre Bourdieu's article *The forms of capital* (1986), James S. Coleman's article *Social capital in the creation of human capital* (1988) and Robert D. Putnam's book *Making democracy work* (1993).

3.3 Research methods

The methods used to study the concept of social capital are bibliometric methods, interviews and literature studies. The bibliometric methods have not been used very actively in Finland. That is the reason they have been described more than the other methods that have been used in this study.

3.3.1 Bibliometrics

3.3.1.1 History and origins

The history of bibliometrics dates back to the 1920's, when it was called statistical bibliography by E.W. Hulme (Donahue 1973, 3-4). Pritchard (1969) introduced the term bibliometrics as the application of mathematics and statistical methods to books and other media of communication. He defines further: the task of bibliometrics is to shed light on the processes of written communication

and of the nature and course of development of a discipline (in so far as this is displayed through written communication), by means of counting and analyzing various facets of written communication.

Almost simultaneously the term scientometrics (in Russian 'naukometrija') was introduced by Nalimov and Mulchenko (1969). They defined it as the application of those quantitative methods which are dealing with the analysis of science viewed as an information process (Glänzel 2003, 6; Hajtyn 1983, 7). The term scientometrics seemed to become rather popular in the 1970's especially in East Europe. In 1977, the journal named *Scientometrics* was founded in Hungary. Nowadays it is one of the most cited journals in the field of information science. (See a map by Olle Persson http://www.umu.se/inforsk/scientometrics/index.html.)

Later the terms had different definitions. Sometimes the field is limited, sometimes it covers more space. Broadus (1987) defines bibliometrics as the quantitative study of physical published units or of bibliographic units, or of the surrogates of either. Hajtyn (1983) defines scientometrics as a discipline of science studies that measures scientific activities and reveals its objective quantitative rules. Now one can say that the borderlines between these two specialties have vanished during the last three decades, and the terms are used almost synonymously (Glänzel 2003, 6).

There are still some other terms that try to illustrate the field, or to enlarge the field. Informetrics is a term that was adopted by the Soviet Institute of Scientific and Technical Information, *VINITI* (Vsesojuznyj Institut Nauchnoj i Tehnicheskoj Informacii). It stands for a more general subfield of information science dealing with mathematical and statistical analysis of communication processes in science. In contrast to the original definition of bibliometrics, informetrics also deals with electronic media and thus includes topics such as the statistical analysis of the text and hypertext systems, library circulations, information measurement in electronic libraries, models for information production processes and quantitative aspects of information retrieval as well (Glänzel 2003, 6).

The term informetrics (or infometrics) has attracted some bibliometricians. Maybe the reason is in the image of extension of the field from books to other media, although it has been also defined as a subfield of bibliometrics (see Wormell 1998).

At the end of the last millennium, studies of the Web received considerable interest in information sciences. The term webometrics was introduced. Webometrics investigates the nature and properties of the Web drawing on modern informetric methodologies (Almind & Ingwersen 1997). A parallel term to webometrics is cybermetrics that is defined as quantitative studies of the whole Internet (Björneborn & Ingwersen 2001). *Cybermetrics* is also a name of an electronic journal of scientometrics, informetrics and bibliometrics that was founded in 1997 (see http://www.cindoc.csic.es/cybermetrics/journal.html 20.1.2005).

It seems that in spite of these new terms, the term bibliometrics remains. It stands for a group of methods used for research in scientific communication. Bibliometrics is seen as the mother term – just like the term library that refers to books remains in spite of all the Web material. This study speaks about bibliometrics and bibliometric methods, even if the focus of the study is on Web resources or digital information.

3.3.1.2 The scope of bibliometrics

There are several ways to define the scope of bibliometrics (Borgman 1990; Borgman 2000; Kärki & Kortelainen 1998). Bibliometric methods can also be seen as a part of other methods that are used in content analysis (Forsman & Laaksovirta 1988, 76-78).

According to Schrader (1981), the bibliometric literature shows that two research traditions have developed in parallel. One is characterized by an analysis of distribution properties and has often resulted in statistical laws or mathematical models. This tradition is based on the work of researchers as Lotka, Bradford, Zipf and Brookes. The other tradition is more strictly empirical and is based on counting of data and studying relations in databases and other collections. Garfield, Griffith, Price, Line, Narin and Small are some of the researchers in this tradition.

Glänzel (2003, 9-10) presents the three components of present-day bibliometrics. Firstly, there is bibliometrics for bibliometricians. This is the domain of basic bibliometric research. Methodological research is conducted mainly in this domain. Secondly, there is bibliometrics for scientific disciplines. The researchers in scientific disciplines form the bigger, but also the most diverse interest group in bibliometrics. Due to their primary scientific orientation, their interests are strongly related to their specialty. This domain may be considered an extension of science

information by metric means. Here we can also find convergence with quantitative research in information retrieval. Thirdly, there is bibliometrics for science policy and management. This is the domain of research evaluation. Here the national, regional and institutional structures of science and their comparative presentation are foregrounded.

This study belongs to the second tradition of Glänzel's classification. The bibliometric tools are used in order to find out of the quantitative bibliometric data the origins and development of the concept of social capital as well as the network formation around it.

In principle, the idea of a dynamic mapping of science requires an independent operationalization of structural (that is, latent) dimensions of the maps and observable variation which is to be penciled into these maps. Science, however, develops not only in terms of the variation, but also by changing its structural dimensions. Because of the prevailing reflexivity within the science system, previous structures can be felt as constraints and at the same time are used as resources. The construction of structure may historically be stabilized, but reflexive actors are able to deconstruct and to assess the previous constructions with hindsight (Leydesdorff 2002).

The methodological apparatus for the mapping of science in terms of multivariate statistics (multidimensional scaling, cluster analysis, etc.) was a product of the 1980's (Leydesdorff 2002). In 2005 there are some bibliometric tools that are freely available on the Internet for the analysis of bibliometric data. In this study the BIBEXCEL program (http://www.umu.se/inforsk/Bibexcel/index.html/1.10.2005) that has been developed by Olle Persson has been used.

Social network analysis is not a formal theory in sociology, but rather a strategy for investigating social structures. It is also called "structural analysis". In information sciences we study publications, citation and co-citation networks, collaboration structures and other forms of social interaction networks (Otte & Rousseau 2002, 441).

Bibliometric data are particularly useful for studying longitudinal trends in scientific disciplines because of the massive data sets that can be used. Virtually no other method provides as comprehensive coverage of a topic in scientific communication. Bibliometrics, and citation analysis in particular, are most useful for achieving a macro perspective on scientific communication processes. Bibliometric studies are reliable in that the data are collected unobtrusively, from the

published record, and can be easily replicated by others. They are valid to the extent that we accept the aggregation of citations to represent the importance of links between citing and cited documents (Borgman 1992). Still the goal of studying science is to seek an understanding of social and cognitive processes general to science.

It is important to note that bibliometric studies give a simplified picture of scientific communication. Bibliometric indicators can give signals about what is going on in the research system, but the results have to be interpreted in relation to the complexity of the studied environment. Jochen Gläser and Grit Laudel (2001) have tried to connect bibliometrics or scientometrics with sociology of science and more qualitative aspects of bibliometrics. As Leydesdorff (2002) states, the scientometric representation is formal: it remains in need of an interpretation.

3.3.2 Citation analysis

Most of the bibliometric analyses are based on citations. Citation analysis is either used alone or in combination with other methods. By using the references included in texts or the literature lists in publications, many aspects on science and technology can be identified. These are, among others,

- Citation praxis in different subject fields
- The characteristics of the literature used in publications
- The coupling between publications, authors, research organizations and disciplines or subject fields
- The visibility of publications in the research literature (Kärki & Kortelainen 1996, 14).

The material of citation analysis can be loaded from databases that record citations, like the Web of Science databases. The data can also be gathered from publications of some subject field or theme. Citation analyses have been done in libraries, too, when the focus is on the use of the library collections (Hurme 1989). A common use of citation analysis has been in research evaluation (Luukkonen 1990).

3.3.2.1 Co-citation analysis

Co-citation analysis is a method of investigating scientific networks and their development. One can trace a network of citations to discover the history and evolution of a chain of articles on a particular topic. The goal of citation analysis is to make the structure of such a network more recognizable and more accessible (Chen 2002, 144).

There are two mainstream approaches to the co-citation analysis, document co-citation analysis and author co-citation analysis. The usefulness of co-citation analysis was firstly suggested by Garfield. Small has developed this approach in his articles (Small 1973; Small 1977; Small 2000; see also Cawkell, 2000, 185). Author co-citation analysis has been used to map intellectual structures of a specialty (Chen 2002, 151), It is guided by the premise that co-citations between documents by any two scientists represent a suitable indicator for proximity in terms of content within a school of research (Gmür 2002, 28). The document co-citation approach (Small 1977) is founded on the premise that the most valid and reliable indicator of a school of research and its scientific assessment or method are its documents in organs or publications with peer review procedures (Gmür 2003, 28). The cluster of co-cited documents is considered to represent the knowledge base of a specialty (Small 1977). In this study the document co-citation analysis has been used.

A co-citation analysis begins with the selection of the co-citation object to be studied, together with the selection of approach, which can be based upon either document co-citation or author co-citation. In most cases, documents and authors are chosen on the basis of their frequency of citations within a delineated ISI database. There are also other possibilities to choose or construct databases for a closer study (Gmür 2003, 29). In this study have been chosen the ISI databases, in other words, the Web of Science.

When the selection of documents has been made, the frequencies of co-citation are then determined. There are several alternatives for the weighting of co-citation counts:

- The highest absolute co-citation counts are assessed for cluster formation, up to a specified limit.
- Co-citations are measured in relation to the co-citation partners' citation counts.

- Co-citations are converted into Pearson's correlation coefficients, which also achieve a standardization effect. This procedure is chosen when the number of documents or authors has been pre-defined as a basis for subsequent factor analysis or multidimensional scaling (Gmür 2003, 29-30).

In the history of co-citation analysis two approaches have been developed. The macro approach is usually based on the ISI databases, and it focuses on the overall structure of disciplines, and on the question of which laws govern the evolution of science. Here the document-oriented citation structures are dominant. The micro approach aims to describe retrospectively the structure and historical development of individual disciplines or schools of research and their interdependencies. Here an author-centered approach dominates. With this approach, a discipline's structures and lines of development are drawn along its most prominent representatives (Gmür 2003, 30-31).

In this study there is an attempt to combine these two approaches. The material has been collected on the Web of Science databases, but in the focus is a defined specialty of social capital. The aim is to have a general picture of the structure and development of the concept.

A basic concept of co-citation analysis, as well as co-word analysis is a cluster. The number, form and interconnections of generated clusters are what we interpret in order to find networks and links. Cluster is the name given to a group of references with multiple connections to each other, defined by the connection rules for the co-citation network. Gmür (2003, 32) names the basic forms of clusters that can be distinguished in network analysis:

- Complete cluster: each reference is connected to other references and there is no dominant document within the cluster. Such a cluster is a clear indicator of the formation of a school of research.
- Star-shaped cluster: a single, often-cited reference dominates, around which several other references are grouped, which themselves show little connection to each other. Such a community is grouped around one or two documents, which either founded the cluster historically or cover all main aspects. The satellites, meanwhile, represent part-aspects of the area of research.
- Chain- or ring-shaped cluster: a string of co-citations with no significant cross links. It is assumed that each group of three may share a common issue, whilst the next overlapping group of three already has something different in common to the first. This explains why the outermost

references of the chain may show little overlap. These clusters can scarcely be interpreted as a community.

Network measurements are cluster size, the in-degree e.g. the sum of internal relationships, cluster density, centralization, the outer-degree e.g. the sum of all external relationships, differentiation within the network, network size, penetration of the complex network, and network differentiation (Gmür 2003, 33).

Gmür compared the influence of different selection criteria for co-citation relations, and found different results of co-citation analysis. In this study co-citation analysis is based on the highly cited documents of certain periods and their co-occurrence.

3.3.2.2 Critical viewpoints of citation analysis

Critics of citation analysis usually take up the following points (MacRoberts, 1989):

- Citing a document is supposed to mean that the document has been used by the author.
- Citing a document reflects quality.
- The best works are cited. Often other factors than quality determines what is cited, e.g. availability, coverage by bibliographic databases, format, age, language.
- The content of a citing document is related to the content of the cited document.
- All citations are equal.
- Formal influence is not always cited.
- Biased and wrong citations are common
- Informal influence is not cited
- The types of citations vary
- A variation in the degree of citing depends on the type of publication, nationality, time period, size and type of specialty. The citing behavior varies in different subject fields, but the general trend is towards more citations.

The criticism of citation analysis is nowadays well-known in the communities of bibliometrics, and can be taken account of in studies.

3.3.3 Diffusion analysis

In the field of information studies a widely cited classic in diffusion studies is an article by Lancaster and Lee (1985) on acid rain. They used bibliographic databases to track the growth of literature on the topic of acid rain, and diffusion of the new concept in language. At the same time they studied how bibliometric methods can be applied in issue tracking.

Lancaster and Lee (1985, 391) state that one obvious way of recognizing a key issue is from the rate of growth of the literature on this issue at a particular point in time. An issue would be considered “key” when it reaches some pre-established increment of growth.

In this study the “key issue” is social capital. The frequency of literature on social capital, which has had a great significance on the views and perspectives of many fields, is listed on the basis of the searches that have been made using different databases. The time series tell us about the growth of the literature. Comparing time series compiled on the basis of the searches conclusions can be drawn as to the diffusion and implementation of the concept in different fields of sciences.

The analyses of the growth and diffusion of social capital literature is the basis of further analyses. The results give information about the periods of rapid growth as well as quiet decline. The time series are the basis of e.g. citation analyses and co-word analyses.

3.3.4 Co-word analysis

The co-word analysis technique was first developed in collaboration between the Centre de Sociologie de l'Innovation of the Ecole Nationale Superieure des Mines of Paris and the CNRS (Centre National de la Recherche Scientifique) of France during the 1980s, and their system was called "LEXIMAPPE." For about twenty years, this technique has been employed to map the dynamic development of several research fields. One of the early studies was carried out by Bauin (1986) to map the dynamics of aquaculture from 1979 to 1981. Based on the inclusion and proximity indexes, inclusion and proximity maps were created for 1979 and 1981 (He 1999).

The co-word method arose originally out of a sociological analysis of the structure and role of texts in scientific inquiry. Thus it was argued that though scientists do much more than simply write

papers and reports, the activity of writing and publishing is both central to their work and represents a reasonable record of the “public face“ of science. It was also argued that scientific authors attempt to draw links between problems, topics, methods, findings and solutions, and try to persuade their peers that these links are soundly based. Applied to the shape of scientific knowledge in a given area of inquiry, this analysis suggests that the latter could be treated as the network or relationships generated by aggregating all the relationships found in the relevant population of scientific papers. Some of these relationships – those that appeared in many articles – would be much stronger than others (Law & Bauin & Courtial & Whittager 1988, 252-253).

Callon, Courtial, Turner and Bauin (1983, 191-196) show the weaknesses of traditional citation analysis. They also criticize the internal/external distinction in analyzing science. They write about problematic networks, and propose an analytical method - co-word analysis - which permits us to identify and visualize these problematic networks and their evolution.

According to them, "the words of a scientific or technological text are linked together in phrases, designed to convey credible information for a given population of producer-readers. But the text also aims to impose results by convincing the reader that he must give them consideration and use them" (Callon & Courtial & Turner & Bauin 1983, 199). So the words should have the power to tempt the reader, to seduce him.

They also talk about the force of words. Word associations are successful when they situate a reader or an auditor in a field of forces in such a way that 1) he is obliged to take an interest in the text's content and in the information presented; 2) he is placed in a position where he cannot (or will not) call into question the interpretations and deduction which lead him to accept the results. So the words can capture the reader. "Certain words and word-associations are stronger than granite, and the reader cannot muster enough dynamite to blow them apart" (Callon & Courtial & Turner & Bauin 1983, 199).

Co-word analysis may be used as a tool for understanding and depicting relations between scientific concerns. It is, in other words, a method for revealing the context in which research activity takes place – a context that is not so much a function of the disciplines of origin of scientists but of the links that they create in their own research between different topics, methods and solutions (Ungern-Sternberg 1994; Keränen 2004; Keränen 2005).

However, the co-word method makes it possible for us to distinguish between the "local" and "global" contexts of research themes. What we will refer to as "local context" is roughly, a function of the strength of the links between the keywords located within a theme of research – that is, the number of times the keywords in question crop up together in articles. It is, in other words, a rough measure of the amount of (interconnected) work within the theme. By contrast, what we call "global context" refers to the strength of the links between words in one theme of research and those located in others. It is, in other words, a rough measure of the extent to which a theme is well connected with other themes of research (Law & Bauin & Courtial & Whittager 1988, 256-257).

Co-word analysis can be discussed in connection with two research currents. The first aims at mapping the structure of scientific research; the second aims at exploring conclusions to be drawn from the fact that scientific production is similar in a number of respects to literary production (Callon et al. 1983, 194). So, if we consider publications as a product of science, we can study the development of scientific fields by exploring the diffusion in numbers of publications.

As He (1999) states, since the World War II, the scope and volume of scientific research have increased dramatically. This is well-reflected in the growth of the literature. In the 1960s, the amount of scientific literature was estimated to be doubling approximately every ten years (Price, 1963). Three decades later, in the 1990s, along with developments in information technology, especially in the area of data storage, the amount of information in the world is estimated to be doubling every twenty months (Piatetsky-Shapiro & Frawley 1991). In such a situation, it is hard for scientists to detect the subject areas and the linkages among these areas in their research fields, and science policy makers have difficulties in mapping the dynamics of science to do research planning.

According to He (1999), co-word analysis is a content analysis technique that uses patterns of co-occurrence of pairs of items (i.e., words or noun phrases) in a corpus of texts to identify the relationships between ideas within the subject areas presented in these texts. Indexes based on the co-occurrence frequency of items, such as an inclusion index and a proximity index, are used to measure the strength of relationships between items. Based on these indexes, items are clustered into groups and displayed in network maps. For example, an inclusion map is used to highlight the central themes in a domain, and a proximity map is used to reveal the connections between minor areas hidden behind the central ones. Some other indexes, such as those based on density and centrality, are employed to evaluate the shape of each map, which shows the degree to which each

area is centrally structured and the extent to which each area is central to the others. By comparing the network maps for different time periods, the dynamic of science can be detected.

In this study, co-word analyses have been done in order to obtain maps of connections between terms that exist as keywords describing publications that deal with the issue of social capital in bibliographic databases. The analyses have been done for different periods and years in order to track the possible change.

3.3.4.1 Title words or keywords?

There is one problem to resolve before the co-word analyses. It is the answer to the question "Title words or key words?" As we have discussed earlier, researchers use different signals to be noticed. One can assume that title words have power, and many researchers know this. Sometimes the titles are - especially in social sciences - very descriptive or even picturesque. In that case, the title words do not help an information seeker to find texts; they have to rely on keywords and classification.

Whittager states (1989) that co-word analysis is about the use of word patterns as a means to the elucidation of structures of ideas, problems and so on, represented in appropriate sets of documents. It relies upon the argument that

- authors of scientific articles choose their technical terms carefully;
- when different terms are used in the same article it is therefore because the author is either recognizing or postulating some non-trivial relationship between their referents; and
- if enough different authors appear to recognize the same relationship, then that relationship may be assumed to have some significance within the area of science concerned.

There is also one premise by Whittager:

- The keywords chosen by trained indexers as descriptors of the contents of articles are in fact a reliable indication of the scientific concepts referred in them, and this makes it possible to use the keywords as the basic data for co-word analysis.

Whittager (1989, 474) mentions two serious critical points concerning co-word analysis:

- The representation of scientific fields to which the method gave rise were so difficult to read as to be unhelpful; and

- The results were in any case influenced by the way in which the indexers who choose the keywords conceptualized the scientific fields with which they were dealing, so that the pictures which emerged were more akin to their conceptualizations than to those of the scientists whose work it was intended to study. This was referred to as the 'indexer effect'.

Leydesdorff (1987, cit. Whittager 1989) states that "it is well known that keywords selected by an indexer who is not a practicing scientist tend to be conservative: the keywords reflect the world of the scientists of two years ago".

Whittager has three examples of keywords being two years behind (1989, 475):

- Indexers may have available a lexicon of permitted keywords which is itself out of date. We can call them thesaurus situation and 'real time';
- Indexers, in their efforts to be helpful to users of the database, may use combinations of keywords which reflect the conventional views of science as they were previously. This may, however, give an out-of-date picture of a science if it has moved to a different structure of ideas, or has a new paradigm, or a new school;
- There is an inevitable delay between the publication of an article and the appearance of an entry in the bibliographic database.

Whittager admits that co-word analysis has the same difficulties as all database-oriented techniques, referring to the above notes. He also states that co-word analysis is a relatively cheap, fast and satisfactory way of studying a field of scientific research (Whittager 1989, 476-477). Leydesdorff states that an answer to the problem of the 'indexer effect' is to use title words instead of keywords as the basis of co-word analysis. This reveals researchers' views of the signal words, but it also has some disadvantages that are connecting with the way researchers choose their titles.

Leydesdorff notices two difficulties connected with title words (Whittager 1989, 477-478). The major one is that the authors might choose their title words deliberately in order to address a particular readership, producing an 'audience effect'. The second concerns the use of what might be called non-standard titles: the title might be provocative in the form of a rhetorical question.

Practicing scientists in modern big science are, however, aware of the importance of choosing their title words with respect to the classification of their articles under the appropriate headings in indexing and abstracting services. Whittager (1989, 479) confirms this by saying that this is not

very different from the argument that they choose the terms used within their articles with considerable care.

As a summary to title words and keywords in co-word analysis, Whittager (1989, 489) says, on the basis of an analysis he made that co-word analysis is capable of generating coherent and useful results whether using keywords or title words; and that keyword analysis generates a picture similar to, but substantially more detailed than that created by title words. Title words, as well as being in a sense one step closer to the author's ideas than keywords chosen by indexers, generate a simpler picture which may well be sufficient for the examination of small document sets or closely defined areas of science, but keywords reveal more of the problematic network of an area of science and are to be preferred for the examination of larger or more heterogeneous data sets.

Wormell (2000, 209) points out that bibliometric co-word mapping studies aiming at generation of an exhaustive historical overview of a science field, will benefit from the usage of controlled terms, whereas studies aiming at exploring recent developments and trace the up-to-date jargon of the field, will benefit from the usage of free text.

This leads to a practical solution that when a new concept or term comes up in a field of science, it may be used in titles (a title word), maybe also in abstracts. But it may take time until it is approved and enters a thesaurus. A methodological conclusion in this study is that the research material for detecting new concepts and ideas should be selected through free text searches on the databases, not by using thesaurus terms.

The most important elements in co-word analysis are words. There are two ways to extract words from journal articles, conference papers, research reports and even chapters from a book. One way is to extract keywords from keyword lists, title, abstract or sometimes also from classification codes. Cambrosio et al. (1993) chose keywords added by indexers and title words as research material because they found the level of indexing so poor in the database. Coulter et al. (1998) chose keywords added by professional indexers. They believed that it is useful to study a fixed system with a common nomenclature. Professional indexers have experience of similar use of nomenclature. Some have collected a database of keyword added by indexers and authors. Noyons and Van Raan (1998) built a community of neural networks researchers by using co-occurrence of classification codes. (See Ding, Chowdhury & Foo 2000, 3.)

Another method of data collection involves extracting words directly from full-text documents by using some software. The words or phrases with proper frequency are chosen as the subject of co-word analysis to represent the core topics of the specific field. This method was chosen to avoid the negative effort of indexer and time problem of thesauri and classification systems, such as the lengthy time involved in constructing the thesauri or classification systems, difficulties to maintain and keep abreast of new development in the corresponding fields and so on (Ding, Chowdhury & Foo 2000, 3).

One of the most important conditions is the possibility of 'indexer effect'. It is connected with the fear that indexing might reflect prejudices and points of view developed by indexers during the course of their training, rather than the structures actually being put forward in the literature (Law & Whittager 1992, 422). Another fear is the probable inconsistencies in keyword selection by professional indexers working with different databases. (King 1987; ref. Ding, Chowdhury & Foo 2000, 3.)

In this study the co-word analyses have been made on the basis of keywords, e.g. index terms. This kind of analysis gives an impression of the way of indexers think: which index terms they use, when a new concept is not included in a thesaurus that is used in the database.

3.3.5 Focused interview

A focused interview has specific traits. The interviewed persons have experienced something in common. The social scientist who is doing research, has analyzed something about the research problem, its structures, processes and parts. He makes an outline for interviews. Then he focuses the interview on the subjective experiences of the interviewees (Hirsjärvi & Hurme 1980, 50).

In this study focused interviews have been used. The interviews were semistructured (see Appendix 2). The interviewed persons were asked questions that were specified during the interview situation, if necessary. They also had the possibility to say more than just answer the questions, if they felt it necessary. The avareage duration of each interview was one hour. All the interviews were tape-recorded.

The interviews had two goals in this study. They ought to give background information to the research process by increasing understanding of the phenomenon of social capital. They should also give information about the network formation and information flows of the respondents. In addition, the interviews reveal also the social capital that the gatekeepers of social capital research have themselves.

4 The case of Social Capital

The aim of this research was to study a concept that has had influence in different fields of sciences during the so-called digital era. Since the early 1990's, scientific information has been more available than before because of the digital information networks. They have also offered possibilities for fast communication.

The concept that was chosen as a case is social capital. It is a concept that has attracted growing interest since the millennium. It has become one of the most widely-used concepts in social sciences, and it is also implemented in other fields of sciences. Social capital has been an issue in newspapers and everyday speech, too. As Portes (1998) states, the concept of social capital has become one of the most popular exports from sociological theory into everyday language. Social capital has evolved into something of a cure-all for the maladies affecting society at home and abroad. "Like other sociological concepts that have traveled a similar path, the original meaning of the term and its heuristic value are being put to severe tests by these increasingly diverse applications" (Portes 1998, 2). The charm of the term has not diminished in our century. As Farr (2004) states, "social capital is one of our trendiest terms, heard with increasing frequency by professors, pundits, and politicians worldwide". Woolcock and Narayan (2000) argue that a significant virtue of the idea of and discourse on social capital is that it helps to bridge orthodox divides among scholars, practitioners, and policymakers.

This study begins with some review articles that try to explain, what social capital is, then moves to a bibliometric analysis of the growth and diffusion of the social capital publications. On the basis of this analysis compiled with the interviews of gatekeepers and the review articles that have been analyzed, a closer study of some publications that have had a great importance for many other publications that deal with social capital is made. These publications present the pre-history of the term, and different stages of development of the research area. Three of the publications have been chosen as so-called Milestone Publications that have had a special value for later research.

4.1 The concept of social capital

In the contemporary literature, social capital is often called a term or word(s), as well as a concept. Often, distinctions are not and need not be drawn between these items of speech, language, and thought. Concepts are certainly linguistic entities, in that none exist or can be articulated without the vocabularies of terms in language. Indeed, this is crucial to the pursuit of conceptual history, as well as for understanding conceptual change politically (Farr 2004, 9).

Farr refers to Skinner (1978) who observes: "The surest sign that a society has entered into possession of a new concept is that a new vocabulary will be developed, in terms of which the concept can then be publicly articulated and discussed."

There are occasions in which terms and concepts do not match. There may be the concept without the term, or the term as "social capital" without the concept. The former situation was nearly universal before the 1980s, given the capaciousness of the concept and the fact that "social capital" is to some extent merely new language for a very old debate in American intellectual circles. Alexis de Tocqueville who has been called "the patron saint of contemporary social capitalists" displayed concept without term when surveying associations in democratic America.

So, too, did the grand theorists of economic sociology like Marx, Weber, and Durkheim, as well as their predecessors, Hume, Smith, and Mill, when analyzing civil society under capitalism. Such abundance of conceptual riches in the eighteenth and nineteenth centuries suggests why the exciting discovery lies in early uses of the term itself as that sure sign that social capital has arrived for articulation and discussion. But not just any use of the term 'social capital' will do, since the converse situation of term without (relevant) concept may be obtained. For example, when lamenting its "excessive rate" of destruction in the 1970s, Buchanan used the term 'social capital' to denominate not associations or trust, but a society's "capital investment characteristic of adherence to [legal] rules." Woolcock observed that earlier economists from Marshall to Hicks used the actual words 'social capital', but only to distinguish temporary and permanent stocks of physical capital. Farr (2004, 9-10) states that the mismatch of term and concept seems essentially correct.

A common view nowadays is that social capital is conceived of as the networks, norms of reciprocity and trust facilitating collective action. Four ideas of social capital are identified by Woolcock (2000, 15-16) from the current literature: the communitarian view, the networks view, the institutional view and the synergy view. Woolcock (2000, 17) states that the aphorism "It's not what you know, it's *who* you know" sums up much of the conventional wisdom regarding social capital.

Woolcock is a well-known researcher of the World Bank in social capital research circles. The World Bank has its own social capital web sites with much information on research, publications, events, databases etc. (http://www.worldbank.org/poverty/scapital/whatsc.htm 21.2.2005). The definition on the World Bank's web site is: "Social capital refers to the institutions, relationships and norms that shape the quality and quantity of a society's social interactions. Increasing evidence shows that social cohesion is critical for societies to prosper economically and for development to be sustainable. Social capital is not just the sum of the institutions which underpin a society - it is the glue that holds them together."

Farr (2004, 9) sums up different definitions, and states that “social capital is complexly conceptualized as the network of associations, activities, or relations that bind people together as a community via certain norms and psychological capacities, notably trust, which are essential for civil society and productive of future collective action or goods, in the manner of other forms of capital”.

4.2 The origins and history of social capital

When one goes closer into the origins of the term ‘social capital’, we find out that it became very popular in a few years during the 1990’s. But the idea of social capital is not really new to sociologists. As Portes (1998, 2) states involvement and participation in groups can have positive consequences for the individual and the community in a staple notion, dating back to Durkheim’s emphasis on group life as an antidote to anomie and self-destruction, and to Marx’s distinction between an atomized class-in-itself and a mobilized and effective class-for-itself. The term social capital has its roots in the very beginnings of sociology.

Woolcock (2000, 20-30) identifies four traditions of social capital, each associated with a grand theorist of economic sociology. To Marx and Durkheim, he adds Weber with the concepts of Gemeinschaft (traditional kinship-based community life) and Gesellschaft (society) and Simmel with insiders and outsiders of groups, as well as Benthamite utilitarianism as a fifth tradition.

In this study a citation analysis was made on the Web of Science databases. Scientific publications concerning social capital include citations to these classic theorists of sociology: Max Weber, Robert Merton, Emile Durkheim, and Karl Marx. These citations are occasional, however, and there should be a more detailed citation context analysis to find why these authors were cited.

Some other researchers of social sciences have often been mentioned in connection with social capital. In some review articles there are references to the strong and weak ties of Mark Granovetter (1973; 1985), to the American society of Alexis de Tocqueville (orig. 1840) and to the human capital of Gary S. Becker (1964). All of them have also citations through the years, although Granovetter has been the most cited.

On the basis of the interviews made with Finnish gatekeepers of social capital Max Weber (2), Karl Marx (2), Adam Smith (1), Emile Durkheim (1), Thorstein Veblen (1) and David Ricardo (1) are mentioned as classic theorists of social sciences that have connected “social” and “economic”. Also Mark Granovetter (3), Joseph A. Schumpeter (1) and Michael Polanyi (1) were mentioned.

In his often-cited article, Woolcock (1998, 26-31) has a review of the “founding fathers and mothers” of social capital, beginning with Lyda J. Hanifan. It seems that after the publication of Woolcock’s article all these publications have been cited rather often. It is possible that the authors in whose publications these citations were included, have not read these publications themselves, but just cite them in order to show that they know the pre-history of the present discussion in social capital. The citations may be conceptual or evolutionary (see Moravcsik & Murugesan 1975).

Woolcock states that although there was a great interest in the 1990's, the term social capital was employed as early as 1916 by Hanifan, a practical reformer and a state supervisor of rural schools in West Virginia. Hanifan states that with social capital “I do not refer to real estate, or to personal property or to cold cash, but rather to that in life which tends to make these tangible substances count for most in the daily lives of a people, namely, goodwill, fellowship, mutual sympathy and

social intercourse among a group of individuals and families who make up a social unit, the rural community, whose logical center is the school." And then: "If [an individual] may come into contact with his neighbor, and they with other neighbors, there will be an accumulation of social capital, which may immediately satisfy his social needs and which may bear a social potentiality sufficient to the substantial improvement of living conditions in the whole community" (Hanifan 1916, 130).

Hanifan has the same kind of fear as many recent social scientists: "That there is today almost a total lack of such social capital in rural districts throughout the country need not be retold in this article. Everybody who has made either careful study or close observations in country life conditions knows that to be true"(Hanifan 1916, 131).

One of the interviewed Finnish gatekeepers also knew Hanifan's work.

4.2.1 Social capital from the 1950's to the 1970's

Social capital as a term disappeared for four decades, but was discovered by a team of Canadian urban sociologists John R. Seeley, Alexander R. Sim & Elizabeth Loosley (1956), and Jane Jacobs in the early 1960's (Jacobs 1961). Jacobs was strikingly brief, drawing the discussion tightly around "networks" without articulation of norms or trust. Seeley and his colleagues conceptualized social capital as the "status" that individuals accrued or lent as a result of their group activities; and since the groups came from upper-crust suburban clubs, the sociologists did not conceal their critical distance from this "commodity similar to money" (Farr 2004, 9).

In the early 1970's there are publications of radical American economists who used the term social capital. Social capital was elaborated upon by the economist Glenn Loury in the late 1970's (Loury 1977). According to Farr (2004, 9), Loury used the term only once when concluding his initial article to "represent the consequences of social position" as a possible explanation of differences in "human capital" characteristics, where one's social position was dictated by "racialism" and other "social forces."

For this research, a bibliographic search was made on the Sociological Abstracts database that covers world sociological literature in several languages and includes references since 1963 (see

Appendix 1). The first reference by the free text search "social capital anywhere" dates back to 1969, and the next one to 1971. They seem to be the same article by Henri Noilhan on rural sociology that was first published in French in a conference report and then in a periodical. In the 1970's there were three social capital publications written by Pierre Bourdieu, and they are also in French.

ERIC database that covers the literature of education has one social capital reference in 1969. It is a book of J.R. Kidd "Education for perspective" that contains selected speeches by Kidd delivered around the world during the last two decades. One of the topics is investment of social capital in education. The database also includes another reference from 1974. That is a study of OECD (Organization for Economic Cooperation and Development), "The Effects of the Employment of Foreign Workers" by W.R. Bohning and D. Maillat. The next references are from the late 1980's, and many of them have influence from articles written by J.S. Coleman.

In the MEDLINE database that includes literature of medicine there is one social capital reference from 1979. It is an article "Homes or hospitals? Contradictions of the urban crisis", by H. Waitzkin, J. Wallen and J. Sharratt. The article deals with medical expansion, and the term social capital is not used in the meaning we understand now, but it refers to "social capital expenditures". However, in 1981 there is an article "Social networks and mental illness in a peasant society" by J. Westermeyer and E.M. Pattison, where social capital is connected with social networks and family ties in relation with mental health. The next references date back to the 1990's.

Two of the Finnish interviewed gatekeepers mention works of Jacobs from this time period.

4.2.2 Social capital in the 1980's and the early 1990's

An analysis of several subject databases shows that there are only few social capital publications at the beginning of the 1980's. Robert D. Putnam (2000, 19) mentions a German economist Ekkehart Schlicht as one of the 1980's researchers.

In this study an analysis on the Web of Science databases in 1986-2003 shows on a general and interdisciplinary level that the number of publications has been growing since 1986, when one of

the most cited publications, an article by Pierre Bourdieu, was published. Analyses made on several subject databases also confirm this. At the beginning, there are references only sporadically, but over the next ten years social capital gains the interest of researchers, as can be seen in figure 4.

	86	87	88	89	90	91	92	93	94	95	96	97	98	99	0	1	2	3
Soc Cap publ	2	0	2	0	0	2	3	15	12	27	37	61	102	127	150	220	250	292
Soc Cap publ - cum	2	2	4	4	4	6	9	24	36	63	100	161	263	390	540	760	1010	1302

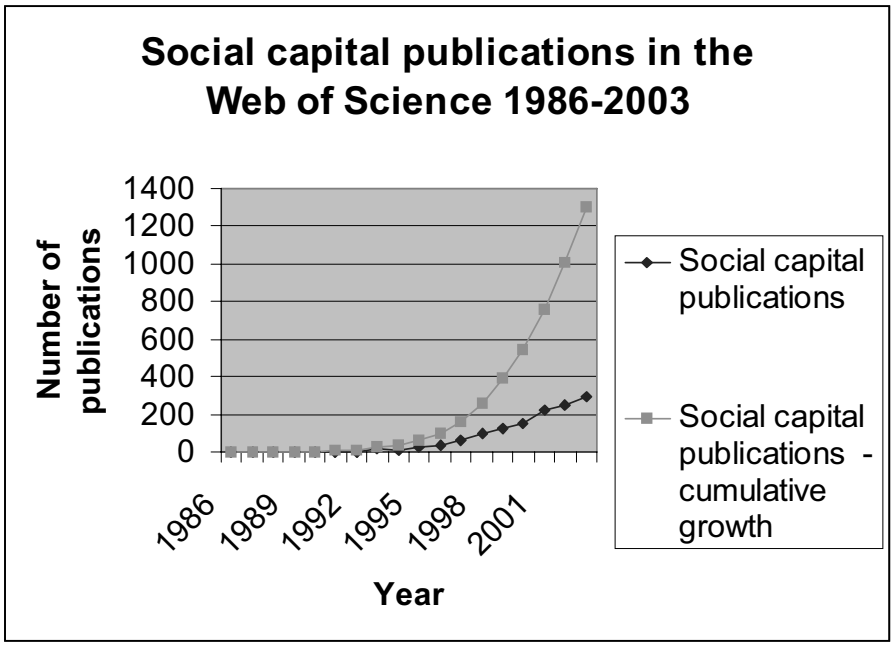


Figure 4: Social capital publications in the Web of Science 1986-2003

Woolcock (2000, 26) states that "a complementary approach" of social capital was developed by the French sociologist and philosopher Pierre Bourdieu in the 1970's, though Anglo-American scholars were not fully aware of this until the late 1980's. This notion arouses curiosity as to cultural and linguistic barriers in scientific communication.

According to the database analysis on the Sociological Abstracts, Bourdieu had already dealt with the social capital in 1975 in connection with social fields. In his article *Les modes de domination* Bourdieu defined social capital as "the foundation of all the significant differences between modes of domination resides in the degree of objectification of the accumulated social capital, i.e. in the existence of relatively autonomous fields: economic (self-regulating market), cultural production (educational system), and political (legal and governmental apparatus)" (Bourdieu 1976, 122-132).

Portes, however, notes that the initial treatment of the concept of social capital was produced by Bourdieu as late as in 1980 in *Provisional Notes* published in the *Actes de la Recherche en Sciences Sociales*. He states that the article did not garner widespread attention in the English-speaking world, because it was in French. (Portes 1998, 3.) A citation analysis that was made in this study on the Web of Science shows that also the German article *Okonomisches Kapital, kulturelles Kapital, soziales Kapital* and its translation to English *The forms of capital* (1986) did not get wider interest before the mid 1990's.

Bourdieu sees the concept of social capital as one of the forms of capital. Bourdieu (1986, 248-249) defines that "social capital is the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition – or in other words, to membership in a group – which provides each of its members with the backing of the collectively-owned capital, a "credential" which entitles the to credit, in the various senses of the word." Bourdieu's concept includes network connections and the volume of capital (economic, cultural or symbolic capital). Social capital is totally governed by the logic of knowledge and acknowledgement that it always functions as symbolic capital (Bourdieu 1986, 257). As Farr (2004, 9) states, Bourdieu stressed "institutionalized relationships of mutual acquaintance and recognition," as well as found class "distinction" more important a "resource" than trust.

Another highly-cited social capital publication is the article *Social capital in the creation of human capital* by the American sociologist James Coleman It was published in 1988 in *The American Journal of Sociology*.

Coleman (1988) starts with the two intellectual streams of social action: sociological end economic. He introduces from this background the concept of social capital, paralleling the concepts of financial capital, physical capital and human capital, but embodied in relations among persons

(Coleman 1988, 118). Coleman examines three forms of social capital: obligations, expectations and trustworthiness of structures, information channels, and social norms (Coleman 1988, 101-105). He does not want to give any definition of the term.

Coleman's article has, according to Portes (1998, 6), the undeniable merit of introducing and giving visibility to the concept of social capital in American sociology, highlighting its importance for the acquisition of human capital, and identifying some of the mechanisms through which it is generated. Portes emphasizes the discussion of closure when Coleman (1988, 99) analyzes the community of Jewish diamond traders in New York City. Closure means the existence of sufficient ties between a certain number of people to guarantee the observance of norms.

Coleman continued with social capital in his book *Foundations of social theory* (1990) that is also one of the highly-cited works in social capital research.

At the beginning of 1990's, other theorists published analyses of social capital. One of them was Ronald S. Burt in *Structural holes* (1992). Burt (1992, 9) understands social capital as "friends, colleagues, and more general contacts through whom you receive opportunities to use your financial and human capital". Burt has the idea of structural holes, e.g. relative absence of ties that facilitates individual mobility. He shares the idea with Granovetter (1972) that weak ties can be sources of new knowledge and resources.

Another highly-cited author from the 1990's is Francis Fukuyama. His books *The end of history and the last man* (1992) and *Trust - the social virtues and the creation of prosperity* (1995) have received interest in social capital publications.

Most influencing in contemporary scientific discussion on social capital is, however, political scientist Robert Putnam's work *Making democracy work - civic traditions in modern Italy* (1993). The main theme of the book is regional governance in Italy, but at the same time it made the concept of social capital popular. This project inspired his subsequent research on the state of social capital in America (1995, 2000), which culminated in his thesis that Americans in the late 20th century were "bowling alone", e.g. becoming increasingly disengaged from one another by withdrawing from public life.

According to Woolcock (2000, 27), Coleman's and Putnam's works have inspired research into different fields of science and into different themes. These are 1) families and youth behavior problems; 2) schooling and education; 3) community life; 4) work and organizations; 5) democracy and governance; 6) general cases of collective action problems; 7) public health and environment issues; 8) crime and violence; and 9) economic development.

When the Finnish gatekeepers were asked to name some influential authors or works, the most often mentioned in the 1980's and early 1990's were Coleman (10), Putnam (9), Bourdieu (7), Fukuyama (4) and Burt (3). The article"Social intelligence" of Cronin and Davenport (1993) was mentioned by the information scientists, which reflects its importance in that field.

4.2.3 The new wave of social capital at the Millennium

For some reason the number of social capital publications grew remarkably in 1996-1998. According to the Web of Science, the annual number of publications almost doubled from 1996 to 1997 and from 1997 to 1998. At the Millennium, the sharpest growth was from 150 publications in 2000, to 220 publications in 2001. Social capital was implemented in different fields of sciences.

At the Millennium, however, criticism of social capital was rising among researchers. Already in the 1990's, there were some articles about the negative social capital, but at the Millennium this viewpoint received more interest (Portes 1998, 15-18). Critical views towards the concept of social capital were also published (O'Connell 2003; Ilmonen 2000, 154-158; Woolcock 2000, 18-19). O'Connell has studied economic equality in the European Union, and he asks why the model of social capital became so popular. "Why social capital instead of social equality?" And he offers an answer: "It may well be that it is because social capital promises so much in return for so little". Difficult social problems can be overcome, if we only communicate and ultimately trust each other more (O'Connell 2003, 246-247).

A search result (23.2.2005) on the Web of Science databases shows that in 1986-2004 there are 32 references that are critical towards social capital. The first was published in 1996, and during the 1990's there were only 6 critical views. In 2000 there was only one critical article, but in 2001-2004 there are in total 25 critical articles. A citation context analysis shows that the articles belong mostly

to sociology or economics, and they include general criticism of the concept of social capital. In 1996-2004 seven articles are especially against Putnam's theory and its possible weaknesses.

The rise of critical voices may give clues about changes in the paradigm. When a field comes to a mature stage, increasing controversy rises, and that may predict a crisis (see Crane 1975, 172).

In the interviews of the Finnish gatekeepers as the most influential works and authors at the Millennium Michael Woolcock (4), J. Nahapiet & S. Ghoshal (2), Don Cohen & Lauren Prusak (1), P.S. Adler & S.W. Kwon (1), Daniel Goleman (1), Avshalom Caspi (1) and Ichiro Kawachi (1) have been mentioned. These researchers represent different fields of sciences, such as organization studies, medicine, and psychology. It seems that interest is moving from the basic social sciences to interdisciplinary fields and specific research problems. This is also suitable to the model of the characteristics of scientific knowledge and scientific communities by Diana Crane (1975).

4.3 The most cited social capital publications in 1986-2003

In this section the most cited publications in the scientific literature that concern social capital are more closely examined. The research material consists of bibliographic data of the Web of Science databases in 1986-2003.

PUBLICATION	N CITATIONS (02/05)
Putnam, R.D. (1993) Making democracy work	490
Coleman, J.S. (1988) Social capital in the creation of human capital	434
Coleman, J.S. (1990) Foundations of social theory	318
Putnam, R.D. (1995) Bowling alone : America's declining social capital	266
Fukuyama, F. (1995) Trust	166
Bourdieu, P. (1986) The forms of capital	159
Portes, A. (1998) Social capital : its origins..	150
Putnam, R.D. (2000) Bowling alone : the collapse and revival…	148
Granovetter, M (1985) Economic Action and Social Structure	144
Granovetter, M. (1973) The strength of weak ties	137

Table 1: Ten most cited publications of the social capital literature in the period 1986-2003

The most cited authors are James S. Coleman, Robert D. Putnam and Mark Granovetter. Figure 5 shows changes in citation rates in 1986-2003. We can see that some of these "Top Ten" publications are highly cited. But we can also see decline of citations and growth of new publications at the Millennium. The total number of social capital publications in 1986-2003 is 1302.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
PUTNAM 1993									1	3	12	46	46	54	69	96	85	84
COLEMAN 1988						1	2	8	6	10	11	40	43	44	52	77	80	88
COLEMAN 1990								5	6	9	9	22	39	39	45	54	52	73
PUTNAM 1995											5	17	40	33	27	48	44	52
PORTES 1998												1	1	10	16	35	40	52
BOURDIEU 1986							1	3	1	2	3	8	10	19	10	27	35	40
FUKUYAMA1995										1	2	15	15	19	29	27	35	23
PUTNAM 2000														6	18	37	59	97
GRANOVETTER 1973	1									4	4	13	13	17	18	32	31	4
GRANOVETTER1985			1					1		2	3	14	13	15	23	22	28	22
All social capital publications	2		2			2	3	15	12	27	37	61	102	127	150	220	250	292

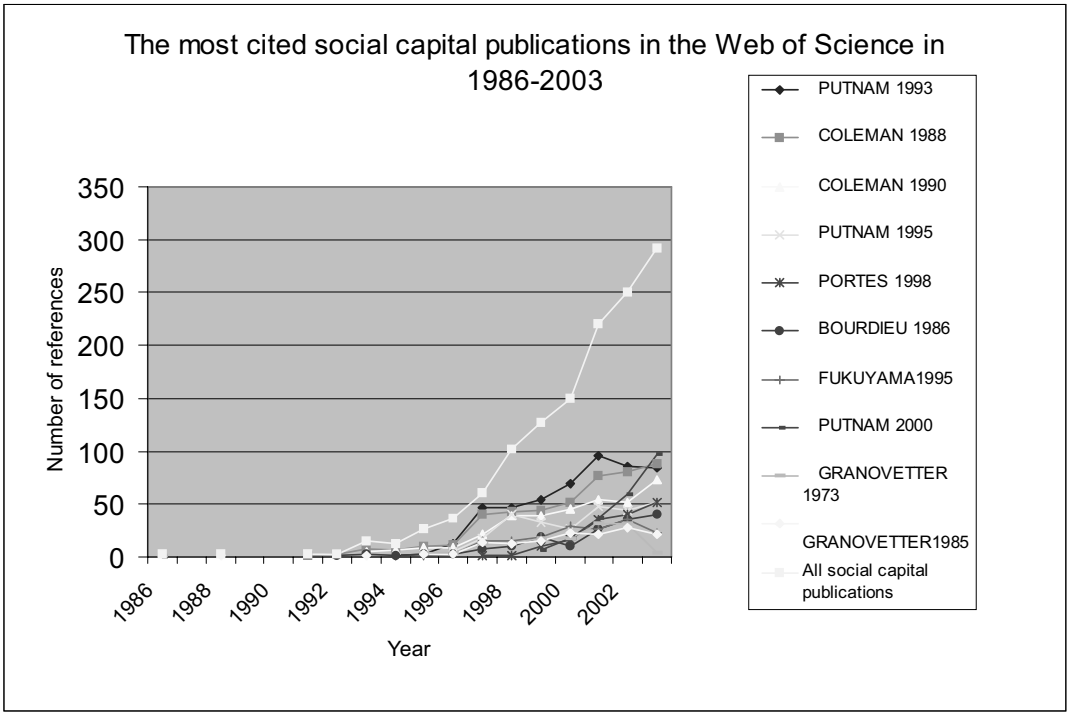


Figure 5: The most cited social capital publications in the Web of Science in 1986-2003

4.3.1 Sleeping Beauties and Milestone Publications

It is a common belief in science that those publications which were considered to be classics were immediately cited very highly. However, this high citation rate has often lasted only for a short period of time. By way of contrast, articles that were cited equally highly, but over a longer period of time, are not now regarded as classics. The reason probably relates to the speed with which these major advances were incorporated into further research. Meadows states that a really epoch-making work was absorbed so quickly that it soon became unnecessary to refer to the original article. So, it became 'tacit knowledge' (Meadows 1998, 101-102).

Some publications that are unnoticed for a long time, and then, almost suddenly, attract a lot of interest are called Sleeping Beauties. These publications are often ahead of their time. (Van Raan 2004.)

Using citation analysis an attempt was made to discover whether there are Sleeping Beauties of social capital. A citation analysis of social capital publications show that there are is one Sleeping Beauty from the 19th century; de Tocqueville's book *Democracy in America* (1840). It got 61 citations in 1993-2003. It is noteworthy that this book has finally been translated into Finnish and will be published in 2005. We can name a Sleeping Beauty that dates back to the sixties. It is Becker's *Human capital* (1964) that has 46 citations in 1992-2003. But the real Sleeping Beauty is Hanifan's article *The rural school community center* (1916), because it can be considered the first publication that dealt with social capital in the way it is treadted in the present research. It had 11 citations in social capital literature published in1997-2003.

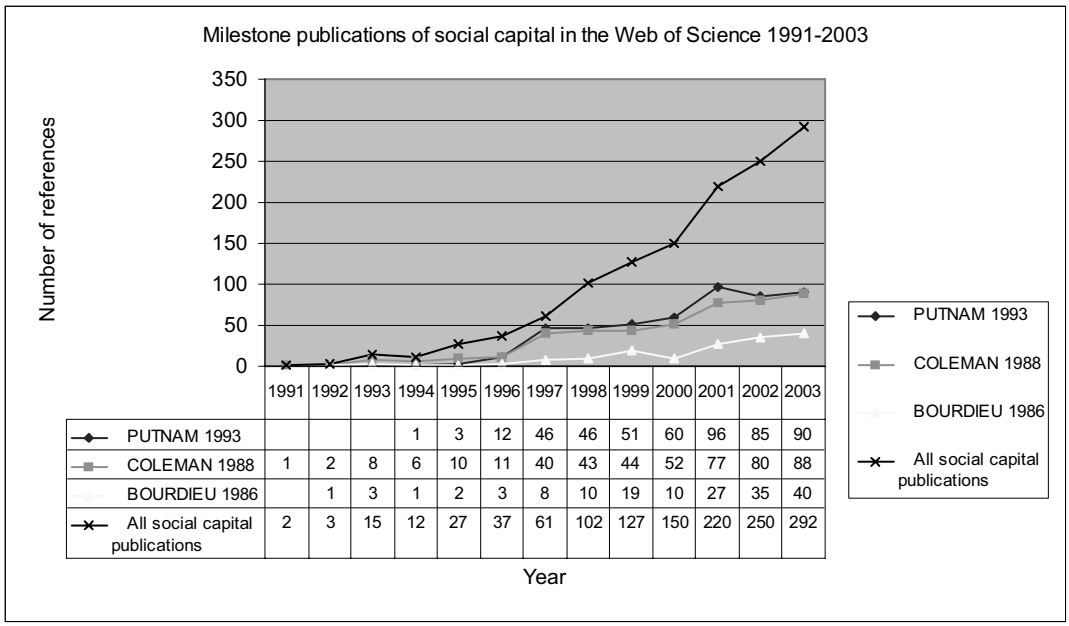
Together with the Sleeping Beauties, we can speak about old classics that live on and give ideas to research after centuries. On the basis of a citation analysis in the Web of Science databases the most often cited authors of classics in the field of social capital studies are Weber (71 citations), Durkheim (58), Simmel (39) and Marx (33). They have all citations in the years 1993-2003.

A publication is often considered significant if it is highly cited. Citation is both a social and an intellectual phenomenon. As Crane (1975, 19-20) states, the extent to which publications are cited is related to the stage of development of a research area and cannot be a simple measure of its growth. We can assume that when a research area is new, scientists cite publications they think are

landmarks or milestones. When a research area becomes more mature, researchers reduce citing these Milestone Publications. They use terms and concepts known to all, without citations to authorities.

When we want to study how and when a term has been transferred to 'tacit knowledge' of a field, one has to compare the number of publications of the theme in focus with the number of publications of that theme that cite a Milestone Publication of that research area. When the number of citations does not grow anymore or even declines, one can assume that the concept is transferring to 'tacit knowledge'. It is also possible that a new paradigm is rising, when the Milestone Publications of a current paradigm are no longer cited.

The following analysis is based on the Web of Science databases. The number of citations has been counted annually and the most cited publications have been extracted. The opinions of the interviewed gatekeepers support the selection, as well as research articles and books that deal with the concept of social capital. The Milestone Publications of this study are Pierre Bourdieu's article *The forms of capital* (1986), James S. Coleman's article *Social capital in the creation of human capital* (1988) and Robert D. Putnam's book *Making democracy work* (1993). Coleman (1988) was mentioned 10 times, Putnam (1993) 9 times and Bourdieu (1986 or some other version) 7 times by the 11 interviewed gatekeepers.



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
PUTNAM 1993				1	3	12	46	46	51	60	96	85	90
COLEMAN 1988	1	2	8	6	10	11	40	43	44	52	77	80	88
BOURDIEU 1986		1	3	1	2	3	8	10	19	10	27	35	40
All social capital publications	2	3	15	12	27	37	61	102	127	150	220	250	292

Figure 6: Milestone Publications of social capital in the Web of Science 1991-2003

Figure 6 shows that it took three years (until 1991) since the publishing of the first milestone work, Coleman 1988, until it was first cited. That was still the beginning of the social capital research boom. Crane would call it the first stage of the diffusion of knowledge when a new paradigm appears.

In 1993, 15 social capital publications were published, and 3 of them cited Bourdieu and 8 Coleman (one cited both). This was also the year, when Putnam published his Milestone Publication *Making democracy work*. The following year this publication was cited once, then three times, then 12 times, and in 1997, four years after its publication, it was the most cited social capital publication of the year. In 1997 the Milestone Publications were highly cited in the social capital publications.

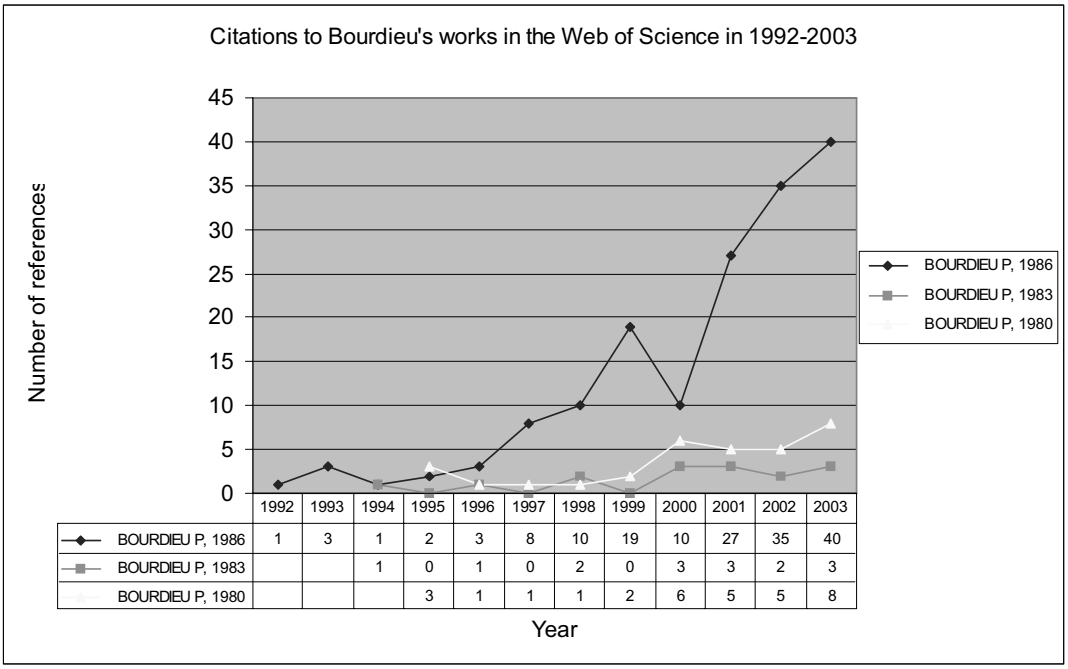
Something, however, happens in 1998. The milestones are no longer so often cited, and it seems that this trend continues still in 2003. We can state that social capital has become 'tacit knowledge', e.g. "everybody" knows what it means, and it is no longer necessary to explain it or to refer to the Milestone Publications or authorities. In 2003 only 31% of the publications cite Putnam, 27% Coleman and only 14% cite Bourdieu.

The works of the American social scientists, James S. Coleman and Robert D. Putnam are more often cited than the work of the French sociologist, Pierre Bourdieu. Although the number of citations to Bourdieu is not very high, it is stable.

Bourdieu's article *The forms of capital* that is often cited in the Web of Science databases was published in English in 1986 in *The Handbook of Theory and Research for the Sociology of Education*. It is also possible that publishing this article in a handbook of the sociology of education has had some connection to the fact that social capital was internationally diffusing in the field of education earlier than in some other disciplines.

Bourdieu's article has been cited 159 times in publications that concern social capital during the period 1992-2003. The same article was published first in German in a special issue of the journal *Soziale Welt* as early as in 1983, but the German version was cited only 15 times in those publications that are included in the Web of Science, and the first citation dates back to 1994. 17 of the 22 citing authors are German or Swiss, i.e. persons that have German as their mother tongue. The article *Le capital social : notes provisoires* (1980) was cited 32 times in 1995-2003 – there is no citation before this in the Web of Science.

It is remarkable that the article that was published in German in 1983 gets first citations (according to the Web of Science databases) in 1994. It is possible that the German article became better known, when it was translated and published in English in 1986. A random sample of social capital publications show that usually when a publication includes a short history of social capital, Bourdieu's works are cited.

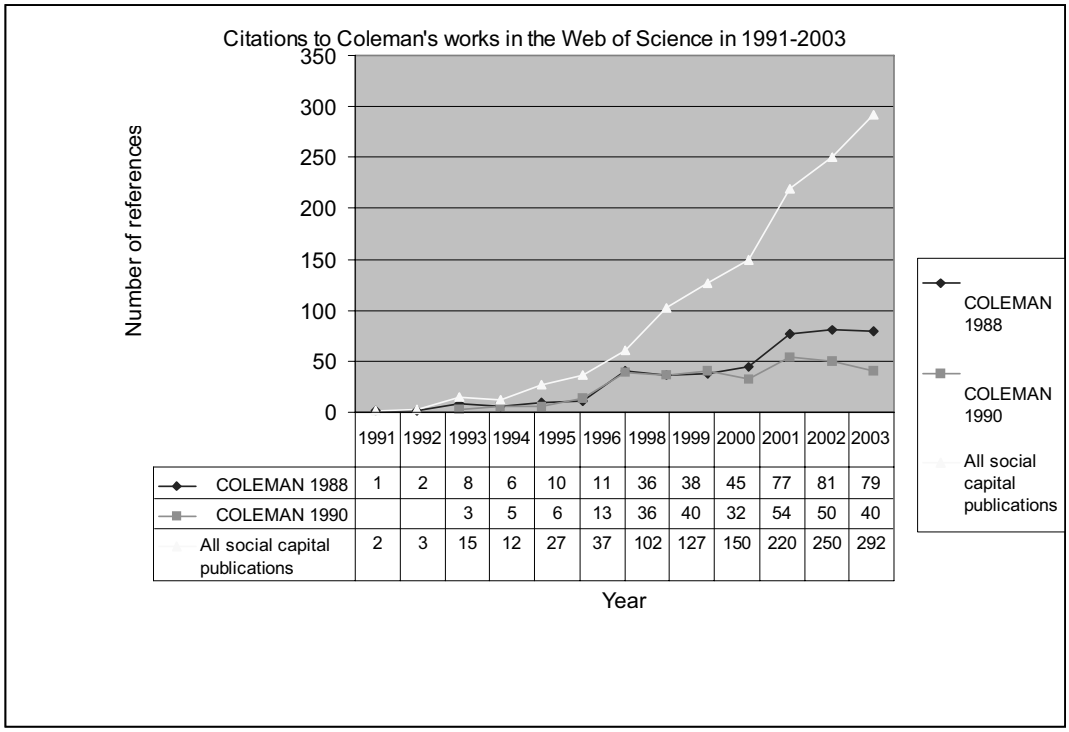


	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BOURDIEU P, 1986	1	3	1	2	3	8	10	19	10	27	35	40
BOURDIEU P, 1983			1	0	1	0	2	0	3	3	2	3
BOURDIEU P, 1980				3	1	1	1	2	6	5	5	8

Figure 7: Citations to Bourdieu's works in the Web of Science in 1992-2003

It is worth noting again that the Web of Science databases cover mostly references to literature published in English. There is no available information about citation rates of Central European, German or French publications. In the 20th century since the World War II, the international language of sciences has been English (Vickery 2000, 141-143). It seems rather difficult that new concepts could diffuse in scientific discussion across language barriers from other languages. We can assume that the language has some effect on the diffusion of concepts in scientific communities.

Bourdieu's article (1986) itself includes only few references; he cites, however, Becker's *Human capital* (1964) that can be named as one of the Sleeping Beauties of social capital.



	1991	1992	1993	1994	1995	1996	1998	1999	2000	2001	2002	2003
COLEMAN 1988	1	2	8	6	10	11	36	38	45	77	81	79
COLEMAN 1990			3	5	6	13	36	40	32	54	50	40
All social capital publications	2	3	15	12	27	37	102	127	150	220	250	292

Figure 8: Citations to Coleman's works in the Web of Science in 1991-2003

Coleman is one of the highly cited authors of social capital. On the basis of a citation analysis made in the Web of Science, both his article *Social capital in the creation of human capital* (1988) and his book *Foundations of social theory* (1990) belong to the three most highly cited social capital publications in 1986-2003. In 1996-1999 they are almost as highly cited, but in 2000 the article (1988) gets more citations, and citations to the book are declining. Robert D. Putnam (1995, 8) states that Coleman deserves primary credit for developing the "social capital" theoretical framework.

Coleman's article includes 30 references, e.g. Becker's *Human capital* (1964) and Granovetter's *Economic action, social structure, and embeddedness* (1985). He also thanks among others Mark Granovetter for criticism of an earlier draft. This gives us a clue that he belongs in some way to the same networks as Granovetter.

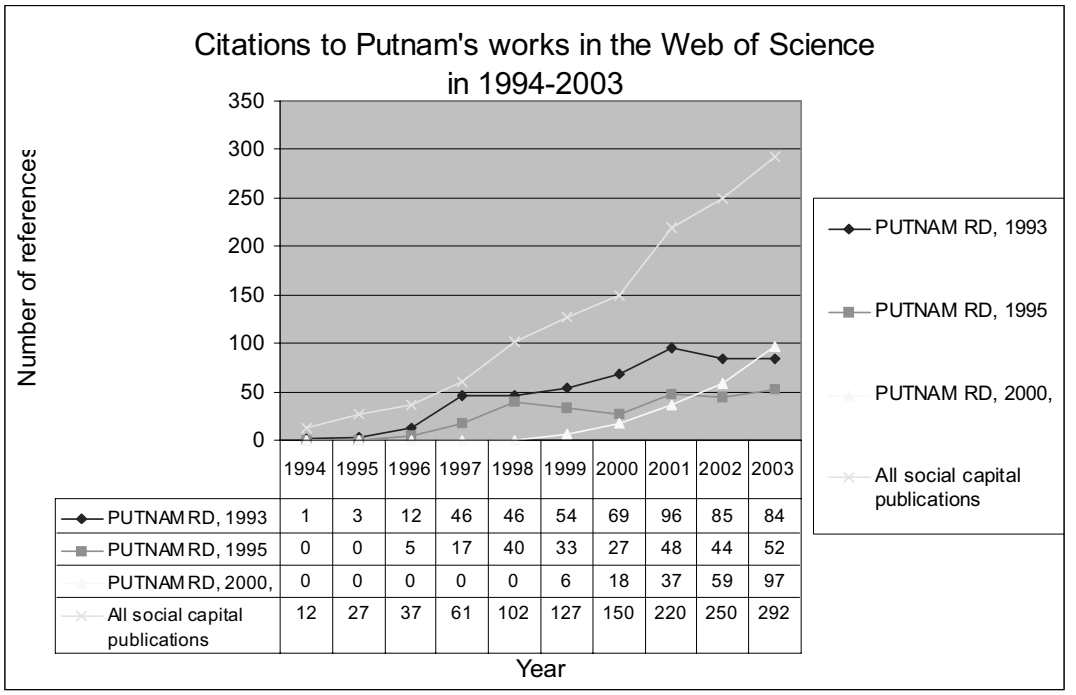


Figure 9: Citations to Putnam's works in the Web of Science in 1994-2003

An impressive and highly cited book in the contemporary scientific discussion on social capital is Putnam's work *Making democracy work - civic traditions in modern Italy* (1993). The main theme of the book is regional governance in Italy, but at the same time it made the concept of social capital popular.

Putnam cites in his works among others the works of Hanifan and Jacobs. He knows the history of social capital, and acknowledges the early theorists of the concept and term. We can consider that his books and articles have palyed an important role in the dissemination of social capital to a wider public. Also, his scientific works "Making democracy work" and "Bowling alone" have very fascinating titles. Markku T. Hyyppä, one of the interviewed Finnish gatekeepers, said that he envies the title of "Bowling alone". He said that he has himself the ideal of good style of writing; he is both a scientist and a well-known author in the popularization of science who has written about health and social capital in newspapers and magazines.

Robert D. Putnam (born 1940) has been rather influential in social and political life in recent years. He has been the focus of seminars hosted by Bill Clinton at Camp David and Tony Blair at 10 Downing Street. His ideas have emerged in speeches by George W. Bush and William Hague. The decline of civil engagement in the USA over the last 30 years or so, which he charted in Bowling Alone (2000), has worried a number of politicians and commentators. Putnam's marshalling of evidence with regard to this shift; his identification of the causes; and his argument that within the new circumstances new institutions of civic engagement can arise has made him the centre of attention. He has been interviewed in newspapers and other mass media. In particular, his article (1995) and book (2000) *Bowling alone* has attracted much debate (see more e.g. http://www.infed.org/thinkers/putnam.htm 8.3.2005).

4.3.2 New milestones of the 21st century

At the millennium we can see changes in the growth rates of social capital publications, as well as citations to the Milestone Publications. We can assume that social capital has become 'tacit knowledge'. Scientists, politicians, and professionals of several fields know what it means; it is no longer necessary to explain the contents of the concept or to refer to the classic works of the field. New works are cited, and social capital interests researchers of new research fields. Bourdieu, Coleman and Putnam are all social scientists; we can classify them as sociologists, although they have different viewpoints in their research interests. We can assume that a paradigm shift has occurred.

In the development of scientific fields it is typical that new publications appear and new theories become new landmarks of the field. New concepts may be developed by new authors. A bibliometric analysis shows that something happened to social capital before the Millennium. We want to find out which are the most cited publications in 2003 that have been published since 1997. In this way we can eliminate the power of the earlier published Milestone Publications and find new possible Milestones.

For this analysis, the ten most cited social capital publications in 2003 published in years 1997-1999 were studied. That was the period of rapid growth of social capital publications. The aim of this is to see which publications are still in active use and how they have been adapted by scientific

communities. The year 2003 has been chosen because this is the latest year that has been recorded completely in the Web of Science by February 2005, when these analyses were made.

PUBLICATION (1997-1999)	N CITATIONS 2003
Portes A.: Social capital : its origins…(PORTES 1998)	52
Woolcock, M. (1998) Social capital and economic development (WOOLCOCK 1998)	29
Kawachi I., Kennedy B.P. & al.: Social capital, income inequality, and…(KAWACHI 1997)	22
Sampson R.J., Raudenbush S.W., Earls F.: Neighborhoods and… (SAMPSON 1997)	21
Knack S. & Keefer P.: Does social capital have an economic payoff? (KNACK 1997)	19
Nahapiet, J & Ghoshal, S: Social capital, intellectual capital, and…(NAHAPIET 1998)	19
Brehm J. & Rahn W.: Individual-level evidence for the causes and…(BREHM 1997)	17
Hall, Peter A.: Social capital in Britain (HALL 1999)	13
Burt R.S.: The contingent value of social capital (BURT 1997)	12
Fukuyama, Francis: The great disruption (FUKUYAMA 1999)	12

Table 2: The most cited Social Capital publications in 2003, published in 1997-1999

The article of Portes (1998) is still the most cited publication of this period in 2003. This article includes a thorough review of social capital and its origins, which is basic knowledge for all social capital researchers. The article is also in digital form, and available on the Internet. Woolcock's article (1998) that includes general and basic information is also available on the Internet. Although these representatives of social sciences are at the top with e.g. Burt and Fukuyama, works of rising fields begin to be in the top ten: Kawachi et al. in medicine, Nahapiet and Ghoshal in organization studies. It is also noteworthy that the article of Sampson et al. was published in *Science Magazine* and Fukuyama in *Atlantic Monthly*. These periodicals are also available on the Internet and have the chance to spread widely in the world.

A further analysis of the ten most cited social capital publications in 2003 published in 2000 or later was made. It is assumed that if a book or an article is frequently cited in a short period after publication it has some value for the research front and it has been known as an interesting and valuable work of that field. As Meadows (1998, 101) notes, classics were immediately cited very

highly. It is also possible that researchers disseminate information about the best or most interesting publications by their informal channels.

PUBLICATIONS (2000-)	N CITATIONS 2003
Putnam, R.D. : Bowling alone (PUTNAM 2000)	79
Hawe P.& Shiell A.: Social capital and health promotion (HAWE 2000)	15
Social epidemiology (KAWACHI 2000)	15
Social capital : theory and research (LIN 2001)	13
Glaeser, E.L., Laibson, D.I., et al.: Measuring trust (GLAESER 2000)	13
Fine, Ben: Social capital versus social theory (FINE 2000)	10
Adler, P.S. & Kwon, S.W.: Social capital : prospects of a new concept (ADLER 2002)	9
Social capital : critical perspectives (BARON 2000)	9
Veenstra G.: Social capital, SES and health: an individual-level analysis (VEENSTRA 2000)	9
Woolcock M. & Narayan D.: Social capital : implications for…(WOOLCOCK 2000)	8

Table 3: The most cited Social Capital publications in 2003, published in 2000-

Five of the highly cited works published in 2000 or later are books and five are articles. Also critical voice can be heard (Fine 2000, Baron 2000). It is also remarkable that three publications belong to the field of medicine. This seems to be a new stage in the development of social capital; it is strongly diffusing from sociology to other fields crossing traditional scientific boundaries. It is also noteworthy that the flow is from (soft) social sciences to (hard) medical sciences, because this kind of trend is not usual in sciences (Lindholm-Romantschuk 1998).

But at the top of the whole year's citations is still Putnam with his book *Bowling alone*. When comparing citations to other popular works of Putnam, this seems to be the most fascinating in scientific communities. As we stated earlier, the title of the book sounds tempting and persuasive. It is, however, interesting that it has been cited also in other countries than in the USA, although it deals with a social problem that is actual there.

An analysis of the Web of Science (10.3.2005) shows that the authors of social capital publications who most often cite Putnam's *Bowling alone* are Lindstrom (11 times) and Kawachi (7 times), who both represent medicine. The language of the citing publications is usually English (97.6%),

German 1.8% and French 0.6%. There are no publications in other languages, but this mirrors also the language structure of the Web of Science databases.

According to the statistics that are available in the Web of Science, the subject categories to which these 329 citing publications in 2000-2005 most often belong are

- sociology 56 (17.0 %),
- public, environmental & occupational health 50 (15.2 %),
- political science 44 (13.4 %),
- economics 28 (8.5 %),
- social sciences, biomedical 22 (6.7 %),
- social sciences, interdisciplinary 19 (5.8 %),
- social issues 18 (5.5 %),
- urban studies 17 (5.2 %),
- planning & development 16 (4.9 %),
- communication 15 (4.6 %), and
- education and educational research 15 (4.6%).

It seems that sociology and social sciences in general are still at the top, but health and medicine also have a strong position. Urban studies as well as planning and development are also important viewpoints; this may have a connection with the civil society debates of this decade.

Closer analysis of the highly cited new publications reveals that it is difficult to predict, whether some of them will be a new Milestone Publication. Robert D. Putnam as an author is such a 'big name' that he will be difficult to surpassed in the near future. On the other hand, if social capital research is diffusing more for example into medicine, it is possible that *Social epidemiology* by Kawachi will be a new milestone of that research field. However, social capital research seems to have reached a stage, when new concepts are developing (Crane 1975). It is possible that critical books of social sciences generate new concepts or terms. It might take a few years until it is possible to recognize this kind of change and influence in scientific jargon.

One reason for the steep growth of social capital publications in general seems to be that it has diffused to new fields of sciences and also to interdisciplinary fields. The combination of social and capital can be seen as a key to solve research problems.

4.4 Content analysis of the Milestone Publications

In this section we return to the Milestone Publications and their contents. In this study three Milestone Publications have been chosen for a closer analysis. The selection criteria were: 1) they have been cited often in other publications, 2) they have been mentioned by other authors as the most important publications in book reviews, and 3) they have been mentioned as important works by the interviewed researchers and experts. The chosen publications are Bourdieu's *The forms of capital* (1986), Coleman's *Social capital in the creation of human capital* (1988) and Putnam's *Making democracy work* (1993).

An initial content analysis of the main ideas of these publications, i.e. how the concept of social capital is defined, was made. Then the terms that illustrate best the definition have been extracted from the texts. It is assumed that these are the words that will persuade readers, and take them to the funnel of interest (see Callon et al. 1983). Finally, a study was made as to how these publications were indexed in subject databases, when the term social capital was not yet in the thesaurus.

4.4.1 Pierre Bourdieu: "The Forms of Capital" (1986)

As we have noted in earlier chapters, Bourdieu used among other forms of capital the concept of social capital as early as the 1970's. He means something that an individual has, capital of a person, something that helps him to move forward in life. By Bourdieu social capital is the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition – or in other words, to membership of a group – which provides each of its members with the backing of collectively-owned capital, a 'credential' which entitles to the credit, in the various senses of the word (Bourdieu 1986, 248-249). Bourdieu's concept includes network of connections and the volume of capital (economic, cultural or symbolic capital). Social capital is totally governed by the logic of knowledge and acknowledgement that it always functions as symbolic capital (Bourdieu 1986, 257).

Some keywords can be extracted from this article. They are:

network;
connections;
solidarity;
social relationships;
recognition; and
credit.

This article was indexed in the database Sociological Abstracts, but as the German version (1983). The descriptors that the indexers chose are

economic/economics/economical;
culture/cultures /cultural/culturally;
social; and
capital.

The thesauri of the databases will be studied below. It is noteworthy that social capital is not even included in the *Thesaurus of Sociological Indexing Terms*. The indexers have to try to find terms to best describe the contents of the publication.

As a conclusion, the indexer has found the key words, but on a general level. The definition and discussion of Bourdieu could give more detailed information.

4.4.2 James S. Coleman:"Social Capital in the Creation of Human Capital" (1988)

Coleman states in his article that his aim is to import the economists' principle of rational action for use in the analysis of social systems proper, including but not limited to economic systems, and to do so without discarding social organization in the process. The concept of social capital is a tool to aid in this (Coleman 1988, 97). He starts with the two intellectual streams of social action: sociological and economic. He introduces from this background the concept of social capital, paralleling the concepts of financial capital, physical capital and human capital, but embodied in relations among persons (Coleman 1988, 118). He does not give any definition, but he tries to shed

light on the concept. He examines three forms of social capital: obligations, expectations and trustworthiness of structures; information channels; and social norms.

On the basis of content analysis some keywords can be picked up from the text of Coleman, and they are:

trust and trustworthiness;
social structures;
social ties and relations;
social networks;
information;
norms and sanctions;
closure

This article was indexed in Sociological Abstracts. The descriptors that the indexers chose are

human capital;
action theory;
rationality;
theoretical problems;
high school students; and
dropouts.

Social capital was not yet a meaningful concept in sociology in 1988. The indexer has chosen both some terms that indicate the theoretical approach of sociology and concrete problems of education. These terms can be signal words that take an information seeker to the funnel of interest and if he reads the whole article, he can adopt a new concept of social capital.

4.4.3 Robert D. Putnam:"Making Democracy Work" (1993)

A great impact on the scientific discussion of the topic came with political scientist, Putnam's work *Making democracy work* (1993) on regional governance in Italy. As we have noticed earlier, this project inspired his subsequent research on the state of social capital in America (Putnam 1995; 2000), which culminated in his thesis that Americans in the late 20th century were "bowling alone" (see Woolcock 2000, 26-27). In his milestone book (1993, 167) Putnam defines social capital "as

those features of social organizations, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions" (Putnam 1993, 167). In his article "What makes democracy work" (1994) that was published in IPA Review year after this famous book, Putnam deals more about the crisis of democracy all over the world. As an explanation, he offers the decline or lack of social capital, "networks and norms of civic engagement".

From the text of Putnam's early definition the following key words have been extracted:

networks;
norms;
values; and
trust.

This book was indexed in a database of political science, PAIS. The descriptors that the indexers chose are:

democracy: Italy;
institution building: Italy;
Italy: government and politics;
political participation: Italy;
community organization: Italy;
regionalism: Italy; and
citizen participation: Italy

Common to all these descriptors is the viewpoint of Italy. General and theoretical terms are democracy, political participation and citizen participation; the others may be classified as terms of political science. Social capital was not chosen as a descriptor.

4.4.4 Summary

As a summary it can be stated that all the Milestone Publications include common elements in understanding the meaning of social capital, like *networks, connections, trust and solidarity, norms and values*. It seems that social capital was not, however, the authors' main function of publishing these articles. It was an important part and a good viewpoint from which to study some concrete problems (Coleman, Putnam) or to understand some concepts that are interconnected (Bourdieu).

It is noteworthy that these references are included even now only in one or two subject databases, and in the indexing process social capital has been emphasised only in the description of Bourdieu's article. From the other two publications, empirical research problems have been described. Following the concept of 'funnel of interest' it can be stated that these descriptors are signal words or macro-terms that guide a reader into the funnel, to new signal words. In these cases, these descriptors guide towards the concept of social capital.

Finally, one example of the indexing of one of the Milestone Publications, Putnam's book *Making democracy work* in the Union Catalogue of Finnish University Libraries LINDA is given. The book was indexed at the time when social capital was dncludes in the General Finnish Thesaurus (YSA). There were three different references, one of which was an electronic publication. The subject descriptors were almost identical, and this list includes all the descriptors chosen by the indexers:

politics;
governments;
regional research;
democracy;
Italy;
civil society:
regionalism—Italy; and
decentralization in government—Italy.

Although this book has been so famous in the scientific communities, librarians who index for the databases do not identify the concept of social capital. This confirms the claims of Leydesdorff (1987) about the 'indexer effect'. Another reason may be that libraries and database constructors use internationally use aech other's indexing work. It is provocative to say, but saving time may mean that indexers copy references from each other without thinking through the subject description themselves. At worst, this means copying mistakes and hiding essential information.

The best thesaurus constructors and indexers might be the amateurs in science, as Meadows (1998) describes. It seems that we return to Whittager's question (1989) "Title words or key words?"

4.5 The intellectual base of social capital publications in 1986-2002

This analysis was completed in autumn 2004 on the Web of Science databases. The years 1986-1995, 1998 and 2002 were chosen for a closer study. The three stages have been chosen according to Crane's (1975) models concerning the diffusion of knowledge. The first stage represents the period when a paradigm appears and there is little or no organization in the scientific communities. The second stage is the period of normal science, when groups of collaborators and invisible colleges appear. The third stage is characterized by the solution of major problems and anomalies appear. In the scientific communities increasing specialization and increasing controversy can be observed.

The latest year that was chosen for the analysis is 2002 because it is probable that the publications of the year 2002 were almost completely indexed in the databases. One or two new publications may be missing, but for the general picture this has no relevance. The year 2003 was not completely indexed in 2004; new publications of that year have appeared to the databases at the beginning of 2005.

Co-citation analysis has been done on the most cited documents in order to find their co-occurrence. The varied titles of publications and spelling of names have been checked carefully, and all the mistakes that have been noticed, have been corrected.

The cluster of co-cited documents is considered to represent the knowledge base of a specialty (Chen 2002, 151). Document co-citation analysis gives us a picture of the intellectual base of social capital publications in different periods. A high co-citation rate implies a strong intellectual tie between two works (Chen 2002, 147). The citation maps show which publications have been cited together in different stages of the paradigm development of social capital.

The research frontier is "where we meet the unknown" (Chen 2002, 1). The research front has been defined variously, but the idea seems to be the same. Price (1964) understands it as "growing tip or epidermal layer" of current papers and those papers in the immediate past cited by them. Garfield (1994) defines it as co-citation clusters and documents that cite them. Olle Persson (1994) defines it as clusters of articles grouped by co-citation clusters they cite. Morris et al. (2003) criticises these

definitions and define the research front as clusters of documents that tend to cite a fixed, time invariant set of base documents.

4.5.1 The first stage (1986-1995)

The years 1986-1995 belong to the first stage of the present wave of social capital, when a new paradigm appears and there is little or no social organization (Crane 1972, 172). In that period the Web of Science databases includes 63 publications that deal with social capital.

PUBLICATIONS	N CITATIONS
Coleman, J.S.: Social capital in the creation (COLEMAN JS, 1988)	26
Coleman, J.S.: Foundations of social theory (COLEMAN JS, 1990)	16
Bourdieu, P.: Outline of a theory of practice (BOURDIEU P, 1977)	11
Becker, Gary S.: Human capital (BECKER GS, 1964)	6
Blau, P.M. & Duncan, O.D.: The American occupational..(BLAU PM, 1967)	6
Bourdieu, P.: The forms of capital (BOURDIEU P, 1986)	6
Bourdieu, P.: Distinction (BOURDIEU P, 1979)	5
Granovetter, M.: The strength of weak ties (GRANOVETTER M, 1973)	5
Granovetter, M.: Getting job (GRANOVETTER M, 1974)	5
Becker, Gary S.:A treatise on the family (BECKER GS, 1981)	4
DiMaggio, P. & Mohr J.: Cultural capital, educational..(DIMAGGIO P, 1985)	4
Gordon, Milton M.: Assimilation in American life (GORDON MM, 1964)	4
Granovetter, M.: Economic action and…(GRANOVETTER M, 1985)	4
Light, I.: Ethnic Enterprise in America (LIGHT I, 1972)	4
Portes, A. & Rumbaut, R.G,: Immigrant America (PORTES A, 1990)	4
Putnam, R. D.: Making democracy work (PUTNAM RD, 1993)	4

Table 4: The most cited Social Capital publications in 1986-1995

On closer analysis the map (figure 10), one can notice that Coleman's works are in the middle. A cluster includes citations to Bourdieu's works, and DiMaggio & Mohr also belong to that cluster. This can be called a Cultural Capital cluster.

Another cluster includes Granovetter's works, and also Becker 1964 belongs to that group. This can be called Human Capital cluster.

Light is in the centre of the third cluster with links to Granovetter's works, Portes, Blau and Gordon. This can be seen as a cluster of American problems, especially ethnic, minorities and economic viewpoints. It is noteworthy that Light's book has been mentioned as a Milestone Publication in the field of migration studies (Reitz 2005, http://www.library.utoronto.ca/tantalizingbooks/contrib_r.html 11.3.2005)

Putnam is still rather alone with weak links to Coleman's works. Becker 1981 has weak ties with Blau, Coleman 1988 and Bourdieu 1979.

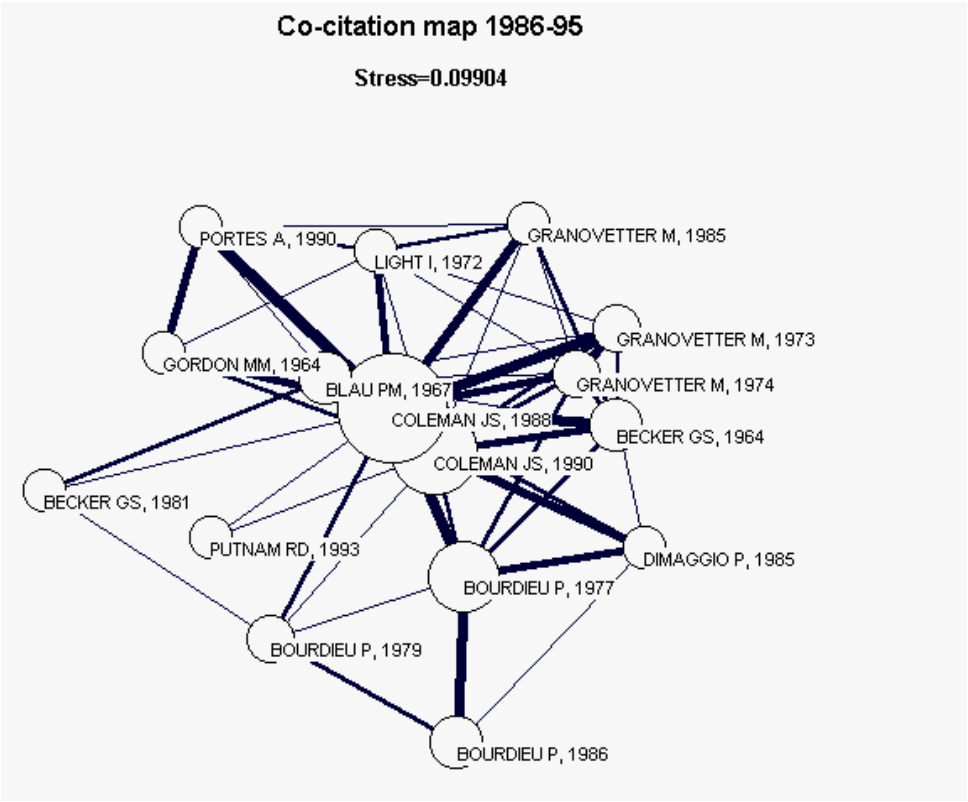


Figure 10: Co-citation map 1986-95

The map is star-shaped where several works are grouped around Coleman's works. These are some subclusters around Granovetter and Bourdieu. Putnam's book (1993) is a lonely satellite linking only with Coleman's works.

From an analysis based on the statistics of the Web of Science databases in 1986-1995, works on social capital that have been published in the period, have a structure like the following.

Authors (more than 2 works)

Marjoribanks K (4)

Coleman J.S. (3)

Parcel T.L. (3)

Zhou M. (3)

Language

English (92.1)

French (4.8)

And two other languages have the rest 3.1%

The top ten subject categories of 1986-1995 are listed below:

Sociology (42.9%)

Economics (14.3%)

Demography (6.3%)

Social Sciences, Interdisciplinary (6.3%)

Education & Educational Research (4.8%)

Ethnic Studies (4.8%)

History (4.8%)

Political Science (4.8%)

Social Sciences, Biomedical (4.8%)

Environmental Studies (3.2%)

24 subject categories have less than 3.2% of the references.

At this stage sociology was the field where most of the publications were classified. Economics is the other field that had already been at the top during the first years of the social capital boom. We can, however, already see interdisciplinary and multidisciplinary nuances in the research field, like demography, ethnic studies and social studies with a biomedical viewpoint.

4.5.2 The second stage (1998)

The year 1998 has been chosen, because that was the year of a sharp increase in social capital publications according to the Web of Science databases. It also represents the period of normal science.

In the year 1998 there were 102 social capital publications. A co-citation analysis has been done on the basis of the 20 most cited publications that have been cited at least 7 times.

PUBLICATIONS	N CITATIONS
Putnam, R. D.: Making democracy work (PUTNAM RD, 1993a)	46
Coleman, J.S.: Foundations of social theory (COLEMAN JS, 1990)	38
Coleman, J.S.: Social capital in the creation… (COLEMAN JS, 1988)	37
Putnam, R. D. : Bowling alone : America's… (PUTNAM RD, 1995a)	35
Putnam, R. D.: Tuning in, tuning out (PUTNAM RD, 1995b)	18
Fukuyama, Francis: Trust (FUKUYAMA F, 1995)	15
Granovetter, M.: Economic action and (GRANOVETTER M, 1985)	14
Granovetter, M.: The strength of weak ties (GRANOVETTER M, 1973)	13
Putnam, R.D.: The prosperous community (PUTNAM RD, 1993b)	13
Brehm J. & Rahn W.: Individual-level evidence… (BREHM J, 1997)	13
Burt, R.S.: The structural holes (BURT RS, 1992)	12
Becker, Gary S.: Human capital (BECKER GS, 19649	10
Portes, A. & Sensenbrenner, J.: Embeddedness and .. (PORTES A, 1993)	10
Verba S., Schlozman K.L. & Brady H.E.: Voice and equality (VERBA S, 1995)	10
Bourdieu, P.: The forms of capital (BOURDIEU P, 1986)	9
Levi M.: Social and unsocial capital (LEVI M, 1996)	8
Jacobs, Jane: The life and death of.. (JACOBS J, 1961)	8
The economic sociology of immigration (PORTES A, 1995)	7
Lin, N., Ensel, W.M. & Vaughn, J.C.: Social resources… (LIN N, 1981)	7
Granovetter, M.: Getting a job (GRANOVETTER M, 1974)	7

Table 5: The most cited Social Capital publications in 1998

The co-citation map shows that the center cluster includes Putnam's and Coleman's Milestone Publications as well as their other publications. These publications have strong links with other clusters. Becker's classic work is linked to this cluster. This middle cluster represents basic theoretical viewpoints to social capital discussion.

Another cluster includes Brehm, Verba, Levi, Fukuyama and Putnam. This seems to represent a discussion on social capital.

One cluster includes Burt, Lin and Granovetter. This seems to be a cluster of ties and structures

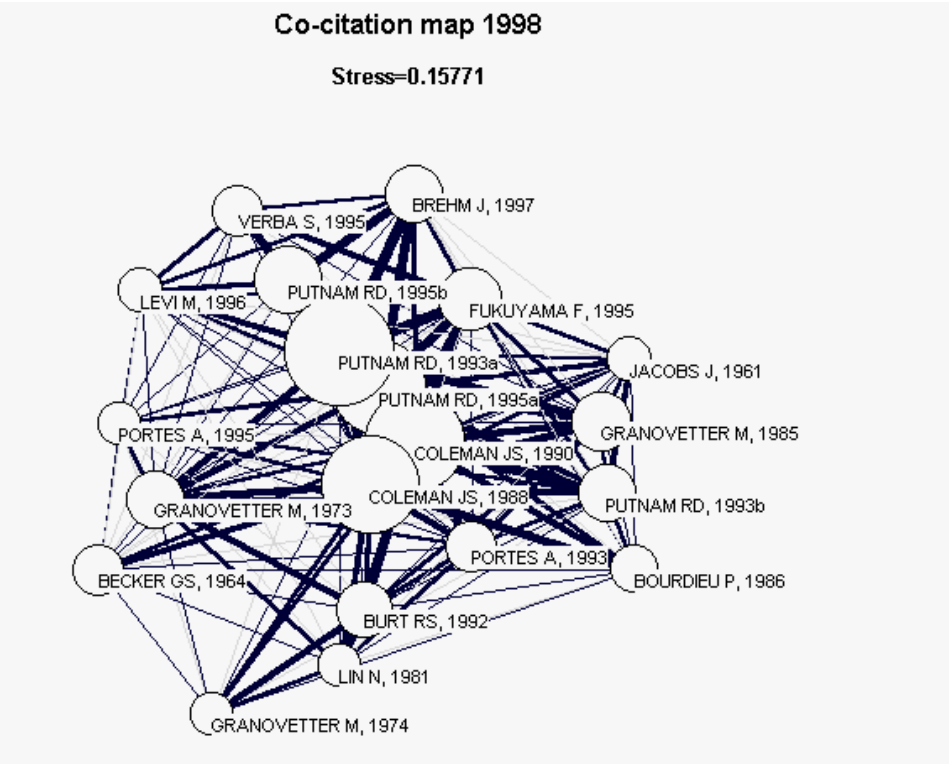


Figure 11: Co-citation map 1998

The shape of the figure is no longer a star, but rather a complete cluster with several nodes connected to other nodes.

The research front of the year 1998 is according to the analysis on the Web of Science somewhat different than at the early stage. The databases include 102 references.

There are more authors than earlier, and only one of them, Hagan (3), has published more than two works. 99% of the publications are in English, one publication in some other language.

The top ten subject categories are listed. It is noteworthy that there are 27 other subject categories with a few publications.

Subject categories
Sociology (20.6%)
Planning & Development (16.7%)
Political Science (14.7%)
Social Sciences, Interdisciplinary (13.7%)
Economics (9.8%)
Psychology, Social (7.8 %)
Urban Studies (7.8 %)
Psychology, Clinical (6.9 %)
Business (4.9%)
Education & Educational Research (4.9%)

Sociology is still at the top, but economics have declined clearly. Interdisciplinary approaches have increased, and also psychology, both social and clinical, is increasing.

4.5.3 The third stage (2002)

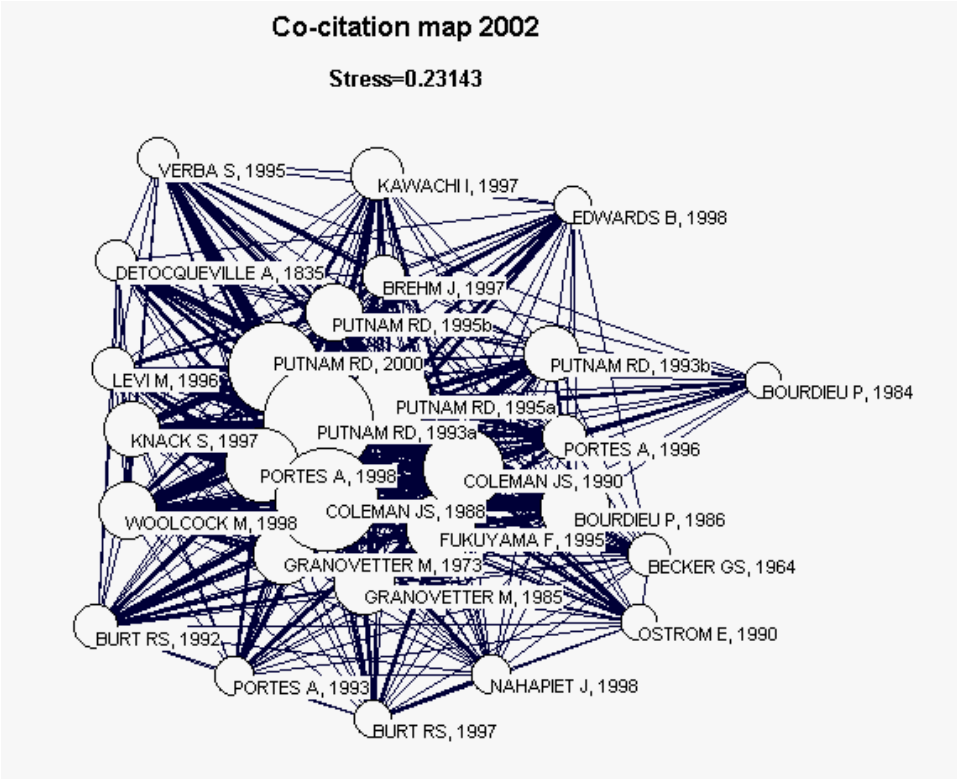
The third stage of this analysis presents a period when new changes seem to have appeared. The number of publications has grown sharply; it has more than doubled since 1998, and is now 250.

PUBLICATIONS	N CITATIONS
Putnam, R. D.: Making democracy work (PUTNAM RD, 1993a)	87
Coleman, J.S.: Social capital in the creation… (COLEMAN JS, 1988)	76
Putnam, R.D. : Bowling alone : the collapse… (PUTNAM RD, 2000)	60
Coleman, J.S.: Foundations of social theory (COLEMAN JS, 1990)	49
Putnam, R. D. : Bowling alone : America's… (PUTNAM RD, 1995a)	45
Portes, Alejandro: Social Capital (PORTES A, 1998)	40
Bourdieu, P.: The forms of capital (BOURDIEU P, 1986)	35
Fukuyama, Francis: Trust (FUKUYAMA F, 1995)	35
Granovetter, M.: Economic action and…(GRANOVETTER M, 1985)	28
Granovetter, M.: The strength of weak ties (GRANOVETTER M, 1973)	27
Woolcock, M.:Social capital and economic… (WOOLCOCK M, 1998)	25
Putnam, R. D.: Tuning in, tuning out (PUTNAM RD, 1995b)	25
Knack S. & Keefer P.: Does social capital have…(KNACK S, 1997)	23
Putnam, R.D.: The prosperous community (PUTNAM RD, 1993b)	23
Kawachi I, Kennedy BP & al.: Social capital, income (KAWACHI I, 1997)	20
Portes, A. & Landolt, P.: The downside of social capital (PORTES A, 1996)	15
Burt, R.S.: The structural holes (BURT RS, 1992)	15
Becker, Gary S.: Human capital (BECKER GS, 1964)	14
Levi M.: Social and unsocial capital (LEVI M, 1996)	14
Brehm J. & Rahn W.: Individual-level evidence BREHM J, 1997	14
Verba S., Schlozman K.L. & Brady H.E.: Voice and equality (VERBA S, 1995)	13
Tocqueville, Alexis de: Democracy in America (DETOCQUEVILLE A, 1835)	13
Portes, A. & Sensenbrenner, J.: Embeddedness and … (PORTES A, 1993)	12
Nahapiet, J & Ghoshal, S: Social capital, intellectual… (NAHAPIET J, 1998)	12
Burt R.S.: The contingent value of social capital (BURT RS, 1997)	11
Edwards B. & Foley M.W.: Civil society and social …(EDWARDS B, 1998)	11
Bourdieu, Pierre: Distinction (BOURDIEU P, 1984)	10
Ostrom, E.: Governing the commons (OSTROM E, 1990)	10

Table 6: The most cited Social Capital publications in 2002

The structure of the co-citation map is different from the earlier stages. It has developed towards a complete cluster with several links in the middle. Ring-shaped figures have grown around the centre.

The central cluster in the middle includes Putnam (1995a, 1993a, 2000), Coleman (1988, 1990) and Fukuyama that can be called the cluster of the classics. But then there are no separate clusters, but different circles are around them and have connections with the centre. The second circle is formed by Brehm, Putnam (1993b, 1995b), Portes (1996, 1998), Bourdieu 1986 and Granovetter (1973,



1985). **Figure 12: Co-citation map 2002**

The outer circle is formed of rather new publications like Edwards, Ostrom, Nahapiet, Burt (1993, 1997), Portes (1993), Woolcock, Knack, Levi and Verba. de Tocqueville's and Becker's classic works are also there, and Bourdie's distinction belongs to the extreme outer circle, too. An interpretation may be that these circles both bring new themes and push out older ones.

An analysis on the Web of Science databases shows some changes in the structure of the research front. In 2002 the databases include 250 references. In 2002 only one author Campbell has published more than two works (5); in total there are 427 author values of that year.

The main **language** is still English (96%). Some publications are in German (2%) or in French (1.6%).One work is published in some other language.

The top ten subject categories are:
Economics (16.0%)
Sociology (16.0%)
Planning & Development (11.6%)
Management (8.0%)
Public, Environmental & Occupational Health (8.0%)
Political Science (6.8%)
Social Sciences, Interdisciplinary (6.0%)
Business (5.2%)
Geography (5.2 %)
Social Sciences, Biomedical (5.2%)

The percentage value of economics and sociology has decreased, and more interdisciplinary and multidisciplinary fields have adopted social capital as a viewpoint. Health studies, business and management, and also geography are these fields of sciences. It is remarkable that as many as 52 categories are outside the display options.

4.6 International diffusion of social capital

A research question that has arisen on the basis of the research material is, to which geographical and language areas has social capital research been diffused. When and at which stages of the paradigm development this happened?

International diffusion has been studied on the basis of the researchers' country. A study was made on the basis of the large international and multidisciplinary databases of the Web of Science. The bibliographic data was downloaded in May 2003 from the databases covering the period 1986-2001. The material was classified record by record according to the publishing year and the country of authors. The number of authors exceeds the number of publications, because of co-authorship. It seems that during the first ten years of social capital research there has not been much co-authorship, but at the end of the 1990's there is often more than one author. International co-operation on the authorship level was not studied, because it did not belong to the original research questions, and the material was not collected for this kind of analysis. This would, however, be a possible research topic.

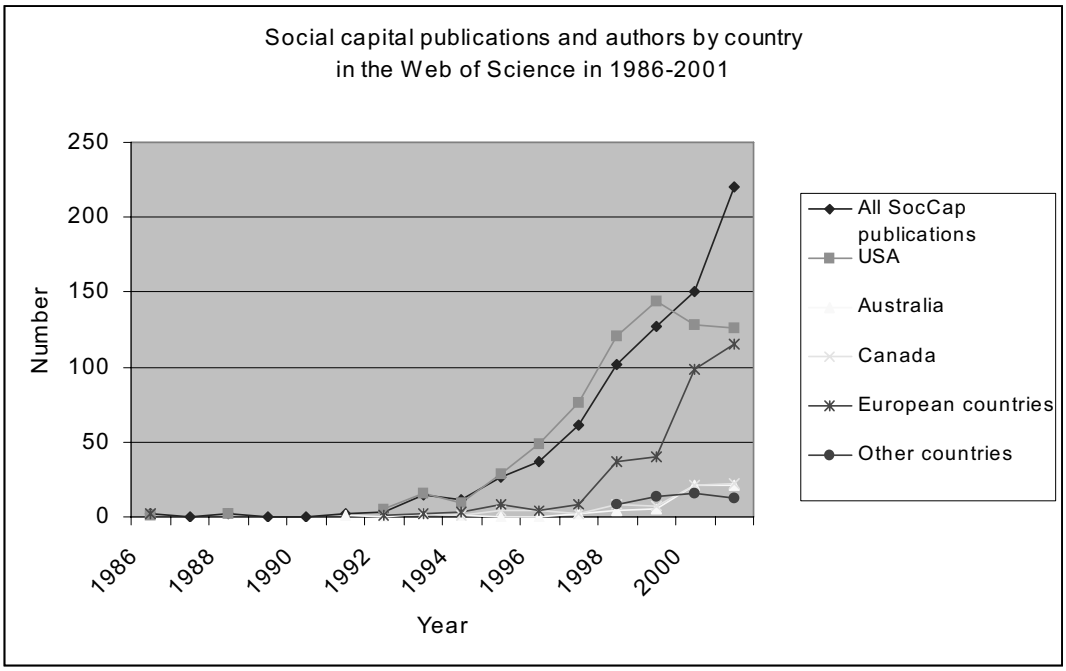


Figure 13: Social capital publications and authors by country in the Web of Science in 1986-2001

In the period 1995-1999 there are more American authors than social capital publications by year. This illustrates American co-authorship concerning this theme. In 2000, the number of U.S. authors declines, and, at the same time, the number of European authors rises sharply. There were also some Canadian and Australian authors in the 1990's, and in 1998 authors of other global areas also became interested in social capital. Thirty nine authors are from Asian countries in 1998-2001.

As was stated earlier, social capital is a concept that has been popular in the USA. Danell (2001) studied management research and its homogenization, internationalization and Americanization. There is an assumption about the dominant position of U.S. researchers in the social sciences. The term *Americanization* is used to denote a reinforcement of the central position of American research in an international context. Danell points out that the Americanization of research can be considered as a specific case of a more general process of Americanization. Scientists are part of society and are assumed to be influenced by changes in society (Danell 2001, 3-4).

On this basis it is debatable whether the diffusion of social capital research is a way of Americanization in the social sciences. Two of the three Milestone Publications that have had an influence on research are by American authors (Coleman and Putnam), whereas one of them is by a European (Bourdieu).

Bourdieu and Wacquant (1999) have also a critical point on the diffusion of a new term or concept from one culture to another. A term or a concept is not always translated from one language or culture to another so that its meaning stays the same. As examples, they give terms like ‘multiculturalism’, ‘globalization’, ‘underclass’ and ‘racial minority’ that tend to impose on all societies American concerns and viewpoints.

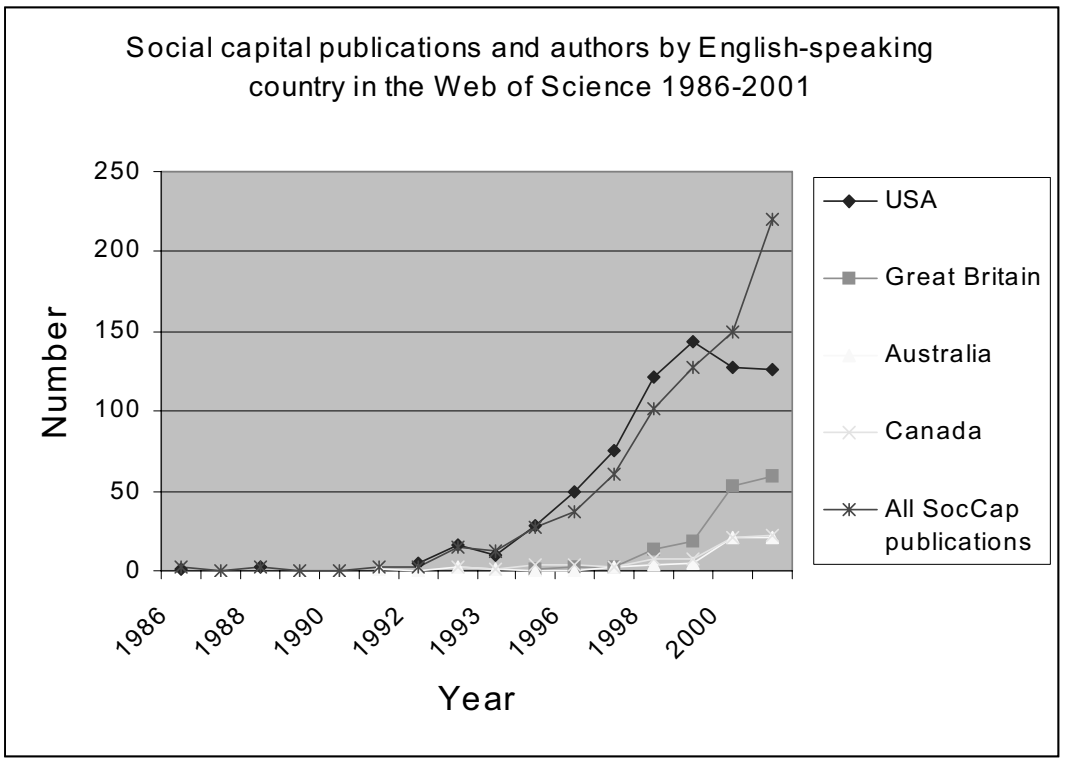


Figure 14: Social capital publications and authors by English-speaking country in the Web of Science 1986-2001

There is also an assumption about the dominance of English language in science and in the diffusion of scientific ideas. The number of authors from English-speaking countries has been analyzed closer. It seems that social capital has been a very American concept up to the Millennium. There are only a few authors from Canada or Australia, and also the British authors are not interested in social capital before the end of the 1990's. It is good to remember that it takes a few years until the ideas of research generate new knowledge and research results, and materialize into publications (Whittager 1989).

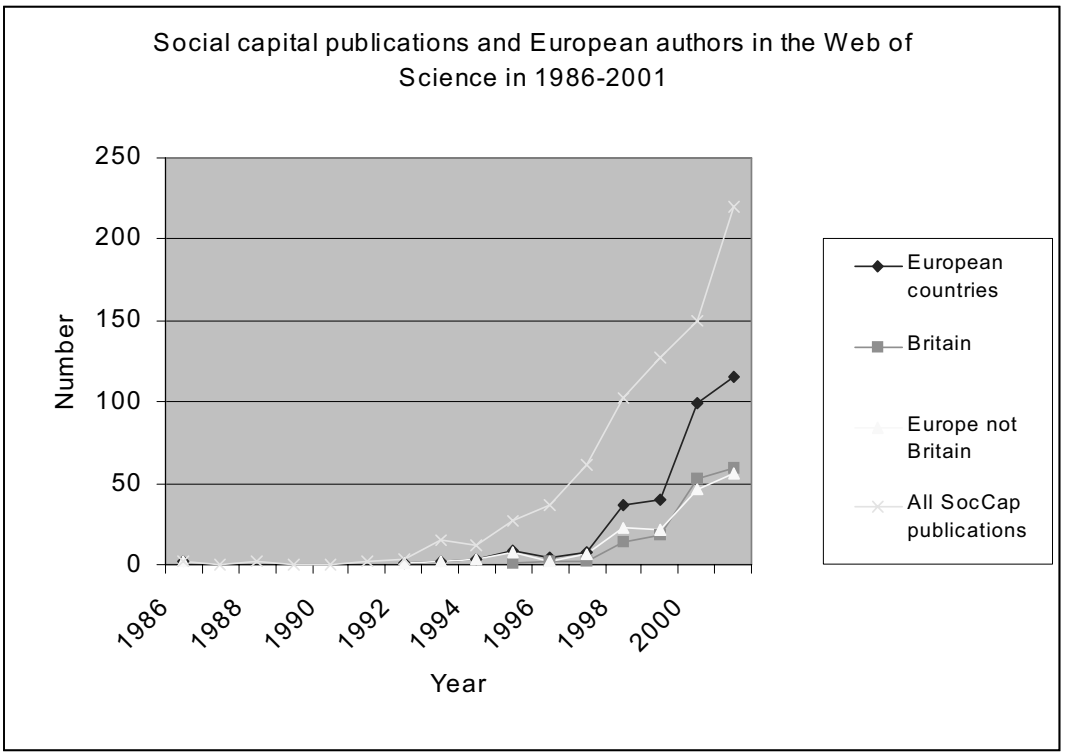


Figure 15: Social capital publications and European authors in the Web of Science in 1986-2001

A closer analysis has been made of the European authors. An interesting question is whether social capital has been diffused to European research communities from the USA along with British researchers, who have the language advantage over other Europeans, when some ideas or concepts are diffusing from the United States. On the basis of this study it seems that there is a European tradition of social capital research among not-English-speaking countries. The British researchers became interested in social capital only at the end of 1990's, and since then the number of British authors and other European authors has been almost equal. The influence of Pierre Bourdieu can be traced in the European social capital research.

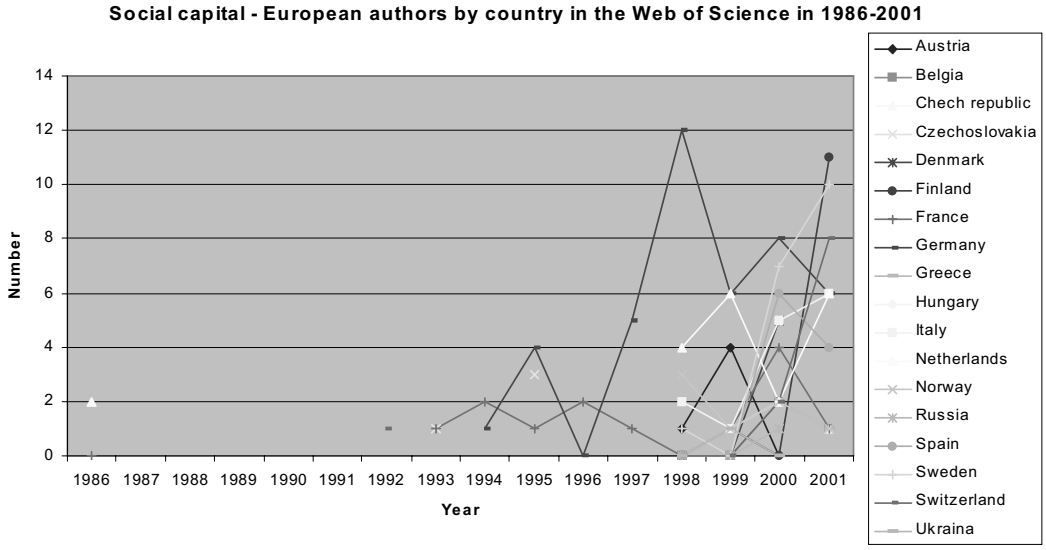


Figure 16: Social capital – European authors by country in the Web of Science in 1986-2001

Figure 16 shows that in the Web of Science databases, the authors of publications are from several European countries. The number of authors is not, however, very high. The first authors at the first stage (years 1986-1995) are from the Netherlands, France, Germany, Switzerland and Czechoslovakia. These authors have been in the forefront of European social capital research. At the second stage there appear to be some new authors from new countries. At the Millennium there is a visible diffusion to new countries and language areas. The most prominent new countries are Finland, Italy and Sweden.

In this connection it is interesting to discuss the center-periphery problematic in the diffusion of scientific knowledge. The center-periphery distinction is a metaphor which has been used in various ways, like objective material conditions of science or more qualitative evaluation of science. Objective factors that have an impact on the center-periphery position of countries are physical location and language, which affect the accessibility to the international scientific community. Political and cultural factors may also have an impact (Kaukonen 1990, 25-26).

Kaukonen (1990, 27) lists some advantages and disadvantages of being on the scientific periphery. First, the peripheral countries may be more open to dialogue and collaboration with each other on

the basis of mutual interest. Second, the peripheral lag and the smaller scale of scientific activities need not be dysfunctional in every aspect. As a result of the scarce available results, the differentiation of science has not gone so far as in the big centers of science. Therefore the problems studied and approaches used are often broader and more integrative than those in the center. In a small scientific community there is an objective need for more selectivity in making science policy decisions and setting priorities.

When science is being done on a smaller scale this often necessitates an individual researcher trying to follow and cover a relatively wide area of research and to gather ideas from many directions and centers, even from various linguistic areas, as has been typical in Finland. The other aspect of this situation is the dilemma of scholarly loneliness. The peripheral position may give, however, more room for intellectual freedom than in the shadow of the dominant centers. As late-comers the peripheral scientific communities have to be strong enough to be able to utilize efficiently the scientific potential and experiences gained by the international research forefront. This is a matter of material, intellectual and communicative resources (Kaukonen 1990, 27-28).

There are different reasons why new concepts and ideas diffuse to new geographical and language areas. Sometimes the reason is very clear (research funding, a good research group, ‘old fellows network’), sometimes Dame Fortune influences things: a researcher meets by accident other researchers who are interested in the same kind of issues. Both lie behind the diffusion of social capital into Finnish science.

4.6.1 Diffusion of social capital in Finland

The diffusion of social capital research in Finland has been studied on the basis of database searches that have been fleshed out with the interviews of Finnish gatekeepers as well as Finnish publications.

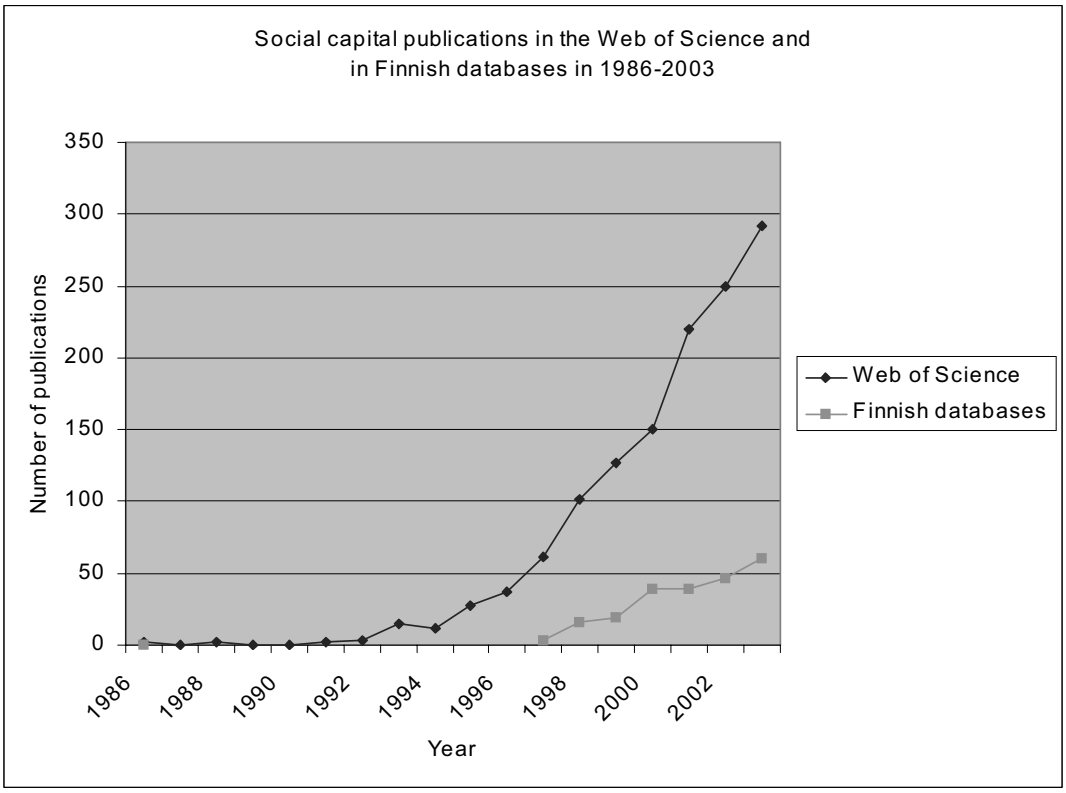


Figure 17: Social capital publications in the Web of Science and in Finnish databases in 1986-2003

The database analysis was made in January 2005 in order to detect when the first publications of social capital were published in Finland and how the growth of publications developed compared with the international development. The material was downloaded from the Web of Science databases and the Finnish databases FENNICA (the Finnish National Bibliography), ARTO (an article database covering mostly articles from scientific periodicals) and ALEKSI (an article database covering articles from different periodicals, including scientific and professional journals as well as newspapers). The materials of the Finnish databases were checked with care, duplicates removed, and the data compiled to one file.

According to figure 17, the first Finnish publications appear in 1997-1999, i.e. at the same time the concept began to diffuse widely. An increase can be found at the Millennium. It is noteworthy that the Academy of Finland encouraged the research of social capital in 2003 by a special funding

program for the years 2004-2007 (*Social Capital and Networks of Trust*). Twenty seven large research projects are funded. According to the information of the titles of the project plans as well as the project leaders' field of science, conclusions can be drawn about the themes of social capital research in Finland. Ten of them can be classified in organizational and working life studies, four economic and social history. Then there are a few studies on social policy (3), health (1), sociology (3), philosophy (1), and political studies (1). Some of them take the viewpoint of youth studies (2) or regional studies (2). It is apparent that most of these projects are interdisciplinary and they include several viewpoints and research questions. The first three publications of that research program were published by June 2005 according to the Web pages of the project (http://www.agora.jyu.fi/soca/index.php; 6.6.2005).

The concept of social capital came to public scientific discussion in Finland in 1997, when Reino Hjerppe (Director of the Government Institute for Economic Research) published his article in the journal *Hyvinvointikatsaus* (Welfare review) published by Statistics Finland under the title "Social capital – a concept worth studying". The article was based on a speech gave at a Committee of Sustainable Development in 1996. In the background was his work as the principal academic officer of the WIDER Institute of the UN that is focused on the problems of developing countries. He knew the works of Coleman and Putnam, and had been influenced by international authors (Hjerppe 1997). His article inspired some other social scientists and decision makers.

Finnish researchers of social and economic policy, Kajanoja and Simpura have told in interviews about a seminar that was soon held in Helsinki in 1997. This can be seen as a most effective impetus to the rapid diffusion of social capital in Finnish scientific communities. On the basis of this seminar a report (Kajanoja & Simpura 1998) was published that has often been cited in Finnish social capital discussions.

So there were active and influential persons who had networks and in contact with other possible active persons who might be interested in the new concept of social capital. Both researchers and politicians, as well as directors of governmental institutes that have concern on public health and social welfare, participated in the seminar (Kajanoja & Simpura 1998). This is consistent with Roger's (1995) model of diffusion. Informal contacts are important at the early stage of diffusion processes.

At the same time the Government of Finland published a report for the future (1997) that included the concept of social capital. The academic sociological community was interested in social capital, and especially in one of its key concepts - trust (e.g. Ilmonen 2000). Some researchers are focused on the health of Swedish-speaking Finns compared with Finnish-speaking Finns (e.g. Hyyppä 2002). At the Millennium the research of social capital diffused to several disciplines and scientific communities in Finland. (See also Kajanoja & Simpura 2002.)

The interviews of Finnish researchers illustrate the diffusion of the concept of social capital in Finland. Interviewee Jouko Kajanoja stresses the importance of Hjerppe, who has become acquainted with the discussions of global problems and in particular the problems of the developing countries with his work. He has also influenced social capital discussions of the World Bank. It is noteworthy that when the Government Institute for Economic Research published the next report on social capital (Kajanoja & Simpura 2000) one of the main articles was written by Michael Woolcock from the World Bank. Woolcock also participated earlier in the 1990's in a seminar arranged by the Finnish Association of Social Policy (according to the interviews of Simpura and Valtonen).

Kajanoja, an economist and at that time a researcher at the Government Institute for Economic Research, was an influential person in the diffusion of social capital in Finland. He was the convener of the first Finnish seminars with leading scientists and other influential persons. As a member of several formal and informal networks he knew people who would be interested in the new concept. Kajanoja also published articles in different journals, edited books and wrote research reports about social capital. He was very productive especially in the late 1990's. He told in the interview about collecting an email network on social capital, as well as the first Web pages of social capital in Finland.

Kajanoja (then Government Institute for Economic Research and now Social Insurance Institute of Finland) and Simpura (then National Research and Development Centre for Welfare and Health (Stakes) and now Statistics Finland) were both in a key position when the concept of social capital was diffusing in Finland. Simpura told in the interview that it was the luck of the draw, when people who knew each other became interested in the concept, and when they in a seminar informally discussed the proposal for a research program to the Academy of Finland. Both Kajanoja and Simpura remembered in the interviews that the idea of the research program popped up – in a very Finnish way – in the sauna.

In health research field there is an influential person, Markku T. Hyyppä, who studied social capital when the term was not well-known. He spoke about social networks, social support and cultural anthropology viewpoint as early as the beginning of 1990's, when he studied the health and health behavior of people. He says that he is a member of "old-boy networks", and in that way he has had possibilities to discuss and influence in the background. Hyyppä read in the 1990's Putnam's works rather early and got fascinated with his way of writing about scientific research. Hyyppä is himself a senior researcher in medicine, a doctor and a popularizer of scientific knowledge. He has published articles on social capital in newspapers (e.g. Hyyppä 2005) and given interviews to magazines about health and social capital (e.g. Lamberg 1998; Malmberg 2003). He is also one of those Finns whose publications can be found in international databases like the Web of Science. It seems that he has had a great influence in the diffusion of the concept of social capital to the everyday speech. Many of the other interviewees mentioned him as an influential person. We could say that according to Roger's model he is a typical innovator.

In the field of sociology there was already in the 1990's a research community at the University of Jyväskylä, who were interested in the theme "Trust and economic depression". The works of Putnam were influenced, but Bourdieu was also familiar to the Finnish sociologists. The European viewpoint was well-known (interview of Ruuskanen 2003). The Jyväskylä circle has been very productive (e.g. Ruuskanen 2002; Siisiäinen 2003; Ilmonen 2000). It seems that they, as sociologists, have given theoretical background to the Finnish social capital research. In the interviews Ilmonen, who is the leading person of this research circle, has been mentioned most often, and he seems also to be a link between different clusters that represent different traditions.

The Committee for the Future of the Parliament of Finland drafted reports concerning "Social capital and the development of information and communication technology" (2002) and "Initial social capital and ICT" (2003). The committee members were Members of the Parliament, and the scientific experts were Pulkkinen, Pekonen and Mustonen. This was an interesting link between science and decision making, as Lea Pulkkinen described in the interview (2003). The connection between the scientific experts and political decision makers was partly chance, partly a result of earlier informal networks. This happened at the beginning of 2002, when social capital was not broadly known in Finland. According to Pulkkinen, the Internet played a major role in gathering information about social capital for the reports. It seems that this circle could be classified as early adopters (Rogers 1995).

In conclusion one can state that the concept of social capital has diffused in Finland in many ways and from different directions. Personal contacts and networks – both international and local – have played an important role. Seminars and conferences have been occasions for scientists and experts to meet and exchange opinions. Important publications – both the milestones and those later published - have given ideas to researchers.

It is evident that some researchers have taken on the role of disseminator. They have arranged seminars, written articles, edited books and prepared material to obtain research funding. Those who have been manifestly active at the first stage of the development of social capital in Finland seem to be people who are active also in other fields of society and not only science. Some of them have already moved to new research themes, and left social capital to others. In this sense one might think that social capital in Finland has reached the third stage of Crane's (1975) model, when there is a solution of major problems and anomalies appear. There is also increasing specialization and increasing controversy in the scientific communities.

Researchers that became interested in social capital at the second stage of its development have often shorter research careers, and according to the interviews they did not see themselves as members of any specific networks of social capital. When they were asked whether they belonged to a network or knew about such, one of them said that "Is there some network? Maybe there is, because you ask, but I do not know." Anyhow, all the researchers that were interviewed have interdisciplinary connections and experience. Either their fields of sciences are interdisciplinary or they have belonged to multidisciplinary research communities. They have also international contacts and they have participated in scientific conferences. It seems on the basis of the interviews that those who have been influenced about the new concept at an early stage are in many ways "inter" or "multi" people. According to earlier research they are not necessary respected in pure scientific circles, although they have an important role in the diffusion of a new idea (see e.g. Lievrouw & Carley 1990).

4.6.1.1 The intellectual base of social capital research in Finland

As noted, social capital research in Finland has gbeen influenced by different sources. The interviewees were asked to name the authors that have been most important in the field of social capital. On the basis of the interviews a map of the intellectual base has been constructed.

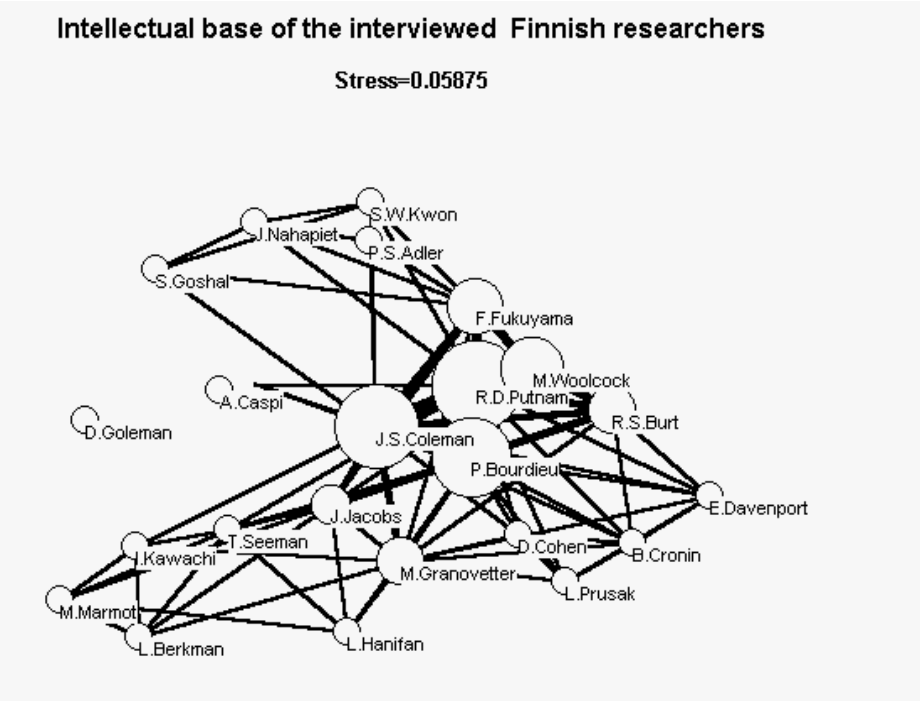


Figure 18: A map of the intellectual base of Finnish social capital researchers

For this analysis all the 23 researchers mentioned by the interviewees has been chosen. At the core are Coleman, Putnam and Bourdieu. Also Woolcock, who has played an important role in the diffusion process of social capital to Finland, as speaker in Finnish seminars on social capital, is also well.known. Sociologists Burt and Granovetter have been mentioned a couple of times, too.

We can find a cluster from medical viewpoint down in the left, a cluster of information studies in the right, and a cluster of organization studies in the upper part of the figure.

It seems that the interviewed researchers know the authors of "Milestone Publications" well. Then the scientific fields have their own authorities who have been influential.

This figure does not give the whole picture of the intellectual base of Finnish social capital researchers. It reflects the situtation in 2003, when most of the interviews were conducted. Now, when there are more researchers in this specialty, there might be a different figure.

4.6.1.2 Themes of social capital research and discussion in Finland

According to the Finnish bibliographic databases ARTO, ALEKSI and FENNICA, social capital has been a theme of research, scientific discussion, professional writing and everyday speech in Finland since 1997. There were, however, a couple of publications in the 1980's (Siisiäinen 1986; 1988) but they were occasional. Only at the end of 1990's was the discussion on social capital diffused more widely in Finland. Siisiäinen was influenced by Bourdieu, when the boom of the 1990's was mostly influenced by the American researchers Coleman and Putnam (see also Ruuskanen 2003). Siisiäinen (2003) continued later with analyzing the two viewpoints of the social capital research.

When the duplicates have been removed, there are 229 references in the Finnish databases in 1997-2003. A file has been collected, and a co-word analysis was made in order to find out which themes most often occur with social capital and how these themes are linked together.

The analysis was made on the basis of the 30 most often used descriptors. They have been translated from Finnish to English, and general words like "research" and "book reviews" have been deleted. The aim was to find out whether there are clusters, clear themes or strong links, and which the main subject fields in Finland have been at the early stage. The descriptors used in these databases are included in the General Finnish Thesaurus. "Social capital" was approved as a keyword to this thesaurus in September 1998. This means that the indexers have that term as a tool to use in the document description.

It seems that in 1997-2003 there are several themes that are interconnected. We can find loose networks of health research, organization studies, and economic policy and research with connections to development research. The Swedish-speaking Finns have links with health, social relations and trust. Information society has links with values, participation and welfare.

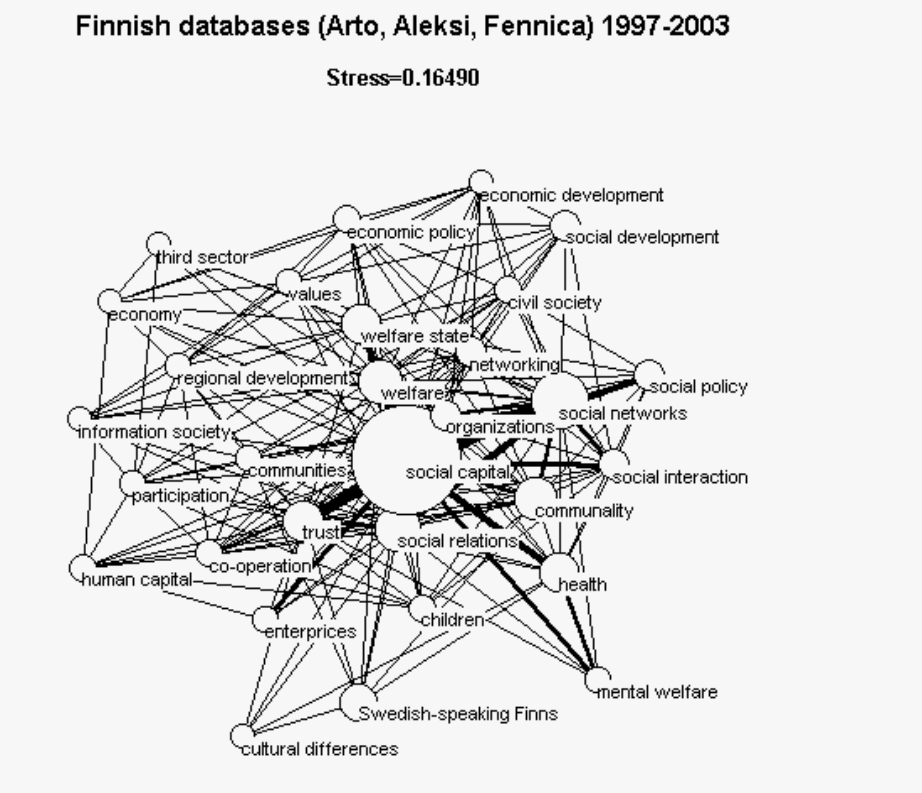


Figure 19: Finnish databases (ARTO, ALEKSI, FENNICA) 1997-2003

The shape of the figure is a rather complete cluster. We can interpret that different schools or networks are connected with each other.

The big research program funded by the Academy of Finland started in 2003, and there are more than 60 researchers working on the theme in June 2005. One should remember that it takes about 3-4 years before a researcher's concept or an idea appears as a research report. And often it takes 1-3 years before an article is published after approval. So, we can expect in 2007-2008 a big boom of publications in Finland in the field of social capital.

The research themes that are now funded by the Academy of Finland are very different. They can be classified under organizational and working life studies, economic and social history, social policy, health studies, sociology, philosophy, political studies, youth studies and regional studies. It would be interested to make a co-word map in five years time in order to see, whether the products of the research projects, or publications, reflect the same themes.

As a summary we can state that the diffusion of social capital in Finland has been more according to the model of Lievrouw (1992) than the model of Rogers (1995). At the conceptualization stage, communication processes are typically interpersonal in nature, allowing individual scientists to refine and promote ideas within an immediate circle of colleagues and trusted assessors (Lievrouw 1992). This is consistent with the stories of Kajanoja, Simpura and Hyyppä.

At the documentation stage, communication processes are more organized. Researchers produce a documented record of a coherent body of research, such as the publication of scientific papers and books, or the presentation of research findings at professional meetings. Researchers at this stage in their work tend to communicate in a more stylized, rule-bound fashion to reach a larger audience than the original tightly-knit group of colleagues that characterizes the conceptualization stage (Lievrouw 1992). This is very similar to thatwhich happened when research funding by the Academy of Finland became available. According to the interviews, researchers began to work in a more goal-oriented fashion in order to find like-minded colleagues and to create research groups. There was also competition between researchers and fields of sciences.

At the third stage of the cycle, popularization, ideas that have been developed by scientists at the conceptualization stage and then recorded at the documentation stage may be communicated further to the society at large. Communication processes at this stage tend to encourage the acculturation of ideas; they may accelerate the development of institutions or awards, the introduction of new words into the language, or encourage new social behavior as a result of scientific innovation or ideas. For example, new terms may become part of the everyday language of the general public (Lievrouw 1992). We can also assume that words from everyday language will become part of the scientific terminology. Scientists may pick words from the speech of people in order to popularize research results and to make them more understandable to a wider public. In Finland the popularization stage seemed to be earlier, at the same time as the documentation stage. Active journalists and researchers, such as Hyyppä, who are also active in popularization of science have had their influence on that.

4.7 Diffusion of social capital to subject fields

This part of the study began in spring 2002, and it has developed during the research process. The first step was a rank search on the DIALOG information system. The next step was making searches on the Web of Science databases. The aim of this was to map the diffusion of social capital research on a general interdisciplinary level. On the basis of these analyses conclusions have been made to determine what are the main subject fields and research topics around the concept. As a result some subject fields and databases have been chosen for a closer study.

In May 2002 a search was made on the DIALOG information system that covers more than 900 databases on different fields (see material description in Appendix 1). The so called "rank search" that was made gives a picture of the themes and subject keywords that co-occur most often with the term social capital. The area of this sub-study covers all fields of sciences without limitations, and it is based on keywords that have been used as subject description. The time period was unlimited. The point of this analysis was to make a general picture on social capital research in the world from the first references recorded in the databases to the present.

1100 social capital records were found with 2540 unique terms as the result of the rank search. 1581 of the terms appeared only once, and they covered most different fields and social problems. The top 12 list includes the following terms that have been indexed in records that deal with social capital. The term social capital (924 items; most used) is not included, and also a geographical term United States (110 items) has been excluded from this list.

The most often used subject keywords of the social capital publications in the databases of DIALOG information system in May 2002 are the following

- human capital 9.6% (106 items)
- civil society 7.8% (86)
- social networks 6.8% (75)
- community development 6.2% (68)
- elementary secondary school 6.0% (66)
- foreign countries 4.8% (53)
- social aspects 4.3% (47)
- economic development 4.0% (44)

- democracy 3.5% (39)
- academic achievements 3.5% (38)
- rural development 3.5% (38)
- trust 3.5% (38)

Most of the rest of the terms can be classified into education, communities, public policy and citizenship, as well as parenthood and family issues. Other keywords that occur often describe countries and ethnic groups, and most miscellaneous themes. We can assume that social capital is an often used viewpoint for different research problems, or maybe we can call it an umbrella concept that covers different research questions.

In order to map the field, searches were also made in the Web of Science in 2002. The material was analyzed record by record according to the title, keywords and abstracts. The references have been classified by a field of sciences or a research topic. This kind of qualitative content analysis seemed to be necessary, because the keywords in the Web of Science databases are often not valid. This sub-study gave results that support the dialog searches.

In the Web of Science there is now in 2005 also the possibility to classify the search result by fields of sciences as we have done earlier in this study, but it is a rather rough classification. The aim of this analysis was to detect, which kind of research topics have risen around social capital and which fields of sciences would be interesting to study closer. This analysis confirmed the results of the DIALOG analysis.

When we study different fields of sciences more carefully, we form an impression of the orientation of research. Social capital was in the 1990's a new concept with an upward trend. As we have noticed earlier, in many fields of sciences the term "social capital" was not included in the thesaurus; so it is not necessarily a subject keyword. To obtain all the publications dealing with social capital on the databases we have to use a free text search, e.g. social capital might appear in any field: in title, in abstract, or in keyword or description field.

In this study, the decision of choosing the years for a closer analysis is based on a comparison of diffusion of social capital in different fields of sciences with Crane's (1975) model on characteristics of knowledge and paradigm appearance.

The information that was obtained on the basis of the DIALOG analysis and the Web of Science analysis offered a general picture of the development of the concept. On the basis of these analyses, several international subject databases have been studied closer. These databases cover subject fields like sociology, psychology, education, economics, political science, library and information studies, business and organization studies, agriculture, medicine.

The database searches were compared. They showed that there are some fields in which the term "social capital" has been created, developed and adopted early. These fields are sociology and economics. Then there are fields that can be seen as later adopters of social capital. Databases of these fields have been chosen for a closer analysis.

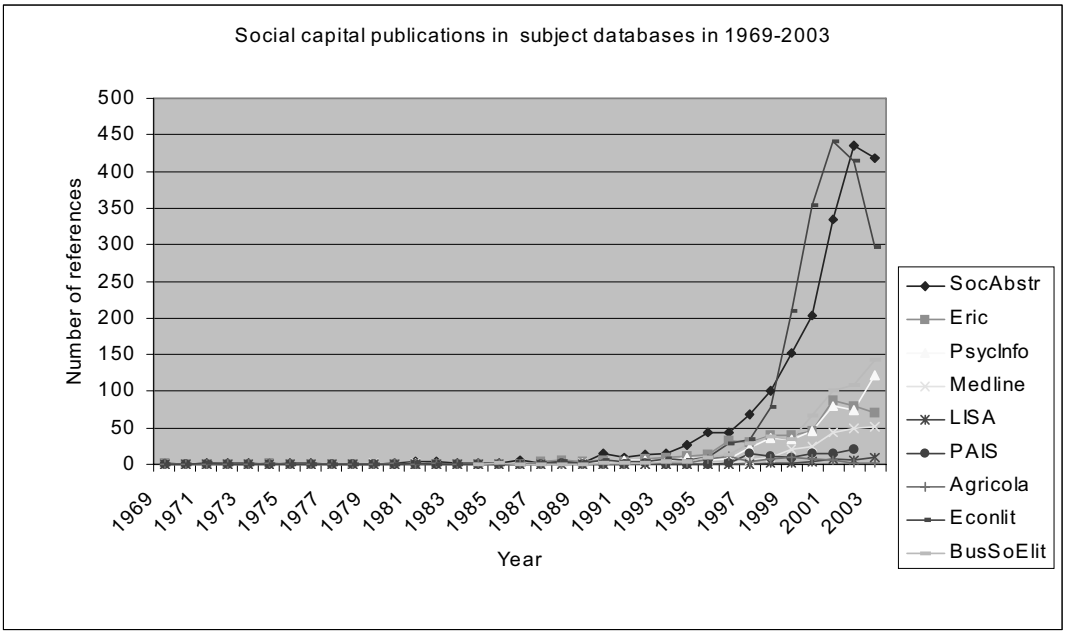


Figure 20: Social capital publications in subject databases in 1969-2003

Analyses were made on several international subject databases. The selection criteria for the subject fields that were first browsed were based on the DIALOG "rank search" that has been described earlier. The databases were selected on the basis of their international coverage, time coverage, importance in their own fields, as well as free availability in the Finnish university libraries network.

The search strategy was "social capital anywhere", i.e. a free text search. That was based on the fact that social capital is such a new concept that it often is not necessarily included in thesauri of the databases. The time period was not defined. The aim was to also detect the early publications. The first publications that were found in the databases are from 1969.

In summary, the forerunner sciences are sociology and economics. They also had a seeming growth in the 1990's, but after the Millennium the yearly number of publications has sometimes declined. Also in the database of education there are some early publications, but the real diffusion in education seems to happen in the early 1990's. The number of new publications is declining. In agriculture, too, there are a few publications in the 1970's and 1980's, and another peak is in the late 1990's, but then the annual number of publications seems to decline.

In 1997-1999 several new publications have been recorded in the databases of new fields. Medicine belongs to the second wave, but it seems that the annual number of publications is no longer growing. In business and organization studies as well as in psychology, the annual number of new publications is still growing. In the databases of political sciences as well as information studies, the number of social capital publications was not very high when these analyses were done.

Database	**Field of science**	**Since**	**Total references**	**Social capital references - 2003**
Sociological Abstracts	Sociology	1963-	600 000	1911
ERIC	Education	1966-	1 100 000	487
PsycINFO	Psychology	1872-	2 000 000	456
Medline	Medicine	1966-	4 500 000	212
Business Source Elite	Business and management studies	1985-	No exact information	555
EconLit	Economics	1969-	610 000	1898

Table 7: Analyzed subject databases at the end of 2003

After the browsing of databases six subject databases have been chosen for a closer study. Two of them (Sociological Abstracts and EconLit) present the fields of sciences that have been at the forefront of social capital studies, sociology and economics. They also belong to the core of social sciences (see e.g. Lindholm-Romantschuk 1998). In this study they are called first wave disciplines. Two of them (ERIC and Medline) present the fields that belong to the next wave, education and medicine. They do not belong to social sciences, and they are more applied fields of sciences often with practical research questions and practical needs for new research knowledge. They are called here the second wave disciplines. Finally, two of them (Business Source Elite and PsycINFO) present the fields that are still at a stage of growth of research and publications, organization, business and management studies, and psychology. They do not belong to the core social sciences. They are rather interdisciplinary fields with practical research needs and utilization. They are called in this study the third wave disciplines.

Both the number of publications by year and the cumulative growth of publications are studied closer. According to Crane (1975), the cumulative growth of publications shows the diffusion of an innovation, a concept or a paradigm in science. Different stages in the diffusion process also indicate some characteristics of scientific communities.

On the basis of this diffusion analysis as well as the knowledge we have about the landmarks of social capital by the Milestone Publications, some points of time have been chosen for a more detailed co-word analysis in all the chosen fields. In other words, the co-occurrence of social capital with other concepts and terms are studied.

1) In every field of sciences during the first years only a couple of publications were published, and they have been analyzed. This makes it possible to find out something about the roots of research traditions, as well as in which context the concept appeared in the field.
2) The year 1998 seems to be rather remarkable in many fields. Also analysis of the Web of Science databases has shown that both internationally and in an interdisciplinary way this year was important for publishing social capital research.
3) The year 2002 tells us about the present situation and gives some hints about the immediate future. The material for co-word analysis was collected in 2004, when the year 2002 was almost completely recorded in the databases. It is noteworthy that in 2005 some new records from the year 2003 have were to the databases. It is important to be aware of the time delay in database updating.

Change and development of the concept over time and in different fields of sciences is the focus. The aim is to find out which terms are most often used to describe the research publications of social capital in a specific discipline from past years compared to now.

4.7.1 Social capital in thesauri of subject description of the databases

A thesaurus or a controlled vocabulary can function as guidelines to a field of science and knowledge. They have been composed for a database and a field of science. An analysis of the thesauri of the specific databases that have been studied was made in order to see, how the concept of social capital has been understood in the databases of subject fields.

Table 8 shows the situation in April 2005. Those thesauri that are used in the ERIC (education) and in the EconLit (economics) databases include SOCIAL CAPITAL as a descriptor (keyword). Something about the context in which the term is used in different fields of sciences tells the *USE* term in the Sociological Abstracts (CULTURAL CAPITAL) and in the Business Source Elite (INFRASTRUCTURE, Economics). In the EconLit thesaurus "SOCIAL NORMS AND SOCIAL CAPITAL" is a narrower term of "cultural economics". In the PsycINFO (psychology) SOCIAL CAPITAL was introduced in June 2004. PsycINFO records from the past 10 years were re-indexed using this term. In the Medline's MeSH (Medicine Subject Headings) thesaurus the term "social capital" is not found.

In the ERIC Thesaurus the term "social capital" was added as late as in 2001, although there were references of social capital publications in the database already in the 1980's. It takes time before a term is so established in a field of science and in the language that it is accepted as a thesaurus term. Thesauri are usually conservative, although nowadays when they are in digital form and available also on the Internet, it is possible to update them more often and more flexibly than earlier. It might, however, take some years from the appearance of a term in a scientific text to the day when it is approved as a thesaurus term.

So, if an indexer follows the thesaurus, he is always conservative in the subject description work, and he must find appropriate synonyms. We have noticed this already in the section dealing with the content analysis of the Milestone Publications. It presupposes knowledge about scientific development and discussion. Leydesdorff (1987, cit. Whittager 1989) states that it is well known that keywords selected by an indexer who is not a practising scientist tend to be conservative: the keywords reflect the world of the scientists of two years ago. Whittager (1989) states that the keywords chosen by trained indexers as descriptors of the contents of articles are in fact a reliable indication of the scientific concepts referred in them. This makes it possible to use the keywords as the basic data for co-word analysis. We can add that if we want to know how a concept has been understood by database constructors (indexers) co-word analysis is a chance to do that (see further Keränen 2005).

Database	Thesaurus	Social capital in the thesaurus
Sociological Abstracts	Thesaurus of Sociological Indexing Terms	Use CULTURAL CAPITAL (added 1992)
ERIC	ERIC Thesaurus	SOCIAL CAPITAL (added 15.2.2001)
EconLit	Journal of Economic Literature Thesaurus	SOCIAL NORMS AND SOCIAL CAPITAL (BT cultural economics)
Medline	MESH Thesaurus	Term not found
PsycINFO	PsycINFO Thesaurus	SOCIAL CAPITAL (term introduced in June 2004)
Business Source Elite	Business Thesaurus	Use INFRASTRUCTURE (Economics)

Table 8: Social Capital in thesauri

To sum up, the term social capital is not included in most of the thesauri of the subject fields that are studied in the beginning of the 2001st century. It is interesting that although sociology is one of the forerunner sciences of social capital research, the concept is not included in the thesaurus.

If we know the date a term was added to a thesaurus, it tells us something about the degree of institutionalization of a concept in a field. It is, however, not usual that there is any information about the date or even the year of the addition to thesauri.

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4.7.2 The first wave disciplines

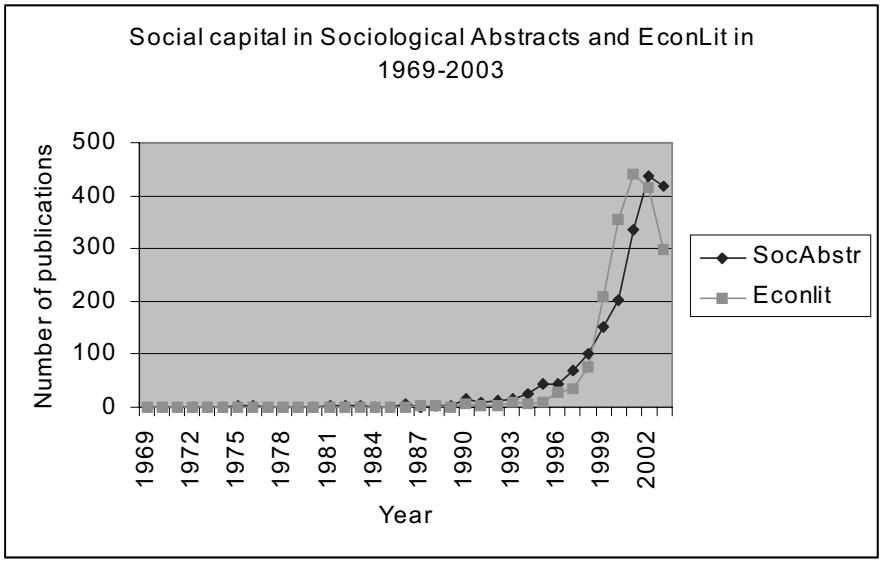


Figure 21: Sociological Abstracts and EconLit in 1969-2003

The first disciplines to adopt social capital as a concept of research were sociology and economics. The analyses of the Sociological Abstracts and EconLit show that there were some publications already in the 1970's, but the growth of research and publications began in the early 1990's and grew sharply in the late 1990's. At the beginning of the 21st century the annual number of new publications has declined.

4.7.2.1 Sociology

An analysis of Sociological Abstracts shows that the first publications were recorded in the database as early as 1969. There were some occasional publications on social capital in the 1970's and 1980's, and there are years when social capital works were not published. However, the number of publications grew sharply in the mid 1990's. It seems that at the beginning of the 21st century,

social capital research is globally declining in sociology. At the same time it is growing in more applied fields of sciences, as we have noticed earlier in this study.

Diffusion of knowledge can be detected by studying the cumulative growth of publications in a field. It seems that sociology has now come, according to Crane (1975), to the third stage of "solution of major problems". At the same time, the term 'social capital' has diffused to several other fields of sciences. It is possible that the forerunner science has paved a way to other disciplines, and is now at a stage of seeking a new concept to analyze and understand the development of societies.

The first stage lasted rather a long time. It took some time before the concept was adopted by wider research communities. As we found earlier in this study, social capital is a concept that was used in Europe already in the 1970's. The publications were often in French and sometimes in German. But only in the 1990's did the concept gain more popularity, when also the English-speaking research communities discovered it. We can conclude that the second stage began about in 1995, and sociology is now shifting to the third stage.

A co-word analysis was not made of the early stage or the "ripening years" of social capital, because the number of publications was small. The keywords in Sociological Abstracts were various but they were mostly connected to labour and employment, economic problems, social planning, education and networks.

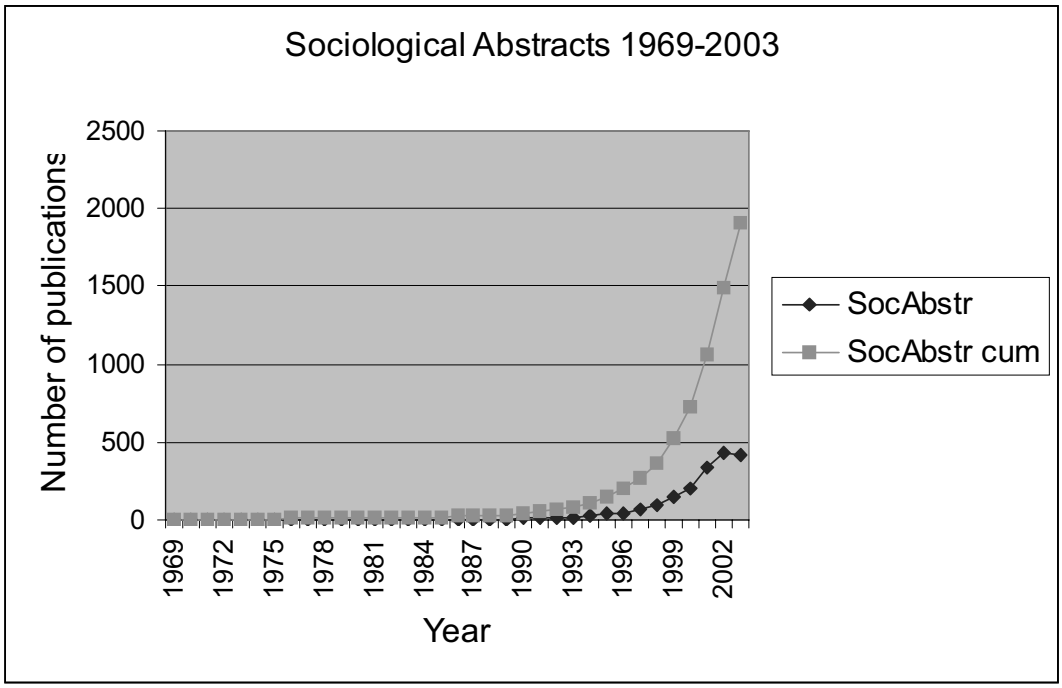


Figure 22: Sociological Abstracts 1969-2003

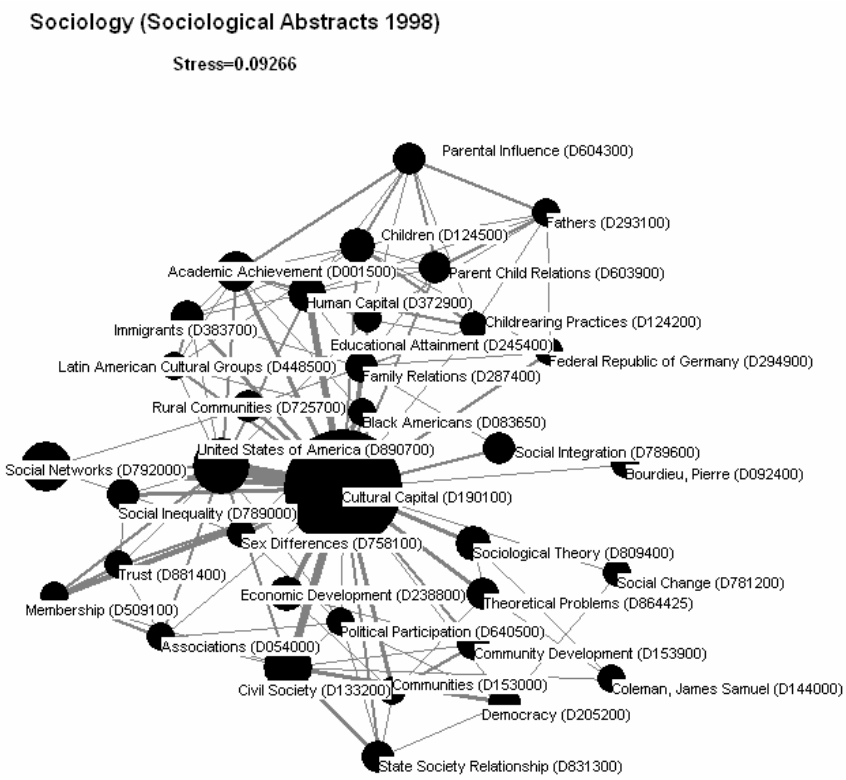


Figure 23: Sociology (Sociological Abstracts 1998). Co-word analysis

A co-word analysis was made of the records of 1998. It shows the co-occurrence of other terms with social capital. In 1998 there were 100 records that were described with 396 different keywords, and 35 of them occurred at least 4 times. These 35 have been chosen for a closer analysis.

In the thesaurus of the Sociological Abstracts 'social capital' is not a descriptor. There is instead a referral to use the term "cultural capital".

The indexing term "Cultural capital" can be found in the core with links to other terms so that the form of the figure is rather star-shaped. A cluster of "Family, children and parenthood" can be found that has connections with another cluster concerning "Academic achievement, immigrants and ethnic groups". A cluster of "Theoretical problems", a cluster of "Political participation, democracy and civil society", and a cluster of "Networks, trust and membership" can also be identified.

In 1998, the clusters are not, however, strongly separate. The terms are grouped around “Cultural capital” that can be seen as the core. There are not many links between different themes on the circle

In 2002 there were 419 records in Sociological Abstracts, with 501 different keywords, and 37 of them occurred at least 10 times. For a closer analysis these 37 keywords were chosen.

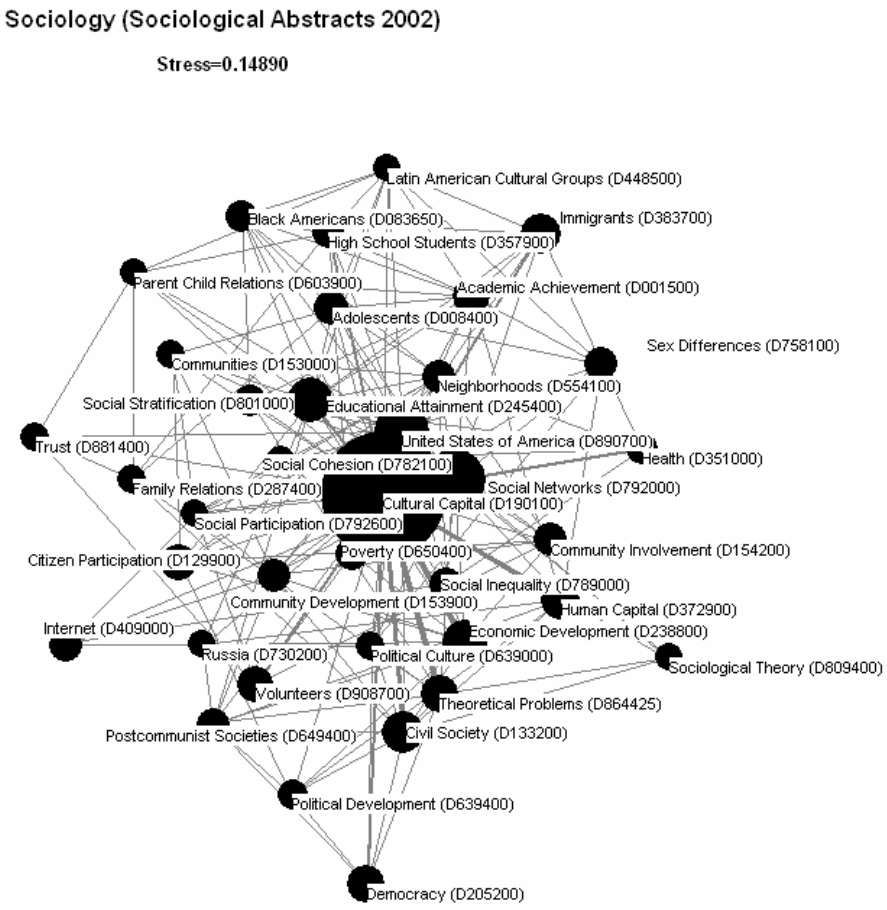


Figure 24: Sociology (Sociological Abstracts 2002). Co-word analysis

In 2002 new themes had appeared. The structure of the figure has changed although the figure is still rather star-shaped: there are more connections between the separate clusters than in 1998. “Cultural capital” is still at the core with close connections with “Social networks”. The cluster of

"Civil society, democracy and political development" is clear, and it has connections to "Internet", "Social participation" and "Citizen participation". Still there are clusters like "Immigrants, ethnic groups and education" that have connections with parent-child relations and neighborhood. There is no longer a separate cluster of "Theoretical problems", but this has connections with different themes. There are new themes like "Internet" with links in different directions, as well as "Postcommunist societies". One of the core terms of social capital "Trust" is now on the edge.

4.7.2.2 Economics

The other first wave field of social capital is economics. It covers the other side of the coin – capital. The main international database was been studied is EconLit.

Social capital was a topic in economics in the early 1970's. The first record of social capital publications in EconLit database dates back to 1971, and it is an article by the Japanese researchers Susumu Nishibe and Yukihiko Kiyokawa. This article deals with economic growth and social capital. Then, the concept appears in publications in the 1980's a couple of times, but as late as in the second half of the 1990's it begins to interest a wider community of researchers. At that time we can find more publications, diffusion of knowledge and a sharp increase. The growth begins in 1997-1998, and more than half of all the publications were published in 2001-2003. The peak can be seen in 2001. It seems, however, that the growth of publications is now declining. It is possible that new ideas and concepts are developing in economics.

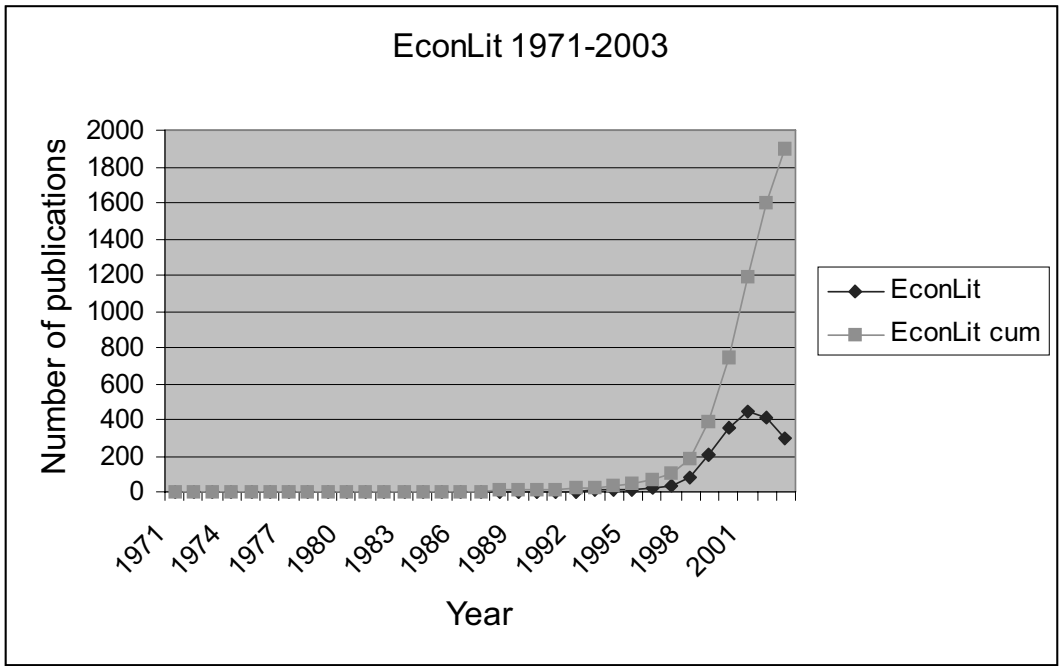


Figure 25: EconLit 1971-2003

In this case there were the problems of database structures and contents. At the beginning of this study the EconLit database was easily available on the university library's network. During the study it changed host, and it became more difficult to download information for research material from the Internet. It seemed that the fields in the bibliographic description were also changed, or at least there were rather fewer subject descriptors. Leaving EconLit out of this study was even considered, but it does give a good impression of the growth of literature, so it was decided to use it to give a general picture of the development.

This is also an example of the difficulties that a researcher may meet when using bibliographic databases on the Internet as research material.

4.7.3 The second wave disciplines

Education and medicine are two disciplines that have adopted social capital as a concept of research on the second wave that was rising in the middle of the 1990's. There was interdisciplinary diffusion of the concept from core social sciences to more applied sciences, education and medicine. The analyses on the ERIC and Medline databases show that there were some publications already earlier, in the 1970's and 1980's, but the growth of research and publications began in the1990's and grew sharply in the late 1990's. At the beginning of the 21st century, the annual number of publications no longer grew.

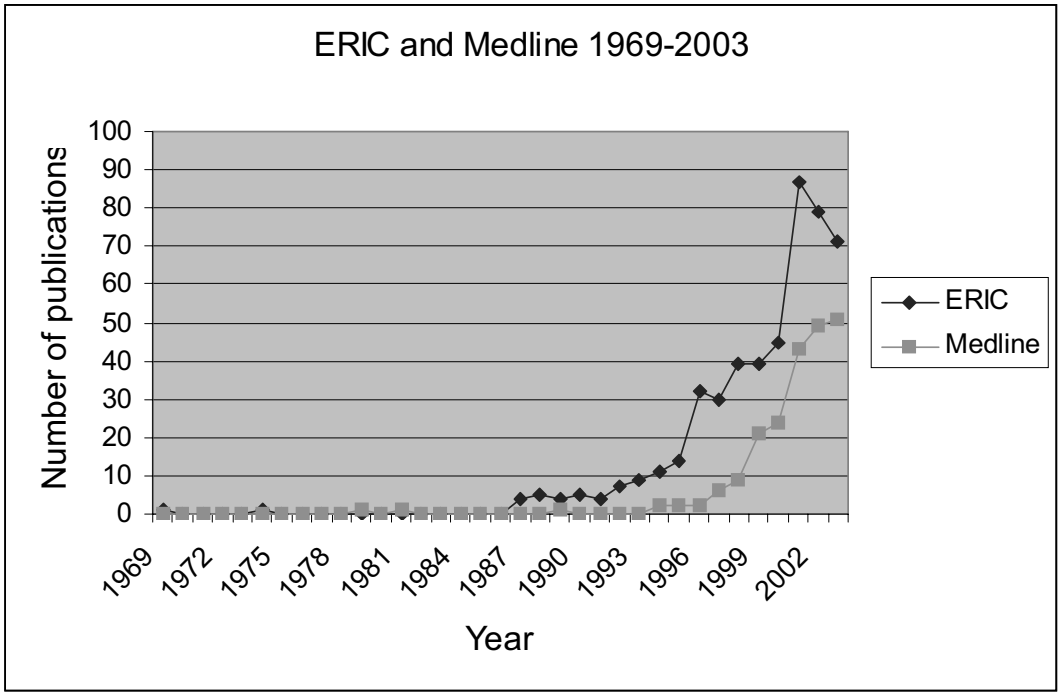


Figure 26: ERIC and Medline 1969-2003

4.7.3.1 Education

The concept of social capital has been widely used also in education research. In the ERIC database the first social capital publication record dates back to 1969. It is a book by an Indian researcher

J.R. Kidd, and it is compiled of several articles on education. The next publication is from 1974, and then it took 15 years, until the number of social capital publications started to grow in the field of education. In 1987-1991 there were 4-5 new publications every year. In 1992-1995 the growth continued slowly. In 1996 the number of publications (30) doubled the number of 1995 (14), and the growth of publications increased. Again in 2001, the number of publications of the year 2000 doubled from 45 to 87. It seems that the growth has now stopped; in 2002 there were 79 new records and in 2003 only 71 (checked 1.4.2005). We can state that according to Crane's model, education is moving from the third stage to the fourth stage, from solution of major problems and increasing specialization to exhaustion and decline in membership of scientific communities.

Education is one of the subject fields that adopted the concept of social capital first in the United States (Hanifan 1916; Coleman 1988), and also globally. It captured the interest of Finnish education researchers rather late, and then the stimulator was the funding of the Academy of Finland (interview of Poikela). According to a recent dissertation on science policy in Finland (Nieminen 2005) research funding is an important tool in research management and control.

On the other hand, enthusiastic researchers can create their own invisible colleges, if they find a research theme important. The Finnish education researchers have published an anthology on learning and social capital, although they did not get the official position and funding in the research program of the Academy of Finland (see Poikela 2005).

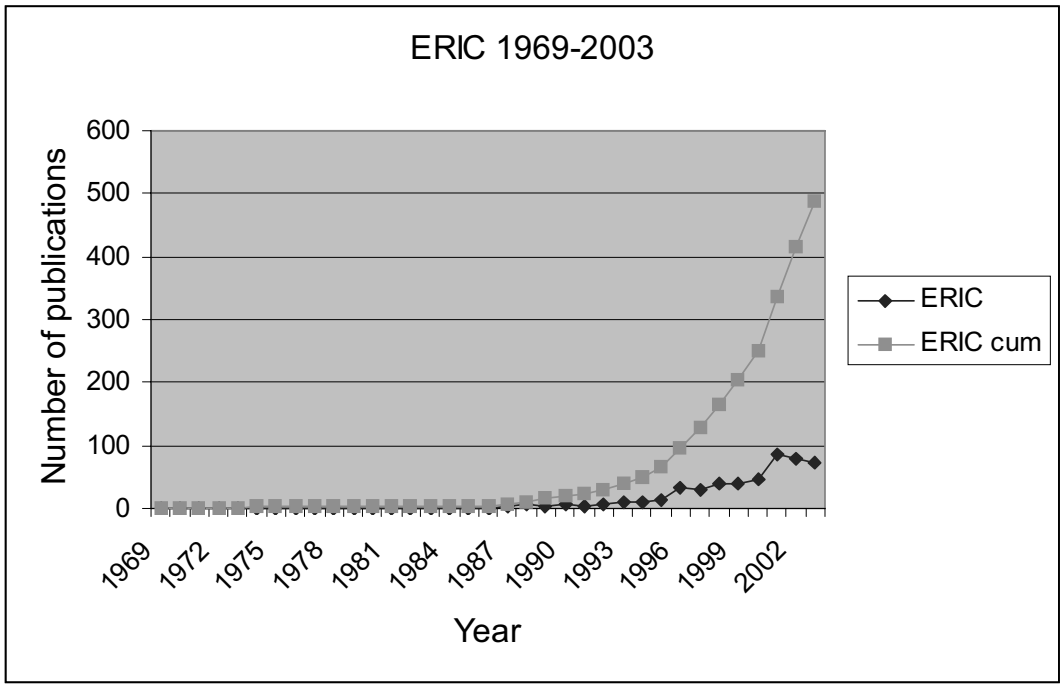


Figure 27: ERIC 1969-2003

On the basis of the data collected from the ERIC database a co-word analysis was made in order to find the networks of the most often used keywords. In 1998 there were 39 records with 287 keywords, 29 of them occurred at least 3 times, and they were chosen for closer analysis.

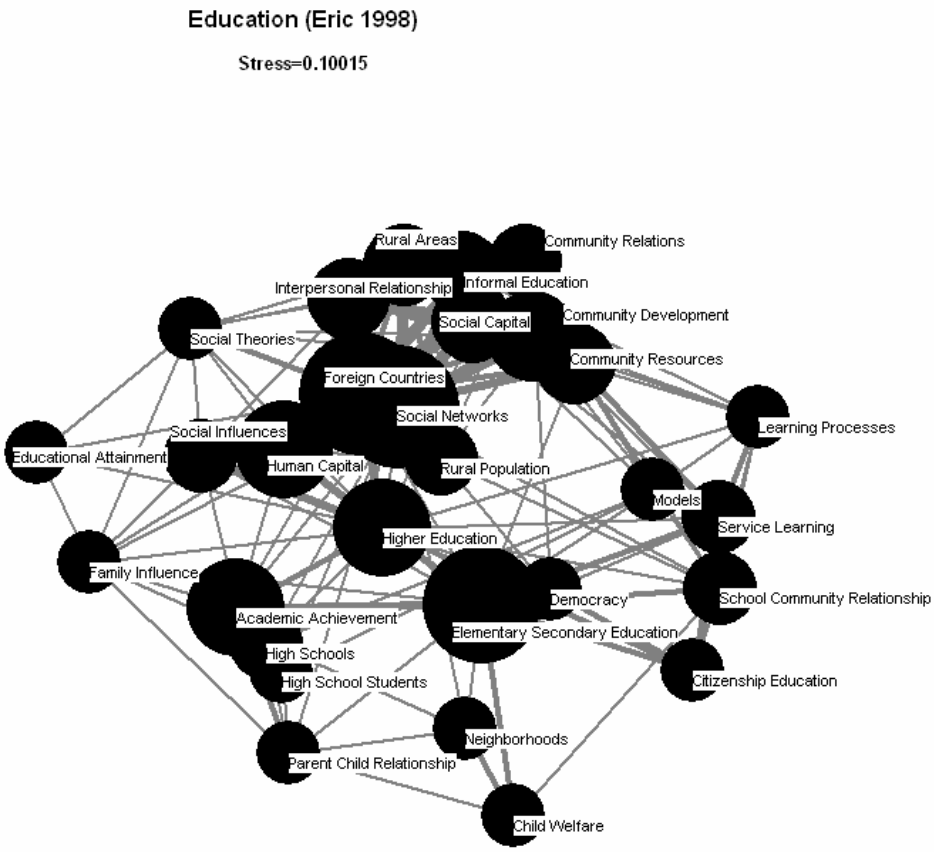


Figure 28: Education (ERIC 1998). Co-word analysis

In 1998 there is no clear one core. The figure has many cores that might refer to different schools and approaches. We can see some clusters, like "Family, parents, high school students and academic achievement" and "Communities, interpersonal networks and informal education". "Elementary secondary education and democracy" form a cluster with connections to other themes like "Citizenship education" and "School community relationship". "Higher education" is in the middle and it has links with many directions, strong links seem to be to "Human capital" and "Social networks". A strong cluster in the middle is "Human capital, social networks and rural population". "Foreign countries" also seem to be a central theme

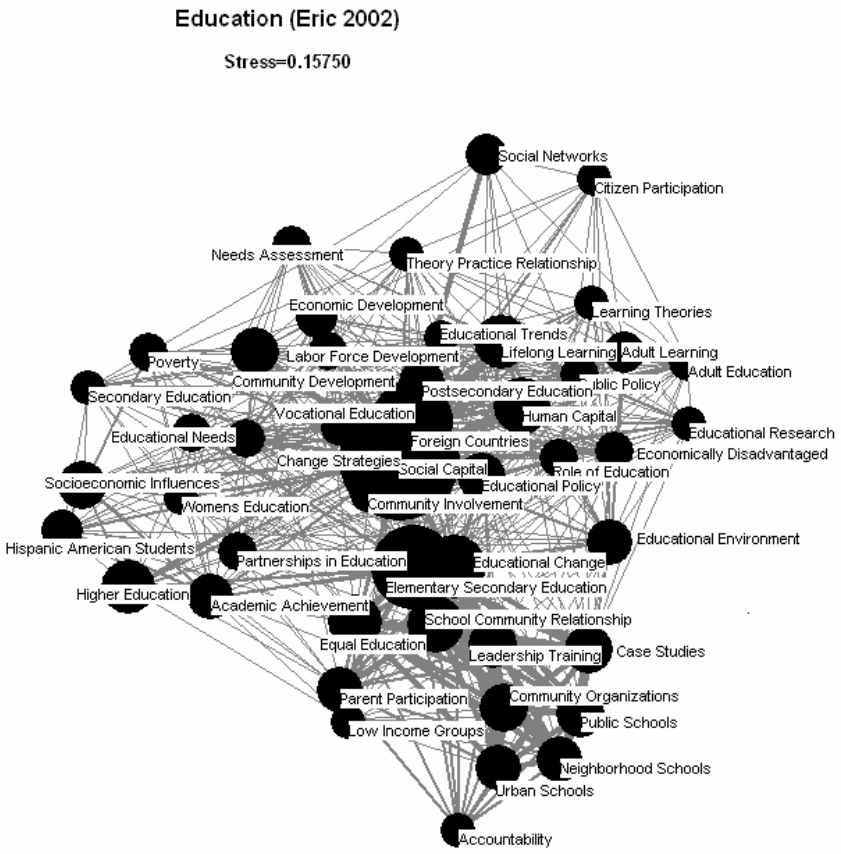


Figure 29: Education (ERIC 2002). Co-word analysis

In 2002 there were 75 records with 447 keywords, 45 of them occurred at least 7 times. These were chosen for a closer co-word analysis.

In 2002 there seem to be two cores. The shape of this figure is rather complete in the sense that the terms have a lot of links with each other. A core cluster includes ”Elementary secondary education and educational change” with strong connections to e.g. ”Equal education”, ”Parent participation” and ”School community relationships”. The other core cluster includes ”Social capital and foreign countries”, and also it has several links to different themes. A third cluster includes different themes of ”Learning”. On the ring we can find ”Social networks”, ”Citizen participation”, ”Needs assessment”, ”Poverty” as well as minority and ethnic problems.

4.7.3.2 Medicine

Medicine is one of the disciplines that adopted the concept of social capital in the middle of the 1990's. It belongs to the second wave. The main international database in the field of medicine is Medline.

In the Medline database the first social capital publication was recorded in 1979, the second in 1981, and then it took eight years until the next one appeared. More new publications appear in the second half of the 1990's. The annual number of new publications doubles from 1999 to 2001. It seems, however, that in 2002-2003 the annual number of new publications is not growing.

According to the model of Crane, the first stage was rather long (1979-1997), the second stage only a couple of years (1999-2001), and now it seems that diffusion in medicine is at the third stage (2003). It is possible that there are new approaches developing.

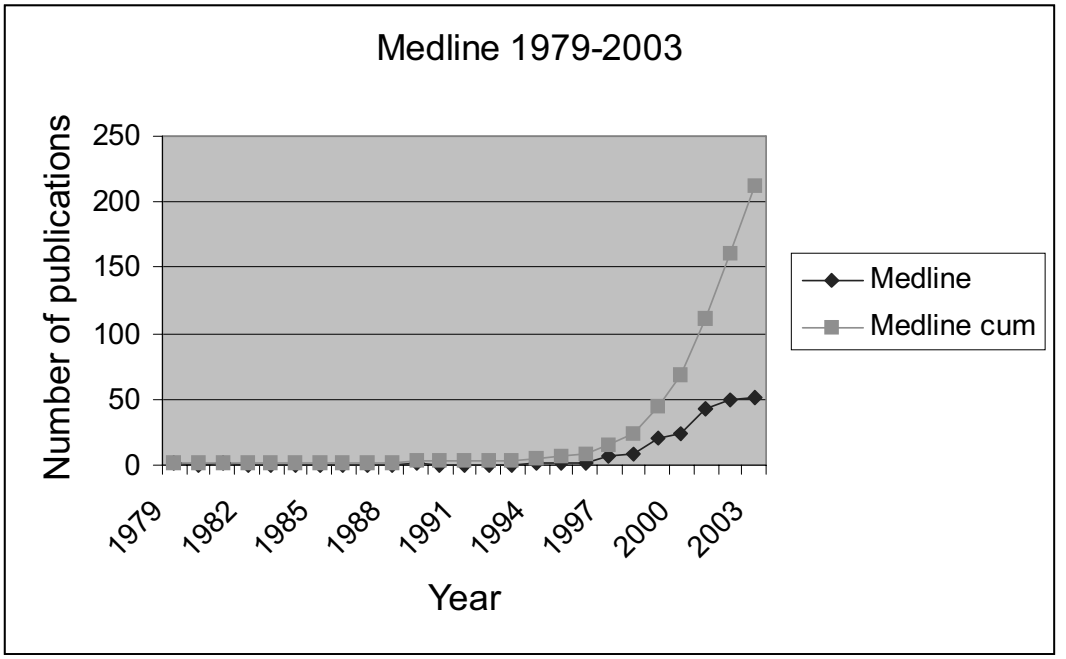


Figure 30: Medicine (Medline 1979-2003)

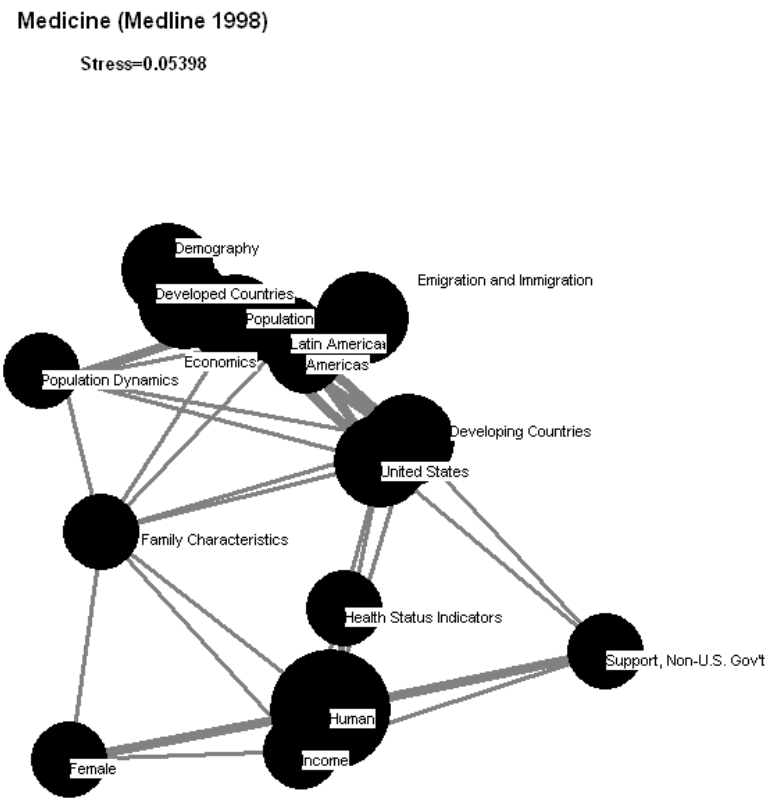


Figure 31: Medicine (Medline 1998). Co-word analysis

A co-word analysis shows the main themes in the years 1998 and 2002. In 1998 there were only 9 records with 83 different keywords, of which 8 occurred at least 2 times. So, 75 keywords occurred only once. Although the material is rather small, these were chosen for a closer analysis.

A cluster includes “Demography and population”, another “Health status, human and incomes”. Then there are separate themes. The figure is chain-shaped. As a conclusion we can state that in 1998 the social capital research themes in medicine were focused on demographic viewpoints.

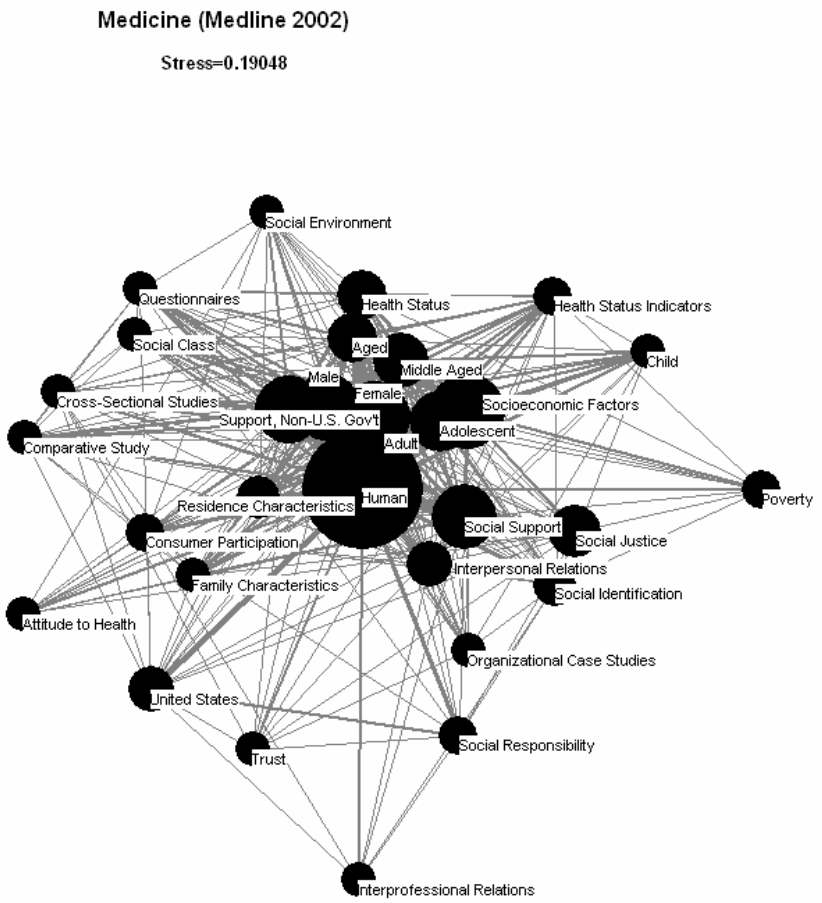


Figure 32: Medicine (Medline 2002). Co-word analysis

In 2002 there were 49 records, with 357 keywords, 31 of which occurred at least 4 times. Now there is a strong core with human viewpoint and different age and sex groups. Near the core cluster are also ”Supports”. On the ring there are ”Trust”, ”Social responsibility”, ”Social justice”, ”Poverty”, ”Social environment” and ”Social class”. The list of the most often studied themes does not include any special diseases. Social capital is connected with a social medicine viewpoint.

The figure is rather star-shaped with links to the human core. This gives us a clue that the viewpoint of social capital is in the social medicine and health studies.

4.7.4 The third wave disciplines

Two of the disciplines that have adopted the concept of social capital as a research viewpoint on the third wave have been business, organization, and management studies, and psychology. They are fields that are near to practice, and they also have interdisciplinary approaches. Sometimes psychology is included in social sciences, sometimes not. The analysis of the Business Source Elite and PsycINFO databases show that there were already some publications in the 1980's, but the growth of publications began at the end of the1990's and continued sharply at the Millennium. At the beginning of the 21st century, the annual number of publications is still growing.

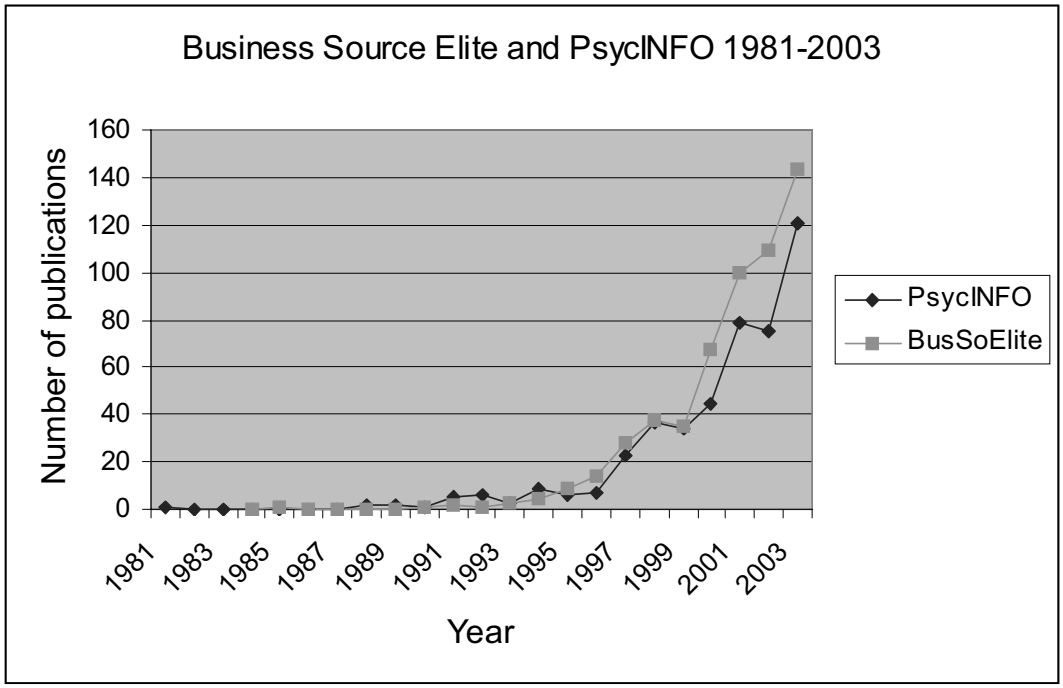


Figure 33: Business Source Elite and PsycINFO 1981-2003

4.7.4.1 Business and organization studies

Business, organization, and management studies are fields in social capital research that belong to the third wave. There are several databases covering research publications of these fields. The Business Source Elite database has been chosen for a closer study as an international database that covers years since the 1980's.

In the Business Source Elite database the first publication concerning social capital was published in 1985. It dealt with economic development in the Soviet Union. The next one was about consumer behavior and it was published in 1990. Then there were every year 1-3 new publications until the year 1994. In 1995 the growth rate changed, and at the Millennium social capital became a rather popular research issue. At the end of 2003 the total amount of publications on social capital was 555. It seems that the growth is still continuing; in 2003 there were 143 new publications on social capital.

According to the model of Crane the diffusion of social capital in organization, business and management studies had its first stage in 1985-1996. Then the diffusion has been rather strong. It seems that organization, business and management studies are now at the second stage, the period of normal science, when groups of collaborators and invisible colleges are forming.

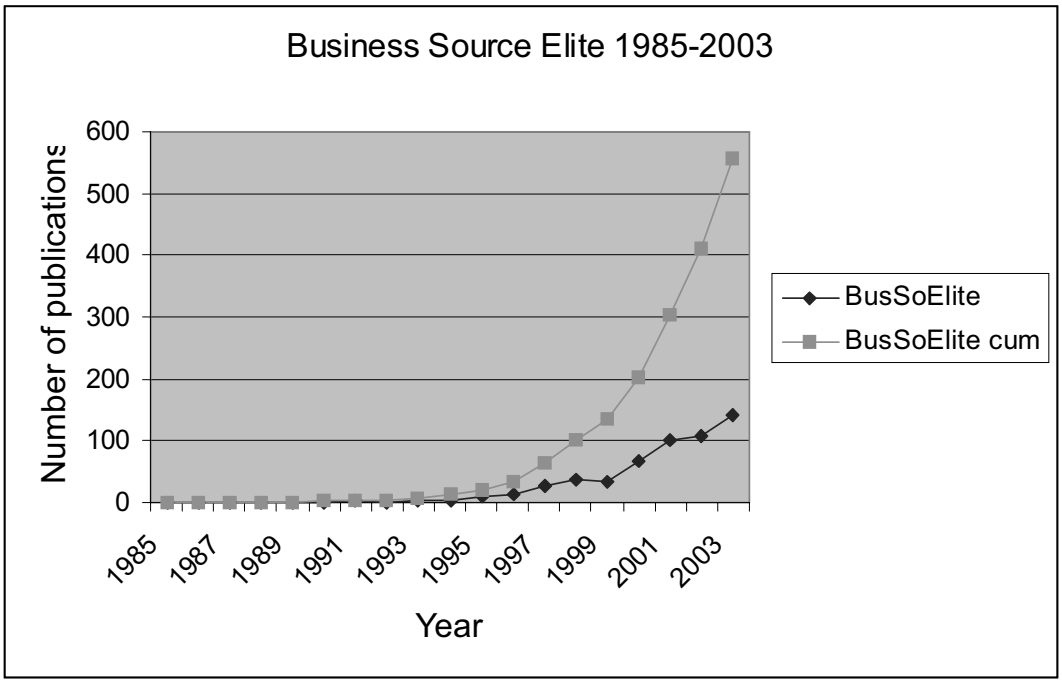


Figure 34: Business Source Elite 1985-2003

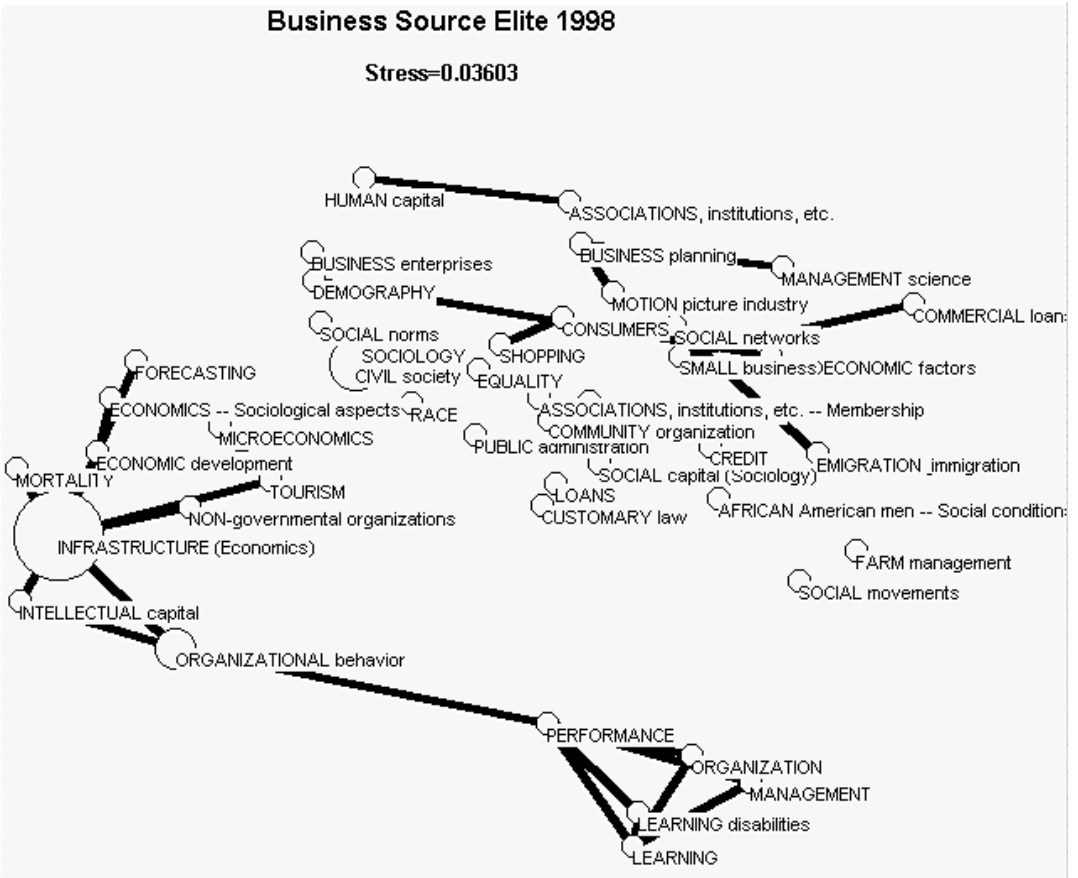


Figure 35: Business and organization studies (Business Source Elite 1998). Co-word analysis

In 1998 there are 31 records with 56 different descriptors in the social capital research. Most of them occur only once. That is the reason why all the terms have been exeptionally chosen for a closer analysis. There cannot be seen a core, but different separate clusters or themes without connection to others. A clear cluster includes “Learning, organization and management”. This cluster has a connection via “Organizational behaviour” to “Intellectual capital” and “Infrastructure (Economics)” with different economic aspects. A cluster includes “Sociology and demography”, but mostly there are isolated themes.

The figure is chain-shaped where the chain is partly in pieces. There are also terms without any links to other terms; this can be interpreted as a result of the indexing practice of the database. In 1998 there is little or no social organization in this field.

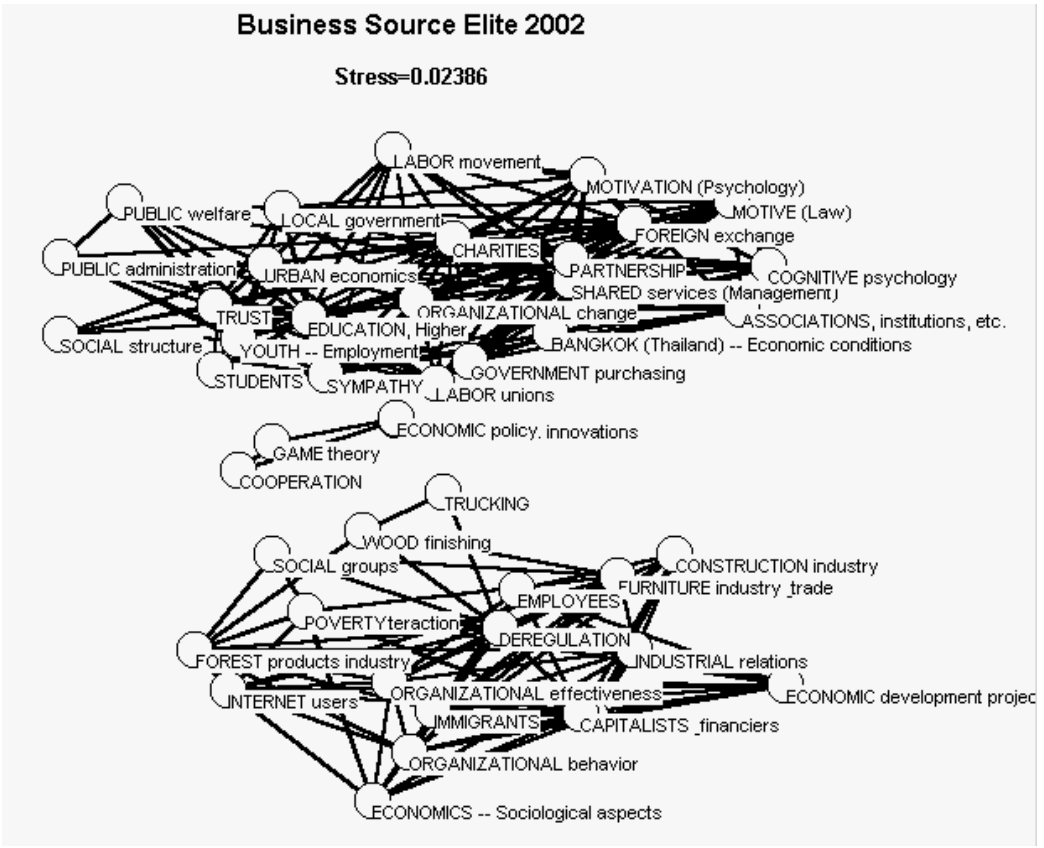


Figure 36: Business and organization studies (Business Source Elite 1998). Co-word analysis

In 2002 there were 93 records with 54 different indexing terms. The figure is formed so that there are two networks without a link between them. The first network focuses on labour and economics, with psychological and educational viewpoints. Most of the themes are connected to each other. The second network seem to include more macro level problems, like “Economic development project”, “Economics--sociological aspects”, “Organizational viewpoints” and “Internet users”. Both networks seem to be rather complete clusters. This can be interpreted as two scientific schools developing.

A co-word analysis after a few years might give a different figure. It is possible that these clusters unite or become still more isolated. It is also possible that there are more separate, satellite-liked clusters. These pictures may reveal something also about the structure and contents of the database. It is multidisciplinary, and this can be seen in this kind of an analysis.

4.7.4.2 Psychology

Psychology is a field of science that has adopted the concept of social capital on the third wave, at the end of the 1990's. The main international database in psychology PsycINFO has been studied closer. By analysing the PsycINFO database we can state that social capital was a point of view in psychological research first in 1981. The publications were connected with mental health and social support networks. It took seven years for the next two publications. In the middle of the 1990's there can be seen some steps forwards, and since 1997 the number of publications has grown clearly. The growth seems not to be fading; 25 % of all the publications of the 19-year period were published in 2003.

If we evaluate the diffusion of social capital according to the model of Crane, we can state that the research in psychology reached the first stage in the middle of the 1990's. At the Millennium it seems to be at the second stage, and we can deduce that it is moving to the third stage soon.

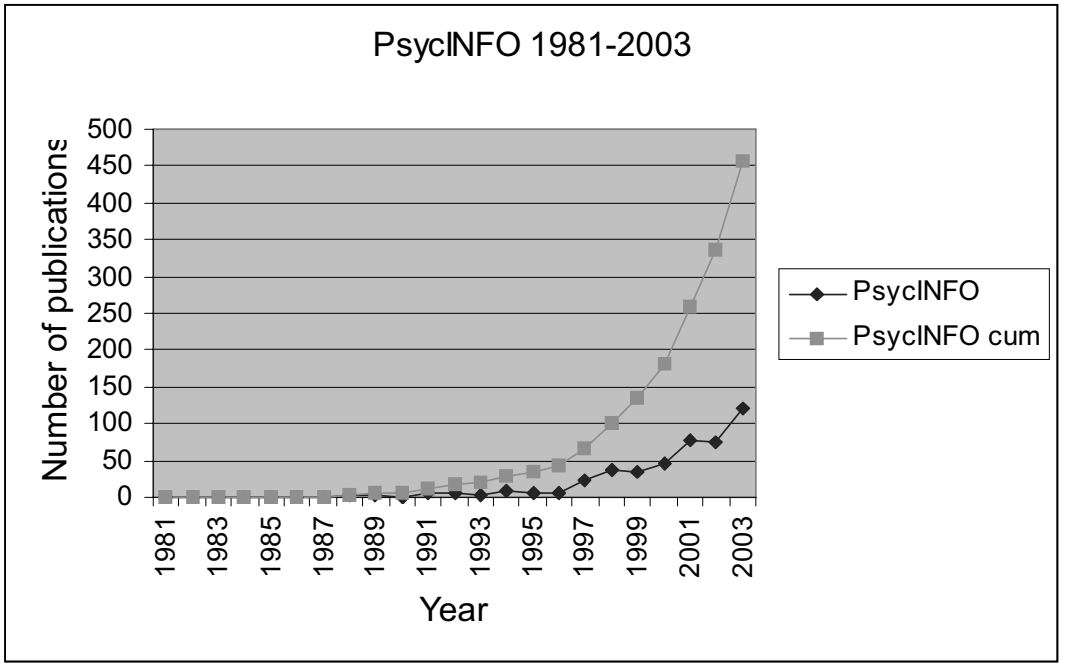
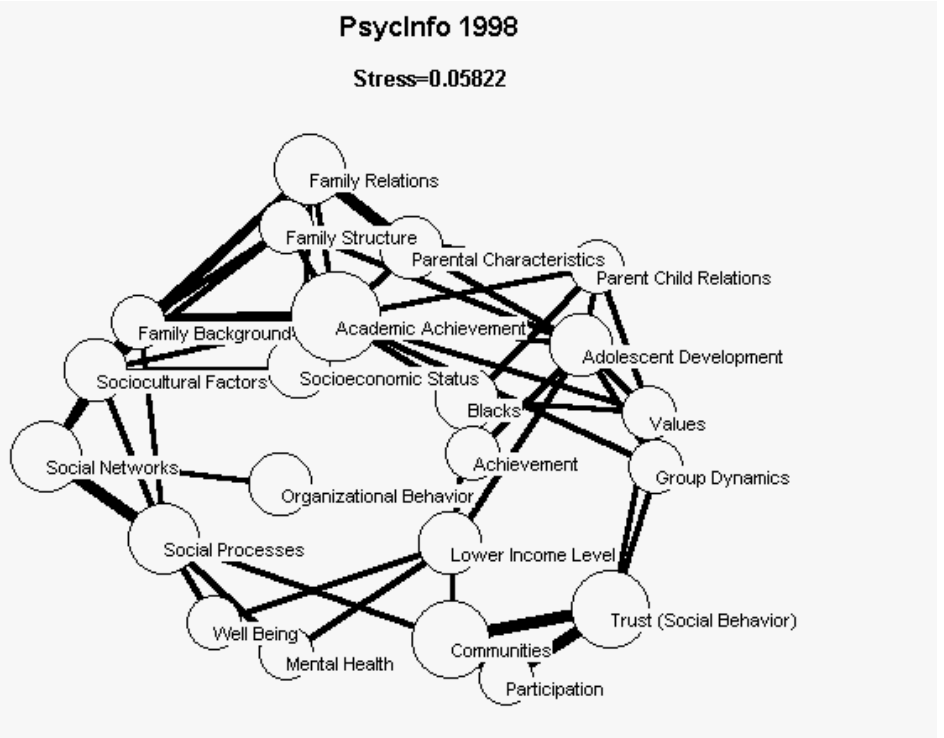


Figure 37: PsycINFO 1981-2003

Figure 38: Psychology (PsycINFO 1998). Co-word analysis



In 1998 there were 49 records with 170 keywords, 13 of which occurred at least 3 times. These were chosen for a closer study. The figure is ring-shaped with a few cross-links. Clusters of family (parents, children) can be detected, and these clusters have a strong link to academic achievements. No other clear cluster can be seen, but we can find a group of "Mental health and well being" with links to lower income level and social processes. A group of trust, communities and participation include elements that are the basics of social capital. There is no clear core of the networks, but a figure like a ring. We can deduce that there are no clear scientific communities, but some starting research lines or viewpoints.

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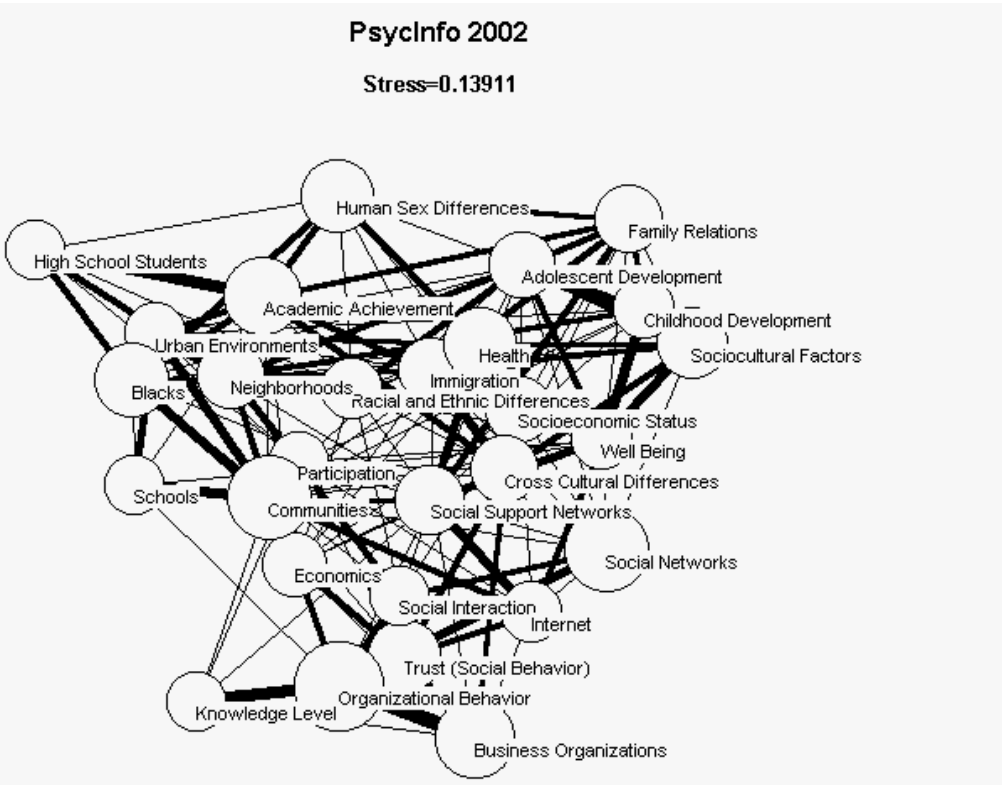
Figure 39: Psychology (PsycINFO 2002). Co-word analysis



In 2002 there were 435 records with 501 different keywords, 48 of them occurred at least 11 times. These were chosen for a closer co-word analysis. In 2002 the figure is more complete than in 1998. Several terms have links with other terms. There is no clear core, but some strong links and nodes. The terms concerning ”Business and organization” have links to “Knowledge level” and “Trust”. Another cluster includes “Family relations”, and it has strong links with well-being and health. A new term is Internet, and it has links with social support networks, trust, communities and well-being.

4.7.5 Summary

It seems that publications of social capital in different databases include same kinds of theme. They also seem to be interlinked; there are themes of business and organization in the psychology database, and vice versa. Education and psychology are close to each other, and sociology has different special sub-fields that are interdisciplinary.

When comparing the years 1998 and 2002, it seems that in 1998 there were more general themes. In 2002 the research has become more specialized in many fields, and specific research questions have arisen. The references of *Sociological Abstracts* include many of the themes that are included in other subject databases. We can draw the conclusion that the specific research themes have diffused from sociology to other, more applied fields of sciences. Maybe they have acted like an embryo of some theme in the framework of sociology, and then developed towards concrete research problems in specific fields.

These database analyses give a picture of the international development of research on social capital as three waves with different subject fields. In Finland, the development has been somewhat different. Invisible colleges and networks between researchers have been important, especially at the first stage. However, it seems that diffusion is partly dependent on the public financing of research.

When considering the diffusion of social capital in Finland, we have to note that there were some influential senior researchers, who have international and national networks and contacts both in science and outwards playing a leading role. They have themselves social capital. When they have paved the way to the others, they may stand aside and let the next generation continue. This is an interpretation on the basis of the interviews.

It seems that according to the model of Crane Finland is now, in autumn 2005, at the third stage of development at a general level. Separate specialties may be at different stages; some have just realized the idea of the umbrella concept of social capital, others have moved forward. We have stepped from the stage of groups of collaborators and invisible colleges to the next step. The research program and financing of the Academy of Finland have supported this. Increasing specialization and increasing controversy can be seen, as well as solution to major problems.

4.8 Social capital and the web environment

In the digital era, the Internet is a powerful tool for information exchange and networking. Web pages, electronic journals and books, databases and discussion forums are examples of this. According to interviews with researchers and specialists, the Internet has been important both in information-seeking and dissemination in the case of social capital.

4.8.1 Social capital web pages on the Internet

Earlier it was a matter of course that stages of the institutionalization of a new scientific discipline included its own journal, a scientific society, and finally a department at a university. Nowadays, it can add its own web pages, and it seems that this is one of the first steps of this process.

According to the interview with Kajanoja (2002) the first Finnish web page on social capital was founded after a seminar to which a handful of researchers, specialists of social and economic problems and some other influential persons and opinion leaders were invited. They came to a conclusion that social capital research is worth promoting, and one way was to inform and exchange information via web pages. The web pages were founded as a part of the Government Institute for Economic Research web pages.

Later on some similar web pages were founded by *Statistics Finland*, *Finnish Social Science Data Archive* and, finally, as a part of the research program of the *Academy of Finland*. They all have their own profiles, goals and links.

On the Internet, there are many web pages that deal with the theme of social capital. A Google search with “social capital” gave a result of about 1 380 000 pages, of which in Finnish about 355, and in Finland about 16 000 pages (in May 2005).

On the basis of these web pages two kinds of analyses have been done. The aim of the first analysis is to detect a network of web pages, starting from a Finnish scientific web page.

A result is that there are some web pages of social capital, but they have not been updated. It seems also that constructing a web page depends on some active persons, who collect material and links, but if they change post or if the theme is no longer current in an organization, the web page becomes mummified.

My original intention was to start from a Finnish social capital web page in order to find outlinks to other organizational web pages and to build a map of the networks. I found, however, that in 2002-2004 there were collected much material that is no more valid. There are good lists of research resources and material (Statistics Finland, Finnish Social Science Data Archive) and links to research programs in Finland and abroad (SoCa research program of the Academy of Finland). Also there are occasional links to web publications (Government Institution for Economic Research). They are not updated and the links to other organizations often break.

The same problem occurs with international web pages. The World Bank PovertyNet has a lot of information, but there is no clear list to outlinks to web pages of other organizations. There are, however, many links to different net publications. In May 2005 these web pages were under development and it is possible that the structure of the pages has also been changed.

"Social Capital Gateway" of the University of Rome (http://www.socialcapitalgateway.org/ 31.5.2005) is a qualified web site with classified links that are updated. This page is edited by Fabio Sabatini, a PhD student who is interested in social capital research. It is, however, one of those web sites that seem to be a result of an active researcher, not an organization. The future of this kind of site is rather uncertain.

The biggest problem in using web pages as research material and especially as material of webometric studies is that they have different structures. There is no standard web page construction. Often the web pages have been built sporadically and by enthusiasts. When these people are no longer interested in this theme or when they move to another post the web pages are not developed or updated. Also, the web pages are unique and there are no standards set for their creation. As research material, the web pages need different tools and more qualitative methods of content analysis.

The aim of the second analysis is to find themes of social science web pages. The material has been collected from SOSIG (Social Science Information Gateway) and Sociological Abstracts in May

2005. The material has been combined, harmonized and duplicates have been removed. The analyzed material includes 52 web sites, and there are 145 different keywords that have been given by the indexers of SOSIG or Sociological Abstracts. On the basis of a co-word analysis a picture of the links and networks of the themes the Web pages has been built. For a closer study keywords that appear at least twice have been chosen; the amount of terms are 25.

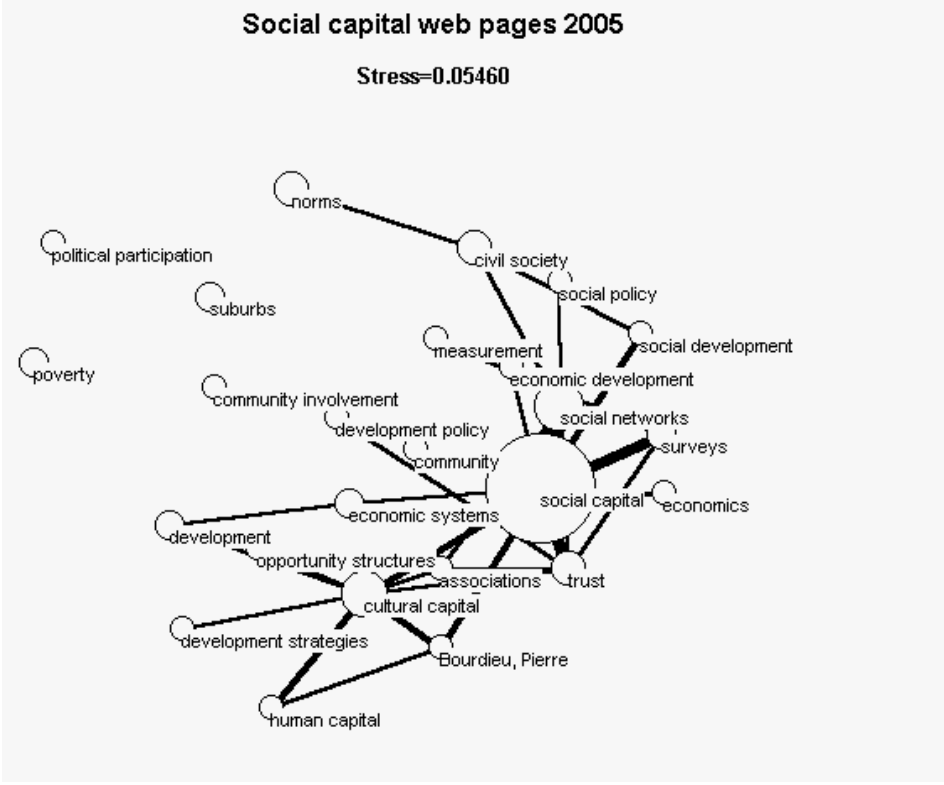


Figure 40: Social capital web pages 2005. Co-word analysis

In the centre is social capital with strong links to social networks and trust. Some weak clusters can be seen. One of them includes cultural capital, human capital and Bourdieu. Another cluster includes social and economic development, social policy and civil society. Then there are themes that are not linked to others, like poverty, political participation and community involvement.

In summary, the themes of web pages are very similar to themes of publications. The structure of the picture of the co-word analysis is looser. Its shape is chain-like. It is possible that this tells us something about themes and the structure of web pages, as well as the indexing of web pages in

databases. Also the subject coverage of web pages is much wider than e.g. journal articles, and they are not indexed as detailed a manner.

4.8.2 Discussion forums

Another, more personal way to participate in the current issues is by membership of discussion forums. According to one interviewee (Kajanoja) a social capital discussion group was founded after the earlier mentioned seminar in 1998. The aim was to form a network. Later also as a part of the research program of the Academy of Finland a mailing list was founded, and it is also coordinated by the project coordinator. These kinds of lists are often available only on request, and they are not necessarily open to all. This kind of discussion groups and mailing lists are the basis of "electronic invisible colleges" (Brunn and O'Lear 1999) where researchers can meet researchers of the same specialty.

According to a Google search in May 2005, there are about 3060 messages on discussion groups that deal with social capital in the world, and 39 in Finland. These messages are on several open lists that are focused on different fields from sociology and politics to physics and human relations.

A closer study of the discussion forums and mailing lists of social capital might be a task of another study. They can yield fresh data about the informal communication between researchers. Anyway, discussion forums are important in the formation of new information, and they have also different functions in different kinds of information-seeking and exchange as Lotta Collin (2005) has found in her study.

4.9 Social capital outside the scientific communities

Social capital is a term that has diffused to information sources outside the scientific communities, for example to speeches of presidents, to newspapers, to professional journals, to weekly magazines and finally to professional practice and everyday speech.

Putnam has been influential also in this sense in the USA. According to his home page (www.infed.org/thinkers/putnam.htm 31.5.2005), he has been the focus of seminars hosted by Bill

Clinton at Camp David and Tony Blair at 10 Downing Street. George W. Bush has also used in his speeches the ideas of Putnam. The decline of civil engagement in the USA has worried a number of politicians and commentators. Putnam has been interviewed in newspapers like *Sunday Times* (25.3.2001) and on radio.

In Finland, social capital has also been a topic of politicians. In this sense, one of the first was the President of Finland (1994-2000) Martti Ahtisaari, who spoke about the meaning of social capital in the society in his New Year Speech on the Finnish National TV (Ahtisaari 1.1.2000). Also Paavo Lipponen, the then Prime Minister of Finland, spoke about the meaning of voluntary work and social capital in a seminar at the Parliament of Finland (Lipponen 4.12.2001). At the same time, the Committee for the Future of the Parliament of Finland asked for professor Lea Pulkkinen to write a report about social capital, and in collaboration with Dr Pekonen, she published a book, where she also implemented a new concept of 'initial social capital' (Pekonen & Pulkkinen 2002). The second report for the same committee focuses on this concept, children and ICT (Mustonen & Pulkkinen 2003). Pulkkinen is a famous researcher in psychology, and she has been very influential in the diffusion of the idea of social capital in Finland.

At the Millennium, some of the political parties in Finland exploited the concept of social capital for political purposes. The term can be detected in the program of the principles of the Social Democratic Party of Finland (1999), the program of principles of the Green League of Finland (2002), the program for the Parliament election 2002 of the Centre Party of Finland, and the political and economic program of small parties "Finland rises – nation unites" (2002) and "Finland – Fatherland" (2003). In the 2004 municipal elections, the term social capital was included in election programs of political parties, like the Green League, the Social Democratic Party, the Swedish People's Party, and the Centre Party. (See "Aatemaatti" (Ideamatics) of the Finnish Social Science Data Archive (FSD) http://www.fsd.uta.fi/aatemaatti/).

The Finnish newspapers *Helsingin Sanomat* (the leading daily newspaper in Finland) and *Hufvudstadsbladet* (the leading daily Swedish-speaking newspaper in Finland) have published noteworthy articles in Sunday editions at a time when there were only few research publications on social capital, i.e. when the concept was in the scientific communities at a conceptualization or documentation stage. It is difficult to say, what was the first article or news item in Finnish newspapers, because newspaper articles are recorded in databases only occasionally, and newspapers' own databases on the Internet have been available only for a couple of years.

However, one of the first articles in *Helsingin Sanomat* was an interview of two Finnish researchers, Jouko Kajanoja (economist) and Esa Saarinen (philsosopher), who have been active both in science and in social life. The subtitle of the article "Social capital – a new fashion term of social sciences – unites an unexpected pair" includes the idea of social networks and connections, and also interdisciplinarity and social activities (Snellman 1999). It is difficult to believe the solidity of the term 'social capital' when the author uses the word 'fashion'. A more concrete article from the same year in the column "Work and economy" deals with networks, social capital and unofficial decision-making process in economic life, for example while a group is skiing, hunting or in a sauna (Isotalus 1999).

Health and welfare are human interest themes, and Markku T. Hyyppä, a medical doctor, has been an active popularizer of scientific knowledge. His column "Trust makes welfare" deals with social capital, the life of Swedish-speaking Finns and their culture (Hyyppä 2001). An article two years later focused on the health of Swedish-speaking Finns and their social capital: choral singing, good friends and social networks (Snellman 2003). This article seems to be inspired by studies of Hyyppä and his colleagues. It is no wonder that one of the latest articles in *Helsingin Sanomat* is an opinion letter to the editors about the meaning of culture and social capital to health (Hyyppä 2005). - Other opinion articles have been concerned with, for example, public services, municipalities and citizen participation (Ovaska 2003).

It is quite natural that *Hufvudstadsbladet* has been interested in the life of Swedish-speaking Finns. In 2003 several articles on social capital were published. The network and social relations are the focus (Rosenberg 2003). Happiness and good health interests the newspaper (Mattheiszen 2003). An article deals with research on the population group, and social capital is a viewpoint (Saarela 2003), and two days later Hyyppä continued on the same theme (Hyyppä 2003). Hyyppä explained in the interview that he had been a goal-oriented popularizer of science for years.

Some leading provincial newspapers like *Aamulehti, Turun Sanomat* and *Savon Sanomat* have also been interested in social capital. In 1997-2003 ALEKSI database recorded 28 articles. Some of them are opinion articles, some editorials, some reports. The themes vary from health and welfare to networks and economic co-operation.

In some weekly magazines there have been interviews with Hyyppä on health and social capital (Lamberg 1998; Malmberg 2003; Stenius 2000). In a women's magazine there was an article on trust, networks and social capital (Niemi 2002). In the weekly journal, *Suomen Kuvalehti*, there have been some more philosophical essays on social capital (Heikka 1995; Heikka 1999; Heikka 2001).

Social capital has also been the focus of professional journals. According to the Finnish databases many professional and occupational groups like social workers, information specialists, voluntary workers, local administrators, rural activists, health workers, IT specialists, gerontologists, youth workers, educators and other professionals working with children and young people have been interested in social capital. Often editors of professional journals also have academic education, and they can be classified as amateurs of science (cf. Meadows 1998).

4.9.1 Social capital in professional practice

Social capital is a concept that has also attracted people working in practical professional work in several fields, like health and social work, education and libraries. Among others, the Finnish social workers had "social capital" as the theme of their national conference in 2002. For this study two professionals of library and information field have been interviewed. They were two of the first to use this concept in publications (Niinikangas & Näätsaari 2000, 115; 120-121). They both have also been interested in scientific and post-graduate education and have worked both in practical library work and as trainers of library staff.

Niinikangas and Näätsaari used the concept when they were planning their library management projects. "It was connected to a kind of know-how barometer that we were developing. We both had an idea about what we should know in the library and information work. …We were talking about intellectual capital, on an individual level, not on the community level… It was kind of our own discovery. It suited well that there is cultural capital – and social capital. We thought that it describes that side with which it is possible to develop the communicative side in management." (Interview of Niinikangas & Näätsaari 2003)

They deduced the term on the basis of their earlier knowledge. They had not read Robert D. Putnam's works, but they knew about Bourdieu's thinking. In the interview they thought themselves that it is possible that Bourdieu has unconsciously influenced their thinking.

The know-how barometer (Niinikangas & Näätsaari 2000, 115) and the figure of the structure of social capital with "annual rings" did attract library professionals in seminars and discussions. Niinikangas and Näätsaari wrote an article for a Finnish library journal that – in their own opinion - did not get any special feedback from Finnish librarians. Some librarians were interested in it in St. Petersburg so much that the article was translated in Russian and published in a Russian library journal in 2003.

Niinikangas and Näätsaari understand that social capital includes management of oneself, communication and interaction, understanding a situation and showing direction, and management of others. They emphasize networks and working in teams, as well as interpretation, understanding, listening and learning. They believe that social capital means a change of paradigm now when it has become a point of scientific discussion in information studies. It enlarges the field to a more social perpective. (Niinikangas and Näätsaari 2003.)

They are typical examples of gatekeepers (Rogers 1995) and active disseminators of new knowledge, as they work in information professions and have also academic training. Meadows (1998) calls them 'amateurs of science'. They are active people with contacts to different spheres.

4.10 Funnel of interest of Social Capital

At the beginning of this study the concept of 'funnel of interest' was introduced. This concept describes the progression by which a reader is gradually obliged to take into consideration the specific results of a paper. Law (1983) shows that when authors set up their arguments, they carefully determine which interests they want to capture, and how they wish to do this.

The macroterms of Social Capital have in this study been shown to move from the Milestone Publications (Bourdieu, Coleman, Putnam) to the funnel, and finally to the new macroterms of different subject fields. The process as a whole can be schematized as in the following figure. It is like a double-mouthed funnel, wide at the ends and narrow at the middle.

The general terms, often theoretical, take readers into a funnel. At the other end are the research themes that are connected with the signal word, here Social Capital. The research themes can be either theoretical or conceptual (as in sociology) or more practical (as in education). These new terms take a reader to new themes and research problems. It is possible that a new macroterm that is as influential as Social Capital will arise. On the basis of this study it can not yet be detected, but this could be an issue for future research.

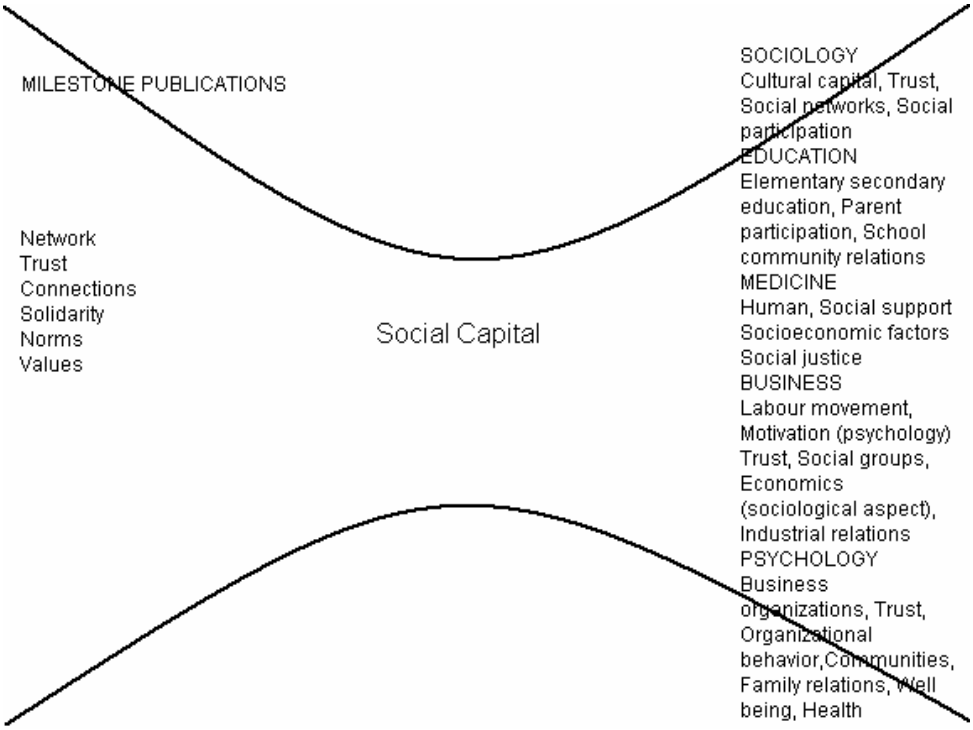


Figure 41: Funnel of interest of social capital

In this figure, the signal words are the terms that are in the core of the definitions of the Milestone Publications. They lead a reader or information-seeker to the macro-term Social Capital. Social capital in turn takes them into new themes, new signal words that are connected with social capital. These signal words are different in different fields of sciences and reseach areas. Some of them may be the same as those at in the other mouth of the funnel. These words, again, can lead to another funnel with new signal words and macro-terms. This is never-ending process and belongs to the development of science.

It is possible that this can also be seen on a general scientific level. The material of this study did not give answers to this question. It needs more specific studies and focus on this theme. This is a challenging problem for future research.

4.11 Invisible colleges and scientific networks

Informal connections between researchers have an impact in the diffusion of new knowledge, as we have noticed in this study. Often the diffusion process is based on earlier connections, but during the process new connections are often developing. In discussions between researchers new ideas are born. This is much about what Fleck (1979) states about thought collectives. Loose social circles have a role in the diffusion of new ideas (Crane 1975). In social circles we can meet both scientific expertise and social and political influence.

For this study, the Finnish gatekeepers were asked, who they think belongs to the influential persons in the diffusion of social capital in Finland, and what kind of networks they believe there are. A sociometric map has been constructured on the basis of their answers. The respondents themselves have not been added to the map.

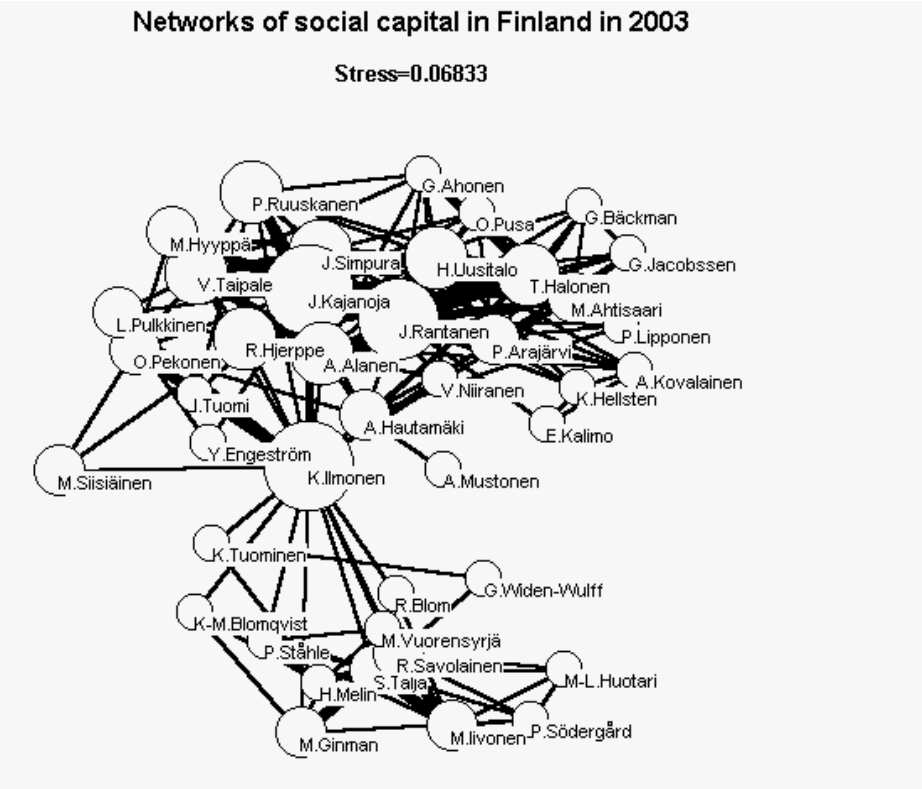


Figure 42: Networks of social capital in Finland in 2003

The figure includes two clusters. The main cluster includes those researchers and socially influential people like politicians that have been active at the first stage of the diffusion. Many of them have participated in the first national seminars on the theme in 1998. Two of them, Ahtisaari and Halonen, have also been the Presidents of Finland, and Lipponen was the Prime Minister at that time. The other cluster includes researchers of the second wave, and they are mostly information scientists or their colleagues in their present activities. The connecting link is Ilmonen, a sociologist who is one of the first Finnish social scientists to be interested in trust, co-operation and social capital for several years. His publications are well-known and influential in different fields of sciences.

It is interesting that most of the interviewed experts who represent different disciplines had such similar opinion about the networks and influential persons. On the other hand, the information

scientists seem to have their own views of the network. The reason may be that they belong to a later wave of social capital, and have a different viewpoint. They see more concrete research problems, whereas the first wave experts see the network of those researchers that brought the concept to the Finnish discussions.

This gives a picture of the networks where the respondents themselves feel that they belong. Most of them are the innovators or early adopters of the concept, and they participated in the first seminars. It is self-evident that they mention their colleagues or mates.

It would be interesting to conduct a similar interview now, and ask the researchers who found out about social capital later about their networks or their conception of those networks.

5. Discussion

The aim of this study was to find answers to several research questions. In the course of the research project new questions have also arisen. In the following chapter, we will see how the research questions have been answered, and which new research themes have been developed.

5.1 The research questions

When did the term occur the first time? Who introduced it?

Social capital is a term that became popular in different fields of sciences in the 1990's. Rather soon it became popular in the media and now it is used in everyday languge. The database analyses show a sharp growth rate of publications at the end of the decade. The first publication in which social capital as a concept appeared for the first time in scientific discussion was published as early as in 1916. It is possible that someone else had used the term earlier either in speech or in publications, but Hanifan's article (1916) is the first that can be traced in bibliographies, databases and review articles (see Woolcock 1998, 26-31). This is the phenomenon that Rogers (1995, 15) calls 're-invention' of a term. This article is also a Sleeping Beauty in the field of social capital studies.

In what context and in what subject field did it occur?

The field in which the term *social capital* occurs for the first time is education. Hanifan was a practical reformer and a state supervisor of rural schools in West Virginia. He emphasised the meaning of school in the development of a rural area and picked up the great importance of community and in this sense, social capital. The article was published in *Annals of the American Academy of Political and Social Science* that has published articles that belong widely to social and political sciences.

Half a century later the concept was re-invented or "reincarnated" in the field of sociology. We can state that on the crest of new waves of social capital sociology was the forerunner science.

Which publications were important when the term was introduced?

Hanifan's article was not so impressive that it could have caused a boom in research on social capital, or even discussion on it. There is no trait of this in the literature. It became a cited publication as late as in the 1990's, i.e. 80 years later. We can call it a Sleeping Beauty of Social Capital. According to bibliometric analyses and content analyses of social capital publications, the next smooth wave of social capital research rose in the1950's and 1960's in Canada and in the USA. In the 1970's, Bourdieu used the term as "one of his capitals". Some other European researchers used the term, when it included the meaning of characteristics of an individual. The American concept that became popular in the 1990's by Coleman and Putnam includes the feature of a community or a larger society.

However, it seems that it is not possible to name just one important publication. According to the bibliometric analyses and the interviews that were done, three publications were chosen as so-called Milestone Publications of Social Capital. These publications have been cited year after year and are still cited again and again. These are Bourdieu's article (1986), Coleman's article (1988) and Putnam's book (1993). The last one has been most important in the popularisation of the concept, and it is still highly cited in spite of the later publications on social capital by Putnam (1995, 2000).

Were these publications cited or used as hyperlinks? How?

All these publications have remained highly cited over the years. They are also included in many web articles, now when the information about these publications or the full-text can be linked.

Putnam's book is not freely available on the Internet (a scholar.google.com search, made in May 2005). It was, however, possible to look inside the articles of the book at Amazon.com, and see the contents, the first chapter and the index. Bourdieu's article could be detected on the Internet by a scholar.google.com search in May 2005 (http://www.viet-studies.org/Bourdieu_capital.htm). The availability of this publication tells us about the changes that are happening all the time on the Internet: at the beginning of 2005, this article was not found on the net. Coleman's article is included at least in the JSTOR electronic journal collection, and has a stable URL (http://links.jstor.org/). Both of these web publications can be used as a hyperlink in web publications.

In general, we can assume that when more scientific publications are available on the Internet either in the electronic collections of libraries or on the Open Access web sites, the researchers can find them better and make more hyperlinks in their articles. The hyperlinks form a network of paths from one issue to another. Tracing hyperlink paths on the Internet is one interesting theme for research of information studies and social studies of science in the future, when there is enough material for research, and when the publishing culture of researchers has changed so much that publishing on the web is more the rule than the exception in scientific communities.

How did the growth of publications based on the term proceed?

The growth of social capital publications was occasional in many subject fields until the beginning of the 1990's. Bibliometric analyses that have been made on several subject databases, as well as on the interdisciplinary Web of Science databases show that in the second half of the 1990's there was a clear and often sharp increase in social capital publications. It seems that in fields like sociology and economics the annual rate of new publications has declined. It may be temporary or it may be a sign of a new concept or paradigm. During this research process it was not possible to find it out, but a new study after 5-10 years might tell us more about the trends. In education and medicine the growth rates seem to have slowed down. In psychology, and business and organization studies the annual number of new publications is still growing. The concept of social capital was implemented in these fields later.

Did the concept influence the development of the subject field?

The bibliometric analyses show that the concept must have had influence on the development of subject fields like sociology, economics, psychology, education, business and organization studies and medicine. The number of publications has been growing, and the subject descriptors illustrate new fields of research that have been influenced. Some other fields such as agriculture, library and information studies, and political sciences have also been influenced. The expert interviews confirm this result.

The sociologist who was interviewed in this study does not think that there is a paradigm change; he said that the phenomenon of social capital has come into discussions. It is like a Trojan horse that brings rational thinking in social sciences. A multidisciplinary social scientist thinks that in

economical welfare studies there is a paradigm change. The economists said that maybe there is no paradigm change but a new point of view on research, a softer social point. The health economist thinks that the paradigm change is possible. He said that maybe not in economics, but in sociology and social policy studies. Also in health studies it has given a new viewpoint. The researcher in health and medicine believes that the paradigm change is real; in health sciences and epidemiology many things progress rapidly so we can not examine health only from a narrow medical point of view.

The researcher in psychology does not believe that there is a paradigm change, but we can see social capital as an interpretative addition to the research. Also it means that in psychology the social psychological side is taken into account. The researcher in education thinks that there is a paradigm change and new viewpoints to the field. In library and information field the interviewed experts that work in practice believe that in information science there will be a paradigm change from a technocratic and information system viewpoint to a more social view. Both of the interviewed information scientists are interested also in organization studies. They see the importance of social factors to information studies. One of them hopes that there will be a paradigm change that means change to a more social from an individual viewpoint.

As Kuhn says, the paradigm is what the members of a scientific community, and they alone, share. Conversely, it is their possession of a common paradigm that constitutes a scientific community of a group of otherwise disparate people. (Kuhn 1974, 294) On this basis we can assume that a paradigm change is happening in some fields, and at least a new viewpoint has been adopted in many disciplines. Another thing is, how long a new paradigm lives.

Did the term have an impact on the language?

A new term has an impact on the language when it has been approved generally into the everyday speech. According to the bibliometric and content analyses, social capital is a term that has been used also in newspapers and weeklies, i.e. in mass media. It has been approved as a part of the language that the ordinary people understand, or little by little they will understand the meaning of the concept, if it is often used in the media. It is also possible that a fashion term will be an empty slogan, and people understand it in a different way in different situations. As one of the interviewed researchers said, “it can be an umbrella concept that covers several meanings”.

A new term has an impact on the language also when it has been accepted into vocabularies or thesauri. As we noticed earlier, the thesauri of ERIC, EconLit and PsycINFO have approved "Social Capital", but not e.g. *Thesaurus of Sociological Indexing Terms* that is used in indexing of the *Sociological Abstracts*. Also, The *International Encyclopedia of Social and Behavioral Sciences*, *The Concise Oxford Dictionary of Politics*, *The Oxford Companion to the Politics of the World*, *Dictionary of the Social Sciences*, *A Dictionary of Sociology* and also *A Dictionary of Geography* include a chapter of "Social Capital" in May 2005.

How was the concept defined? What other terms where used to describe the concept?

The concept has been defined or understood in different ways in the Milestone Publications, but the different definitions include the same elements of community, trust and networks. The same elements can also be found by co-word analysis. In the interviews for this study, the experts refused to define the concept, but they explained how they understand it or which elements they think are included in it.

The other terms to describe the concept were studied with Dialog rank analysis, co-word analyses of selected subject databases and interviews.

According to the Dialog rank analysis – if the terms that refer to some subject issues like education and terms that refer to countries or nationalities have been cleaned away - the most often used terms to describe the concept are human capital, civil society, social networks, community development, social aspects, democracy and trust. In co-word analyses of different databases, the same terms and synonyms of these terms are on the top.

The interviewees mentioned as synonyms or narrow terms of social capital, social intelligence, co-operation, knowledge management, intellectual capital, cultural capital, human capital, social cohesion, welfare and social policy, social networks, clusters (in economics), growth theory of new economics, changes in social structures, economic growth, social support, sense of belonging, community spirit, sense of coherence, trust, solidarity, social, economic, organization, interaction, and organizational capital.

How did the term diffuse to other fields?

It is not easy to show how a term has diffused to other fields. If we think about the chosen Milestone Publications and their authors, the field where the concept and term has developed is sociology. Sociology belongs with economics and political sciences to the core of social sciences, and it is often a link that acts as a bridge between different fields of social sciences (see e.g. Lindholm-Romantschuk 1998, 98-102). The flow of information is also more often from the core to other fields.

As Lindholm-Romantschuk (1998) has shown in her studies, book reviews are an important way in the flow of new ideas, especially in social sciences. Bibliometric analyses of the Web of Science in 1986-2004 on the field of social capital show that there are 81 book reviews on the topic of social capital. 23 (28.4%) of them belong to sociology, 10 (12.3%) to political sciences, 9 (11.1 %) to planning and development, 7 (8.6%) to economics and 7 (8.6%) to urban studies. There are still 17 other fields of sciences that have 5 or fewer book reviews. Most of them are social sciences, but also journals in the fields of geography, history, psychology, psychiatry and religion have published book reviews about social capital.

The interviews tell a lot about the importance of informal contacts in the diffusion of new ideas, especially at the beginning of the diffusion process. Coincidence also plays a major role. The invisible colleges and networks that cross the boundaries of disciplines, as well as between science and politics are extremely important. Seminars and conferences have a meaning in this sense, and often they enlarge the original networks.

The interviews confirm the hypothesis that the Internet has become important both in networking, publishing and information-seeking. The web pages may have outlinks that help to go further, when a researcher wants to find more information, new publications or like-minded colleagues. Also, the databases and e-journals are valuable when he wants to obtain information. Different discussion groups and e-mail lists form a typical way to network in the information era, and according to the interviews this has been understood well.

Anyway the diffusion of new ideas, concepts and innovations is a social process, where different actors have their own roles. An information sensitive researcher at a right time in a right place may be an important change agent in the diffusion process.

What fields were influenced?

This study shows that the fields that were influenced are mostly social sciences. The flow has gone from the core of social sciences to other disciplines of social sciences, and also to interdisciplinary research problems. However, fields like health and medicine, psychology and agriculture have been influenced, although some years later than social sciences. The research in these fields has a social point of view.

The usual way in the flow of new ideas is from hard sciences to soft sciences (see e.g. Lindholm-Romantschuk 1998). In this case the flow has been from a softer science (sociology) to a harder science (medicine). It is interesting to discover why The interviewed researchers in health studies and in health economics emphasised the importance of social viewpoint that might give some fruitful explanations to the health and welfare topics. In psychology and information studies this social side is also seen as valuable.

How was the concept introduced and defined in other fields?

The concept of social capital has been defined or explained in the Milestone Publications (Bourdieu 1986, Coleman 1988, Putnam 1993), and other researchers have tried to define it further or to present some nuances or their thumbprint (Portes 1998). The interviewed researchers mostly refused to define the concept, they rather stated which elements they think belong to social capital. Some of them emphasised that social capital is an umbrella concept that helps to understand some social action and phenomena.

How did the concept change the terminology?

Social capital has changed the terminology in different fields in the way that it is used as a term that "we all understand". It has also diffused to everyday language. It covers several aspects like network, trust and communities; researchers of social capital understand that when we talk about social capital, we are talking also about these things.

On the other hand, social and capital have been core words in social sciences, and they are well known. Their combination, social capital, is a new concept that has different interpretations and is more than Social plus Capital.

What concepts does the term include and how does it change the controlled vocabularies used for indexing in the subject fields?

The content analyses of the definitions or explanations in the Milestone Publications, as well as co-word analyses and interviews tell us, what other terms or concepts the term includes. This helps us to situate the term in a larger context.

The term has been approved by some thesauri, but not in all. For example, it has not been approved by the *Thesaurus of Sociological Indexing Terms* that is used in *Sociological Abstracts*. During this research process the term has been approved by the *PsycINFO Thesaurus* (2004).

When a term is not included in a thesaurus and research results on this theme are, however, published, the indexers of databases have to use some other keywords in subject description. The indexers have to understand the idea of a publication, and they try to find terms that are the closest to the idea of a concept. Indexers can be those who persuade readers to these publications by using adequate terms.

The professional expertise of an indexer is ultimately important, when a new term appears in a field of science. Especially in social sciences and humanities - in spite of all the possibilities of automatic indexing – the indexing should be done by people who can think logically and who have 'tacit knowledge'. It is important to understand the history of a field and its scientific schools. And in fact, indexers should have an opportunity to keep their knowledge of the development of science up-to-date. Connections with scholars and scientific communities are also important.

Indexers can be gatekeepers and disseminators of new concepts. They can influence the progress of science by guiding readers - researchers - to new paths of knowledge. When we read a text, we are not alone, isolated. The library professionals that are responsible for indexing and subject description belong to broader cultures and small groups or networks, which have their influence on the ways of reading. Indexers as readers are interpreters, they are producers of meanings.

On the basis of this study we can say that every indexer constructs a new piece of work. Going further, those who index a book or an article for a database are creating something new and giving an interpretation of an idea, concept and term.

The concept of 'social capital' has different interpretations, as we have seen. Social capital has diffused so widely both in science and everyday language that it has been "translated" many times. We can ask, whether it has the same interpretation in Finnish sociological studies in 2005 as in Coleman's article in 1988. Putnam's fingerprint on this concept has also been important. He has used it in a way that made it popular, easy to adapt. It is sure that not all the scientists have the same idea of the contents of social capital. It is easy to use the concept for different purposes, like a practical umbrella to obtain funding for research or to be a member of a scientific network. Social capital was a fashion concept in many fields of sciences at the Millennium.

5.2 Evaluation of research materials and methods

The empirical research material was collected mainly from the Internet: bibliographic databases, electronic publications and web pages. Other research material includes books, articles and expert interviews. The main research methods were bibliometric, but also content analysis and qualitative analysis of interviews were used to complete the picture.

The Internet offers a huge store of research material for information studies. Increasing numbers of bibliographic databases are available for users. Libraries all over the world offer their users electronic publications. Quantitative and qualitative research data have now been collected to data archives of scientific fields. Open access to research publications means a new possibility for faster and more open availability to new scientific information.

There are, however, reasons to be critical. The quality of databases is not always good enough for bibliometric research. Misspellings and human errors also in databases of good repute mean a lot of checking and manual work before bibliometric analysis. We should not assume that the databases are static. Bibliographic databases on the Internet are continuosly regenerating. During the three years of this study the number of references in every database changed all the time, concerning at least the last two or three years. This means that the researcher can never be sure, if all the

important references are in databases. This means also that one day the researcher has to draw a line and stop checking and compiling the datasets.

The subject description is a key issue when we evaluate databases. It seems that some databases have exellent updated tools of indexing, while others have not. Indexers of some databases are also subject specialists, and it seems that they aim to understand the contents of publications and give the indexing terms creatively even when a concept is not included in the thesaurus of that database. On the other hand, some databases are collected with less effort, when the indexing terms may give an incorrect or inexact view about the contents of a publication.

One problem is that the availability of databases may also change, and sometimes the host of a database changes, too. It is possible that the search strategies or downloading possibilities are changing at the same time. This may cause problems with constructing time series and making comparisons of different periods.

In webometric analysis the continuing activity of web pages may also cause problems. Links are changing, the structure of pages varies. Some pages that were new, important and current two years ago, are not updated anymore. Reasons may vary, but often they are human. If the web pages are not official pages of an organization, they are very vulnerable. On the basis of this study, it has been noticed that if a person who has been active in updating web pages changes job, the web pages are left to degenerate, if there is no follower. Many web pages, even official, depend on enthusiasists' activities.

However, the material on the Internet offers new possibilities for information studies. Bibliometric methods will surely be "reborn" in information studies as well as in social studies of science. As has been mentioned in earlier chapters, there are sophisticated tools for bibliometric analysis, like the Bibexcel that was used in this study and that can be freely downloaded from the Internet (see http://www.umu.se/inforsk/Bibexcel/). This kind of tools can also be used in bibliometric mapping and studying network structures.

The analyses and interpretation of bibliometric maps requires, however, understanding of the subject field. The qualitative expert interviews shed light on quantitative results, as has been done in this study. The old fairytale about an elephant and blind men is worth to remember when studying a new concept. If we approach it from different directions, exploring and illuminating, we can

discover more than just by using one research method. In this study the aim has been to gain an impression of an elephant called Social Capital.

5.3 Conclusions

The contribution of the present study lies foremost in understanding the development of network structures around a new concept that has diffused in scientific communities and also outside them. The network means both networks of researchers, networks of publications and networks of concepts that describe the research field. The emphasis has been on the digital environment and on the so-called information society that we are now living in, but at this transitional stage, the printed publications are still important and widely used in social sciences and humanities. The network formation is affected by social relations and informal contacts that push new ideas, as Rogers (1995) among others has noticed.

This study also gives new information about using different research methods, like bibliometric methods supported by interviews and content analyses. It is evident that interpretation of bibliometric maps presupposes qualitative information and understanding of the phenomena under study.

This study has been a tour of bibliometric databases as research material, not only as a resource in information-seeking. This has given rise to many critical views about the quality and coverage of databases.

In this study we have understood the digital environment mainly as the networked world that is called the Internet or the Web. Since the middle of the 1990's the Internet has been a developing and growing worldwide digital network that makes it possible for people to communicate and to find information in a new way that is increasingly easier. At the same time as technical facilities have become easier and more available, especially in the developed countries, the amount of information has been growing. On the other hand, the information explosion has been an issue already in the 1960's and even earlier (see Price 1961).

Search engines like Google and information gateways like SOSIG have been built to support information seeking on the Internet. Portals like NELLI in Finland (http://www.lib.helsinki.fi) built for researchers and students to access scientific information try to help users in information seeking from different sources.

On the basis of this research we can see that the diffusion of a new idea is fast in the networked world. Electronic invisible colleges have developed around the concept of social capital in discussion forums, and the possibilities of email have enlarged it. Networked world even can lead to changed paradigms in some subject fields. We can see that there is a lot of information on the Web and we know that researchers have used that information, and they produce also new information in new ways. There are tools to access and disseminate information.

Persuasion occurs when an individual (or other decision-making unit) forms a favorable or unfavorable attitude toward the innovation (Rogers 1995, 20). Scientific papers can be seen as "tools of persuasion". A scientist who has obtained results, which he believes to be true and important, has to persuade the scientific community, or certain parts of the community, to share his opinions of the value of his work. For it is only when some degree of consensus among his colleagues has been achieved that his research findings will be transformed into scientific knowledge (Gilbert 1977, 115).

The Milestone Publications of Social Capital have all managed to persuade the research communities. They are all highly cited and form the basis of persuasive communities. We can also state that the function of citations is important in scientific communities. It is sure that there is a Matthew effect: highly cited publications receive more citations. If some publications are Milestone Publications, and there seems to be consensus about this, it belongs to the scientific culture and intelligence to cite these publications. We can state that it is a circle.

The development of a common terminology is the basis for this persuasion. The terminology develops differently in different fields, and has a strong influence on the new paradigm or changed views in the field.

Language has a great impact on information seeking. Bourdieu used social capital as a form of other capitals he included in his theories. Coleman saw social capital as a mean to create human capital that is a concept that has been well-known among sociologists at least since the 1960's (e.g. Becker

1964). Putnam saw the meaning of social capital in explaining the differences of society between North Italy and South Italy. He has also the ability to popularize the concept using a descriptive and picturesque language. His book titles *Making democracy work* and *Bowling alone* sound poetic.

The indexers of databases have a role in persuasion. They are often the next ones after the author who try to understand and sum up the idea of a text. If the central terms are missing from the thesauri that are used in subject description, they have to find terms that are as close as possible to the concept. This is the method that indexers use, when they describe information about new concepts, theories and viewpoints. This is also a tool for persuasion, because a thesaurus can be seen as a knowledge structure reflecting a subject field. It is a tool for the researchers when they develop search strategies in their information searches.

In this study we have noticed that the Milestone Publications are highly cited, or they have been chosen as Milestone Publications because they are so cited. According to a citation analysis on the Web of Science databases, they were cited in almost all publications concerning social capital until 1998, but then the proportion of citations in the publications began to diminish. On the basis of these empirical studies we can state that social capital became 'tacit knowledge' at the Millennium. It is now a term commonly accepted in both scientific and daily communication, and it is no longer necessary to cite these authorities in every publication that deals with social capital.

A paradigm does not develop easily, especially in the social sciences. There can be several paradigms or viewpoints in a field at the same time. On the basis of terminology we can state that a kind of paradigm change has happened when a term become 'tacit knowledge', or is a part of the common language of the field and when we do not need to explain what a term means. The changed terminology affects the storage and retrieval of information in databases when a term has been approved in a thesaurus. Then the term is a guide to the research field, and the broader terms, narrow terms and related terms give information about the context, where the term in focus is situated. Before that, the indexers have had to use synonyms as signal words that persuade readers to use the documents, texts, new concepts and new ideas.

In an information retrieval situation new terms and concepts are difficult. If a term is not included in a thesaurus, the information searchers must find other ways to build a search strategy than the keyword search. They have to – just as has been done in this research – make so-called free text searches, when the search engine seeks the words from all the fields of a reference.

The term in the focus of this study, social capital, is a concept that often can be found in the title or abstract, but not always. One of the Milestone Publications, Putnam's "Making democracy work" does not include social capital in the title. Also, as we have seen, the early indexers of a database do not necessary see the key idea of a publication, or they cannot predict which terms or ideas will survive.

The circumstances in scientific communication have changed considerably as a result of the development in telecommunications, computer networks and the Internet. Digital libraries give new possibilities to browse and search information. Electronic journals and books come to a researcher's desk in a few seconds. There have been obvious changes compared to old-fashioned libraries with card catalogues and interlibrary lending, when it took days or weeks to get a book or an article. This all means that information flows faster, less formally and across different boundaries. This gives possibilities for faster change and diffusion of new concepts.

Another question is how can we ever know which concepts will survive? How could Lyda Judson Hanifan ever have known that his practical concept would have such a success 80 years later? The reasons are often mysterious. It is possible that the combination of economic and social characteristics suits our Western societies at the Millennium. It gives new viewpoints to many social problems and research problems, as many of the interviewees emphasized, i.e. something soft to hard sciences, something hard to soft sciences. However, social capital has caused, if not a commonly accepted paradigm change then at least a new viewpoint for several fields of sciences.

During this study which began in the autumn 2001, much has happened to the concept of social capital. It has evidently diffused in many disciplines and also globally. The number of publications and ongoing research has grown especially in Finland. There is, on the contrary, some decline of the number of publications in the fields that have been the first to adopt this concept. A question is what shall be the next concept that has such an effect on different fields of sciences. In this study it seems difficult to trace any concept that could be an inheritor of the concept of social capital in its contents and in its fast diffusion and popularity.

5.4 Ideas for future research

On the basis of this research some ideas for future research have arisen:

When this research project started, there was rather little social capital research or publications in Finland. During the research process the Academy of Finland financially supported several research projects in different fields of sciences. I have interviewed some researchers and specialists that have been in the forefront for this research. Now, it would be interesting to interview a larger number of researchers asking at least the same questions. This could give more information about the implementation of a new concept in scientific fields.

Another interesting question in this context would be the evaluation of the subject description of social capital literature in different bibliographic databases by researchers on social capital. What is their view about the indexing? Another interesting question is, how do researchers search for information about social capital on the databases? What kind of search strategies they have used? And finally, do the researchers and indexers meet each other? This is a complex of research questions that would need its own project.

It seems that research on social capital is now at a maturing stage in Finland. It would be interesting to make a similar bibliometric study on the Finnish data after a couple of years, i.e. when most of the research results of the projected financed by the Academy of Finland are completed and published. What kinds of changes have there been? To which fields of sciences has research reached? Anyway, social capital is a concept that has retains much interest. Now it seems that it is no longer a "social butterfly", but a concept that has power to explain social phenomena scientifically.

One interesting research theme in science studies might be to trace hyperlink paths on the Internet. This presupposes that there isenough material for this kind of research. One day the publishing culture of researchers changes so much that publishing on the web is more a rule than an exception. The efforts to Open Access publishing are showing a way to this.

Finally, use of the Internet as a tool in research work could be a fascinating issue for further research. We need to know more about the research culture of different fields of sciences in the digital era. On the other hand, when there is more and more material in electronic libraries for

researchers of various disciplines, for humanists and social scientists, too, the digital libraries themselves can affect research routines. This kind of research would also give new information for practical library and information work.

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List of interviewees

Jouko Kajanoja (May 2002)

- PhD, senior researcher, economist and social scientist, active in social and political life, The Government Institute for Economic Research.

Hannu Valtonen (January 2003)

- PhD, health economist and social policy researcher, University of Kuopio.

Jussi Simpura (February 2003)

- PhD, researcher of social policy, statistics and mathematics, The Statistics Finland.

Markku T. Hyyppä (February 2003)

- MedDr, researcher in medicine and health with experience in popularization of science, wide social networks, The Social Insurance Institution of Finland.

Lea Pulkkinen (February 2003)

- PhD, professor in psychology with connections to politics and practice, University of Jyväskylä.

Petri Ruuskanen (February 2003)

- PhD in sociology, a senior researcher, University of Jyväskylä.

Inkeri Näätsaari (March 2003)

- MA, library chief and educator with connections to practice, City Library of Turku.

Vesa Niinikangas (March 2003)

- MA, information specialist, science-editor and educator with scientific education in library and information field, Enostone.

Maija-Leena Huotari (May 2003)

- PhD, professor in information studies, information scientist with specialization in management; University of Oulu.

Gunilla Widen-Wulff (May 2003)

- PhD, lecturer in information studies, information scientist with specialization in organization studies, Åbo Akademi University.

Esa Poikela (February 2005)

- PhD, professor in education, University of Tampere.

Appendix 1: Database descriptions

DIALOG is the worldwide leader in providing online-based information services to organizations in such fields as business, science, engineering, finance and law. It includes more than 900 databases. Searchable content on Dialog services includes articles and reports from thousands of real-time news feeds, newspapers, broadcast transcripts and trade publications, plus market research reports and analyst notes providing support for financial decision-making, as well as in-depth repositories of scientific and technical data, patents, trademarks and other intellectual property data. Additional content areas include government regulations, social sciences, food and agriculture, reference, energy and environment, chemicals, pharmaceuticals and medicine. (http://www.dialog.com/about/ 17.9.2005)

Sociological Abstracts abstracts and indexes the international literature in sociology and related disciplines in the social and behavioral sciences. The database provides abstracts of journal articles and citations to book reviews drawn from over 1,700 serials publications, and also provides abstracts of books, book chapters, dissertations, and conference papers. Records added after 1974 contain in-depth and nonevaluative abstracts of journal articles. (http://oh1.csa.com/csa/factsheets/socioabs.shtml 16.12.2003) The database covers approximately 600 000 references (in May 2003).

The **ERIC** (Educational Resources Information Center) database is sponsored by the U.S. Department of Education to provide extensive access to educational-related literature. The ERIC database corresponds to two printed journals: *Resources in Education (RIE)* and *Current Index to Journals in Education (CIJE)*. Both journals provide access to some 14,000 documents and over 20,000 journal articles per year. (http://oh1.csa.com/csa/factsheets/eric.shtml 16.12.2003) The database covers approximately 1100 000 references (in August 2002)

EconLit, the American Economic Association's electronic database, is one of the world's foremost sources of references to economic literature. According to EconLit advertisement EconLit adheres to the high quality standards long recognized by subscribers to the *Journal of Economic Literature* (JEL) and is a reliable source of citations and abstracts to economic research dating back to 1969. It provides comprehensive information on accounting, capital markets, econometrics, economic

forecasting, government regulations, labor economics, monetary theory, urban economics and much more. *EconLit* records include abstracts of books, journal articles, and working papers published by the *Cambridge University Press.* (EBSCO host research database; information 16.12.2003) These sources bring the total records available in the database to more than 610 000 (in December 2003).

PsycINFO provides access to international literature in psychology and related disciplines. Unrivaled in its depth of psychological coverage and respected worldwide for its high quality, the database is enriched with literature from an array of disciplines related to psychology such as psychiatry, education, business, medicine, nursing, pharmacology, law, linguistics, and social work. Nearly all records contain nonevaluative summaries, and all records from 1967 to the present are indexed using the Thesaurus of Psychological Index Terms. (…) PsycINFO includes psychological research and its applications; the database is of prime relevance to many industries and research establishments worldwide. The sources include over 1,800 professional journals, chapters, books, reports, theses and dissertations, published internationally. Additionally, there are more than 8 million cited references in 185,000 journal articles, books, and book chapters. PsycINFO is a department of the American Psychological Association (APA) dedicated to creating products that make it easier for researchers to locate psychological literature relevant to their research topics. PsycINFO staff members locate and summarize psychologically relevant documents from a wide range of disciplines, and disseminate these summaries in forms suited to easy access and retrieval. (http://oh1.csa.com/csa/factsheets/psycinfo.shtml 16.12.2003) The database covers about 2 000 000 references (in September 2003)

MEDLINE database contains over 4 million citations and abstracts, providing unparalleled access to worldwide biomedical literature. The database contains a broad range of medical topics relating to research, clinical practice, administration, policy issues, and health care services. Produced by the U.S. National Library of Medicine, MEDLINE contains all records published in *Index Medicus* and since 2002, most citations previously included in separate NLM specialty databases such as *SPACELINE* and *HISTLINE*. Subject content includes anatomy; communication disorders; microbiology; paramedical professions; pathology; physiology; psychiatry; toxicology; dentistry; parasitology; reproductive biology; epidemiology; gene therapy; surgical and pharmaceutical intervention; nursing practice; ethical and legal issues; institutional operations; laboratory techniques and procedures; diagnosis and management; clinical research trials and experimental treatment protocols; legislation and regulation; allied health specialties; continuing education;

investigational drugs and new drug uses, and some veterinary medicine. (http://oh1.csa.com/csa/factsheets/medline.shtml 16.12.2003) MEDLINE covers about 4 500 000 records (in February 2003).

LISA (Library and Information Science Abstracts) is an international abstracting and indexing tool designed for library professionals and other information specialists. LISA currently abstracts over 440 periodicals from more than 68 countries and in more than 20 different languages. (http://oh1.csa.com/csa/factsheets/lisa.shtml 16.12.2003). The database covers about 250 000 references (in December 2002).

The PAIS International database contains references to more than 460,000 journal articles, books, government documents, statistical directories, grey literature, research reports, conference reports, publications of international agencies, microfiche, Internet material, and more in the field of political sciences. Newspapers and newsletters are not indexed. PAIS International includes publications from over 120 countries throughout the world. In addition to English, some of the indexed materials are published in French, German, Italian, Portuguese, and Spanish. (http://oh1.csa.com/csa/factsheets/pais.shtml 16.12.2003). The database covers about 500 000 references (in October 2001).

AGRICOLA is a bibliographic database consisting of literature citations for journal articles, monographs, proceedings, theses, patents, translations, audiovisual materials, computer software, and technical reports pertaining to all aspects of agriculture. This extensive database provides selective worldwide coverage of primary information sources in agriculture and related fields. The literature cited is primarily in English, but over one-third of the database comprises citations in Western European, Slavic, Asian, and African languages. Since 1985, the CAB Thesaurus has been used to select controlled vocabulary terms for subject indexing. Library of Congress Subject Headings are used as controlled vocabulary for cataloging records. (http://oh1.csa.com/csa/factsheets/agricola.shtml 16.12.2003). Agricola covers about 3 600 000 records (in October 2001).

Business Source Elite provides full text coverage for more than 1,100 scholarly business, management and economics journals, including nearly 500 peer-reviewed publications. In addition to the full text, this database offers indexing and abstracts for nearly 1,800 journals. Business Source Elite contains full text from the world's top management and marketing journals. This

database includes full text (PDF) coverage dating back as far as 1985, and detailed company profiles for the world's 10,000 largest companies. This database is updated daily on EBSCO host. (EBSCO host research database; information 16.12.2003).

SCIMA, the management bibliographic database, is produced to provide access to main European and international journals in business, management and economics since 1978. The content is multilingual with English as the main language. It belongs to the *HELECON* database family produced by the Helsinki School of Economics Library. SCIMA covers more than 200 000 references on management, business economics and communication studies. Most of the recent references include also abstracts in English. (http://lib.hkkk.fi/database/SCIMA/help/ updated 15.9.2005)

ARTO - Reference Database of Finnish Articles is an index of articles from approx. 700 Finnish journals since 1990, but there are occasionally some older references e.g. in history and social sciences. ARTO contains 1 025 000 journal article references and (occasionally) references to articles in monographs. If an article is available in digital form, it is linked to the bibliographic record. (http://www.lib.helsinki.fi/kirjastoala/linnea/ARTO.htm updated 1.9.2005)

FENNICA is the *Finnish National Bibliography* and it contains references to monographs, serials, maps, non-book material and computer records published or in other way produced in Finland. It also includes publications published outside Finland but with a Finnish author or related to Finland. The FENNICA database contains more than 778 964 references (1.7.2005). Books and serial publications are from 1488 and maps from 1967 onwards. Older material is partly available (for instance parish maps). Audiovisual material is included from 1981 onwards, and some hundred electronic publications, occasional online publications. (http://www.lib.helsinki.fi/english/libraries/fennica.htm updated 15.9.2005)

Aleksi WWW / On Line includes 450 000 references to articles published in 290 periodicals ja 15 newspapers. The database covers Finnish general magazines and main scientific journals. The yearly growth is 30 000 references. Periodical articles are from 1982 and newpaper articles from1996 onwards. Aleksi WWW is produced by BTJ/Kirjastopalvelu. (http://www.btj.fi/kehyt/kehale.htm updated 15.9.2005)

Appendix 2: Interview questionnaire

1. You are one of the key persons in the diffusion of Social Capital in Finland. How, when and where did you discover or find the concept?

2. Which are the works (books/articles) that have been the most influencing?

3. Who are the researchers that have been internationally the most influential?

4. Who are the researchers in the Finnish scientific communities with whom you believe that you share the same research network which is interested in Social Capital?

5. Do you think that there are other networks of Social Capital in Finland?

6. Who, in your opinion, are the influential persons of Finnish society that belong to the network of Social Capital?

7. How do you define the concept of Social Capital now?

8. To which themes or subject areas is Social Capital connected in your opinion?

9. The phenomenon of Social Capital has existed before, with different terms. Which terms or concepts do you think have been used before, when talking about Social Capital?

10. You have done research for many years. How do you see Social Capital connecting with your earlier research interests?

11. Do you believe that the concept of Social Capital will cause a paradigm shift in scientific discussions or research?

The aim of this study is to explore how a new concept appears in scientific discussion and research, how it diffuses to other fields and out of the scientific communities, and how the networks are formed around the concept. The concept that has been chosen as a topic for this research is *Social Capital*.

The contribution of the present study lies foremost in understanding the development of network structures around a new concept that has diffused in scientific communities and also outside them. The emphasis has been on the digital environment and on the so-called information society that we are now living in, but in this transitional stage, the printed publications are still important and widely used in social sciences and humanities. The network formation is affected by social relations and informal contacts that push new ideas.

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