National Healthcare Information Infrastructures: Modular Implementation Strategies

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Today’s topic

• What can we learn from comparing large-scale, strategic national projects (which usually fail to deliver) with small-scale initiatives that succeed?

• Paper with Tina Blegind Jensen (CBS):
  – Case study of two Danish projects

• Our initial focus:
  – The project’s ambitions (and the consequences of these ambitions)
  – The project’s approach – “how to get there from here”

- “Ambitious targets for electronic records development have repeatedly been set and missed”
- “The initiatives and strategies [...] are not learning from experience”
- “Two types of responses would seem possible if this pattern is to be broken: either to devise new approaches that will ensure targets are met, or to set more modest targets”
Background

• Initial version of article (published in local Working Paper Series):
  – Compare Norway’s and Denmark’s strategies for interoperable EPR systems
    • Step 1: Introduction of Electronic Patient Record (EPR) systems
    • Step 2: Standardization to achieve interoperability between EPR systems
  – Norway and Denmark as cases:
    • Favourable conditions for achieving interoperability and standardization:
      – Small population, rich countries, predominantly public services
    • Both countries have addressed standardization at national, strategic level
    • Neither country managed to achieve standardization of EPRs as planned
## Data sources

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<th>Data sources</th>
<th>Denmark</th>
<th>Norway</th>
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- “National Strategy for IT in healthcare 2008-2012”, Digital Health 2007 | Action plans from the Norwegian Ministry of Health:  
- “More Health for every bIT”(1997-2000)  
- “Te@mwork 2007” (2004-2007)  
- “Teamwork 2.0” (2008-2013) |
- “EPR standard: Architecture, archiving and access control” (KITH 2001)  
- “EPR standard”, (revised version of 2001 standard) (KITH 2007)  
| **Evaluation studies**              | - EHR Observatory status reports from 2000-2006  
- Evaluation reports of B-EPR implementations  
- “Office of the Auditor General’s report on ICT in hospitals and electronic collaboration in the healthcare sector” (RR 2008) |
| **Public debate**                   | - Radio broadcast July 2008  
- Debates in: The Journal of the Danish Medical Association, Daily Medicine, Danish Nurses’ Organization, Computer World  
- Websites: Digital Health, Ministry of Health and Prevention, Danish Nurses’ Organization | Comments from public hearing of EPR standard (KITH 2000)  
- Various articles in Computerworld, Digi, Daily Medicine, Journal of the Norwegian Medical Association  
- Websites of central actors |
| **Conferences, seminars, workshops, meetings** | - “Electronic Health Record Observatory” conferences (attended in 2003, 2005, and 2006)  
- Workshop on Reform, Management and Organizational Processes in Healthcare, 2004  
- Scandinavian Conference on Health Informatics, 2005 | Tromsø Telemedicine and eHealth conference (attended in 1999 and 2003)  
- Health Informatics Conference in (attended in 2007 and 2008)  
- 1st National Seminar for Research on Management and Organization of the Healthcare Sector, October 2004 |
Framework: Three dimensions of complexity in information infrastructures

Possibly more ‘dimensions’?
For example:
Degree of change (how radical)
Depth of penetration (how comprehensive)

Jensen, Tina Blegind and Aanestad, Margunn:
"NATIONAL INITIATIVES TO BUILD HEALTHCARE INFORMATION INFRASTRUCTURES"
Zooming in on Denmark:

• In the next version of the paper we contrasted:
  
  – The (failed) B-EPR initiative
    • Danish: G-EPJ – Grundstruktur for EPJ (Basic Structure for Electronic Patient Record Systems)
  
  – The successful SEP initiative
    • Danish: SUP – Standardiseret Udtræk av Patientdata (Standardized Extraction of Patient Data)
    • Today: the ”eRecord” in www.sundhed.dk
Background

• “Action Plan for EPR systems” in 1996:
  – promote, stimulate, and coordinate the development of EPRs in Danish hospitals
  – 13 EPR implementations, the EPR Observatory

• The Board of Health created the B-EPR project
  – Important conceptual principles of B-EPR vision:
    • structured data, process-orientation, problem-orientation, cross-disciplinarity, trajectory-orientation (“2nd generation”)
  – Renewing national database:
    • Develop a new Forløbsbasert Landspatientregister to replace existing Kontaktbasert Landspatientregister
Denmark’s B-EPR initiative

- The EPR should be structured to support the clinical process (i.e. the problem solving process:)
  - Diagnostic consideration
  - Planning
  - Execution
  - Evaluation
Political backing

- The National Strategy (2003 – 2007) says:
  - The B-EPR should be the foundation for the coordinated development and implementation of EPRs in Denmark (i.e. the national standard).
  - Purpose: “...to ensure a common structure for communication among [EPR] systems and between [EPR] systems and other information systems in the healthcare service”
  - A full-scale implementation across Denmark should be achieved within January 1st 2006
    - This was agreed upon in the ‘Economy Agreement between the Government and the Association of County Councils’ for 2003
Development of the B-EPR

- Managed by Sundhedsstyrelsen/Board of Health
  - 2000: version 0.1 was subjected to a hearing
  - Version 0.2 – the ABE project (Gentofte)
  - A larger revision - version 1.0
    - 2002: UML specification for two modules (medication, imaging)
  - The GEPJ was included in the National Strategy (2003-2007)
  - Updates to version 1.0 was published in 2003 and 2004
  - Version 2.0 published in March 2004
  - The GEPKA projects (7 counties’ hospitals) as well as a hearing provide inputs
  - Version 2.2 accepted by EPR standardization group (August 2005)
GEPKA pilots

- 2003-2007: a number of pilot projects initiated to test and evaluate the B-EPR model in practice (GEPKA projects)
- Hospitals in seven counties participated
- Evaluation reports showed that a common structure for EPR systems was challenging
- Not easily transferable to a clinical setting; would require substantial changes in clinical practices
- Information was too fragmented and not well-structured, leading to poor user interfaces
- Difficulties for two EPR systems built upon the B-EPR structure to exchange data:
  - What data to be communicated?
  - What rules for security issues and consent?
  - Which technical standards to be used? Etc.
The end of B-EPR

- Critical report by P.S. Olsen 2004, dismissed by the Board of Health
- The EHR Observatory status report for 2005:
  - mentions technical and organizational challenges in realizing the B-EPR model
- The EHR Observatory status report for 2006:
  - recommend that the B-EPR is put on hold
- Winter 2006/Spring 2007: Deloitte conducts an independent review of the EPR status, which documented that
  - A full-scale implementation of any B-EPR based EPR was not imminent
  - Development work was not ongoing, current version not yet tested
  - Danish healthcare terminology (SUNDTERM) not finished until 2010.
  - The municipalities were not interested in implementing G-EPJ
- Current strategic plan: the B-EPR was only mentioned in an appendix where the conclusion from the Deloitte report on B-EPR was repeated.
Large ambitions on many fronts

- **Functional span:**
  - Problem-oriented documentation and cross-disciplinary
  - The need for structured clinical terminology
  - Revised: medicine card and national patient index

- **Geographical scope:**
  - Define a patient record for both primary healthcare and hospital sector across the whole country
  - A lot of local EPR systems already existed
  - In steps implementation of medicine card and national patient index

- **Temporal reach:**
  - Radical changes were expected within a short time frame
  - The ambition that all Danish hospitals should have EPR systems before 2006 was modified

*Ref. Jones: “more modest targets”*
A different story - SUP

• SUP - Standardiseret Udtræk af Pasientdata
  – Extract data from different EPR systems, provide access through web browser to a SUP database

• Developed in Jutland hospitals (Vejle and Viborg)

• Solved real problem:
  – Transfer of newborn children & mother to pediatric and gynecological/obstetric wards
  – Patient transfer between surgical dept., medical/coronary dept and thoracic surgery dept.

• [http://www.epj-observatoriet.dk/konference2001/slides/parallel1datamodeller/PeterSylvest270901.pdf](http://www.epj-observatoriet.dk/konference2001/slides/parallel1datamodeller/PeterSylvest270901.pdf)

• Comparing: [http://ringholm.de/images/04500_full_HL7_RIM_before_USAM.PNG](http://ringholm.de/images/04500_full_HL7_RIM_before_USAM.PNG)
A different story - SUP

• Pilot testing
  – Somewhat limited functionality in pilots, but real-life use
  – Continued use (in pilot site) after pilot period ended

• MedCom project from 2003
  – Inter-county communication, address registries, security administration, distribution of XML standards, coordination of purchase processes
SUP growth

• 2004: available for hospitals in Vejle County
• 9th January 2007: available for all citizens in previous Viborg county.
• 23rd January 2007: opened for all General Practitioners within the previous counties of Viborg, Aarhus, Vejle, Southern Jutland, and Funen.
• 10th December 2008: Copenhagen Region – for doctors and citizens
• April 1st 2009 there existed an e-record for 4.3 million Danes
• *Denmark has achieved (sort of) interoperability between EPR systems through a non-strategic project*
Differences w/SEP (from B-EPR)

- No changes in data registration or work practices required
- Hospitals could keep existing EPR systems
- Small work task for EPR vendors
- Immediate, not future benefits
- Low number of stakeholders
- No need for comprehensive, new healthcare terminology
- No coupling to national registers (FLPR/KLPR)

- In other words:
- Building on installed base
- Gradual evolution, iterative, step by step (cultivation)
- Minimizing (avoiding) complexity
• Deloitte report stated that one of the main difficulties had been in realizing “large and ambitious goals in a few giant leaps” (Deloitte 2007, p. 49).

• Large undertakings must be broken down to smaller tasks (decomposed), sequenced, etc.
  – But how?
    • B-EPR was composed by modules, pursued iterative development, learning from pilots etc...
Modularity/hierarchy in complex systems

- Herbert A. Simon:
  - “The Architecture of Complexity”
  - The parable of the two watchmakers

From Wikipedia:
American political scientist, economist, sociologist, and psychologist, and professor—most notably at Carnegie Mellon University—whose research ranged across the fields of cognitive psychology, cognitive science, computer science, public administration, economics, management, philosophy of science, sociology, and political science. With almost a thousand very highly cited publications, he is one of the most influential social scientists of the 20th century.
Modularity in software design

• Seminal paper:

• Criterion of information hiding
  – Alternative formulation: high cohesion within modules and loose coupling between modules

• “It is almost always incorrect to begin the decomposition of a system into modules on the basis of a flowchart. We propose instead that one begins with a list of difficult design decisions or design decisions which are likely to change. Each module is then designed to hide such a decision from the others” (Parnas 1972, p. 1058).

From Wikipedia:
David Lorge Parnas, a Canadian early pioneer of software engineering. Developed the concept of information hiding in modular programming/software design.
Modularity in IIs

• Challenge in inter-organizational IIs
  – To mobilize, organize and coordinate the action of a diverse set of actors
  – Assymetric distribution of costs/investements and benefits give rise to ”collective action” dilemmas

• Existing II studies:
  – Bootstrapping (Hanseth and Aanestad, 2003; Hanseth and Lyytinen, 2010)
    • How to select a wise starting point and to sequence the growth process (maximize no. of users, reach critical mass, unleash self-reinforcing effects)
Collective Action, Public Goods etc.

- Sociology, political science, economics, game theory etc.
  - "Prisoner’s Dilemma", "Tragedy of the Commons" etc.

- From Wikipedia on **collective action problem**:
  - The term "collective action problem" describes the situation in which multiple individuals would all benefit from a certain action, which, however, has an associated cost making it implausible that any one individually can or will undertake and solve it alone. The rational choice is then to undertake this as a collective action the cost of which is shared
Modularity

• Modular implementation approach
  – A precondition for “realizable” IIIs?
  – Assist in stakeholder mobilization/organization

• Vs H+L – modularity not (just) in order to deal with the adaptability challenge, also the bootstrap challenge...
Modular implementation approach

• Direct usefulness:
  – The solution (at each stage of development) solves a concrete/actual problem
  – Thus costs/investments can be justified

• Generic solution
  – Reusable by many

• Decoupled implementation
  – Lesser demands on stakeholder coordination
Summing up

• Modular architecture – modular implementation
  – Simon: “stable intermediary form”
    • Subassembly
    • Ref. watchmakers parable
    • A partial result that represents recognizable progress toward the goal

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