Visions of Health Care Information Systems in Finland by the year 2007 - at the Point of Intersection between Different Cultures

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Abstract

Health care information systems are an area between two intersecting fields: Information Systems and health care. The development of health care information systems (HCIS) is influenced by software and hardware as well as medical innovations/development. The HCISs in also intersects with a wide range of other areas including management science, statistics and biomedical science. The technological development in health care is connected to the overall social development. The overall trend is quite similar in to the whole Western world, but individual countries show differences due to different cultures regarding, eg, the

strictness of regulations on data security. In the future, the increasing number of aged people and the resulting increase in demand for health care services will cause a financial crisis in health care. Some (health care) professionals see IT applications as an answer to this crisis, although this assumption is not valid in all systems. The purpose of this article is to offer for researchers and practitioners viewpoints on how to foresee the development of health care information systems and give some guidelines for the future of this rapidly expanding, multidisciplinary, cross-cultural area.

1. Introduction

The development of information system applications is unpredictable as it depends on unexpected factors: how market forces react, who spends most money on marketing, who allies with whom to gain market leader position and which solutions end users finally adopt into use. Sometimes a very simple idea turns out to be an important innovation and causes great changes in the way people think of and use new technology. Surprisingly, the development of health care information systems can be affected by impulses generated in surprising areas of research and practices. As cultures and financing models vary from country to country, the pace/speed of development also varies in different parts of the world.

The various IT applications in health care are generally referred to as health care information systems (Ragupathi 1997). Behind these systems there is a wide range of different sciences including medicine, nursing, health care, organisational science, statistics and biomedical science. Health care applications can be divided into groups such as diagnostic, treatment, nursing, administrative, support and auxiliary systems (Van der Loo et al. 1995). As medical information systems into other health care information systems, the semantic importance of the term *health care information system* will gain ground from *medical information system*.

The rate of investments in HCISs is expected to rise as a result of the financial crisis and attempts to reduce the overall costs of health care while improving the quality (Ragupathi 1997). Health care is investing in information systems, such as electronic medical records, Intranets, the Internet and telemedicine and tries to catch up with other sectors. In a survey made among some 200 health care IT professionals, 47% of the respondents believed that in ten years, health care IT costs will rise to 3% from the present 1.2% (IIR 1998). The speed of development varies in different countries. Finland is some years ahead of central Europe and some years behind some American organisations. The future will show if the growing importance of this field and the integration development of health care information systems will gain more independence as a separate HCIS field of research.

To foresee the future of this multidisciplinary/cross-cultural area is not as problematic as it first seems. The examination of the evolution of HCIS reveals some trends. These trends can be assumed to continue in the future and consequently they serve as road maps for both academics and practitioners. This article also attempts to recognise and describe other important factors possibly playing a part in future health care information systems.

2. Interaction of human actors and technology in western countries and its impact on health care

In “Computers in Context – The Philosophy and Practice of System Design (1993)”, Dahlbom and Mathiansen (1993) link very convincingly technological development to the western idea of man. The Platonic and hermeneutic ideas of man represent people and the positivistic and deterministic represent computers and developers of technologies. The dialectic relation between computers, or more generally between technology, and people is one of the richest sources for developing computer systems and organisations (cf. Dahlbom et al. 1993). There seems to be interaction between organisational culture and information systems (Figure 1). It is widely known that

organisational culture and the way it works affects the development of information systems and vice versa.

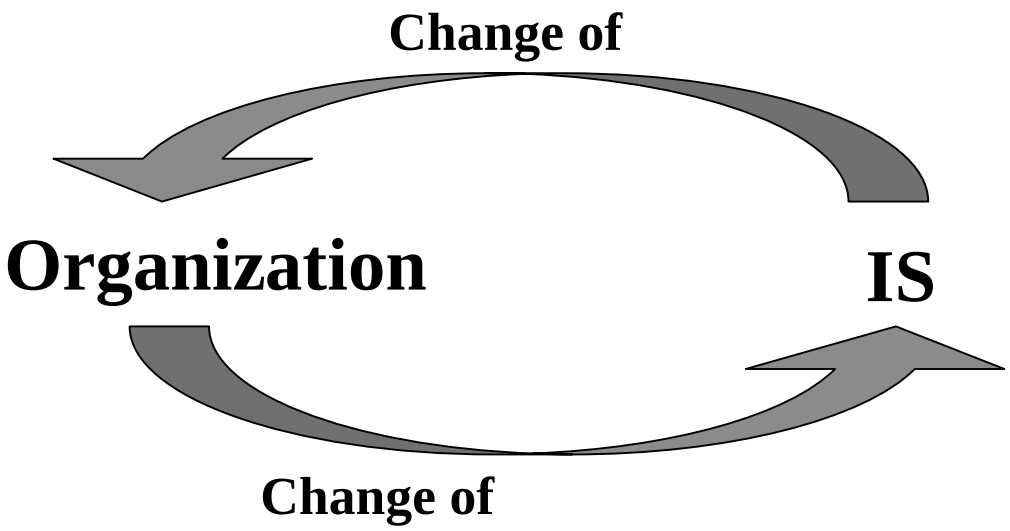

Fig. 1 Interaction between organisation and IS

Similarly, there is a relation between the idea of man and technology. The Western idea of man emphasises individualism, democracy, globalisation, global village, human rights, eg, freedom of speech, and free market economy. These ideas have strongly affected the development of IT as they emphasise the importance for example end users, customers and global networks. On the other hand, the Internet enables freedom of speech to such extent that was earlier technically impossible. Furthermore, the Internet changes our ideas, legislation and finally the whole Western culture.

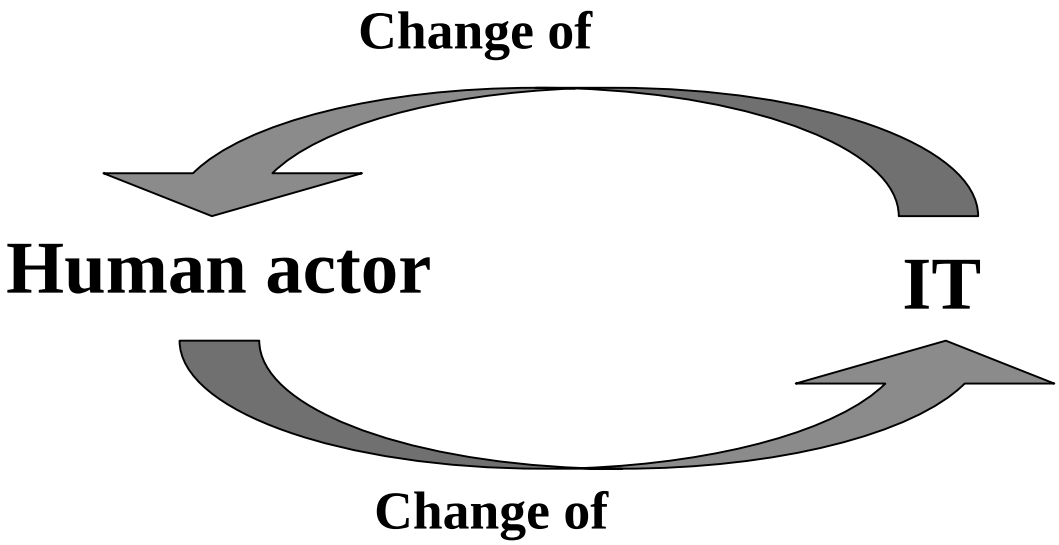

Fig. 2 Interaction between human actor and IT

The general social movements also affect health care. At the moment, health care is institution-centred. The European Commission has estimated that at the beginning of the next decade, health care will shift from institution-centred to citizen-centred care (EHTO 1997). This seems be in line with the general social trends. People's increasing consciousness of their own health (Saranummi 1995; EHTO 1997) and today's information-intensive society is leading to a situation where consumers of health care services want to be better informed of their health (Ragupathi 1997; EHTO 1997). The demand for higher quality service and information together with the financial crisis in health care will result in the growing importance of free economic aspects in health care. In addition, the globalisation trend, based on ideas mentioned above, can not be without effects on the health care sector.

Two important trends are strongly interconnected: 1) policy makers try to limit the use of expensive secondary care, 2) patients are better informed of different treatment options and demand more than before. Traditionally, secondary care has been understood as health care provided by specialists in hospital. Patients are asking for higher quality and, at the same time, society is trying to limit the use of secondary care. This may lead to decreased use of hospitals but increased use of specialists in primary care. Therefore, this development will hit hardest the hospitals, but not the

specialists. In most European countries, medical doctors work as private clinicians. Even if they work in a hospital, the clinicians charge their fees on a separate bill and the hospital will charge for the use of hospital facilities, examinations and drugs. In Finland, where all salaries are paid from the hospital budget, there is no clear difference between the clinicians' impact and other hospital costs. As a result, the ratio clinicians/other personnel in Finnish hospitals is 1/8-10. This is a very low ratio compared with many hospitals in Europe where the ratio is 1/4-5. This creates demand for cost-effective patient-specific hospital information systems (cf. Hallman et al. 1994).

3. Health care trends and those impact on HCISs

3.1 Growth trend

One important trend in health care information systems is the growing investment rate. According to the public opinion, it seems that the limits of health care costs are already reached (Roine1997). The Finnish model with free-of-charge health care and its increasing costs have led to discussions on which patients should be treated and what diseases should be left outside the public health care. Little emphasis has been put on the fact that many elderly people would be able and willing to pay for their treatment but the possibilities to do so are usually limited. One striking example is that many Russian patients would be prepared to pay for an operation in Finland. However, this is impossible in public hospitals if there are Finns queuing for the same operations. If hospitals were managed like private companies, a solution to treat both Russian patients and Finns would have been found rapidly. After all, the service sector is the area that can offer most new jobs in the future and health care services would be

a very suitable area. During the economic crisis in hospitals, cutting costs was the only aim. However, it will soon lead to so-called "organisational anorexia nervosa" where cost reductions lead to decreased productivity and a need to further cost reductions.

The British public health care system has many similarities to the Finnish model. However, Prime Minister Tony Blair has started a major health care reform and tries to increase individuals responsibility for their own health. Patients are given more freedom to select what they want from the health care, but they also have to be prepared for services that are above the accepted public standard.

One attempt to resolve the financial crisis in health care is the use of information systems to reduce costs and improve patient outcome (cf. Saranummi 1995; Ragupathi 1997). However, information systems cannot replace expensive new treatments and medical technology. Therefore, information technology does not remove the need to cut costs, but it helps decision-makers to base their decisions on facts and not assumptions. Investments in health care information systems are still inferior to those made in banking, the airlines, and manufacturing. Some information system experts expect further exponential growth (see Ragupathi 1997). Probably the growth will not be exponential. It is quite common for professionals to exaggerate growth estimations in their own research areas, because it makes their own research area seem more important. Unfortunately, experience has shown that it has taken years for many IT solutions to finally break through (e.g. Turunen 1996). Also, the conservativeness of physicians slows down the pace of IS development.

3.2 Observer position

Why do physicians oppose the introduction of new information systems? Increasingly, physicians want to ensure the reliability of new treatments before they are adopted into routine use. This conservative, attitude has prevented new methods with potentially unexpected consequences from being accepted to use. It would be unethical to accept new treatments to everyday use without knowing if they are

harmful than useful. This conservatism also covers other areas. The outcomes of information systems and information technologies have varied, which may have affected the willingness to implement new systems. Hospital information systems have been helpful mainly in administrative tasks. In clinical work, the support has been minimal. There are several reasons for this. Health care is not easily accessible for the information technology industry. Too often it draws an analogy between a hospital and a car factory and tries to apply software used in factories to help in hospital processes. The industry has not realised the complexity of the ethical and economic factors influencing each decision. Another factor limiting the eagerness to introduce information technology to hospitals has been the lack of standards. Software companies have even tried to use their own secret standards in storing ,eg, ECG signals just to make the customers use their products. Most medical data are still stored in a software-specific format and consequently there is very little interoperability between different systems.

At the moment, the state of health care information systems resembles that found in other fields in the 80s. As a rule, the HCIS field seems to be some 10 years (Kilpeläinen 1998), partly almost 15 years behind other areas (see Ragupathi 1997). However, the development of health care information systems is not exactly linear. Some innovations are put into use in HC faster than others (that are not seen very useful in health care). For example, the very recent WWW and Intranet technologies have been adopted very fast in HC organisations.

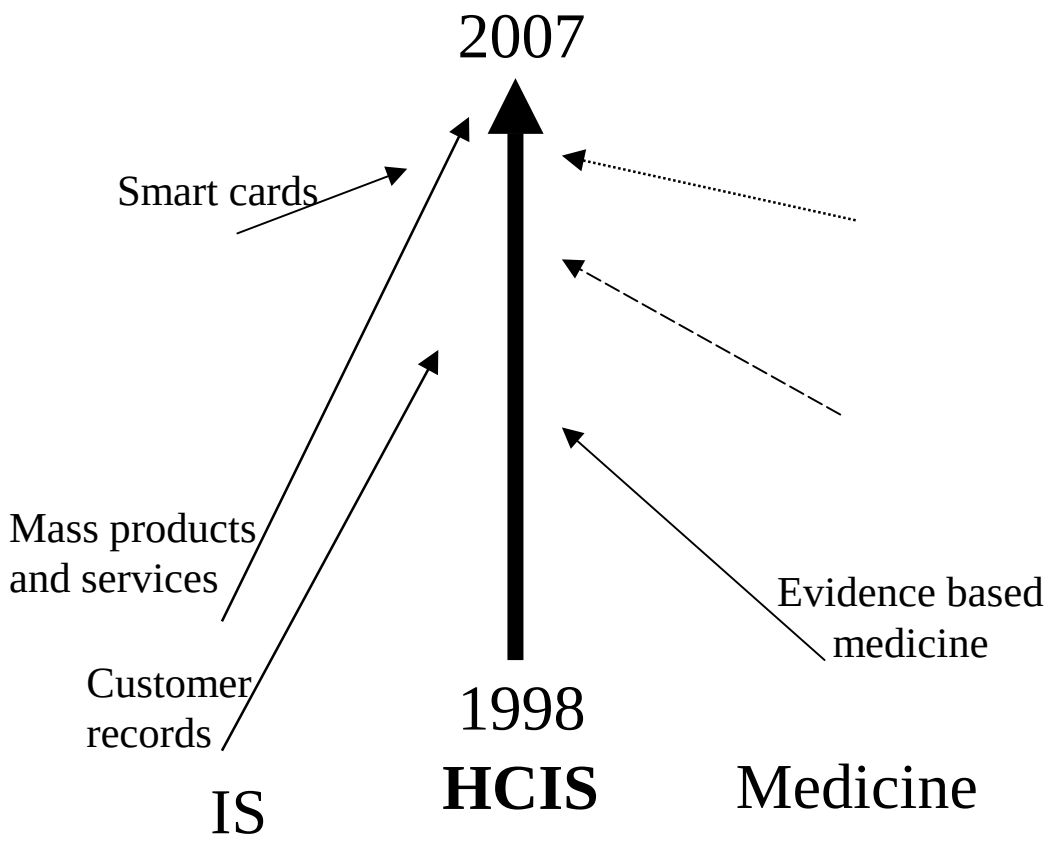

Fig. 3 Diffusion of IT and medicine into field of health care information systems

Another important factor affecting HCISs is medical research and development. For example, the ideas originating from evidence-based medicine have been translated into computer-assisted forms. As a rule, it can be said that the diffusion time of medical ideas into information systems is shorter than that of general IT ideas (see Figure 3) (cf. McDonald et al. 1990). This is because physicians are strongly participating in those projects.

4. Visions of practical solution of HCISs for the year 2007

This chapter presents some visions of practical HCIS solutions on the basis of trends presented above, the present situation of information systems in general and future innovations of IT applications.

Traditionally, health care information systems have been very specific that are used only in HC. Consequently, there has not been very much general software in the field. In the future, the public sector will enter a competition situation. Some researchers have anticipated that the future economic model may well be provider-purchaser split (Salminen et al. 1996). Public health care will probably have to adopt and other management practices developed in private companies and select the software accordingly. Consequently this software may take over from health care -specific applications.

So far, the barriers between health care institutions have been high in different countries. Together with HC-specificity, this has meant that most information systems have been self-made. Due to small markets, there are only a few HC software producers in Finland. In the future, the EU will probably remove market barriers. Thus it can be expected that IS and Internet services will be increasingly supplied from abroad. According to Jaakko Kilpeläinen from Mercastor, Coopers & Lybrand, the application markets will be dominated by international products in the future (Kilpeläinen 1998).

At the end of the 90s and the turn of the millennium, health care information systems will focus on end users. At present, health care information systems are primarily information-centred or organisation- centred. Health care professionals, eg, physicians, have participated little in system development, which has slowed down the development of usable applications. In other fields, this was the case in the late 80s. In other fields, user participation in IS planning has increased the acceptance and use of new IS systems, and this will probably be the case with health care ISs as well.

It is anticipated that the next step is from end user -centred systems to customer-centred systems (Hannus 1994 p. 225). As physicians' primary task is to take care of patients' health, this will most probably be the case in HC. It seems that in information-intensive societies, consumers want better information of their health options and easy access to relevant health information (Ragupathi 1997). At the moment, there are many patient information systems, mostly used in consulting rooms or as reference books (eg, CD-ROMs). In actual fact, these consulting room systems are not customer-oriented, although customers are using them (cf. Aydin et al. 1995). However, what may be the solution, is the Internet. It will probably play a crucial role in the future (Ragupathi 1997).

In the next decade, mass-produced off-the-shelf software will come increasingly into use. The situation will be much the same as nowadays in the corporations. As the younger generation of physicians and nurses has good computer skills, there is pressure to replace the old mainframe systems with graphic ones. However, if huge investments have already been made, the transition will not be easy. Although net computers will probably not increase their total market share, NCs have potential to replace fast connections by easy-to-use WWW technology in health care.

According to the Finnish social and health care information technology strategy (1996), the barriers between primary and secondary care will grow smaller. It would be reasonable to build inter-organisational systems between primary and secondary care, but the year 2007 may be little too early for fully integrated systems. Problems may be caused by organisational or technical barriers between the units. However, integration could be possible if a new way of thinking were adopted. The attempts to limit the use of expensive secondary care and the better awareness of patients on treatment possibilities may decrease the use of hospitals but increase the use of specialists in the primary care. Most likely, large hospitals will not have such a central role in health care as before. Therefore, it is not reasonable to develop electronic patient records based on hospital information systems. Patient records will most likely

become patient-specific so that electronic health care data can be accessed anywhere the patient is treated. This model would be more useful for the patient and perhaps more cost-effective for the society in the long run (cf. Hallman et al. 1994). However, it is not clear who would be in charge of the costs in Finland. In countries such as Switzerland there is a long tradition of private health insurances. In Switzerland, the insurance companies will most likely take care of the patient-specific electronic patient records as well. It is only one additional service provided by the insurance company. Although the relation between secondary and primary care is not yet clear, it is obvious that municipalities together or in some cases municipalities with regional hospitals will form larger units to gain synergy and to negotiate together with IT and health service producers.

If we were able to access both the patient information and the medical information needed by the clinicians over the net, treatment would be less place-dependent. This would make it possible to shift the focus on outpatient care. Doctors could start home-visits again, because there would be no need to ask the patient to come to the clinic. For example, about half of internists' work could be done with inexpensive portable equipment. The other possibility of ambulatory services is patient-physician consultation via the Internet. At best, in the year 2007, consultation can be done by means of picture and voice. What are still needed are legislation, electronic identification and electronic money. When the problems related to electronic identification are solved, the supply of skilled physician services will expand rapidly on the net. According to experts, data transmission capacity will not limit the usability of telemedicine or nets for picture transfer. If funding is found, the technique is available.

Evidence-based medicine and different practice guidelines and treatment protocols will become available on the Internet. Clinicians will be able to select from available services the ones the want to use. There may be some services for clinicians to help them find high quality information. However, traditional hospital information system developers may be left behind/dropped out of this development. The introduction of

information services is like subscribing to a medical journal. There is no need for involvement by hospital administrators.

It can be anticipated that both intra-organisational information systems and inter-organisational information systems (between group of small units) will be integrated as large Hospital Information Systems (HIS) (Kim et al. 1990) (see also Wiederhold et al. 1990). In the USA, there are some good examples (Grönroos 1997; Gardner 1990; Gardner 1994) of systems integrated with each other. In the 70s, it was estimated that the integration takes about 20 years (Nolan 1979), but the present open systems and mass products are speeding up the pace. The integration process is well under way in especially in small units and presumably most organisations will have integrated systems by the year 2007.

One of the important trends is the move toward electronic patient records (Ragupathi 1997). In the worst case, development toward electronic patient record may happen at the organisational level in the following phases. In some hospitals, paper-based patient records will be replaced with 1) computerised medical records. Then one step more developed 2) electronic medical records will be used in hospitals. After that, life-long patient records covering all different health care areas will be adopted into use. Finally, 4) electronic patient records (or electronic health records) will cover all health and social sectors. (cf. Lauharanta 1997)

In the USA, applications utilising AI, neural network, and fuzzy logic techniques are being developed to provide clinical decision support to physicians (Ragupathi 1997). The objective of this category of HCISs is to assist physicians in diagnosis and treatment. The quality assurance of decision support tools has to be developed and the liability issues must be defined before clinicians are ready to use the DSS tools.

5. Conclusion

The field of health care information systems is a mixture of different sciences and practical areas. Despite the impulses coming from different directions, forecasting the future development of this field is not so difficult as it seems. The purpose of this article was to present some viewpoints on the future development of HCISs. By examining the general HC trends affecting health care information systems, the present state of information systems in general, and some future solutions, the visions of the area are presented. We hope that researchers and practitioners will be able to benefit those ideas in their work.

This article attempts to present how things will most likely develop. Often articles concerning future developments focus on how things should be done, not how things will most likely develop. Unfortunately, experience has shown that the human actor is unrational: he or she does not do what would be reasonable. This paper also includes some alternative visions, which are recommendations how to do things reasonably and how they may at best case happen. Thus, it is useful to remember that forecasting is always difficult, especially forecasting of the future.

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