

## Strengthening local food systems: tracing learning of knowledge and skills by content and discourse analysis

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### Abstract

The local food systems meet the food systems of scale on the local market, where the local and regional chains are looking for ways to survive and even to strengthen. The operations of local food systems become decided by many actors embedded in a socially complex local environment. Yet there is very little understanding about the actors' perceptions and learning about the local food systems and the effects of this on the operations of the system. Also the meanings for the local food system implied in the speech and activities of the actors are part of a dynamic but invisible reality in the food system. The understanding of the role of learning of knowledge and skills as a possible dynamic development factor in the local food system is needed. This paper discusses some approaches to learning in the food chains and some qualitative research methods to capture learning in the chains through empirical material. The main research question, the learning of the actors in the local food chain and the effects of learning on the activities of the local food chain are opened as more detailed and operative questions. They concern the thematic fields of knowledge and skills, the ways of knowing and the communication of knowledge within the chain, which is considered as an indicator of contextual learning. The study is expected to reveal knowledge interchange activity and connectedness by knowledge in the local food chains. Also future development potentials of the actors of the local food chains can be referred to. First of all, knowledge and skills – represented by speech and activities of the actors in the local food chain - is thought to be manifest result of learning. The categorisation of knowledge is suggested to be used as an analytical dimension in combination with thematic dimension in content analyses highlighting the contact points of the chains. Also discourse analysis is proposed to be used as a research method offering cultural view of actors' positions in the chain and actors' views of the different production methods. On the basis of this understanding, it is planned that the actors and public bodies can reflect upon their future activities.

### Introduction

The local food systems meet the food systems of scale on the local market, where the local and regional chains are looking for ways to survive and even to grow. The operations of local food systems become decided by many actors embedded in a socially complex local environment.

The concept of local food has been used in Finland for some years. It obviously influences – like distant food – on the cultural, social, economic and ecological aspects of the locality. Strengthening the local food system is seen as a way of supporting and stabilising the rural community and landscapes as well as the economic structures of the society. When looking for ways to develop food systems, the idea of learning food systems has been presented by the Finnish Ministry of Agriculture and Forestry (Puolanne et al. 2002).

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The understanding of the role of learning of knowledge and skills as a possible dynamic development factor in the local food system is needed. What is learning in the context of food system? Are possible results of learning represented in the speech and activities of the actors in the local food system? What is learned, by whom and in which connections? Has learning a role to play in current and future operations of the local food system? Can learning be enhanced? In addition to several studies in the fields of economics and marketing, it is essential to look on the food system actors' 'inside' view and to converse this 'close look' made intelligible by researchers for readers in relevant fields. This would add to the understanding of the contextual past and present as well as possible future developments by the food systems' actors and public bodies on different levels.

Studying learning of knowledge and skills in the local food system is a rather elusive and scattered research theme, which presents some methodological difficulties. This paper deals with defining learning in a way suitable for this research and choosing feasible methodology, which covers both chain level factual and community level cultural aspects of learning of knowledge and skills. Learning is understood in its informal and vocational context. Ethnography, content, conversation and discourse analysis are discussed as possible methodological approaches.

### **Empirical context of the local food system**

The locality chosen for the site of the study is Juva, a small South-Eastern municipality of 7,500 inhabitants. Juva is located near to Mikkeli, the South Savo regional capital, where the Helsinki University Institute for Rural Research and Training is located also. In Juva there are about 400 farms and 6 dominant industrial units for organic milk, turkey meat, beef and pork, fresh mixed salads and additionally two glass house growers. About 18 % of the cultivation area is in organic production. (Juvan kunta, Toimintakertomus, Juva Municipal Annual Report 2002). The local consumers shop at the two main supermarkets in the centre of the municipality. The locally and regionally remarkable purchasers are the municipal caterers, which are members of the region-wide purchasing network. The purchase network buys food stuffs for about 3,5 million € yearly for altogether 36 catering units, of which the Mikkeli Central Hospital's share is c. 3 million € (Anneli Oranen, personal communication, 29.11.2003).

The employment in Juva by agriculture and food industry is about 30 % of the working force (Juvan kunta, Toimintakertomus, Juva Municipal Annual Report 2002). The municipality has a strategy based partly on agro-food sector, which, although of low productivity, offers long-standing development possibilities due to the rather stable population in Finland in spite of the slowly decreasing population in the region. (Heikki Laukkanen, personal communication 3.7.2003)

### **Empirical reduction of the local food system to local food chains**

The starting point of the study was to make the social structures of the local food system visible by identifying the actors and groups of actors attached to the system. This structural information would base the approaches for learning of actors at individual, organisational, interorganisational and system level. Because of the qualitative approach, the local food system – although very small compared with that one of big cities – proved to be too extensive by the number of commodities, enterprises and retail customers. According to Etelä-Savon TE-keskus (Employment and Economic Development Centre for South Savo, 2002), there are more than 40 different crops and about 5 animal species in production in Juva. According to the Juva service information, there are tens of local small scale food enterprises in addition to the industrial units named above.

This is why the local food system, producing commodities for basic Finnish diet, was simplified by analytical reduction from a local food system as a network to a local food system as food chains. This corresponds to the understanding of the food system as the flow of food in the form of different commodities through the relevant sequences from production to consumption. This physical understanding of the flow of food is basic to the social structure as well; the flow of food is socially organised and carried forward by the actors of the chain, whether they be individuals or organisations forming the chain.

The chains were identified and chosen from the deliverers of the municipal caterers in Juva and Mikkeli on the following criteria: they represented both conventional and organic production of different volumes, all actors were serious entrepreneurs (making their living in the food chain, except one organic farmer) and they have established their activities at least some years ago, having experience of the operation of the food chain. These criteria resulted on commodity level as one chain of conventional and one chain of organic milk and two chains of conventional vegetables and one chain of organic vegetables. All the five different chains have the same end user: the municipal caterers and regional purchase network for hospitals, schools and nursery units.

Already now it can be concluded, that the inherent heterogeneity of the local food chains was surprisingly large. In addition, their business relations varied from weekly to one or several years of duration. This diversity emphasises the need for understanding the operations and embedded learning in the local food chains.

### **Constructed and contextual learning**

Concepts of knowledge, skills and learning are basically very intertwined; all knowledge and skills are learned, and they have manifest results as speech and activities. Learning can be theoretically divided to acts of knowledge transfer, transaction for the knowledge and transformation of the knowledge to part of one's own knowledge constructions. Knowledge transfer is appearing widely, but obviously only part of this available knowledge becomes the object of transaction by learners. Transaction, the trial to merge the knowledge into one's own knowledge structures, can be followed by true transformation. There the knowledge structure is richer than earlier and it is also personalised in the way that the actor has access to his knowledge and all the possibilities it potentially holds. In this study only the results of transformation, which have very concrete expressions as occupational activities, relations or speech, are observed. The cognitive processes are left beyond the focus; only the visual, auditive or material evidence of learning of knowledge and skills are studied.

Basically individuals learn; organisational, interorganisational and chain level learning is understood as new ways of organisational operations and developments in contact network by adding or subtracting actors. Also new ways to talk about oneself or the other actors as well as the efforts and goals are considered learning. Toiviainen (2003, 28) separates learning-to-network and learning-through-network, which are both followed separately as learning in this study. Learning-to-network is indicated by communication with the (new) actors and learning-through-network by knowledge and skills learned within the contacts.

The physical and social structure of the food chains is the context for learning. Chain structures, when studied more closely, show remarkable variation in the size of volume and personnel, geographic extension and differences in the number and nature of contact points. These features can also be understood as physical and positional dimensions of power. Mutual relations of the actors and organisations may bear on what kind of information is shared within the chain. Unequal, competitive or

tensed relations can effect to the sharing of knowledge. Individual and organisational positions as well as the passing of knowledge in the chain become objects of negotiation, which demands social skills.

The contact points between actors and organisations are also essential turning points in the development of businesses. Actors negotiate – based on the knowledge they have - agreements about the flow of the food for certain periods in the future. Evidence for critical changes are extremely important for the actors and this knowledge is most important to catch from the chain. It is also the question of trust, legal frame and feasibility for actors, who must adapt to their micro environment and change their partners accordingly. Following Durkheim, who maintained that social relations are to be treated like material things, knowledge can be perceived in the same way. Knowledge is passed on as material packages - whether talk, print or electronic - which can be given by an actor to another one in the chain. In this study, learning is followed within contacts by individuals in and between organisations and on the chain level. Also local processes like public projects can be included, because they offer the actors fora for learning.

### **Categorising knowledge and skills in the food chains**

The generic idea of socially constructed origin of knowledge (Berger and Luckman 1984) suits well to knowledge developed in informal, every-day occupational activities. Knowledge learned like this is so pervasive, that it is not easily identified; yet, without it, it is very difficult to know how to find one's way to a specific place or site, deal with people in the work place, use machinery or make contracts. All the operations of the actors, whether individuals, organisations or chains are embedded in cultural and occupational knowledge. In this study, learning is traced in the chains by analysing knowledge and skills of different kinds on the basis of actors speech and trusting on actors' own factual statements of their learning (Nerbonne and Lentz 2003).

Concept of knowledge is strongly dependent on the content of knowledge (Voutilainen et al. 1990, 17); this offers the categorisation of knowledge wide possibilities in the field of philosophy, sociology, education and occupational activities. Dewey (1929) emphasised the active relation to knowledge through the practise instead of the passive spectator theory of knowledge. Knowledge is active, constantly developing in the relation between the actor and the world (Dewey 1929). This activity for use and creation of contextual knowledge may come close to occupational knowledge and skills. These are according to Plato (in Niiniluoto 1992, 51) acquired with time and effort and put to practical experience, and they represent genuine knowledge as 'knowledge of the doer'. Plato considered skills to consist of knowledge and accuracy. Probably Aristotle (VII 1989) was also describing skills in his *Ethics of Nikomakhos* as 'tekhne', which includes understanding how the result is created. Nonaka and Takeuchi (1995) divide the knowledge into tacit and explicit. They draw on Michael Polanyi's (1966, in Nonaka and Takeuchi 1995, 59) distinction between 'tacit' and explicit knowledge. Tacit knowledge can not easily be verbally explained and thus its transfer is limited. 'You have to feel it' states Japanese Nagashima according to Nonaka and Takeuchi (1995, 9).

In this study explicit and tacit knowledge are understood as pragmatic, consisting of propositions as factual statements by the actors (Niiniluoto 1992, 40, 54-55). Tacit knowledge is especially connected to skills and labor. Although it is not transferred as such, it can be referred to in the way that the existence of skills becomes visible. Niiniluoto (1992, 55) discerns several types of factual statements: singular, general, statistical, modal, conditional, explaining, instrumental, evaluative, knowledge concerning norms and possibly metaphorical knowledge.

When using categories by Niiniluoto (1992) for the speech of actors in the food chains, some adaptations are necessary. Because mainly all knowledge dealt with here is singular - historical, individual and

cultural – knowledge, it is not used as a category, but rather as the contextual and meaningful knowledge category it covers all the other categories. Even the general scientific knowledge has for the actors a contextual and constructed character. They use all kinds of knowledge intermingled, be it scientific (by source), statistical, conditional, explaining, instrumental etc. and all these categories are crucially important when working, sharing knowledge, learning new things and putting them into action and developing one's business. The following categories of knowledge are suggested to form the basis of the analysis for the knowledge and skills of the actors in the food chains:

1. General knowledge, which is important to discern because it has connections to scientific knowledge and scientific worldview
2. Statistical (or numerical) knowledge
3. Conditional knowledge describes analysed possibilities and consequences of certain actions
4. Explanations are based on the idea of cause or reason for something to happen
5. Instrumental knowledge, which describes the 'means' to be used in order to achieve something
6. Evaluative knowledge sets an object against its criteria stating the value of the object in relation to the given set of criteria.
7. Knowledge concerning norms of generally accepted nature
8. Metaphores – although seldomly used, serve to explicate a sharp understanding of a matter
9. Explicated (tacit) skills, described in some way, often referred to just as labour or a specific phase in the daily work.

Toiviainen (2003, 29) states that the concept of knowledge tends to remain abstract and the content of learning remains undefined in some texts of organisational learning, which are concerned with learning dynamics. It can be expected, that the knowledge and skills of the food chain actors have a strong connection to their point of view, which directs their interests for knowledge. These themes are to be found in the contextual speech of the actors; methodologies need to be chosen in order to create and document that speech and identify those themes in that speech.

### **Methodological research orientations of the 'bricoleur'**

The operating chains' individuals and organisations are 'silent actors', who do not often have – as Davies (1988) indicates - powerful position as writers or speakers in the local community. Every-day actors' informal learning of knowledge and skills is mainly unrecorded. There are some official interorganisational materials available, especially from the bigger units like Central Hospital of Mikkeli, but practically nothing about the every-day encounters and operations of chain actors. This study has thus the basic task of social inquiry: to make the silent, invisible and unstructured heard, visible and structured. Still, there are plenty of possibilities in the space of qualitative study for choosing different methodological approaches. This study was understood as a task for a 'bricoleur' (Denzin 1998, 4).

Ethnography as the most 'immersed' contextual method offering a multifaceted 'inside-view' would be an excellent way of increasing the understanding the plurality and scale of phenomena going on in the site of local food chains. The more there are options, the more clarity and connectedness to theory is needed by the researchers for the phenomenon to be studied. This richness of options in 'thick description' is the difficulty of ethnography as well; the study is not easily planted on a theoretical basis (Geertz 2001). The possibility of ethnography was rejected for practical reasons only. The study consisted of so many separate units in five chains (13 altogether) that ethnography would have been too time-consuming. Ethnography is more suitable when there is one location and ample time until

unvisibility. The time needed to record the happenings is needed also. According to Emerson and Pollner (1998) ethnographic researchers need to find a 'niche' in the community, they can be helping hands, problem solvers, representatives for the group or they are asked to join as genuine members...these positional questions need to be solved on the site in relation to the members of the community to be studied. In the case of local food chain actor, researchers should have become 'part' of a family farm or a manufacturer environment. This could call a status of an agricultural trainee, for which there were no possibilities. Ethnography, not chosen for this study, could offer the best material for cultural activity – including talk, gestures and a clearly 'labour labelled' look on the local food chains.

Another option would be to deal with local text material for authentic local view. Newspaper texts as public documents have perhaps a stronger touch for local politics than for speech and discussions concerning local food chains. These spheres of text are private and their documentation is a problem. The question of documentation ties the production of the material into close connection with the possible methods of text analysis.

If there would be authentic discussions available these could be used in conversation analysis; the short discussions or agreements of the food chain actors emerging during the operations would need possibly a continuous taperecording device, accepted by all the persons in touch with the carrier. This arrangement seemed somewhat difficult both socially and technically. Conversation analysis itself would be the method when describing subtle, quickly changing turns in interaction, where sometimes very sophisticated formulations make the the positions and power of participants visible. This method can manage of only reasonable amount of texts, and discussions pile up considerable amounts of material. The scattered nature makes chain level study difficult by conversation analysis. Conversation analysis, not used in this study, would open the cultural microworld of interaction and show the fine threads of relations between actors.

Producing texts for analysis can be done by interviews, which offer a balanced work load for producing, documenting and analysing texts.

Of many types of interviewing the open-ended, lightly structured interview could suit best for this study to open up a close look into the worlds of the food chain actors. The focus here is upon their concepts, understanding, activities and mutual relations but not in an unfocussed way; the food system is the common point for departure and the area surrounded by the speech. Interviewing is an art of staying close to the respondent and simultaneously allowing him/her the space to speak and during the speech to explicate things which have not been explicated in the same way earlier. The basic principle would be to allow the interviewees to make their sphere of concepts and activity visible and through this visibility to define and even create the field of their activities, social relations, the interorganisational and chain level, their history and future, difficulties and conceptions concerning different modes of production. Interviews can be held at the respondents' premises or at Helsinki University Institute for Rural Research and Training. Interviewing is easier when there is experience about the settings in agro-food sector, the words, expressions and their interpretations.

These texts can be approached by content or discourse analyses, or both. Content analysis means categorising topics or selecting words on the basis of research interest, often in order to test a hypothesis. Especially content analysis carries an air of rigor, and of these two it can be thought to achieve that rigor with partly mechanistic keeping to single words, counting their presence at certain defined instances according to speaker, audience, situation etc. In this way content analysis offers a structured, very directly text related view of the phenomena described in the text. Also the numerical and statistical way of presenting results supports readers' orientation to results. (Holsti 1968). Bos and Tarnai (1989) clarify the content analysis in a flow diagram, which makes clear that the 'qualitative difficulty' of defining the object of study is inherent in content analysis - as well as in discourse analysis. Of the many variations of content analysis (Bos and Tarnai 1989) the ones combining well based

qualitative categories with statistical methods could offer this study a close look into the occupational in the food chains. Especially different statements about concrete world of labour, ideas of production methods and contact points could help to build up the inside view of the operations of the food chains.

Moving on from the situational view as described by content analysis to discourse analysis could offer societal and cultural views about the food chains. Parker (1992) offers a realist reading of discourses; he understands them as describing intertwined social and material reality, where the material cannot be separated from the social. Parker (1992, 23-41) maintains that studying discourses is investigating how they reify and change the social and material world; discourses effect upon how the material world like food or nature is perceived and how the societal rules about it develop. Actually, the social often speaks 'materially' in many different ways. Discourse analysis dealing with meanings given to the material flow of food, its environment and the actors in the food chain makes possible to see the positions of the actors and their ways to perceive the food chain and change it. This approach of ontological constructionism taken to discourse analysis is a realist one, where the material reality is thought to be reflected in the speech (Juhila, K. 1999). Especially the dimensions of production, labour and nature – although dealt with as categories of knowledge – are considered to be present in texts by actors producing the texts and by readers understanding the text as references to the material and social world. The shared meanings, dominant and challenging concepts can open up future optional developmental paths. Discourse analysis, from the point of this study, offers the cultural permeated by the subcultural, which reveals dynamics of larger societal scale in the food chains.

### **Knowledge and position crystallised in the social structure of the food chain**

Methodology and methods must be estimated on the basis of their ability to answer the research questions. Methodologically speaking, thematic content analysis combined in matrix with knowledge type analysis looks promising when we want to understand what are the relevant themes and what kind of knowledge they represent for the food chain actors. When collecting this data from the contact points in the food chain, we come to the social interchange of knowledge in the food chain. It is expected, that this analysis makes the connectedness by knowledge of the food chain visible; there may areas of dense interchange of knowledge, and then again areas of disrupted interchange of knowledge. Perhaps some relations function well concerning knowledge interchange, some again not; reasons for this situation would be interesting to analyse. Possibly some of the chains could be shown to have a thorough flow of knowledge. Here it is assumed that operations become easier for the chain actors when they have access to operatively important knowledge.

The plans for future are crucially interesting when the chains are looking for ways to survive and even to grow. Thematic fields concerning future activities and the types of knowledge referred to can reveal something of the restrictions and possibilities, their reasons, consequences and norms. This information could help extension to analyse the needs for knowledge and skills for the actors of the food chain. Also possible networking for knowledge could be activated in the food chains when the actors perceive themselves in a new way through the research.

The local food chains are not independent of the surrounding society. The activities and development in the food chains are connected to societal structures and ideas about different production methods. Discourse analysis is used to open up these enlarging cultural circles (Juhila 1999) and it is expected, that the food chain actors both participate in common perceptions of production methods and their position, partly challenge these. Partly the knowledge themes and types can be used to describe the discursive dimension, which represents developing cultural understanding on the chain level. The controversial discourse about the current and future position of conventional, organic and local food as well as gmo food will be concretised by knowledge categories. The rise of themes and their struggle to

be present in discourses, their transfer and cementing to organisational, interorganisational and chain level knowledge means qualitative changes in the local food system. The sites in the chains where these phenomena become visible, are interesting sources for 'turbulence'. Perhaps there are even 'turbulent' chains in relation to societal perceptions.

It is not enough, however, that the methods in themselves are suitable for answering the research questions; they must be valid and reliable. The huge issue of validity and reliability is not taken up here. Huber (1989) maintains, that quality and quantity are complementing one another. This research represents the view that quantity and quality are dimensions of the same phenomena, often quality forming the core of quantity. Quality is actually what is being measured and quantitative results are often interpreted in a qualitative way. Yet food chains need to be studied qualitatively as well, and these qualities have certainly quantitative dimensions, to be studied in future studies.

## Literature

- Aristoteles VII 1989. *Nikomakhoksen etiikka*. Suomentaja Simo Knuutila. Gaudeamus. Helsinki.
- Berger, P. & Luckman, T. 1984. *The social construction of reality. A treatise in the sociology of knowledge*. Penguin. London.
- Bos, W. & Tarnai, C. 1989. *Entwicklung und Verfahren der Inhaltsanalyse in der empirischen Sozialforschung*. p. 1-13. In (Bos, W. & Tarnai, C. Hrsg.) *Angewandte Inhaltsanalyse in Empirischer Pädagogik und Psychologie*. Waxman Wissenschaft. Muenster.
- Davies, B. 1998. *Psychology's Subject: A Commentary on the Relativism/realism debate*. In (Parker, I. Ed.) *Social Constructionism, Discourse and Realism*. 133-147. Sage. London.
- Denzin, N.K. and Lincoln, Y. S. 1998. *Introduction: Entering the field of qualitative research*. p. 1-34. In (Denzin, N.K. and Lincoln, Y. S., Eds.) *Collecting and Interpreting Qualitative Materials*. Sage. Thousand Oaks, California.
- Dewey, J. 1929. *The Quest for Certainty: A Study of the Relation of Knowledge and Action*. G.P.Putnam's Sons. New York. 1960. In Finnish: *Pyrkimys varmuuteen. Tutkimus tiedon ja toiminnan suhteesta*. Gaudeamus. Helsinki 1999.
- Emerson, R.M and Pollner, M. 2001. *Constructing Participant/Observation Relations*. In (Emerson, R.M., Ed.) *Contemporary Field Research. Perspectives and Formulations*. p. 239-259. Waveland Press. Illinois.
- Etelä-Savon TE-keskus 2002. *Vuosikertomus. The Annual Report of Employment and Economic Development Centre for South Savo, 2002*. 22 p.
- Geertz, C. 2001. *Thick Description: Toward an Interpretive Theory of Culture*. In (Emerson, R.M., Ed.) *Contemporary Field Research. Perspectives and Formulations*. p. 55-75. Waveland Press. Illinois.
- Holsti, O.R. 1968. *Content Analysis for the Social Sciences and Humanities*. Addison-Wesley Publishing Company. Reading, Massachusetts.
- Huber, G. L. 1989. *Qualität versus Quantität in der Inhaltsanalyse*. p. 33-47. In (Bos, W. & Tarnau, C. Hrsg.) *Angewandte Inhaltsanalyse in Empirischer Pädagogik und Psychologie*. Waxman Wissenschaft. Muenster.
- Juhila, K. 1999. *Kulttuurin jatkuvasti rakentuvat kehät*. In Jokinen, A., juhila, K. and Suoninen, E. *Diskurssianalyysi liikkeessä*. p. 160-200. Vastapaino. Tampere.
- Juvan kunta. 2002. *Toimintakertomus. (Juva Municipal Report 2002)*. 123 p.
- Heikki Laukkanen, 3.7.2003. Personal communication at Juva.
- Nerbonne, J.F. And Lentz, R. 2003. *Rooted in grass: Challenging patterns of knowledge exchange as a means of fostering social change in a southeast Minnesota farm community*. *Agriculture and Human Values* 20: 65-78, 2003. Kluwer Academic Publishers.
- Niiniluoto, I. 1991. *Informaatio, tieto ja yhteiskunta. Filosofinen käsiteanalyysi*. Helsinki. Valtionhallinnon kehittämiskeskus. Valtion painatuskeskus
- Nonaka, I. and Takeuchi, H. 1995. *The knowledge Creating Company. How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press. Oxford.

Anneli Oranen, 28.11.2003. Personal communication at Mikkeli Central Hospital.

Parker, I. 1992. *Discourse Dynamics: Critical Analysis for Social and Individual Psychology*. Routledge. London.

Puolanne, E., Wilenius, M. ja työryhmät. 2002. *Elintarviketalouden reunaehdot vuoteen 2030 mennessä*. MMM:n julkaisu 9/2002. Maa- ja metsätalousministeriö. 127 p. Helsinki.

Toiviainen, Hanna 2003. *Learning across levels. Challenges collaboration in a small-firm network*. Department of Education. University of Helsinki. Helsinki University Press. Helsinki.

Voutilainen, T., Mehtäläinen, J. and Niiniluoto, I. 1990. *The conception of knowledge*. National Board of General Education. The Government Printing Centre. Helsinki.

