

Integrated environmental research and networking of economy and information in rural areas of Finland

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This article uses material from many extensive research projects starting from the construction of the electric power supply network and its water supply systems in northern Finland in 1973–1986, to the Agropolis agricultural strategy and networking for the Loimijoki project. A list of the material and references of the publications is available in Agronet on the Internet. All these projects applied integrated environmental research covering biology, the natural sciences, social sciences, and planning methodology. To be able to promote sustainable agriculture and rural development there is a pressing need to improve research methodology and applications for integrated environmental research. This article reviews the philosophy and development of the theory behind integrated environmental research and the theory of network economy.

Key words: common agricultural policy, environmental research, integrated research, network economy, research methodology

Introduction

The world is witnessing enormous changes such as globalisation and networking of the economy and information. Beside the ongoing expansion of trade in the 1990s, the international networks of finance, information and production have experienced a further development towards globalisation. A necessary response to the challenge is to expand the marketing of Finnish agricultural products in the EU and at the same time towards world markets. This requires agriculture to

strengthen its ability to innovate, i.e., to modernise production and organisational structures, to overcome traditional forms of the (Tayloristic) division of work, to improve the skills of farmers and to invest in R&D.

Environmental research in such circumstances cannot give solutions and tools to decision-makers (society/political leaders) unless there is extensive integrated environmental research. In particular, such research is needed to promote sustainable agriculture and rural development.

However, there is no separate discipline within environmental research, that systematically

aims at developing systems and applications for this wide field. In fact, the only common denominator in the natural sciences, social sciences and applied sciences is the common direction of problems, i.e. they are all related to environmental issues. Several research projects are currently under way to develop indicators and policy measures to determine the conditions for sustainable development in agriculture in Finland. The main issues cover landscape-related, ecological, regional, economic and socio-economic problems and the evaluation of policy implementation.

Planning ideology of society as the power behind the scenes

In the 1970s the task of research, based on society's planning ideology, was to identify problems in various social sectors and to find possible solutions (remedies). The nature of the entire process was instrumental, segmental and supervisory. In actual fact, the planning comprised quantitative planning of resources and supervision of the use of resources by means of various sub-segmental programming and optimising methods. It was not until the late 1980s, after the global economic crises, that the systematic nature and interactive systems of society began to take shape together with global models and macrosocial research projects (e.g. the disputed global models of Forrester (1971, 1976) and Meadows (1972), the Club of Rome and Mesarovic and Pestel (1974), the Bariloche Model in Latin America, the Sarum Model in Great Britain and the papers produced by the "Secretariat of Futurological Research" in Sweden). Interesting major joint projects in Finland included, mainly in the 1960s and 1970s, the water construction schemes in northern Finland to build up the country's electric power system (Asp et al. 1977, Luostarinen 1978) and, in the 1990s, the integration of economic and social issues with bio-

sciences into environmental research. The creation of a comprehensive perspective of social development became a central theme in environmental research and planning, allowing the goals of previously unconnected sub-systems to be organised into an integrated whole. It is obvious that solving a problem without knowing the entire system only leads to an accumulation of problems elsewhere. With slight exaggeration, then it could be said that problems in a certain sector of society did not arise out of the sub-system alone (e.g. loads on the environment from agriculture) but out of its relation to other sub-systems (e.g. closed domestic market with fixed producer prices with support/subsidy systems). Ackoff (1974), Churchman (1971) and Jantsch (1972) developed this concept in Western countries.

In the 1980s, planning was arranged at three levels:

1. normative or political planning;
2. strategic planning; and
3. operational and technical planning.

This division was of crucial importance to general environmental planning and research. At that time, the sole aim of strategic planning was to identify and assess alternative action plans and goals in order to achieve general objectives, whereas that of operational and technical planning was to define the actions to be taken within the framework of the strategy. Stagnation and the need for an interest in technical sciences (engineering) were evident in the studies. According to Wilenius (1970), this brought self-implementing prophecies to research and planning. Integrated environmental research has been complicated by opposed organisational and political opinions and conflicts of interest. Therefore, the development of sociological and economic environmental research has been to some extent slower in Finland than in the other Nordic Countries, and apart from basic biological research opportunities for academic studies have been inadequate.

The rigidness of the social and organisational structures diminished toward the end of the

Interest in knowledge	Technical interest s-e xxx int xxx q-s xx st xxx	Understanding interest s-e x int x q-s xxx st xx	Constructivism s-e x int xx q-s xxx st xxx	Critical interest s-e int q-s xx st
Methods of gathering information	Empiricism s-e xxx int xxx q-s x st xxx	Formalism s-e xx int q-s x st xxx		Dialectics s-e int q-s xx st
Analogies of the study subject	Mechanism s-e xxx int xx q-s x st xxx	Organism s-e x int xx q-s xx st x		Process s-e int xx q-s xx st x

Groups of methods

s-e = Statistical and empirical methods
int = Intuitive methods
q-s = Qualitative and structural methods
st = Simulation technique

xxx = Crucial area of application
xx = Important area of application
x = Applicable

Fig. 1. Morphologies of integrated research activities and areas of application of the various methods (Niitamo 1977, Luostarinen 1991).

1980s. Project organisations with new research subjects were established and system work gained ground in all social spheres. Clusters of the network economy were promoted. The methodological facilities of environmental research increased simultaneously with the new economic and social needs, making it into a process embracing all human activity. Out of this process emerged research methods that would serve the different interests of knowledge (Fig. 1). According to Niitamo (1977), the same process occurred in the general contemplation of futurological research and its potential.

Social practice and integrated environmental research

Knowledge is connected with the social practice of an individual in his efforts to control his sur-

roundings. The actions of an individual are traditionally divided between three media that he uses in his actions: work, language and power. Of these, work is classified as the medium with which human society maintains and renews the necessities for life; language is the medium for understanding and conveying reality; and power is the medium with which the objectives of work are defined and an organisational order is established.

An interesting contribution to the field of integrated research was that of Mäenpää (1977), who divided the above Habermas tripartition – into three different fields of knowledge and a complementary interest in knowledge. The first of these deals with information, which extends and improves the technical capacity to develop and control the environment. This interest in technical knowledge is closely associated with the theory of empirical and analytical sciences, which interprets reality with the objective of validating

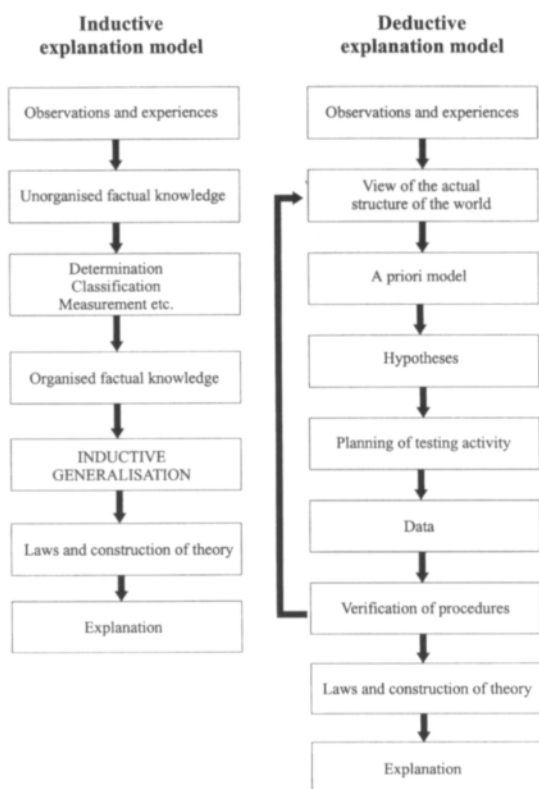


Fig. 2. Traditional view of inductive and deductive explanation models (Luostarinen 1991).

and augmenting the knowledge required for instrumental action. In naturalistic research and the naturalistic world view this is a dominant feature and is evident in the Finnish biological and geoscientific research tradition. This process studies reality through observation and empirical laws (Fig. 2).

It is not possible for environmental science and research to proceed solely from a naturalistic basis. Simply because, in addition to producing information, a necessary prerequisite for planning is interpretation of the data produced. This interpretation imparts meaning and logic to environmental phenomena and enables social activities to be directed on the basis of consensus. When only naturalistic and, at the same time, technical interest in knowledge is used, the fact

that laws express the relations between living, conscious people is often over looked. As a result, there is dissatisfaction/frustration causing mass demonstrations, rebellions, and even wars. There is nothing indispensable or perpetual in social laws. Further, the mode of action of the system is different from that in the natural sciences (Fig. 3). That is why social philosophy – also when engaged in environmental research – must critically demystify established social laws and short-term conflicts of interest and demonstrate that behind them are human beings who, at least in principle, can act of their own free will in harmony with a view of the world looking for hidden historic possibilities of a wider scope (possibilism) than those provided by the naturalistic environmental outlook (environmentalism/determinism) (e.g. von Wright 1988).

Interpretation of multidisciplinary and integrated research

In rural areas, consensus is achieved in a different organisational structure from that in urban areas. The rural community in itself represents a mode of action very different from the rational planning and decision-making process of urban culture (*Gemeinschaft-Gesellschaft*, see Tönnies 1887). Interpretation in rural communities often lacks the capacity to fully identify common advantages and benefits. Among current environmental projects, Natura 2000 is an example of conflicting interpretations by rural and urban populations, causing confrontation of the different interests within a mutual culture. Many environmental projects and their management might have succeeded better had there been better understanding between individual members of organisations, enabling explanations to be replaced by comprehension. In integrated environmental research, it is vital that researchers reach mutual understanding in many different fields of science.

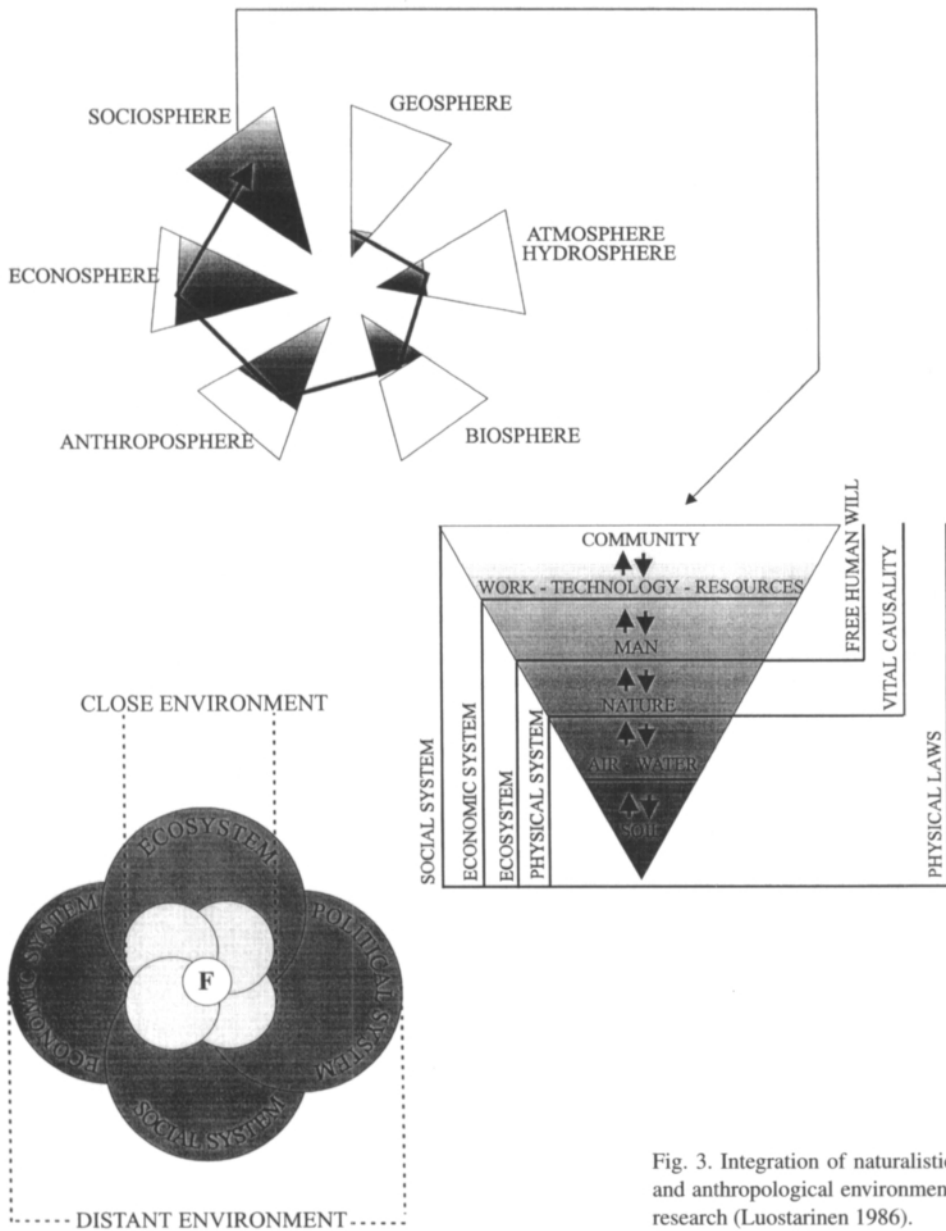


Fig. 3. Integration of naturalistic and anthropological environment research (Luostarinen 1986).

Galtung (1974) introduced a requirement that all sciences should be independent of the exercise of power and unspoken objectives regarded as self-evident truths (science as invariance-seeking and invariance-breaking activity). This reflection embraces a critical interpretation of in-

tegrated research. The process has sometimes been compared to psychoanalysis: undesirable behavioural models in human beings are removed by subconscious forces. The task of psychoanalysis is to bring subconscious forces to consciousness, regulating individual behaviour

in order to gain control of one's behaviour in a new manner.

The evaluation and commensurability of public goods, e.g. landscapes, should be redefined, no longer, however, on the basis of traditional economics with its definitions of ownership and bartering costs, inventories and other costs (Aakkula 1997). There is at the moment no practical method for assessing the economic value of a rural environment and of social benefits versus social costs. Within the framework of critical social science, this entails analysing claims or ideological dependencies that are modifiable rather than subject to constant laws. In practice, this will lead to a dynamic system design of an integrated research project against the background of the general systems theory (Bertalanffy 1973) and a simultaneously initiated discussion about social cybernetics (Asby 1968, Ahmavaara 1976).

The biggest problem in integrated research may be the different systems of interpretation in the various disciplines, preventing interdisciplinary understanding or the transferral of understanding to the "user" through an inappropriate method of interpretation. The rural organisational culture does not accept information with the same interpretation and argumentation as does the urban organisational culture, whose communal nature is not so actively integrated. Therefore, it is not possible to explain social phenomena within the framework of technical knowledge, nor can human behaviour be assessed causally as a result of external factors. Earlier, at the time environmental research was gaining ground in Finland, a typical example quoted was Markovite (1971), who considered human behaviour as a part of our naturalistic thinking and as a natural object. This pattern of thought was authorised by the ways of thinking and norms prevalent at that time. It was assumed that human behaviour was governed by nature and the social environment, cultural heritage and traditions. However, in practice the models applied resulted in fallacious prognoses even when they seemed to be technically exact (see Blalock 1971). Due reason for this was the changes in

human consciousness that have a great effect on the constancy of the variables, or entirely new factors that altered actions subject to valid laws. In this manner the positivistic research methodology continued to approach an introspective and partly also interpretation based on behaviourism (Fig. 4).

Cooperation between integrated research and network economy

The entirely new way of thinking that emerged in the early 1990s has required interdisciplinary cooperation and clustering in agriculture. The cluster model has evidently worked well in cooperation between businesses, the public administration and research institutions. This would not have been possible, however, without the new communications technology and its applications for agriculture.

At the international level, a new global model was required for research and science parks. The operation was organised through the Association of University Related Research Parks (AURRP), and the International Association of Science Parks (IASP), based on the new organisational culture introduced by the EU for the regional economy under the strategic management of the European Business Network (EBN) and Business Innovation Centre (BIC). The "reform" of society and the use of natural resources took place within the framework of the new system (Fig. 5) and was characterised by a large-scale coordinative task based on knowledge environments and by the creation of clusters. In this way, the ideology of environmental research, which earlier applied as a penetration principle, was given a new social mission, and a new organisation of integrated environmental research was introduced. All this has supported the implementation of the network economy theory: as a form of network jobs, social networks, network economy, etc.

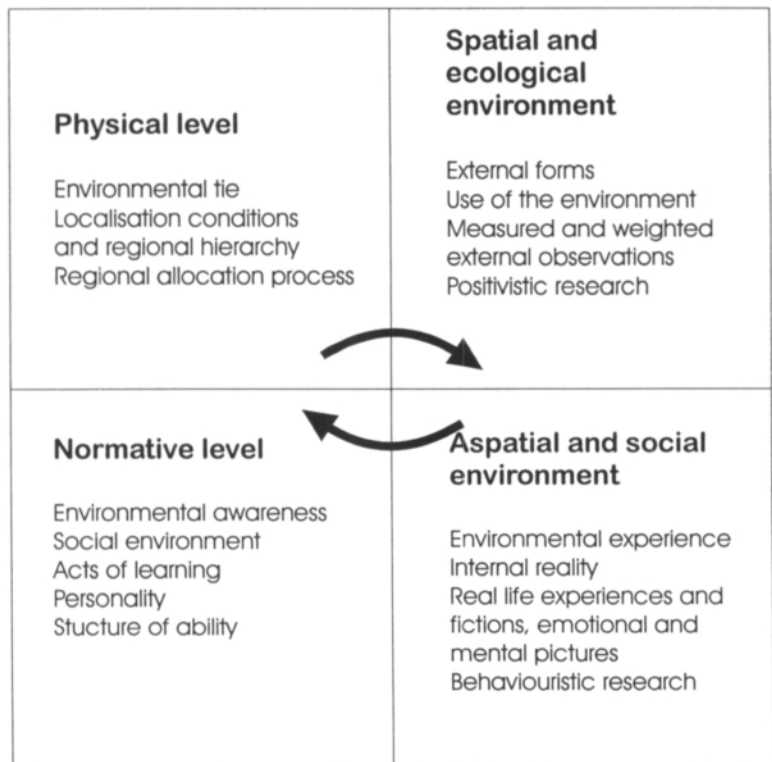


Fig. 4. Integration of physical and normative levels into normative aspatial environment (Luostarinen 1986).

As the network theory spread, it was divided to serve the conceptual systems of the various disciplines, resulting in the least change in the natural sciences and those already based on the systems theory. However, the management of the systems theory in the natural sciences was different from what society expected of integrating organisations, social networks and network maps (see Garrison 1974, Israel 1985, Klefbeck et al. 1987, Poukka 1990), of the process spirals of network meetings (see Speck and Atteneave 1973, Erickson 1984) and of network economy (see Birley 1985) and its applications to regional changes (see Eskelinen and Lautanen 1989).

In rural areas as elsewhere the mass production model for raw materials has been based on an increasing division of labour and specialisation. One of the primary competitive factors in

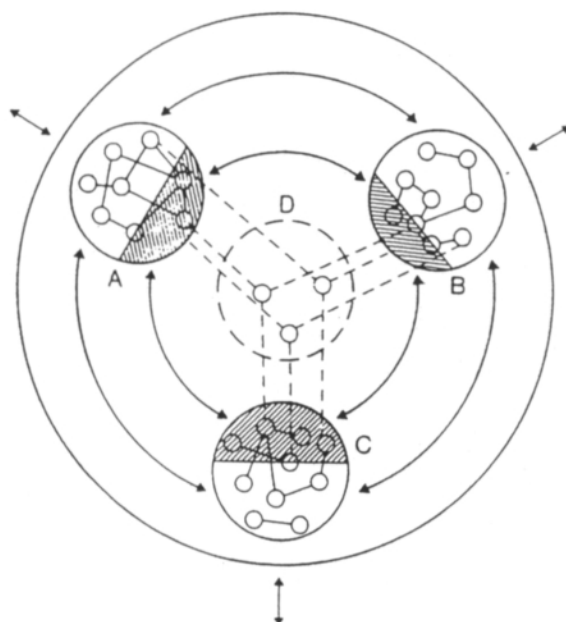
EU agriculture today is the ability to get those agricultural products with increasing demand on the market quickly into production. The profit margin no longer depends so much on the size of the yield or the degree of specialisation.

The main aims for rural development in terms of integrated research are:

1. to improve promotion of new knowledge and new technical applications for rural development;
2. to reduce rural unemployment (caused partly by increased productivity); new jobs can be created primarily through investment and innovation;
3. to develop new ownership patterns, especially for agriculture and the food industry, as a way of alleviating the problems caused by capital accumulation, which creates new markets (for

- A** Renewal of production
- primary production
 - manufacturing
 - natural resources

- B** Renewal of structure and population
- social and health care services
 - zoning, construction and transportation
 - infrastructure (social and technical)
 - Agronet on the Internet



- C** Renewal of intellectual resources
- research and education
 - cultural activities
 - integrated research
 - cultural integration
 - global network (uniting rural and urban areas)

- D** Coordination of regional resources
- integrating regional administration
 - universities, regional colleges
 - extensive research institutes
 - Agropolis centres
 - Technopoles
 - "Good society"

Fig. 5. Integration of social and natural resources in network economy (Luostarinen 1992).

- gaining maximum profit on invested capital) by promoting new consumer patterns regardless of negative social impacts as a whole;
4. in rural areas, to adapt to just-in-time production (JIT) and its methods/organisations;
 5. to develop flexible work relations (telework and flexitime), thereby enabling people to work in/through information networks, also in rural areas; and

6. to develop the transfer of technology and innovation diffusion processes

In the United States it became clear in the 1970s that traditional models of regional behaviour no longer function in network economies and in diffusion processes (Fig. 6). Modern information technology enables innovations to spread, regardless of the physical location (pro-

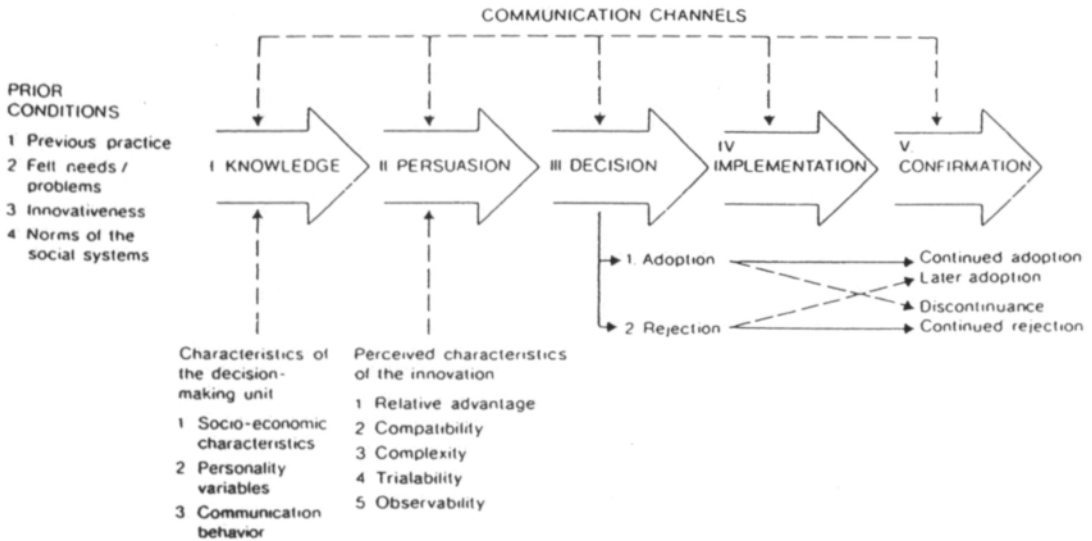
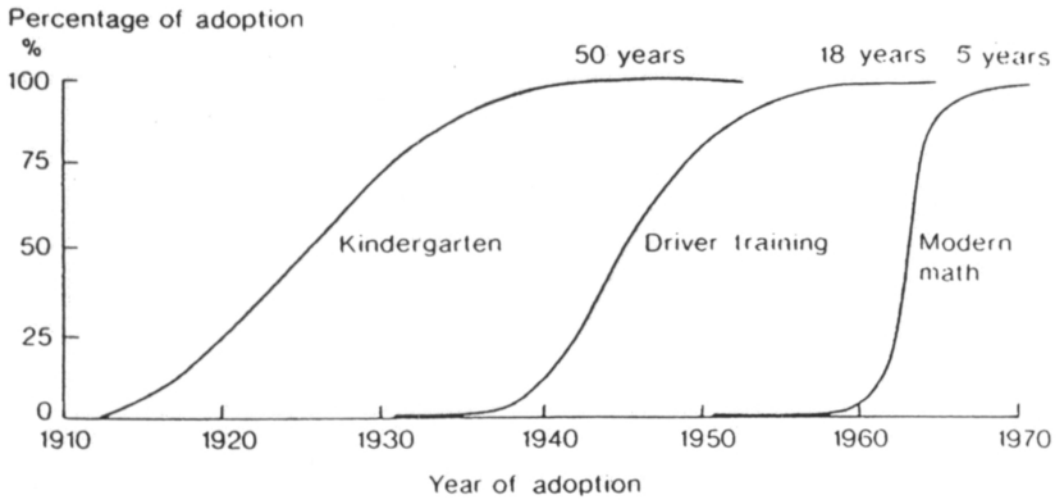


Fig. 6. Changes in adaptation rate of innovations in the United States during the 1900s and on illustration of the innovation process (Rogers and Shoemaker 1971, Rogers 1983).

vided that the required infrastructure exists). Examples of this are the Agropolis agricultural strategy, the agricultural information services system on the Internet (Agronet) and the second-generation science park ideology integrated into the BIC- programme of EBN, which were initi-

ated and developed at the Agricultural Research Centre of Finland (MTT) in Jokioinen. The process was started in 1992, and within 2 years had spread to most Finnish farms. Similar process launched in an urban area apparently could not have given better results. At present innovations

are diffused mainly between nodes (knots in a network) with no links to the field of diffusion to prevent the reception of information (e.g. sub-innovative areas) (see Hägestrand 1953, 1970). In the experience of the Agropolis strategy (Luostarinen 1993), the diffusion processes as a global phenomenon seem to take place mainly between "global villages" and are likely to cause fewer social problems than previous work models. Moreover, the initial structuring of organisational activities has permitted cooperation between different research segments (biological, economic, technical, social) and different sectors of public administration (see Minzberg 1989, Wiberg 1990).

Current results

A promising progress is being made in cooperative projects in integrated research and in networking economy at both national and international level. At the local level the results have been summarised in the reports of the Loimijoki project (1991–1997) and in connection with the Agropolis strategy (Luostarinen 1992, 1996, 1997, Yli-Viikari et al. 1998).

1. Differences between rural and urban communities are narrowing at the same time as the complexity and diversity of technological and social systems are increasing.
2. Great progress is being made in science, and in particular in information and communications technology, biotechnology, production processes and the use of materials. Flexible organisational structures often seem to be easier to implement in rural areas and their communities than in urban communities, where the factors causing rigidity, e.g. trade unions, are more problematic. The main driving forces of change are research, science, education and regional economies as part of the European single market.
3. Mass production is being replaced with the

models of a flexible economy strategy, with a simultaneous increase in the diversity of consumption and products. This will create new challenges for research. The polarisation of social values and global environmental problems are components of the same development process.

4. In rural areas, some people are already living in a "global village", others still in a traditional local village community. Localisation terms as well as old spatial theories and model structures have to be abandoned and replaced with practices that are better suited to and function better in each individual case. Single large-scale models no longer function well.
5. In organisational structures central management is being replaced by networks. The boundaries between the work place and environment are becoming blurred.
6. Farmers are establishing new cooperative enterprises alongside existing central cooperatives, a process that will eventually lead to the disappearance of the old rural communal organisation (Gemeinschaft-Gesellschaft). The conservative, "rational" and post-industrial social structure is making urban cultures more rigid and slowing down process in both production and the adoption of innovations. The applications of a flexible economy do not favour peripheral areas. Periphery, as a concept, will have to be redefined.

Discussion

To reconcile multidisciplinary research and its applications to business and regional public administration, and to transfer technology, the basic analogy of the research subject can be divided into three sections:

- 1) In an integrated cluster, the research subject consists only of fixed parts causally linked

to one another. The mechanism (causal structure) is assumed to be constant. Problems are created by human behaviour, which is not mechanical and cannot be transferred directly to the causal structures.

- 2) If the research subject of the integrated cluster consists mainly of interactive parts then problems are created by areas no longer following the earlier theory of external controllability.
- 3) In integrated research, statistical and empirical methods are highly appropriate for research into fixed causal relations. The methods are less appropriate, however, for monitoring process-type environmental phenomena (clusters); their applications are almost exclusively limited to system dynamics or interactive simulation. Qualitative and structural methods (e.g. scenario analyses) and intuitive methods (e.g. the Delphi technique) (Luostarinen and Olin 1994) are exceptions that can also be used to trace phenomena of process analogy.

In information gathering systems, the integration takes place either by empirical, formalistic, constructive or dialectic media (Fig. 1). Intuitive methods are an information-gathering system associated with the empirical section of integrated research. Because these methods often deal with complex and undefined topics, they are appropriate for constructive information gathering.

When the Agropolis strategy within the Loimijoki programme was implemented (Luostarinen 1992, 1993), the initial planning of the project involved multi-scientific modelling and synergic system work. As the projects progressed, one could see how the technical interest in knowledge, the comprehending interest in knowledge and the critical interest in knowledge had to be connected individually to the right systems of information gathering in integrated environmental research as a rural operation.

1. The technical interest in knowledge is mainly the development of tools and enhancement of their use (know how), for instance in the projects seeking to solve the technical problems of sporadic loading on a water system or those involved in connecting the infrastructure of science park activity to a business.
2. The comprehending interest in knowledge tends to improve the communication and cooperation abilities of organisations (know why). In the experimental projects it mainly meant introducing models for project work and applying the network theory at its various levels.
3. The critical interest in knowledge creates the basis for defining and evaluating the development goals for society (know where to). In the experimental cases this mainly meant charting the future prospects for rural areas, agriculture and the food industry, examining the operational conditions in EU membership and seeking to establish an innovation programme linked to the knowledge environment.

A caricature of a typical example was the case in the Iijoki river valley, where the first phase of biological research yielded results from river construction, showing that the cranberry harvest, optimised and measured by square analysis, exceeded the damage caused to agriculture (Luostarinen 1984). In practice, however, berry harvests have hardly any effect on the regional economy, whereas the damage done to agriculture through river construction has sometimes laid entire villages to waste. A similar problem had occurred earlier along the Kemijoki and the Ounasjoki rivers when the effects of large-scale river constructing projects were evaluated by the integrated research method (Asp et al. 1977, Luostarinen and Mäkinen 1980). We must nonetheless recognise that there are no simple models with which integrated environmental research could deal with multidisciplinary research and its applications.

Conclusion

Sustainable agricultural production needs to be matched with sustainable consumption. However, in an increasingly globalised economy, agricultural companies will only survive if they can develop competitive advantages that appeal to consumers. We have to take this as a challenge and an opportunity to build upon an existing competitive advantage (clean agricultural environment and products) with real differentiation strategies leading to sustainable development

associated with environmental protection and social responsibility.

Finnish agriculture as a part of EU agricultural policy enters into the reformed Common Agricultural Policy in 2000. The reforms are designed to improve the competitiveness of EU agriculture on domestic and world markets. Finnish agriculture has only a year of the transition period left which should be used for the best interest of the country, especially from the agricultural point of view. In this development process, integrated environmental research and networking of the agricultural economy and information in rural areas of Finland play a key role.

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SELOSTUS

Kestävän kehityksen integroidun tutkimuksen ja verkostotalouden teorian tutkimusmenetelmälliset ongelmat

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Kestävän kehityksen monitieteiseltä tutkimukselta edellytetään usein, että sen tutkimusmenetelmät lähestyisivät tulevaisuudentutkimuksessa käytettäviä menetelmiä. Samaa edellytetään myös maaseudun verkostoitumista ja verkostotaloutta tutkivilta tieteiltä. Erillistä ympäristötutkimuksen tieteenalaa tai verkostotiedettä, joka suuntautuisi systemaattisesti alan menetelmien kehittämiseen ja soveltamiseen, ei kui-

tenkaan ole. On vain eri tieteiden välisiä yhteisiä asioita ratkaistavaksi, minkä vuoksi on syntynyt kestävään kehitykseen pyrkiviä menetelmiä ja lähestymistapoja. Humanistinen ja maaseudun ongelmia laajemmin tutkiva verkostoituminen edellyttää erityyppisiä käsittelytapoja kuin luonnontieteellinen aiheen tarkastelu.

Asiaa esitellään useissa maaseudun kehittämiseen

ja ympäristöntutkimukseen liittyvissä suurprojekteissa, alkaen Pohjois-Suomen koskisodista ja vesirakennushankkeista vuosilta 1972–1986, jatkuen Loimijokiin ja Agropolis-strategiaan vuosille 1991–1997. Oleellista näissä monitieteisissä hankkeissa on ollut löytää yhteinen kieli ja käsitteet päätöksentekijöille ja suunnittelijoille laajoja intressiryhmiä koskevissa tutkimus- ja suunnittelukohteissa. Tarve tällaiseen työhön on entisestään lisääntynyt maailmanlaajuisten ympäristökysymysten ja verkostoitumisen sekä kestäväan aluetaloussuunnittelun myötä.

Yhteiskunnan oma suunnitteluideologia ja ideologian historiallinen kehitysvaihe vaikuttavat ehkä merkittävimmin integroituun tutkimukseen ja sen yhteyksiin verkostotalouden teoriaan. Kärjistäen voidaan sanoa, että yhteiskunnan jonkun osan ongelma ei enää synny vain osajärjestelmästä itsestään, vaan osajärjestelmän suhteista yhteiskunnan muihin järjestelmiin. Vanhasta kolmiportaisesta suunnittelusta (normatiivinen, strateginen ja operatiivis-tekniinen) on siirrytty systeemis suunnitteluun ja -dynamiikkaan sekä verkostoteoriaan ja -talouteen. Vielä ennen 1990-luvun alun syvää lamakautta yhteiskunnan kriisiherkkyyden ja systemaattisuuden huomioonottaminen ei ollut integroidun tutkimuksen, suunnittelun eikä ympäristötutkimuksenkaan kantavia teemoja. Sen sijaan 1970-luvun alun määrällinen resurssisuunnittelu ohjaavine toimenpiteineen vaikutti yhä taustalla.

Agropolis-strategia, verkostoituminen ja kestäväan kehityksen mukaiset tutkimusmenetelmälliset näkökulmat ovat yleistyneet niin kansallisesti kuin kansainvälisestikin tilanteessa, jolloin keskeiseksi teemaksi on noussut kokonaiskuvan luominen yhteiskuntakehityksestä. Tämän ansiosta aiemmin irrallisina esitetyt osajärjestelmien tavoitteet on voitu koota mielekkääksi kokonaisuudeksi. Samalla tutkijat ovat havainneet, että integroidussa työssä tulkinta tai ratkaisun etsintä eivät ole yksinomaan teknisiä tai instrumentaalisia. Erityisesti kestäväää kehitystä toteutettaessa ja verkostotaloudessa on jouduttu suunnittelukäytäntöön, jossa kaikille maaseudun ilmiöille on pystyttävä antamaan merkitys ja sisältö yhteisen ymmärryksen pohjalta. Yhä useammin intuitiiviset tai laadullis-rakenteelliset menetelmät korvaavat empiiriset tai formaaliset tietolähteet, tai introspektiiviset positiivistiset. Samalla eri tieteenalojen tiedonkeruu-

ja käyttöjärjestelmät joudutaan tulkitsemaan maaseudun yhteisessä toimintakentässä, jonka

1. tekninen mielenkiinto kohdistuu lähinnä työvälineiden etsimiseen alue- tai ympäristötalouden kehittämiseksi ja valittujen työvälineiden käytön tehostamiseksi (know how). Esimerkkejä ovat tiedonsiirtoverkostot ja uudet infrastruktuurit kuten Agropolis-strategia ja Agronet-verkosto.
2. ymmärtävä mielenkiinto kohdistuu lähinnä ihmisten ja organisaatioiden kommunikaatio- ja yhteistoimintakyvyn lisäämiseen (know why). Esimerkkejä ovat projektityöskentely, osuustoiminta ja kestävä luonnonvarain käyttö (maaseudulla), sekä maareformien, maaltapaon, yhdyskuntarakenteiden muutosten, aliravitsemuksen ja sosiaalisten ongelmien aiheuttama yhteiskunnan kriisiherkkyys (kansainvälisesti).
3. kriittinen mielenkiinto luo lähinnä edellytyksiä yhteiskunnan kehittämistavoitteiden asettamiselle ja arvioinnille (know where to). Esimerkkejä ovat uudet toimintamallit ja -strategiat sekä niiden tulosten arviointi.

Integroidut tutkimusyksiköt käynnistävät yleensä toimintansa mekanismi perusanalogiaanaan, empirismi tutkimusvälineenään ja syy-seuraussuhteet oleuksenaan. Myöhemmin toiminta etenee ymmärtävään ja kriittiseen tiedonkeruuvaiheeseen, jolloin laadullis-rakenteelliset ja intuitiiviset menetelmät lisääntyvät. Kapea-alaisesta perusmateriaalista siirrytään monimuotoisempaan materiaaliin. Koska tutkimuskohde on vaikeasti hahmotettavissa tai siitä on ristiiriitaisia tulkintoja tai teorioita, on välttämätöntä käyttää parempia tiedonhankkijoita, jolloin perinteisistä tiedonkeruujärjestelmistä (empirismi, formalismi) tulee "osarutiineja". Teoria lähestyy dialektista suunnittelua tai toiminta-analogioiden etsimistä osana systeemiteoriaa tai -dynamiikkaa. Toisaalta monitieteisessä tutkimuksessa ja sovelluksissa tulokset eivät voi koskaan olla yhtään sen laajempia kuin valitut menetelmät ja niiden taustalla olevat perusanalogiset rajaukset ovat. Tämä on ehkä tärkein lopputulos, johon päästään laajentamalla luonnontieteellistä näkemystä humanismin suuntaan.