Heavyweight and Lightweight IT: at the core of digital innovation in the health sector

Egil Øvrelid, PostDoc
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Egil Øvrelid egilov att ifi.uio.no

Education
• Bachelor in IS from NITH
• Master in Informatics UIO
• Master in History of ideas UIO
• PhD in Digital innovation in the health sector
• Postdoc project on digitalization of the university

Practice
• Long industrial experience from Ekornes (furniture industry). Both production and logistics / information flow
• Worked for many years in the IT sector as system developer, project manager and team managers (SCRUM). Developed Patient records for the health care system
<table>
<thead>
<tr>
<th>Topic</th>
<th>Aim</th>
<th>Organization</th>
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<tbody>
<tr>
<td>Digital innovation in the health sector</td>
<td>How can Lightweight IT improve coordination challenges in the health sector</td>
<td>Health South-East, Kalnes hospital, AKER sykehus</td>
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| Digital innovation in higher education                 | (i) Understand initiatives and consequences of digitalization at various faculties and departments,  
(ii) Investigate the role of USIT and how they address «ecosystem» challenges | University of Oslo                                |
| How does discourse (retorics and concepts) influence digital innovation | The role of discourse in digital innovation/ transformation         | Health South-East                                 |
| Critical realism                                       | To identify mechanisms that cause certain things to happen            |                                                   |
Agenda

• Goals for the presentation
• Background: challenges in digitalization of the health sector
  • What is Heavyweight IT and Lightweight IT?
  • What is their relation to digital infrastructures and digital innovation
• Two cases: The role of lightweight IT (and heavyweight IT) in process innovation
• Summary
Goals for the presentation

• Improved understanding of lightweight IT and heavyweight IT
• …why these constructs?
• …their role in process innovation and digital innovation – empirical examples from two health institutions in Norway
• …some of the particularities related to each of them
• …how they may collaborate
General interest: Why study digital innovation in the health sector?

• Digitalization of the health sector: often challenging, and expensive.
  • Dramatic failures (NHS programme, e-prescription in Germany, clinical portal in Norway.)
  • Always time-consuming and expensive
• What is it that make digitalization of the health sector so difficult, so complex?
• Why do changes everybody agrees upon take several years and often more to implement?
• What mechanisms contribute to change and what does this lead to?
Pressure: Change factors

• Public sector: collective ownership through tax money, patient information and security. Outsourcing particularly controversial

• More demanding patients with a high degree of techno-use expertise, and that expect more digital accessibility

• Digital innovation in the private sector brings forth expectations and pressure for the public sector
Challenges at HSØ (5700 systems)

Figure 3: The Different Health Applications in the region (Sykehuspartner, 2012)
Integrating multiple systems: new challenges

Integrating systems
- Integrate IT silos
- Increasing cost and complexity
- Trustworthy, secure

IT-architecture in Health South-East. 5000 + systems integrated through Biz Talk. 275 physical integrations, 700 + system interfaces
What the concepts of lightweight IT and heavyweight IT tries to grasp

• Digitalisation presents new opportunities, but also new challenges that must be solved. These challenges do not have to be addressed equally (through one technological regime)

• The technological development towards the consumer market and the individual user creates innovative and user-friendly technology

• The public sector is lagging behind, which presents some specific challenges (difference between technology in private lives and at work)
Examples: Heavyweight IT and Lightweight IT

**Heavyweight IT**
- Integrate IT silos
- Increasing cost and complexity
- Trustworthy, secure

**Lightweight IT**
- Innovativ, user driven, less expensive

IT-architecture in Health South-East.
4000 + systems integrated through Biz Talk
275 physical integrations, 700 + system interfaces

"Robotic Process Automation"
"Internet-of-Things" Cloud-løsninger
### Definitions and distinctions (Bygstad 2017)

<table>
<thead>
<tr>
<th><strong>Heavyweight IT</strong></th>
<th><strong>Lightweight IT</strong></th>
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<tbody>
<tr>
<td>A knowledge regime, driven by IT professionals, enabled by systematic specification and proven digital technology and realized through software engineering</td>
<td>A knowledge regime, driven by competent users’ need for solutions, enabled by the consumerisation of digital technology and realized through innovation processes</td>
</tr>
<tr>
<td><strong>Profile</strong></td>
<td></td>
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<tr>
<td>Back-end: Supporting documentation of work</td>
<td>Front-end: Supporting work processes</td>
</tr>
<tr>
<td><strong>Owner</strong></td>
<td></td>
</tr>
<tr>
<td>IT department</td>
<td>Users and vendors</td>
</tr>
<tr>
<td><strong>Systems</strong></td>
<td></td>
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<tr>
<td>Transaction systems</td>
<td>Process support, apps, BI</td>
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<tr>
<td><strong>Technology</strong></td>
<td></td>
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<tr>
<td>PCs, servers, databases, integration technology</td>
<td>Tablets, electronic whiteboards, mobile phones</td>
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<tr>
<td><strong>IT architecture</strong></td>
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<tr>
<td>Fully integrated solutions, centralised or distributed</td>
<td>Non-invasive solutions, frequently meshworks (heterogeneous networks)</td>
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<tr>
<td><strong>Development culture</strong></td>
<td></td>
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<tr>
<td>Systematics, quality, security</td>
<td>Innovation, experimentation</td>
</tr>
<tr>
<td><strong>Problems</strong></td>
<td></td>
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<tr>
<td>Increasing complexity, rising costs</td>
<td>Isolated gadgets, security</td>
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<tr>
<td><strong>Discourse</strong></td>
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<tr>
<td>Software engineering</td>
<td>Business and practice innovation</td>
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Lightweight IT (a preliminary summary)

• …a knowledge regime with at least three central characteristics:
  
  • – *One* is the nature of the artefact, its usability, its occupation with improving processes and its easiness in implementation.

  • – The *second* characteristic is the providers’ ability to quickly follow up pilots, an implementations, so that users and organizations may experiment and test new functionality.

  • – A *third* important ability of lightweight IT is its easiness in implementation also caused by it being modular, facilitating loose coupling between systems components.
## Two cases: Aker and Kalnes

<table>
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<tr>
<th>CASE</th>
<th>AIM</th>
<th>OUTCOME</th>
<th>LITERATURE</th>
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<tbody>
<tr>
<td>AKER</td>
<td>Improve the patient flow within and outside the unit</td>
<td>A successful lightweight solution</td>
<td>Øvrelid and Halvorsen (2019)</td>
</tr>
<tr>
<td>KALNES</td>
<td>Redesign and digitalise the clinical and logistic processes</td>
<td>A successful infrastructure</td>
<td>Øvrelid and Kempton (2019)</td>
</tr>
</tbody>
</table>
General background for the studies

- Norway: Excellent treatment, but problems with the logistics. Coordination disorders. EPR is sent manually between hospitals.
- Primary and secondary sectors divided with their own system regimes.
- A more demanding patient requires a more dynamic health care system.
- Long comprehensive focus on clinical systems. Hard, expensive and time-consuming to change.
KAD – AKER

• KAD (Emergency unit, Oslo Kommune)
  • (Akuttenhet: 86 man and women-years, 73 beds)
• Medication not surgical
• Often senior citizens living at home
• Messages are sent to the municipality after treatment
Coordination reform in Norway

• Improve interaction between primary and secondary sector. Example: Diagnosed both places
• IT central in these improvement efforts
• AKERs aim was (and is) to improve interaction and cooperation between districts and hospitals, (reveal (avlaste) hospitals) by receiving emergency patients.

Three key activities:
• Improve the quality of information
• Improve patient experience
• Improve interaction and security
Background for SAMKAD project

• «Specialist health service characterized by maintenance and cost-effective thinking. Not much focus on innovation.” (Project manager)

• “Large heavy and bureaucratic systems make it difficult to work effectively” (doctor)

• “The existing system regime was either reluctant or refused to cooperate” (manager)
Establish project: SAMKAD

Project objective:

“Laying the foundations for efficient and secure operation of the KAD unit by showing how innovative interaction solutions and open integration platforms can be used and further developed to make information available to employees where and when they need it in real time.”
SAMKAD (2014–2017)

• Low support in existing organization: Get money elsewhere
• Pre-project (2014) 250 000, -. knew IMATIS from AHUS. Modeled the patient flow together with SINTEF. After 3 months the first whiteboard was in installed and used.
• Main project, main application for regional research fund. Received 6 million – 2014
• Pilot Operations: 2015–2017
Process analysis – «Utfordringsfjellet»
Challenges – areas investigated

• Improve routines related to admission and discharge
• Improve inventory of available resources so that the attending physician can identify and book available rooms
• Give housekeeping staff access to requirements related to meals, diets, rooms to be washed etc
• Makes communication about the patient easier
• Better communication with municipalities to lower the number of phone calls and discussions
Solutions: Vaktrom and clinical head quarter

Digital boards to get a better overview, to communicate more effectively about individual patients and to change the person responsible for treatment.
More transparent overview of resources enable improved logistics
More effective messages

<table>
<thead>
<tr>
<th>Type of request</th>
<th>Structured type of request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Structured categorization and date</td>
</tr>
<tr>
<td>Question</td>
<td>Unstructured text.......</td>
</tr>
<tr>
<td></td>
<td>................................</td>
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[Image of a table with various categories and subcategories]
Processes and systems – Bypassing strategy (Øvrelid and Halvorsen 2019)

Origin

Emergency
Homecare
GP/ Hospital
Family

EMERGENCY UNIT (KAD) AKER, Oslo

Admission → Treatment and meetings → Discharge

Room cleaners and dietary services

ITAS

SystemG

SystemP

Destination

Sent home. City district receive ADL
Sent to hospital

......

Imatis
3.7 million saved

News Release

Millions saved when health professionals requisition IT services
10 October 2017  SINTEF

It is not unusual for health professionals to feel that new technology and organisational changes are being introduced without them having any say in the matter. This is what the municipality of Oslo (Norway’s capital) was trying to avoid when in 2012 it was directed to introduce a municipal acute day bed system (KAD) as a means of relieving pressure on hospitals.

“We needed assistance in finding a technical solution and effective organisational approaches so that we could maintain our maximum three-day hospitalisation target”, says Project Manager Marit Reed Halv at Oslo municipality’s Health Services Department. “Our aim was to meet ambitious targets, and we set out from scratch”, she says. The municipality contacted SINTEF, and together they applied for funding for research and innovation project. The result was the SamKAD project, launched in 2014. (SamKAD is a Norwegian construction for ‘Coordination and Task Support for a Municipal Acute Day Bed Unit’).

The researchers created a system incorporating user-involvement in its development. Three nurses and a doctor have been working part-time to adapt the system to their day-to-day clinical routines. They have also trained other employees.

Millions in savings

The aim of the project was to see how organisation and procedures could be improved by using new and innovative systems that promoted more efficient patient pathways. User surveys show that both employees and patients are very pleased with the result. The data on clinical efficiency are also positive in that there was a 20 per cent reduction in personnel costs per KAD patient in the period 2014 to 2016.
Kalnes hospital opened 2015

- Planned: 1998
- Building: 2012–2015
- Opened: 2015
- Price: 6 billions NRK (61 million euro)
Old hospital vs new hospital 😊
Align with practice mobility.
Kalnes certified at HIMSS level 6 in 2017

Requirements:

• Technology is used to achieve a closed-loop process for administering medications, blood products… blood specimen collection and tracking.

• The technology in use are implemented and integrated with…, pharmacy, and laboratory systems to maximize safe point-of-care processes and results.

• Mobile/portable device security policy and practices are applied to user-owned devices. Hospital conducts annual security risk assessments and report is provided to a governing authority for action.

• Østfold have a goal to reach level 7: remove paper, and more analytics
Activities related to process innovation by the use of digital technology

- Divide processes and measure each process
  - Triage
  - Digital booking
  - Dietary, porters, cleaners
- Make paper processes and manual processes more effective (digitizing)
- Enable digital interaction and digital resources
  - Rooms
  - Equipment
  - Material
Example (simplified)

- Old process: Moving patient from emergency unit to ward
  - Call Ward to ask for available room. Ward checks, call back
  - Call porter to ask for portable bed
  - Prepare «movement» protocol (paper document)
  - Register «move» in EPR
  - Additional paper
  - Move patient

- New process:
  - Check system if rooms are available. Book
  - Register move. Ward receives message. Porter receives message
  - Move patient

- (New system has «flow» functionality that facilitates coordination)
Practical examples of the benefits of process innovation

• Good overview of incoming patients and admitted patients from the "main center" at the emergency room
• Silent reports between emergency unit and health wards
• Enable a better overview of resources, as well as being able to book them digitally
• Attach housekeeping closer to the flow processes (service innovation)
Digital data: capture and visualize
Practical examples of improved visualization

• Easier access to flow information
  • Visualize information
  • Update information

• The effects:
  • Creating / revitalizing interaction arenas
  • Self-management
  • A number of arenas created at Kalnes

<table>
<thead>
<tr>
<th>Meeting</th>
<th>Frequency</th>
<th>Participants</th>
<th>Analytics</th>
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<tbody>
<tr>
<td>Capacity meeting</td>
<td>Every day</td>
<td>Managers at medicine and surgery</td>
<td>Bed capacity</td>
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<td></td>
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<td>dept.</td>
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<td>Top management team</td>
<td>Weekly</td>
<td>Top managers</td>
<td>Trends</td>
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<tr>
<td>Cross-disciplinary improvement</td>
<td>Weekly</td>
<td>Managers</td>
<td>Patient flow and various indicators</td>
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<td>improvement team</td>
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<tr>
<td>Status with process director</td>
<td>Weekly</td>
<td>Analytics team</td>
<td>Patient flow, data</td>
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<td>Process improvement patient</td>
<td>Bi-weekly</td>
<td>Clinic managers</td>
<td>Patient flow</td>
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<tr>
<td>flow</td>
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Reconfiguration of existing portfolio (Øvrelid and Kempton 2019)
Process innovation knowledge regime

- Lightweight IT: more available, faster implementation, more flexible, more user-friendly and visualize information.
- Lightweight IT and heavyweight IT (clinical core systems) configuration: Informate the organization: feed complex process or treatment-oriented issues back to whiteboards so that the organization can participate more actively as a collective.

Lightweight technology as a process innovation knowledge regime:
- Improves an organization’s informating ability
- Enables digitalized interaction
- Easier to identify bottlenecks
- Increased redesign flexibility
- Enables distributed autonomy
- Loosely coupled architecture
Status Kalnes/HSE

• Kalnes: important learning for HSE. Planning, building, structuring a modern hospital and feed it with proper technology

• Health South-East: Kalnes project still not «scaled» within the region, even though it has been primarily successful

• The solution has, however, been acquired by Health West.

• Health South-East a bit innovation resistant, but 6 new hospitals will be built until 2029, and Kalnes is a good experience for these hospitals
Summary

• Lightweight IT’s historical origin is not clear
• Lightweight IT is (as Heavyweight IT is) primarily a knowledge regime.
• Lightweight IT strengthens the process perspective within hospitals (decentralized autonomy, visualization, better user services, synchronization between processes)
• Even better if it interacts with heavyweight IT (through reconfiguration of the two regimes responsibilities)
• Platforms (and ecosystems) can be analyzed using HW (core) and LW (third part)
Literature

