

Health ecosystem as an interpretation framework for knowledge flows

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Abstract — This paper explores the concept of health ecosystem. The concept will be defined in the context of municipal health care in Finland. The paper argues that the ecosystem approach reconciles the descriptive viewpoints of integrated care and health system by highlighting the interconnectedness of the actors and the dynamic nature of the environment.

Keywords — Complexity, Knowledge management, health care

I. INTRODUCTION

A. Health care organizations as knowledge-intensive organizations

According to Miles et al. [1], knowledge-intensiveness is about the way how knowledge is produced and delivered, not about the amount or extent of knowledge. Miles argues that knowledge-intensive work requires a creative problem solving and abstract thinking and to be successful it requires knowledge processing and refining. Maula [2] states that knowledge-intensiveness can be seen in the content of a service, in experts' competences and their way of communicating between each others or with customers, in processes and systems that are used for producing and providing services and finally, it could also refer to the utilization of knowledge as a source of learning, innovativeness and renewal. In health care experts are highly

As it comes to health care services, those can be seen as knowledge-intensive service due the fact that they require highly specified knowledge about human physiology and many medical issues. Scientific research plays an important role in medical knowledge creation as well as human interaction at the operational level of health services. Health care organizations utilize and refine research results and knowledge in the form of services for their customers, which is the key function of knowledge-intensive organizations.

B. Purpose of the paper

Purpose of this paper is to study health care as an example of knowledge-intensive services and to further develop the concept of health ecosystem as a theoretical pattern that could be used for conceptualizing municipal health care in Finland. This conceptualization will be used

as a basis for the study of knowledge flows of health care.

It has been argued that in health care organizations information and knowledge are fractured. This refers to the fact that available knowledge, capabilities and supporting technologies have in many cases developed along with the specialization of services. Specialization has differentiated working practices and complicated knowledge flows between different occupational groups. [3], [4] This has hindered also the accumulation and utilization of knowledge for management purposes. Development initiatives relating to knowledge accumulation and utilization in health care sector are in many cases strongly technology oriented and in Finland, they have been mainly focusing to compilation of statistics at the national level. In many cases these initiatives lack the viewpoint of municipal health care organizations and the needs of their management. Therefore, there seems to be a research gap in the area of knowledge management processes within public health care organizations.

The current Finnish health system is highly decentralized and government regulation has been partly replaced by steering through information. This focus on information urges the need for information and knowledge management research in health care. The paper aims to describe the complex environment of Finnish health care and offers conceptual tools for enhancing the understanding of the role of knowledge management and knowledge processes in the sector.

From the theoretical viewpoint the paper also aims to find answers to the question of: How can knowledge-intensive organizations benefit from the complexity sciences? This is a question that has been raised in many occasions. Academics and consultants highlight the possibilities of complexity thinking in organizational context but business managers are still skeptical.

C. Case study in the Health care district of Forssa

Practical examples presented in this paper are based on the underlying case study that was conducted in the Health care district of Forssa (FSTKY). Qualitative data was collected by interviewing some key personnel of FSTKY. The interviewees were the director of the health care federation, development manager, quality and development manager, chief physician of neurology, medical doctor of health care center and an information specialist. In addition, author observed the meetings of the management group for a period of six months to form a general understanding of the health care organizations. Also many informal

discussions with health care specialists and people involved with health care have greatly advanced the understanding of the sector. Results of the case study have been used for adjusting the theoretical compilation of health ecosystem.

Health care district of Forssa (FSTKY) is a federation of five municipalities that started as a joint municipal health care authority at the beginning of 2001. The current population in the area is about 35 000. Federation provides primary health care, special health care, mental health care, environmental health care and A-clinic services for the inhabitants of its area in the south-west Finland. The federation provides employment in health care for about 640 people.

D. Complexity-based knowledge management

Koivuaho and Laihonon [6] have created the framework of complexity-based knowledge management (CBKM) for the purposes of studying the possibilities of complexity sciences and knowledge management in the area of knowledge-intensive services.

Complexity-based knowledge management is composed of three theoretical backgrounds (see Figure 1). The most important part of the framework is knowledge management, since the main research interest of authors arises from the knowledge management domain. Other domains are complexity thinking and organization theory.

Complexity sciences and knowledge management both highlight the importance of interconnectedness for organizations. It has been pointed out in several discussions how important interconnectedness and knowledge sharing are for contemporary organizations. Based on these discussions, the framework parallels interactions to knowledge flows and communication processes and presupposes that this might offer a promising link for combining these disciplines and their research results.

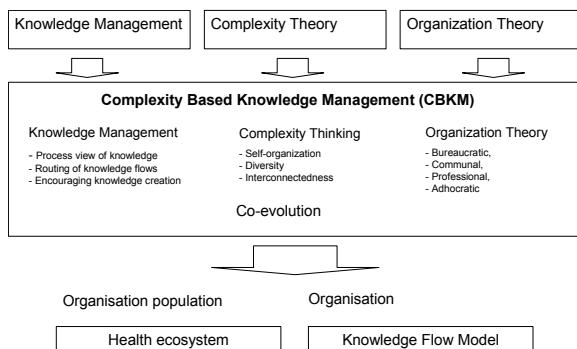


Figure 1. Complexity-based knowledge management (based on [5]).

Koivuaho and Laihonon [5] have previously used the framework at the organizational level. In this paper the focus is at the organization population level and therefore author has made some modifications to the framework. The ideas concerning health ecosystem presented in this paper follow the framework and the concept has been added to figure.

To position CBKM framework in the field of knowledge

management, the framework takes the process view of knowledge. Alavi and Leidner [6] have separated five different viewpoints on knowledge, in which process view is one. According to the Alavi and Leidner [6], process perspective of knowledge management concentrates on routing knowledge flows and on encouraging knowledge creation and sharing activities.

Within the complexity-based knowledge management framework, complexity thinking is brought into the discussion through concepts such as self-organization, diversity, co-evolution and interconnectedness. It could be described that the framework aims to understand knowledge flows from the complexity thinking perspective.

Organizational theories bring in the concept of an organization and different approaches to their functioning. The CBKM framework distinguishes four different categories of organizations from the view point of internal communication and knowledge flows. These organizations are able to accomplish different tasks depending on the context of actions and novelty of the required actions.

CBKM framework, knowledge flow model and the concept of health ecosystem that will be discussed in more detail later in this paper are all interpretative concepts although knowledge flow model might also have some possibilities as a normative tool for managers. It is acknowledged that complexity thinking is a lot more than just knowledge transferring but to be able to understand the interpretation and decision making processes of individual agents it is needed to understand how knowledge is shared within the system.

To summarize, the basic assumption behind the CBKM framework and the ecosystem metaphor used in this paper is that lower level knowledge flows create complex behavior at the system level. In practice this leads to the proposition that the complexity of health ecosystem can be better understood by modeling the lower level interactions and knowledge flows. Based on this proposition the paper aims to further develop the concept of health ecosystem and the understanding of its knowledge flows.

II. HEALTH ECOSYSTEM

The health ecosystem is a novel approach to comprehensive health care. The concept is not very widely used, but few references can be found from literature (see e.g. [7], [8]). The basic idea of the concept origins from the complexity literature and therefore it provides an interesting starting point also for the application of CBKM framework.

In this paper the concept of health ecosystem is defined by integrating two existing concepts of health care literature – integrated care and health system. These two concepts are descriptive by nature whereas the health ecosystem provides also an interpretation framework. Conceptualization of health ecosystem is presented in Figure 2.

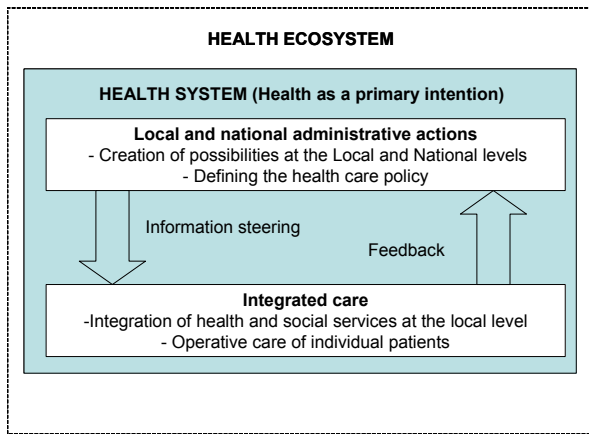


Figure 2. Conceptualization of health ecosystem.

Integrated care level of the system is responsible of integrating the services at the local level. In this integration process appropriate services are provided from the viewpoints of a patient and his/her clinical picture. Hardy et al. [9] have considered integrated care as “a coherent set of products and services, delivered by collaborating local and regional health care agencies.” In this paper integrated care is seen as a local implementation of service provision. Municipalities who are responsible of providing health services at the local level make independent decisions about the operational issues. These decisions cover the care of individual patients. The focus of integrated care is therefore in co-operation of separate specialists and separate activities that in the short run, with no doubt, gain for service users by overcoming fragmentation of services.

Murray and Frenk [10] have defined health system as follows: “A health system includes the resources, actors and institutions related to the financing, regulation and provision of health actions”. Therefore, the concept of health system describes the health care in a larger context. The system includes also the two-way information and knowledge exchange that are used by administrative level for setting the upper level targets and rules for the operative level as well as getting feedback from the operative level.

Health system is in this approach seen more as a political system that focuses on general health policies and creation of possibilities for local implementation of health care. These possibilities include, for example, issues like human resources, financing, legal settings of health care and general guidelines for health. The concept of health system can be used both at the national and local level. At the local level it includes municipal decision making and local adjustment of nationwide health policies to match local requirements. At the national level it presents nationwide health programs, guidelines and performance indicators. This sets the boundaries for local health care for example through legislation, information steering and other external settings from the viewpoint of municipalities.

Figure 3 describes this kind of information steered system where inhabitants of municipalities have a dual role. They are patients and customers of the system and at the same time they as representatives of different interest

groups also compose the information steering authorities both at the local and national levels. Figure 3 presents a highly simplified description of the Finnish health ecosystem. The description leaves out many important agents like private health care organizations but clarifies the idea of health ecosystem and the relationship between the concepts of health system and integrated care in a more practical sense.

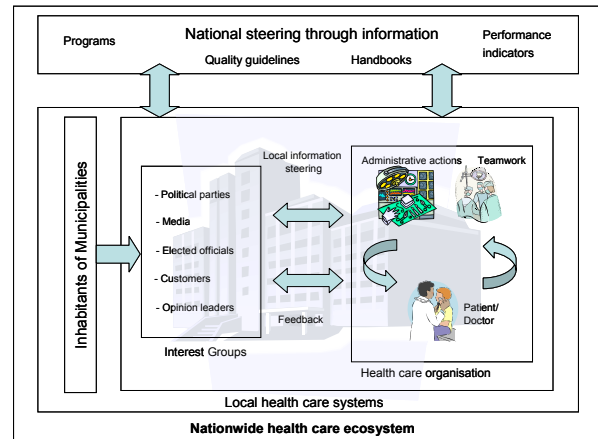


Figure 3. Finnish health ecosystem.

Kernick [8] has suggested that ecosystem metaphor might offer useful ideas for the development of health care. He argues that the emphasis is then on the relationships amongst a system’s components and an understanding of what creates patterns of behavior among them. According to Kernick [8], the important features of health care system are diversity, connectivity, feedback and the existence of self-ordering rules that enable emergence of new order in a system.

The rationale behind the concept of health ecosystem can be drawn from Kernick’s [8] argument that in complex systems, like health care, individual agents cannot be understood in isolation. In social systems agents have their own will and they make conscious decisions based on the existing information and knowledge. This autonomy of agents makes the system highly unpredictable and leads to the situation where, according to Holland [11], the only way to understand the system is to understand those ever-changing patterns generated by the system. Previously presented CBKM framework presupposes that knowledge flows generate these patterns and that by understanding them we can better understand the whole system. This leads to the interpretative nature of the concept of health ecosystem. The concept provides an explanatory framework [12] that could be used for interpreting the actors in their genuine environment and in a continuous interaction with other actors of the system.

Author’s working definition of health ecosystem is:

“Health ecosystem is a dynamic structure which consists of an interconnected population of organizations that influence municipal health care. These organizations are e.g. municipalities, private health care organizations, third

sector organizations, hospital districts, inhabitants of municipalities, government and research institutions that provide the latest research results that are used for information steering or for medical purposes”.

In the next two chapters the focus will be on describing the Finnish health ecosystem with conceptual tools of CBKM framework. In chapter III, it will be discussed how complexity thinking fits in and in chapter IV the focus turns into knowledge flows of the system.

III. HEALTH ECOSYSTEM THROUGH THE LENSES OF COMPLEXITY-BASED KNOWLEDGE MANAGEMENT

A. Self-organizing municipalities

Municipalities that are responsible for providing health care services for their inhabitants gained a lot more freedom in 1993 when there was a major reform in the financing of health care in Finland. This reform can be seen as a one of the most important steps in the deregulation process, although regulation had gradually decreased already during 80's and 90's. [13] As regulation by norms further decreased, being almost nonexistent by 2000, steering through information became increasingly important for the government as a means of monitoring the health ecosystem. These changes provided municipalities the freedom to choose how to organize their health and social services. It can be interpreted that at a certain level the reform in 1993 launched a self-organization process where municipalities are searching for the most suitable organizational structures for their health care.

In practice, the opening of the system led to new kinds of co-operative and competitive relationships between municipalities and their health care organizations. The changes were not restricted to public organizations, the whole system opened and this has produced many innovative solutions of health provision.

Although health care organizations share a general target – the health of the population, there still exists both competition and cooperation simultaneously. Limited resources, specialization and fiscal pressures drive organizations to compete. Organizations negotiate and search for different possibilities to organize. In a sense, interconnections i.e. knowledge flows then act as an enabling factors and facilitators for self-organization as Laihonen [14] has argued. It can be concluded that the integrated care in many cases is an outcome of a self-organizing process. There is not any external source that defines how municipalities should provide the care for their inhabitants. The integration of services is an emergent property of negotiation processes.

Based on the analysis of the health care district of Forssa this self-organization process could be described more concretely. In Forssa district five municipalities started to study the possible advantages of cooperation already in 1993. This study indicated that no significant advantages would be attained. However, some cooperation in auxiliary services was started. Due to the financial pressures another study was conducted later on and finally in 1999 the

decision in principle was made and the first steps towards a current health care federation were taken. This process is one example of the self-organizing process that became possible after the strict legislation on health care was diminished. Currently, FSTKY operates as an administratively independent organization that together with its owner municipalities makes decisions about providing and producing the services of primary health care and specialized health care for the inhabitants of these five municipalities.

FSTKY operates as a service integrator at the local level. Organization's strategy in 2006 is “to defend and maintain activities at the current extent in its core know-how area, and to conceive and strengthen its operations in the selected focus areas and to organize auxiliary services in a most effective way in an overall economy”. In case of lacking know-how FSTKY has established co-operative relationships with other health care providers and produces and therefore it is able to provide also services outside of its own field of know-how. This kind of networking is the main idea behind the integrated care literature. Similarly, other municipalities in Finland have made decisions on their health care and are either producing it themselves or in co-operation with other municipalities. Some have even decided to outsource their primary health care to the private sector. These local processes can be seen as examples of self-organization that has enabled emergence of new order in the health ecosystem.

B. Diversity within the health ecosystem

As it was described in previous chapter, health care organizations in Finland have many possibilities to organize their operations at the local level. Diversity is a measure of these distinct possibilities. Health ecosystem provides a space of possibilities for municipalities. They can produce all the services themselves or they can, for example, join a federation of municipalities as municipalities in Forssa district have done. In addition to these solutions there are also several other ways that have been utilized in organizing health care services locally. Naturally, there are also some limitations that might diminish the set of possibilities. These limitations might include economical restrictions or some social factors like demographics of the area.

Diversity can be divided into the internal and external diversity of an organization. Internal diversity might refer to differences in organizations' employees, such as educational background, experience, skills, targets, ambitions and motivational factors. It could also refer to the internal processes, organizational culture and many other structural characteristics of an organization. External diversity refers to the organizations environment and the possibilities it offers. The greater the diversity the greater the amount of options to choose from. Therefore, increased diversity makes it more probable for the organizations to find an option that is suitable for its purposes.

To summarize, it can be argued that the external diversity sets the requirements for internal structures and for the internal diversity. Balancing of these is, according

to Clippinger, one of the greatest challenges to managers [15].

For health care organizations diversity represents all those possibilities that are available both internally and externally. Internally it is mostly a question of strategy. It is about adjusting internal processes based on the targets of the organization. Strategy defines organizations internal ways of operating. Supportive functions like HR, financing, marketing, management and all others should be defined to support strategy and targets. And most importantly, the key processes that in this case are naturally the nursing processes should be defined and implemented. Finally, supportive functions should be integrated into key processes. All of these describe the management of organizations internal diversity.

It is not possible to recognize all the external forces that influence the health care organization. Therefore, external diversity can not be fully conceptualized. External environment for FSTKY includes at least all the owner municipalities. In case of some of those municipalities is not satisfied with the situation, it might want to reorganize its health care. This would have a great effect on other municipalities belonging to the federation.

Legislation is also an important determinant in health ecosystem because it defines the boundary conditions for provision of health services. There are also countless amounts of different organizations, such as pharmaceutical industry, private health centers, patient associations, government institutions, and research institutions, to mention some, that influence and increase the external diversity of a health care organization. Specialization of knowledge-intensive services has greatly increased the external diversity of organizations and through that the need for co-operation and interconnectedness has also increased.

C. Co-evolution through interconnectedness

In today's highly connected business environment it is important to recognize that the above discussed phenomenon of self-organization always takes place in a certain context and in relation to the environment that is defined by a diverse set of characteristics that should be taken into account in decision making. This kind of interactive evolution is known as co-evolution in complexity literature. Mitleton-Kelly and Papaefthimiou [12] have argued that co-evolution in the context of social ecosystem means that "the evolution of one domain is partially dependent on the evolution of the other, or that one domain changes in the context of the other.

Interconnectedness is finding new manifestations after the opening of the health care system. Health organizations are currently competing and co-operating at the same time. They are competing of their existence but at the same time they also need to form alliances to be able provide integrated services to patients.

Interconnectedness and co-evolution are essential processes behind the idea of a health ecosystem. All the parties within the health ecosystem are interdependent. At the operative level organizations pursue for integrated

service provision, which requires co-operation between different organizations and sectors. These relationships lead to the situation where decisions made by any organization affects the operating environment of other organizations of the ecosystem, i.e. to the co-evolution.

Mitleton-Kelly and Papaefthimiou [12] have divided co-evolution into endogenous and exogenous. According to the authors endogenous co-evolution refers to the internal co-evolution of individuals and groups in organizations. Exogenous co-evolution refers to ecosystem level co-evolution where organizations are interacting.

Within the health system research institutions and governmental institutions are in a close interaction when they prepare health policies and legislation. This is supported by the operative level that provides the most up-to-date information and knowledge about the actual health needs of the population. For example, FSTKY has taken part into several commenting processes of health policies both at the national and local levels. In addition, FSTKY is very active in developing new approaches to health care discussions and actively takes part into knowledge sharing of its own experiences. The latter one includes methods like attendance in seminars and hosting of visitors from other health care organizations. This can be interpreted as exogenous co-evolution at the ecosystem level. Through the interconnectedness of the organizations the decisions made in different part of the system affect the decision environment of any other organization.

At the operational level, exogenous co-evolution refers to the integration of services. According to Hardy et. al. [9], "integrated care is required when the services of individual health care agencies do not cover all multi-problem patients' demands". In these cases organizations have to look for partners who can organize and deliver the care that they are unable to produce. It could be interpreted that also Hardy's ideas in integration of services stand for the usage of co-evolution in this context.

Furthermore, within the health care organizations, different departments continuously need services from each other. Primary health care sends patients for further examinations to specialized care and both of them need services of radiology and laboratory departments. In FSTKY also nursing division has been organizationally separated and therefore also these services are bought from different area of responsibility. These responsibility areas are dependent on each others, they are co-evolving. In this case it is a question of internal i.e. endogenous co-evolution of individuals and groups as Mitleton-Kelly and Papaefthimiou [12] have defined.

Interconnectedness and co-evolution have clear implications at many different levels of health ecosystem. The interdependence of individuals, groups and organizations has increased and will probably still increase in the future. The ideas of co-evolution emphasize the importance of knowledge exchange and communication at the different levels of the ecosystem.

IV. EXAMPLES OF KNOWLEDGE PROCESSES WITHIN HEALTH ECOSYSTEM

Above discussed processes and characteristics of health ecosystem have without a doubt induced requirements also for knowledge processes and their continuous development. In this chapter few of those processes will be described and analyzed based on the findings in health care district of Forssa.

The paper focuses on two levels of knowledge flows. First, knowledge flows within an integrated care will be described with an example of one nursing process. Second, knowledge flows of so called information steering will be described. Focus is on the explicit knowledge due

A. Knowledge sharing within the integrated nursing process

This chapter will describe the findings of modeling of knowledge flows within the process of diagnosing dementia in FSTKY.

The highly simplified process model of diagnosing dementia is presented in Figure 4. It illustrates the different phases and agents that constitute the diagnosing process after the suspicion about dementia.

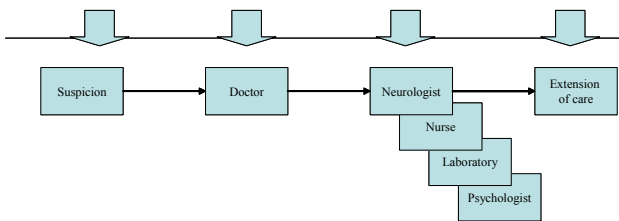


Figure 4. Simplified process model of diagnosing dementia in FSTKY.

Author's presupposition based on the literature was that there would be some problems in knowledge sharing within the nursing processes. These problems would cause, for example, unnecessary waiting for patients that enter the nursing process. Based on the knowledge management literature concerning health care or public organizations in general (e.g. [17]) it was supposed that the main problems would highlight issues like hierarchical structures, resistance to change, strong divisional boundaries and incompatible information systems as potential barriers for knowledge management.

Based on the interviews and observations in FSTKY all of these presumptions had to be discarded. First of all, it became clear that FSTKY as an organization, although hierarchical organization chart exists, is a very flexible one. Resources are transferred based on the actual need and demand peaks are leveled with external resources. These external resources provide the organization with tools for balancing supply and demand. With this kind of arrangements organization can also fulfill possible knowledge gaps in certain medical areas. In case of dementia, neurologist is available in Forssa based on the demand of his services, currently the need is two days in a

week. In a larger frame the continuous shortage of resources often discussed in the context of health care is a question of education politics and is not in the hands of FSTKY, which however has succeeded well in recruiting.

Distribution of work that relates also to the strict hierarchical and divisional boundaries was also not a problem within the studied nursing process. Primary health care and specialized health care have agreed on tasks that should be taken care in each sector. This distribution of work was regarded as a guideline that steers the process internally. The guideline has been established in co-operation between both sectors and organization's management and is considered twice a year in joint meetings. FSTKY has also appointed a responsible doctor for this nursing process.

One probable reason for the clear division of tasks in FSTKY is the organizational structure. Primary health care and specialized health care are provided within the same organization whereas in many cases these two are divided into separate organizations. This reflects also to knowledge sharing. Knowledge can easily be shared with medical workers from different sectors, of course within the boundaries of legislation concerning patient information. Another issue that supports and intensifies information and knowledge sharing is a shared information system. This system is available for both sectors and it contains all the medical information about patients.

It was found out that within a certain nursing process, explicit information has a vital role. Primary health care and special health care transfer information and knowledge mainly through the shared information system. The need for face-to-face consultation between doctors is insignificant, although due to the short physical distances it would be fairly easy. Information about the patient and his/her situation is collected through normal doctor's reception, medical tests, questionnaire sent to patients relative. All this information is stored into the same information system. In some cases patients are also sent into another health care organization, for example, in case of a special surgery. In most cases information can be delivered in electronic form to the receiving organization. Although information systems are under continuous development initiatives it seems that the system could support the process fairly well in this case.

To summarize, it seems that within FSTKY and especially within the processes of diagnosing dementia knowledge sharing is very satisfactory and that a shared information system together with the existing organizational structure where primary and secondary health care operate as a one legal entity creates a solid basis for knowledge sharing.

B. Knowledge flows as channels of information steering

As it was described earlier in this paper, information steering can be detected at two levels. National level of information steering sets the framework for the health care sector. Although information steering has in many cases replaced normative control the government still uses legislation to control the provision of health care services.

The Finnish constitution states that public authorities shall guarantee for everyone adequate social, health and medical services and promotion of the health of the population. To mention some of the most fundamental laws concerning health services we can highlight the Primary Health Care Act that obligates municipalities to provide health promotion and disease prevention, medical care, medical rehabilitation and dental care for their inhabitants. Municipalities are also obligated by law to arrange specialized medical care. The Specialized Health Care Act and the Mental Health Act regulate the organization of these services.

Legislative tools are not the only methods that are used for national level guidance. Tools and channels for information steering are diverse. Both physical and electronic methods are being used. Reports, handbooks, recommendations, guidelines and consulting are some practical examples of these tools. It is important to notice that these authoritative recommendations are not binding. Information steering does not constitute any minimal norms.

The Ministry of Social Affairs and Health publishes general guidelines for the overall development of the sector. For example, The Government Resolution on the Health 2015 is a public health program that outlines the targets for Finland's national health policy. There are also highly specialized recommendations like the one on usage of vitamin D.

The National Research and Development Centre for Welfare and Health (STAKES) is a sector research institute under the Ministry of Social Affairs and Health. Its core functions are research, development and information production. It also supports the Ministry in implementing the strategy of the administrative branch [18]. STAKES' operations are governed by the relevant Act and Decree. Its statutory functions are: to engage in research and development, to evaluate social welfare and health care, to refine and communicate information and develop expertise at national and international levels, to maintain statistics and registers, and finally, to influence social and health policy. As it can be seen from range of tasks and responsibilities STAKES holds, it has a very important role in Finnish health ecosystem as a knowledge broker and innovator.

In FSTKY there are not any formal methods for following this national level of information steering. The most common way of retrieving this information seems to be the traditional mail. In case of changes in legislation or recommendations given through information steering the management group discusses about them and makes a decision on future way of action. Media, pharmaceutical industry and patient associations have their own opinions on many issues and those have to be taken carefully into account in decision making. Current topics will be always discussed in management group as well as in coordination meetings of responsibility areas to form a general understanding about them in FSTKY. These are the official channels through which national level of information

steering is enforced in FSTKY.

At the local level public health care organizations operate under the supervision of municipal decision making. Without diving too deeply into the municipal possessory relationships and their peculiarities the most important municipal administrative institutions will be shortly described.

Municipal council is elected every fourth year. The council selects the municipal executive board and different committees to represent political parties based on the relative results of the election. Municipal executive board is responsible of the daily operations, financial management and prepares and conducts issues that fall into the authority of municipal council. Committees act under the supervision of executive board in their own sphere of authority. Local administrative information steering is mainly conducted by these municipal institutions. Each municipality should be able to enforce national level policies and programs that are suitable and essential for their local situations.

FSTKY is owned by five municipalities and therefore it has to operate according to their best interests. Municipalities negotiate annually on the provision of services with the health care district of Forssa. Municipalities and the FSTKY draw up a framework agreement for the following year on the amount of costs of services. This means that all five municipalities direct their resources aimed at arranging health care for population through the federation. This framework agreement and the whole negotiation process naturally can be seen as strong information steering from the municipalities. The agreement is a local implementation of national health policy.

FSTKY also acknowledges the important role of their individual customers. It provides multiple channels of feedback and all the feedback is discussed in management group meetings. Changes are also made for adjusting the internal processes accordingly. This makes the organization highly adaptable to external requirements.

In the dementia process information steering is discussed in shared meetings few times a year between representatives of primary health care and specialized care. In these meetings doctors form a shared understanding on current issues such as new methods of care. Especially new pharmaceuticals have raised discussions on proper treatment of dementia that has many social and humane aspects. These discussions also provide experts a channel to express their own ideas and to get feedback on daunting issues. These discussions can also be interpreted as learning situations for all participants.

To summarize, it could be concluded that the knowledge flows as a channels of information steering both at local and national levels are diverse and that the studying and understanding of these flows may greatly enhance the understanding of the whole health ecosystem and further, lead to efficiency gains in health care services.

V. DISCUSSION

This paper reported the work in progress. The theoretical

work on health ecosystem is still under development and the case study in FSTKY has not been completed. However some preliminary conclusion can be drawn.

A. Theoretical conclusions

The Finnish health system, as well as health systems in many other countries, is under the influence of many global forces. These economical, political and social forces drive change in health care delivery. In short, structural and organizational opening of the Finnish health system and the transition from normative control to information steering have increased the need for new approaches. The traditional system view of organizations, especially in case of complex knowledge-intensive organizations, has been challenged by complexity theories. Traditional view is not sufficient because of its machine-like approach to organizations. In social systems it is very hard to isolate actions and ideas as independent of each other, therefore the focus should be changed into the interdependencies. This is the basic idea that complexity theorists have highlighted.

Opening of the health system has broken the previously very strictly predefined system into pieces and in current system agents have a freedom to self-organize as it was described in this paper. Diversity of the system has also increased driven by the specialization and financial pressures. Specialization and the followed diversity have induced the need for co-operation and interconnectedness of the system's parts. Interconnectedness and the co-evolutionary nature of the system require holistic approaches. The mechanistic system with strict boundaries is not there anymore.

Based on the analysis presented in this paper the preliminary conclusion is that the concept of health ecosystem might provide a usable interpretation frame for utilization of complexity thinking and knowledge management in health care sector. Recognition of the patterns of interaction, i.e. knowledge flows of health ecosystem might help us to understand and adjust health care services accordingly in situations where change is inevitable.

This paper discusses health ecosystem in the Finnish context but the approach as such is not restricted to any given area. In literature, ecosystem approach has been seen as a novel approach to health care but the references are still few. The definition given in this paper provides the basis for further application. The paper argues that the ecosystem approach reconciles the descriptive viewpoints of integrated care and health system by highlighting the interconnectedness of the actors and the dynamic nature of the environment. Therefore, it also provides a promising basis for the study of knowledge flows.

The author sees the role of knowledge flows as building blocks of organized activity at the system level and assumes that by studying and understanding knowledge flows at the local and organizational level it is possible to better understand functioning of the health system and its overall complexity.

B. Practical implications

The concept of health ecosystem provides an interpretation frame for understanding the underlying patterns of health system. It is assumed that this understanding might also broaden practitioners' way of thinking. The understanding that legislation and information steering are enablers of self-organization should motivate the personnel of health care organizations. Local health care is not restrained by the normative control and it has an opportunity to utilize all its capabilities. The ecosystem metaphor also points out the importance of each decision. In co-evolutionary environment outcomes of any decision might have unexpected results at the system level, which makes decision making and negotiation processes purposeful.

The focus on information and knowledge flows highlights knowledge sharing practices. In the case study of FSTKY it was clearly detected that at the operational level a shared information system and suitable organizational structures greatly lower the barriers of knowledge sharing that were mentioned in literature. However, based on other studies carried out in Finland it seems that there are still problems in information sharing between different sectors of health system. For example, integration of services and knowledge sharing between health and social care still struggle with these barriers.

The concept of health ecosystem might prove to be an adequate concept also for the study of information steering. By interpreting the health system as a network of knowledge flows the focus changes to the interconnections and patterns that steer the system. The paper described that information steering can be detected at local and national levels. By understanding how these two interact and how they affect the actual service provision practitioners might be able to form a more realistic view of their role in this dynamic environment.

At this phase the concept of health ecosystem is merely an interpretative concept but it seems to provide a meaningful tool for interpreting and analyzing phenomena that are far from static and mechanistic. Requirements set for health care delivery change as well as the possibilities of the health system to respond to these requirements. Maybe we should also change our mechanistic view of the world towards a more realistic one.

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REFERENCES

- [1] Miles, I., Kastrinos, N., Flanagan, K., Bilderbeek, R., den Hertog, P., Huntink, W. & Bouman, M. *Knowledge-intensive Business Services: Their Roles as Users, Carriers and Sources of innovation*, 1995, Manchester: Prest.
- [2] Maula, M. "Knowledge-intensive services, knowledge/Information management, and dynamic complexity – An Interdisciplinary Approach to Service Science". *Education for the 21st Century*, IBM Palisades Conference Center, New York, 5th-7th October 2006.
- [3] Sinkkonen, S. (ed.), Hallinnonuudistus ja sosiaali- ja terveydenhuollon yhteistyö kunnissa. *Kuopion yliopiston julkaisuja E*. 1993, Yhteiskuntatieteet 9, Kuopio.
- [4] Launis, K., Asiantuntijoiden yhteistyö perusterveydenhuollossa. *Käsityksiä ja arkikäytäntöjä*, 1994, Tutkimuksia 50, Helsinki, STAKES.
- [5] Koivuaho, M and Laihonon, H, "A Complexity Theory Approach to Knowledge Management - Towards a Better Understanding of Communication and Knowledge Flows in Software Development", *The Electronic Journal of Knowledge Management*, vol. 4, issue 1, 2006, pp. 49-58, available online at <http://www.ejkm.com>.
- [6] Alavi, M. & Leidner, D., "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues", *MIS Quarterly*, Vol. 25(1), 2001, pp. 107 - 136.
- [7] Baskin, K. "Social Ecosystems: A Complexity Context for Health Care Policy", Presentation at *RAND Workshop on Complexity and Public Policy*, Arlington, Virginia, 27-28.9.2000.
- [8] Kernick, D. (ed.), *Complexity and Healthcare Organization: a view from the street*, 2004, Oxford, Radcliffe.
- [9] Hardy, B., Mur-Veemanu, I., Steenbergen, M. and Wistow, G., "Inter-agency services in England and the Netherlands. A comparative study of integrated care development and delivery", *Health Policy*, vol. 48, 1999, pp. 87-105.
- [10] Murray C. and Frenk, J. A framework for assessing the performance of health systems. *Bulletin of the World Health Organization*, 2000, 78(6):717-31.
- [11] Holland, J., *Hidden Order: How Adaptation Builds Complexity*, 1995, Cambridge, Perseus Books.
- [12] Mitleton-Kelly, E and Papaefthimiou, M-C. "Co-evolution of diverse elements interacting within social ecosystem", *Feast 2000 International workshop on Feedback and evolution in software and business processes*. Imperial college, London, UK, July 10-12, 2000.
- [13] Järvelin, J. "Health Care Systems in Transition", *European Observatory on Health Care Systems*, Vol 4, No. 1, 2002.
- [14] Laihonon, H., "Knowledge flows in self-organising processes", *Journal of Knowledge Management*, Vol. 10, No. 4, 2006, pp. 127-135.
- [15] Clippinger, J. III (ed.) *The Biology of Business: decoding the natural laws of enterprise.*, 1999, San Francisco, Jossey-Bass Publishers.
- [16] Shortell, S. M. and Kaluzny, A. D., *Health Care Management. Organization Design and Behavior*. 5th Edition., 2006, New York , Thomson.
- [17] Van Beveren, J. "Does knowledge care for knowledge management", *Journal of Knowledge Management*, vol. 7, no. 1, 2003, pp. 90-95.
- [18] STAKES, <<http://www.stakes.fi/EN/Stakes/valtionihallinto/index.htm>>, 17.9.2006.