

Evaluation and Development of Economic and Administrative Process Technologies for Health Care

Pertti Ahonen
University of Tampere

Technology policy and governance of technology cannot ride solely on technology itself, because technology is intertwined with political, administrative, sociological, cultural and economic issues. Technology policy and technology governance need to adapt knowledge on those issues for their purposes. In dealing with this challenge, let us coin the neologism 'economic and administrative process technologies.' This term can be seen as an adjunct to such key targets of technology policies, technology programmes and their projects as information and communication technologies (ICTs), biotechnologies and new materials technologies. The empirical references of the paper are the Finnish technology policies and technology governance, although the argument runs in a more general than only a country-specific level. Summarising the results of the paper, first, from an international perspective, economic and administrative process technologies supplementing their engineering, medicine and natural science counterparts are far from fully elaborated. Reasons for this include the fact that technology assessment (TA) in health care is still relatively underdeveloped with respect to its full utilisation and its economic orientation. In health care, economic and administrative technologies intertwine with other technologies, importantly clinical ones, and the boundary between those two types of technologies frequently remains hazy. For said reasons, it is advisable to consider the economic and administrative process technologies not only per se but also by combining the two perspectives of economic evaluation in health care on the one hand, and TA in health care on the other. The results suggest, further, that so far, health care has not been blessed with solid evidence-based economic and administrative process technologies, which is unlike the case in several substantive health care fields. So far, most TAs in health care have been constrained in their scope. Economic evaluation has made uneven progress with respect to such development trends in health care as the definition of clinical pathways, the integration of information systems and knowledge types, the improvement of cooperation between various professions dealing with health care and the strengthening of ICT-supported self-care of patients and citizens interested in an effective prevention of illness. Among the economic and administrative process technologies of health care, particular consideration can be directed upon applications of industrial economics and business economics in the management of health processes, small-scale TA in health, and knowledge brokering in health care. The paper concludes with a brief consideration of relevant 'weak signals' for future development.

Keywords: technology policy, technology governance, evolutionary economics, innovation policy, health care, welfare policies, professionalism, economic evaluation

1. Purpose, problem, questions and structure of the discussion

The purpose of this paper is to consider the *economic evaluation of economic and administrative process technologies in health care* with special reference to the small developed country of Finland but with an eye also towards other comparable countries. Why do we need innovation in this field that is derivative of the core technological fields? What is the value added for using the term *economic and administrative process technologies*? First, the expression ‘economic and administrative process technologies’ is free of connotations that burden more established concepts. Second, the term covers a good deal of the conceptual, methodical and technical baggage of scholars and practitioners without being too constrained by boundaries between fields of expertise. The concept can be used to refer to aspects of the expertise of the accountant (e.g. external accounting including the derivation of result statements, balance sheets and flows of funds accounts as well as cost accounting and pricing calculations), the economist (especially health economics), the psychologist (e.g. where profiles of jobs and people are compared in recruitment or the assessment of results) or the management specialist (dealing with any of the above fields possibly promoting some given approach to ‘management’ or ‘leadership’). The concept also covers a good deal of what seasoned experts in nursing promote and apply, and some part of the field of expertise of the ICT specialist. Health care, its technologies, the economics of health care and the economics of health care technology are too important issues with too high costs to be left in the hegemony of those professions, professionals and their affiliate scholars who deal with those questions as their principal occupation.

Next, why should the *economic* and administrative process technologies be further evaluated from the *economic* point of view? This is because such technology not only brings about benefits, but there are also costs arising both from its implementation and its routine use. We will be dealing with some of those costs below under the term ‘transaction costs.’ The economic and administrative process technologies may also have side effects. It is motivated to stabilise the positive including the inventive and innovative ones among these on the one hand, but on the other hand to try to fend off the negative ones such as phenomena of economic ‘moral hazard’ and ‘adverse

selection.¹ One can apply to the economic and administrative process technologies in health care the same critical and conditional conclusion as has been suggested regarding any technologies in the health care field: “The development of technologies of health *may* slow down the rise of costs.” Huttunen 2006, 87, translation and emphasis by the present author.² Conclusions such as the previous one are to be taken particularly seriously observing that the share of health care costs of the GDP is in double-digit figures in such countries as the United States and Germany.

Technology policy and efforts at improving upon technology government are no marginal activities in a country like Finland. For instance, in the 2000s, the budget of the Finnish health care technology programme FinnWell alone was 150 million Euros as provided by the Finnish national government organisation Finnish Funding Agency for Technology Development and Innovation TEKES, and there were also other programmes. Using a concept with presence in the Finnish health care technological field by Saranummi and others (2005, 3), we are dealing with a coordinated effort at *systemic innovations*. Besides innovation in technologies in the sense of engineering or medical science or methods, these also entail innovation in three other areas outlined by Saranummi and others: in services and processes, in networks and value chains and, third, in governance, organisation and resource management. What is here called ‘economic and administrative process technology’ has mostly to do with the third element. It is also related to interpretations of the opportunities provided by generic tools of business management in the development of a national government-regulated and to a large extent local government-provided health care such as that in Finland. (Saranummi et al. 2005, 28)³

The domain we are dealing with has been seen as important both nationally and internationally. However, in many respects, it appears new and uncharted. It holds true even in the United States that a field as integral to our present target field as ‘health information technology’ (HIT) remains without clear crystallisation. (USHHS 2006) This is even truer for the economic aspects of ‘HIT.’ Yet, first evaluative reviews have been carried out, suggesting accumulating evidence but with many remaining gaps so far. (SCEPS 2006)

¹ For both moral hazard and the adverse selection problems, see, e.g., Milgrom and Roberts 1992. ‘Moral hazard,’ first elaborated by *Kenneth J. Arrow*, refers to the possibility that the redistribution of risk changes people’s behaviour. For instance, if a new management-by-results system is introduced and if it is announced that future funding (or tenure or any other valuable property) will depend on the achievement of the result objectives, people may try to have such objectives set for themselves that are easy to reach, to ignore quality to reach their quantitative objectives more easily and hide their failures and negative side effects of the pursuit of their explicit objectives. Note that this is not to say that it will *necessarily* happen so.

‘Adverse selection’ refers to undesirable consequences arising out of asymmetry of information between ‘principals’ and their ‘agents.’ For instance, why would a person whose compensation depends on his or her achievement of quantitative objectives report aberrations or quality problems and other negative side effects? To take it to the extreme, adverse selection may lead to such undesirable consequences as the massive recruitment of people with certain character traits (e.g., a good deal of narcissism, psychopathic lying, black-and-white psychic projection tendencies, sycophancy, etc.) to positions of common employees, experts and managers, cf. Sennett 1998.

² Huttunen is the retired general director of the Finland’s National Public Health Institute (*Kansanterveyslaitos*), next acting as a government top advisor.

³ Saranummi, Research Professor in the Finnish national government organisation Technical Research Centre (VTT), has been active for decades in the promotion of health care technologies. The tone of his discourse reflects well the thinking of a good deal of the Finnish elites on these questions in 2006-2008.

Is Finland a latecomer in the field under consideration?

Sweden and Finland are nowadays EU's very leaders in the R&D share of the GDP with figures of just over and just under three and half per cent. However, that expenditure may not be allocated evenly to all technology fields considered relevant. In a recent book on health care prioritisation, Ryyänen et al. propose: "In applying information technology in health care Finland badly lags behind the leading countries of Europe and the other Nordic countries." ["Suomi on tietotekniikan soveltamisessa terveydenhuoltoon pahasti Euroopan johtavia maita ja muita pohjoismaita jäljessä."] (2006, 75) We should also compare Finland with the United States and Canada. There are good institutional bases for international comparisons in the field. (e.g. LSE 2006, in cooperation with UN's WHO) However, a central question remains to what extent comparisons are really made and applied in health care policymaking.

Let us approach the economic and administrative process technology in health care from two directions. First, let us focus our attention on *technology assessment in health care*. In the particular case of Finland, that activity tends to be seen in the constrained fashion of the assessment of the *impact* of health care technology, 'terveydenhuollon teknologian vaikutusten arviointi.' Moreover, in the context of health, the word 'technology' tends to be translated into Finnish as 'menetelmät', 'methods', and not 'teknologia', 'technology'. This is by and large understandable given the special characteristics of health care, which consists of a myriad of 'methods', but it is not the best choice for achieving intelligibility and translatability over the boundaries of natural languages with respect to specialist fields other than health care. Below, we will mostly focus upon *the economic evaluation of health care technology*. This is not the only, let alone the dominant, focus in TA in health care, although it is not marginal, either. The consideration does not boast to reach such coverage as to make it a *meta-analysis* or even a *systematic review* in the sense that Petticrew and Roberts (2006) take up those two concepts.

Second, let us approach our topic from the economic direction and more exactly from the direction of health economics. From the viewpoint of academic and professional knowledge on public policy and programme evaluation (Virtanen 2007), the economic evaluation of the economic and administrative process technology of health care is quite a specialised domain. Health care's own branch of economics, health economics, offers possibilities for bridge building, as its activists include not only economists but also medical doctors, health scientists and specialists in management and organisation. However, the economic evaluation of the economic and administrative process technologies in health care constitutes such a specialised domain of evaluation that health economics in its established shape in many respects fails to provide adequate conceptual and other tools. (on these, see, e.g., Sintonen and Pekurinen 2006) To proceed, we will have to combine knowledge on health

economics, the economics of technology and innovation and research on health care and its institutions and organisations.⁴

The economic evaluation of economic and administrative process technology in health care: only a partial consideration

This consideration regards its topic such as it is available in research and in observable practice. There are other relevant questions that cannot be considered here. For instance, there is the impact of health technology development upon the formation of new enterprise activities and upon the redirection of exports. (see, e.g., AHFMR 2006a) Such topics or similar ones are not considered here.

2. General consideration of the economic evaluation of economic and administrative process technologies in health care

2.1 A partially unclear field and limited evidence so far

The economic evaluation of the economic and administrative process technologies of health care does not appear as a clearly crystallised field of knowledge so far, although gradual and slow crystallisation can be predicted. It is motivated to consider that emerging field, first, as such. Second, it can be traced in the two directions of the economic evaluation of health care and technology assessment in health care.

In considering the economic evaluation of health care, it is motivated to take into account approaches known and actually applied in that field. Using the very language of evaluation, this stresses the position of *evidence-based evaluation*. In the actual practice of the social, political and administrative sciences, there are numerous and in many respects quite different approaches to evaluation. The proponents of some of those approaches are likely to see reference to evidence-based approaches as old-fashioned positivism. However, when dealing with the health care field, we cannot neglect those approaches because of the status they enjoy in that very field.

⁴ This section stresses the Finnish circumstances. *Petri Virtanen* is the best visible figure in today's Finnish public policy and programme evaluation in the interface of research and practice. Sintonen and Pekurinen are the authors of the seminal Finnish work on health economics, appeared as the first edition in the 1980s. Health economics has by and large arisen in Finland as a result of over two decades of funding by the Yrjö Jahnsson Foundation, the bulk of the funding by which goes to general economic research. Scott and others (2000) provide a good and still current set of applications of many relevant approaches of *organisation research* to health.

Evidence-based approaches: with limitations, but a language widely used in health care

Taking up the evidence-based approaches here does not suggest a presupposition of their superiority. In actual practice, they are only one – albeit a long-lived one – among the multitude of evaluation approaches currently known and applied. (Alkin 2004) Evidence-based evaluation receives emphasis in health care because it is constitutive of the dialogue between many of the actual participants and other stakeholders in that field. This arises from the natural science background of the medical sciences and the importance of the classical experiment with its randomised experimental and control groups. It is no coincidence that the same design is commonplace in evidence-based evaluation. CRT, *the controlled randomised trial*, is the related English term. All this leads to the facilitated comprehension of the evidence-based approaches in health care.

In actual practice the domain of evidence-based approaches continues to be on the rise. Take the example of clinical practice guidelines introduced in numerous countries as an example of the spreading of those approaches at the core of health care. For instance, at the end of 2006, there were no fewer than 70 valid clinical practice guidelines in Finland, and further guidelines were in the process of preparation.

However, this does not rule that to happen in the future. Should this come true, possibilities would arise of evidence-based economic evaluation of technologies in health care and the economic evaluation of the economic and administrative process technologies of health care.

Schneider and others (2006) suggest that further progress in the evidence-based direction in the economic evaluation of health care would be very well-founded. Further, the authors require that the clinical practice guidelines (sometimes in brief called ‘practice guidelines’) be made subject to economic analysis at the stage of their preparation and also after application for a sufficient time to take effect in order to see if there are reasons for their revision or even rejection. According to the authors, there should be a weighting between the cost reduction effects of the guidelines implementation due to better coordination, learning and improved personnel management on the one hand and the costs arising from the guideline implementation and the new information management that must be set up on the other.

Just like other technologies, evaluation and other economic and administrative process technologies generate both benefits and costs: the perspective of transaction costs

The problems discussed so far have been seen as generic. Although the technologies in question may enable increasing care volumes and new qualities of care, they may bring about new costs that possibly exceed the value of the benefits. (Ryynänen et al. 2006, especially 29) This is a serious claim that should be tested empirically in suitable contexts.

One way to approach the economic and administrative process technologies of health care from the economic point of view is to fix attention to *transaction costs*. (Williamson 1985) These costs will be different depending on the mode of governance including that which is being governed, such as a seasonal summer labour force or, on the contrary, the top specialised experts of demanding medical specialties. The common recommendation of transaction cost theories is that the more *specific* the *assets* are that we are dealing with – such as the assets of highly qualified experts – the better motivated it is to attach these resources to the organisation on a permanent basis by the means of tenure or long-term contracts.

It depends on the character of economic and administrative knowledge and know-how if it is well-founded to build it into the organisation or to acquire it from the outside either on the basis of long-term contracts or acquisition from a ‘bulk market’ if there happens to be one. Williamson used the transaction costs to explain what forms of organisation – which he calls forms of *governance* as one of the early users of that term – are the most suitable from the economic point of view.

It follows, conversely, that the mode of governance towards resources exerts influence upon what resources can be governed and how governance may succeed as such but possibly give rise to side effects. Häkkinen and Seppälä (2006) report that both in Finland and in the other Nordic countries the patients themselves pay only a small fraction of the costs of the care they receive. The funding of hospitals is mostly made up of line item public sector budgeting supplemented with newer types of budgeting carried out by functions and activities. According to the authors, the expansion of the latter types of budgeting will improve productivity on the one hand and also possibly decrease demand for hospital care on the other. The same organisers – importantly the municipalities, their federations or self-governing regions – are in charge of many other services such as basic education, vocational education, polytechnics and social welfare services. The authors expect this to maintain possibilities of coordination and also help keep the costs in check. The authors refer to purchaser-provider models, which they expect to improve productivity but also to bring about new coordination costs and other transaction costs.

Kautto and others (2006, 41-42), in turn, write in a critical tone: “It is possible that the way funding is organised may determine the mode of the organisation of the services and guide the development of the services. In the worst case

the incentive effects of the funding will weaken the services received by the customers and increase the total costs of care and cure.” [“Vastuu rahoituksesta saattaa määrittää palveluiden organisointitavan ja ohjata palveluiden kehittämistä. Palveluiden rahoituksen kannustinkysymykset pahimmassa tapauksessa heikentävät asiakkaiden saamaa palvelua ja nostavat hoivan ja hoidon kokonaiskustannuksia.”] This is an example of how economic considerations in public sector development need not lead to the *naïveté* of a belief in the imminence of the ‘best of all possible worlds’.

Information and communication technologies (‘ICT’) may revolutionise modes of organisation for such reasons as their enabling integrated data registers in health care and electronic data transfer to various uses. All this may decrease the specificity of the resources invested in health care. On the other hand, there are tendencies towards higher resource specificity in that data on the health of individuals shall be strictly confidential and there is the challenge to honour their will regarding the use of those data as ICT applications expand. Because the ICTs make new structural elements in organisations, they both provide new opportunities to carry out established activities more efficiently and open up completely new possibilities. The innovative utilisation of the latter possibilities belongs to the preconditions for winning sufficient compensation for the transaction costs arising from the introduction and the application of the ICT.

2.2 The present status of economic evaluation of the economic and administrative process technologies in health care

Even though the economic evaluation of the economic and administrative process technologies in health care is far from being fully crystallised, there is enough of it to deserve consideration. Coughland and others (2006) consider telemedicine from the viewpoint of clinical pathways, which they call *integrated care pathways*, ICPs, and which are also often called *treatment protocols*. They consider different indicators used in the respective evaluation including taking up certain economic indicators.

Coughland and others (2006) take up the criterion of *efficiency*, which they connect to the costs of the measures and procedures of telemedicine. They take up *effectiveness*, which is sometimes connected to economic evaluation but which may also remain free-standing with respect to that evaluation. The authors take up the criterion of *engagement*, which either may not come up outside health care or which may come up with different connotations than in that field. They connect the engagement to patient satisfaction and the critical question of the patients’ *commitment to care*. For instance, surgical treatment of blocked arteries may not lead to sustainable results if the patient remains an overweight smoker; medication is unlikely to help if

the patient refuses to follow the prescription, and psychotherapy fails to show its potential if the patient fails to turn up for the sessions.⁵

Coughland and others (2006) study the entire clinical pathway from the first detection of the symptoms to the conceivable utilisation of telemedicine and eventual cure or decrease in the symptoms. The authors' main conclusion is that it is not enough just to introduce such an ICT application as telemedicine. One must also take into account such side effects as new process bottlenecks that may arise. If they arise, it is possible that although there is better detection and delineation of the patient population, this population will not receive significantly better cure and care than earlier.

The question of coverage of clinical pathways by economic evaluation

Considerations like that of Coughland and others (2006) are promising regarding the definition and improvement of *clinical pathways* in health care. The availability of data is critical for taking steps in the indicated direction.

In the particular case of Finland, the systemic strength is to be observed that the movement of patients receiving hospital inpatient or outpatient care can be traced including the instances that the same patients return to hospital care. This makes it possible to deal with the new care episode and the previous ones as one and the same extended episode. Yet, the Finnish records do not stand out in the coverage of primary care, at least in comparison to the situation in Sweden. It is also hard to acquire occupational health records in contexts like this. There are providers of the statutory occupational health services and patients who do not like the idea of unlimited access to those records of all health care, and it would not help if this took place in the name of public health.

There are limits to the definition of clinical pathways. For instance, the Helsinki University Hospital (HUS 2006) expresses the matter as follows: "We do not need the definition of clinical pathways for all diseases by far. Clinical pathways are mostly defined for those diseases from which large patient groups suffer." (Translation by the author.)

⁵ Häkkinen (2007) has given the briefing that there are concepts of economic evaluation that are imprecise including that they are particularly so once one moves over boundaries of natural languages. He took up the Finnish term 'tuottavuus,' which in the discourse of the professional health economists of Finland refers to what in international economic discourse is known not only as 'productivity,' which is the literal translation, but also 'technical efficiency' referring to cost minimisation. Häkkinen also took up the Finnish term 'tehokkuus,' which is the standard translation of the English 'efficiency.' According to him the Finnish health economists mean by 'tehokkuus' what in standard economics is known as 'allocative efficiency.' This concept refers to the question if resources are allocated in such a way that that which is desired is accomplished to the maximal possible extent. One of the many examples of allocative efficiency is the consideration if the resources allocated in health care turn out maximal contributions towards such values as those measured with such criteria as QALY or 'quality adjusted life years.' That there are many ways of measuring QALY is another question that we do not deal with here.

Economic evaluations of the economic and administrative process technologies of health care are not in ample supply so far. Yet, another exception to the rule of scarce supply is the study by Kopach and others (2005). The authors observed that certain advanced data system solutions of medical documentation led to cost increases. However, the authors came to the conclusion that the implementation of the systems had qualitative benefits that made the systems defensible despite their lacking performance in terms of quantitative economic indicators. Yet, in cases like that, one should control for efforts at explaining away negative results where powerful interests prevail.

2.3 Promises of economic evaluation in health care

The economic evaluation of health care is a field of health economics that displays features of fairly solid establishment. In the case of Finland, this development has roots going back to the 1980s and in some respects even earlier years. (Sintonen 1983, Sintonen and Pekurinen 2006)

Asikainen's (2006) study with a systematic review approaching a meta-analysis draws a longitudinal picture on economic evaluation of health care in Finland since the 1960s. He considers both theoretical approaches, aspects of method and technique of analysis.

Health economics evaluation: dimensions and limitations with special reference to Finland

According to Asikainen, *cost-benefit analyses* in health care have lost a good deal of their popularity in a period of thirty-five years, although they still remain quite common. One conceivable reason is the vulnerability of accounts of social benefits to accusations that the researchers' subjective values play too strong a role.

Cost-effectiveness analyses (here, 'CEA') on health care have become more common both in absolute and relative terms. They regard, for instance, the question if given effects have been accomplished with minimal cost or if given resources have been allocated to generate maximal effects. There are cases in which CEAs have come close to accounting for savings and cutbacks. One of the particularly keen areas of CBAs in Finland are comparative analyses between alternative methods and technologies of health care.

In health care, *cost-utility analysis* ('CUA') can be seen as more typical than in many other social policy fields. The CUAs aim to take into account such features as the quality of the increased life years that arise from health care improvements, as it is of no help if people's longevity entails their last years being spent like 'vegetables.' Reference was made above to the QALY measurements or *quality adjusted life years* measurement developed for these purposes. There are also indicators of the *functional health* of people building upon ratings of their ability to clear the typical daily challenges or, on the contrary, impairments in those respects.

There is the crucial question to what extent knowledge on costs, benefits, effects and utilities is actually being utilised in health care organisations. Ryyänen and others (2006, 51) claim that governance in those terms remains seriously deficient in Finland. If it can be shown that this is extensively so, the challenges are serious. In the particular case of Finland, one can refer to at least one part of the required infrastructure that is in place. This is the CHES unit (Centre for Health Economics at Stakes), Stakes being Finland's National Research and Development Centre for Welfare and Health. Another question concerns CHES' bite, given that in early 2007, it only had two full-time employees funded from the regular budgetary means of the Finnish government. At the turn of 2007 and 2008, it was also announced that STAKES is likely to merge with the larger National Public Health Institute, which is likely to bring about a period of some degree of uncertainty.

2.4 Achievements and problems of technology assessment in health care

In technology assessment in health care, there have been efforts to harmonise the evaluation activities by means of national, EU and international organisation and professional guidelines. Despite the efforts, it is unlikely that strict harmonisation will ensue soon. (AHFMR 2006b) Metaevaluations of institutions of technology assessment in health care that have been carried out can be taken as an indication of continuing harmonisation needs and efforts. (AHFMR 2006c)

Dimensions and limitations of technology assessment in health care

Like many other countries, Finland has a national unit of technology assessment in health care. It is STAKES' FinOHTA unit, Finnish Office for Health Technology Assessment. Economic evaluation has been and continues to be present in evaluations carried out by FinOHTA. For instance, there have been assessments of costs, and there have been cost-benefit evaluations and effectiveness evaluations, part of which can be characterised as cost-effectiveness evaluations. However, economic evaluation does not strongly stand out in the FinOHTA activities.

Although this does not decrease the value of FinOHTA's work, its evaluations of economic aspects have mostly focused on relatively limited measures of general health care and hospital care and the respective methods. The technologies evaluated have mostly been those of various specialties of health care instead of economic and administrative process technologies such as information and communication technologies or accounting methods, which are also seen here as technologies of a special kind.

FinOHTA's Finnish name refers to the evaluation of 'methods' instead of literally 'technologies.' This should not be seen as a drawback but it indicates the specificities of health care, which constrain the transfer of experiences between that field and other fields and the application of broader-based evaluation approaches.

The economic evaluation methods applied in FinOHTA can be seen as quite commonplace both from a national and an international perspective. This is understandable given the mission and function of FinOHTA and the particular definitions of objectives for its projects.

Baltussen and others (2005) generally criticise circumstances such as those outlined above with the sarcasm that possibly cost-benefit evaluations help to save in small matters but may lead to the contrary effects with larger issues. They ask how it would be possible to attain syntheses of the detailed evaluations in order to proceed towards a knowledge base that could be used to support prioritisation decisions.

On the basis of a comparison of national technology assessment units in health care in the USA, Canada, the UK and Spain (García-Altés et al. 2004), one can conclude that the Finnish technology assessment in health care does not focus more or less on economic questions than comparable activities in other countries. However, this is a matter that needs better empirical clarification.

As an example of studies carried out on technology assessment in health care, let us mention the enquiry of Evers and others (2006). The authors used delphi brainstorming regarding the methodological quality of 19 health care technology assessment projects in which economic criteria had been applied. In another study, Kawamoto and others (2005) considered clinical decision support systems in order to identify the reasons why they were more or less successful.

Draborg and Andersen's (2006) international review of recommendations made in technology assessment in health care takes up aspects of economic evaluation. According to the authors, the introduction of the economic aspects increases – together with the introduction of organisational aspects – the likelihood that the evaluation results will lead to practical recommendations in health care organisations. Contrary to that, where evaluations focus upon questions of technology and questions regarding patients, this tends to lead to recommendations for the redirection of research carried out in such health care organisations as large hospitals. Such recommendations tend not to be made where the evaluations have an economic focus. This all boils down to the conclusion that the introduction of the economic

aspects may lead to conflicts with the research aspects. The authors add that the commissioning of external evaluators to carry out technology assessments in health care tends to lead to emphases on research recommendations, whereas evaluations carried out by experts internal to the organisation tend to take a more economic and organisational direction.

Rutten (2004) synthesises results from several countries and observes that technology assessment in health care including that which take into account economic aspects is not utilised to the extent that would be desirable. According to Rutten, the standing orders concerning the responsibility of organisations to have the assessments made are frequently not followed or are followed only to a limited extent. Rutten takes up the example of the Netherlands and its health care system in which the role of insurers in having the assessments carried out is decisive. In that country, an effort at including comprehensive cost-effectiveness information in clinical practice guidelines ran aground, as the medical profession felt that questions of money should not prevent the application of technologies that show good medical promise. This is a version of the claim – possibly sounding absurd in some non-medical ears – that money cannot be an obstacle to the provision of the best possible care that medicine makes possible. (Ryynänen et al. 2006, *passim*.)

Rutten also observes that a good number of health care technology assessments have been carried out but the results of many of them have not been properly applied or utilised. Rutten takes as an example Sweden's local governments and self-governing provinces. Rutten's next example builds upon the observation that it depends on the interpretive competence of leaders of health care organisations if there will be practical applications of the technology assessments. Rutten's exemplary country is France and her hospitals. Rutten concludes that building elements of economic evaluation into clinical practice guidelines has remained tedious. Here he mentions the further example of the British National Health Service NHS.

2.5 Supplementing established approaches to the analysis and evaluation of technological development

Considerations of technological development and innovation have been carried out both in established economics and at its boundaries. In the latter (see Palmberg 2005), let us take up the concept of *path dependency* and its related concept of *lock-in*. Both concepts refer to the possibility that once development starts, it may proceed according to its own laws and even in an automatic fashion. Path dependency is a version of economies of scale arguments with decreasing average cost of further technology development as the respective scale increases. However, it is also possible that once a path dependency has been established, in the longer run it becomes unsuitable but may turn out to be unfortunately difficult to change.

Other relevant concepts include *national systems of innovation* and *cluster*, the latter originating from industrial economics. There are also such distinctions as those between *incremental innovations* and *radical innovations* and attention to the change of comprehensive *techno-economic paradigms*. Nelson and Winter (1982) have brought into this study field the ideas of *H.A. Simon* and *J.G. March* on the possibil-

ity that innovation may take place in very different ways than strictly rationalist ones. It may proceed in terms of *bounded rationality* with reliance on pragmatic rules of thumb. It has also been proposed that technology does not evolve as a separate process, let alone in a vacuum, but through its *coevolution* with the evolution of institutions. This strongly advises against forgetting questions of institutions and governance in technology development settings.

Where we are dealing with explicit efforts at the promotion of technological development, there is an interest in the actual effects of those efforts including the *additionality* of the effort in comparison to what would have happened anyway. Hyvärinen and Rautiainen (2006) have applied a framework first elaborated by the technology studies scholar *Luke Gheorghiu* of Manchester University. The framework regards four types of effects: the separate effects of the new resources allocated upon the own *inputs* by the target organisations, separate *output* effects (in commercial enterprises including effects upon their business result, their market value, etc.), separate *behavioural* effects upon practices and procedures including strategies and networking, and separate *cognitive* effects upon know-how and understanding.

There are further relevant concepts. At the beginning of this paper, the concept of *systemic innovation* was discussed, as was the special *concept of economic and administrative process technology in health care*. Clayton Christensen (2000, Christensen et al. 2006) of Harvard has applied his concept of *disruptive innovation* to health care. He has pondered how technologies that are supreme from the engineering and medical point of view may be excessive from the perspective of the resolution of many diagnosis and care needs. He calls the headstrong application of the supreme technologies *sustaining innovation*. He suggests that disruptive innovation should also be taken into account, that, for instance, advances in information and communication technologies may enable diagnosis and care in units in which this would not have been thought possible with previous technology. Another example of disruptive technology entails the delegation of certain measures from specialists to generalists and from medical doctors to nurses. One can look for analogies to Christensen's disruptive technology in everyday health care and ponder if such technology is represented, for instance, by measures which shorten the patients' inpatient periods, the increased utilisation of information and communication technologies to replace part of reliance upon human labour-intensive inputs, more stress on patient and citizen self-care, more patient responsibility and more stress on prevention instead of cure after the unfortunate fact that disease has set in.

3. Developing economic evaluation of economic and administrative process technology in health care

3.1 Examples of tools: process control, mini-evaluations and knowledge brokering

In many countries, health care applies tools of process control building upon industrial economics and business economics including cost accounting. (e.g. Torkki et al. 2006) The application of categories of those domains have found their way also to private insurance and social insurance. However, there is evidence of conflict between those categories and the categories applied by the medical profession, the members of which possibly claim that engineers, economists and accountants lack the sufficient comprehension of the health and medical field. (Samuel et al. 2005) This gives rise to questions on how to accommodate the different interests that we come across within that field.

Ehlers and others (2006) consider small-scale technology assessments in hospitals in view of their ultimate establishment as one part of systematic decision support. They consider the dimensions of technology, patients, organisational questions and economic aspects. In the last dimension, they take up the costs of technological reform, the effects of reforms, savings due to the reforms and, on the contrary, the new costs incurred, savings and other cost effects in other hospitals due to spillovers and the degree of certainty or uncertainty in the calculations prepared. The authors observe that small-scale technology assessment is quite widespread in their case of the Danish hospitals but devoid of much standardisation so far. They suggest that careful learning from experience and gradual stabilisation of the innovations be studied as the possible path of development efforts.

Knowledge brokering entails innovative ‘stock exchanges’ of knowledge with the purpose of innovative acquisition and application of knowledge. Knowledge brokering has hardly been applied in the *economic* evaluation of the economic and administrative process technologies in health care. The consideration presented by Kammen and others (2006) can be adapted to that end. They analysed Dutch efforts to guarantee cost-effective reproductive medical care and the cost-effective compensation of its costs to the patients. The authors’ conclusions stress the same problems as those that were taken up above, namely conflicts between managerial and economic emphases on the one hand and science and research emphases on the other. They ponder ways to promote fruitful interaction between the actors coming from the two different domains of interest and expertise.

Challenges in the field of knowledge brokering help characterise more generally the needs and possibilities of accomplishing economic evaluation of economic and administrative technologies in health care. Rutten (2004) stresses that to accomplish such evaluation, it is necessary to make the relevant actors commit themselves to cooperation: national or federal government authorities carrying out regulation, private and public sector health care organisations, financing agencies, medical doctors and other health care professions and their organisations, technology companies such as medical drug companies and medical equipment companies, researchers and other experts, and patient associations.

3.2 Health technology assessment in relation to health care procedures: clinical practice guidelines and prioritisation as examples

Health care is unique in many respects. Let us connect two of these to our consideration on technology issues: clinical practice guidelines and prioritisation.

We have taken up above the difficulties in defining clinical practice guidelines especially as regards building aspects of economic evaluation into them. One of the reasons taken up above for the difficulties is the attitude of influential representatives of the medical profession that economic evaluation and its criteria do not adequately promote health care let alone medical research. We do not have to propose a ‘fundamentalist’ approach of applying the economic perspective always and everywhere in health care. There are also softer ways, such as searching for common ground between proponents of the medical perspective on the one hand and proponents of other perspectives on the other hand in order to expand the scope of evidence-based approaches from medical approaches to cover also aspects of economic and administrative processes.

Guidelines do not implement themselves and deserve economic evaluation

Even where clinical practice guidelines are evidence-based, they do not suffice to implement themselves by the sole means of their printed or electronic dissemination. This does not guarantee their actual consultation and application, either. Besides the fact that the guidelines may not be easy enough to apply in the technical sense, there is also the possibility that they may not be generally accepted by their intended users.

Let us repeat that there are representatives of the medical profession who may not favour the building of elements of economic evaluation into clinical practice guidelines if they feel that cure, care and research suffer. This also regards guidelines on the use of technologies including not only machines and devices but also methods and procedures, biotechnologies and chemical technologies. For building economic evaluation into the process technologies of health care and for doing this also with respect to the clinical practice guidelines, the commitment of the stakeholders can be seen as necessary.

We must give a clarification in order to avoid misunderstandings that might arise. We should not presuppose each medical doctor to engage in economic evaluation while he or she is utilising clinical practice guidelines. It is enough that economic evaluation is taken into account while new clinical practice guidelines are being created and existing ones revised. The clinical practice guidelines themselves should hardly be immune to economic evaluation, either. For this, take the example of Booth and others (2006) on the clinical practice guidelines for the care of high blood pressure.

We have taken up above the criticism that technology assessment in health care is too often piecemeal and that this is one of the reasons why health care prioritisation remains deficient. (Ryyänänen et al. 2006) Instead of taking such conclusions as ideological claims, they should be seen as hypotheses to test in concrete, empirical contexts, and to probe in development projects that are experimental enough to allow steps backwards where the hypotheses turn out not to hold.

3.3 Limitations of this consideration, and observations on weak signals

There are important questions that could not be considered above. For instance, we have not considered economic questions related to the definition of clinical pathways except in passing, we have not at all regarded economic aspects related to medical drug control and related social insurance compensation, we have not provided comprehensive coverage of technology assessment in Finnish health care, let alone elsewhere, nor have we considered questions on the availability of patient data more than in passing.

Those who have drafted visions on health care futures have outlined ultimate goals of technological development in this field. One of those goals consists of comprehensive decision support, which would enable the simultaneous utilisation of evidence-based solutions (clinical practice guidelines, records of medical drug treatments prescribed and patient records), the definition of clinical pathways for all key diseases and also the establishment of the information and communication technology (ICT) platforms required to attain the desired integration.

The above consideration has touched upon questions of the economic evaluation of the ICTs utilised in health care organisations and by their professionals in interaction with patients and other citizens. The ICTs are no panacea for better health care effectiveness or higher health care productivity. However, keen eye should be kept on the possibilities that the ICTs may provide for savings in health care costs and possibilities for some degree of their reallocation according to the top priorities and for some degree of substitution of technology for labour inputs by such means as the automation of guidance, consultation and reservation services as far as they are suitable to this. Although diseases must be cured and patients cared for, ICTs should be considered also from the point of view of improving prevention, strengthening the citizens' own responsibility for their health including healthy ways of life, and the responsibility of citizens and patients themselves for their own care and cure in the sense of better commitment to care.

Average figures are important in the economic and other evaluation of process technologies in health care, but distribution figures also count. One can mention the likely effect of differences in citizen and patient income and in wealth, in competency including health status and in the different personal readiness of different citizens and patients to utilise ICTs where it increasingly supports the provision of health services.

It was mentioned at the beginning of this paper (cf. also USHHS 2006) that many of the themes considered, principally made up upon the economic evaluation of economic and administrative process technologies in health care, are globally new and

therefore lack full crystallisation so far. We cannot expect there to be many readily available results so far, let alone evidence-based results to exploit soon. Many of the pieces of information available should therefore be understood as ‘weak signals’ for directions to take in Finland and elsewhere.

Selected weak signals for innovative research and development

Let us adapt the list provided in (CHCF 2004) for relevant weak signals:

(1) According to evidence available so far, the value added stemming from the utilisation of ICTs in health care is in many respects both tangible and considerable, but in many respects it is also heterogeneous and qualitative and therefore hard to outline and to specify.

(2) It is recommendable to try to govern systematically the generation of ICT-related values. They are unlikely to unfold in a spontaneous fashion, but especially large ICT-related projects and programmes require careful delineation and strict accountability for those concerned in order to decrease risks of considerable losses of economic values.

(3) Processes that entail both change and ICTs require the definition and the application of quantitative indicators to keep track with the developments and the learning governance of the organisational changes triggered by the reform processes. However, as indicated, the quantitative indicators do not suffice alone.

(4) Haste can be seen as an enemy to successful change processes that include important aspects of ICTs. There are ICT-intensive processes that will never be fully accomplished in that no stable end state will ever be reached. Bruun Jensen (2005) characterises certain ICTs as procedures that produce futures, such as the electronic patient record systems he analyses. There is no end for technological development in sight, and therefore continuous improvement is not only a fashionable management catchword in that context but also a well motivated although demanding approach.

(5) In health care, one of the further essential elements of change processes that entail important elements of the ICTs has been seen to be made up of education and other change-enhancing measures targeted upon medical doctors and other clinical specialists.

Øvretveit (2005) suggests and Saranummi and others (2006) agree that a good deal can be accomplished by the sole means of applying generic management, quality management and leadership tools. To repeat, health care is too important to leave only in the domain of medical and other health care specialists, economists and business economists, engineers and generic consultants. Political scientists and administrative scientists also have their important contributions to make.

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