

Service Process Engineering

why it is so problematic and
how it can be improved

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Productivity as self service

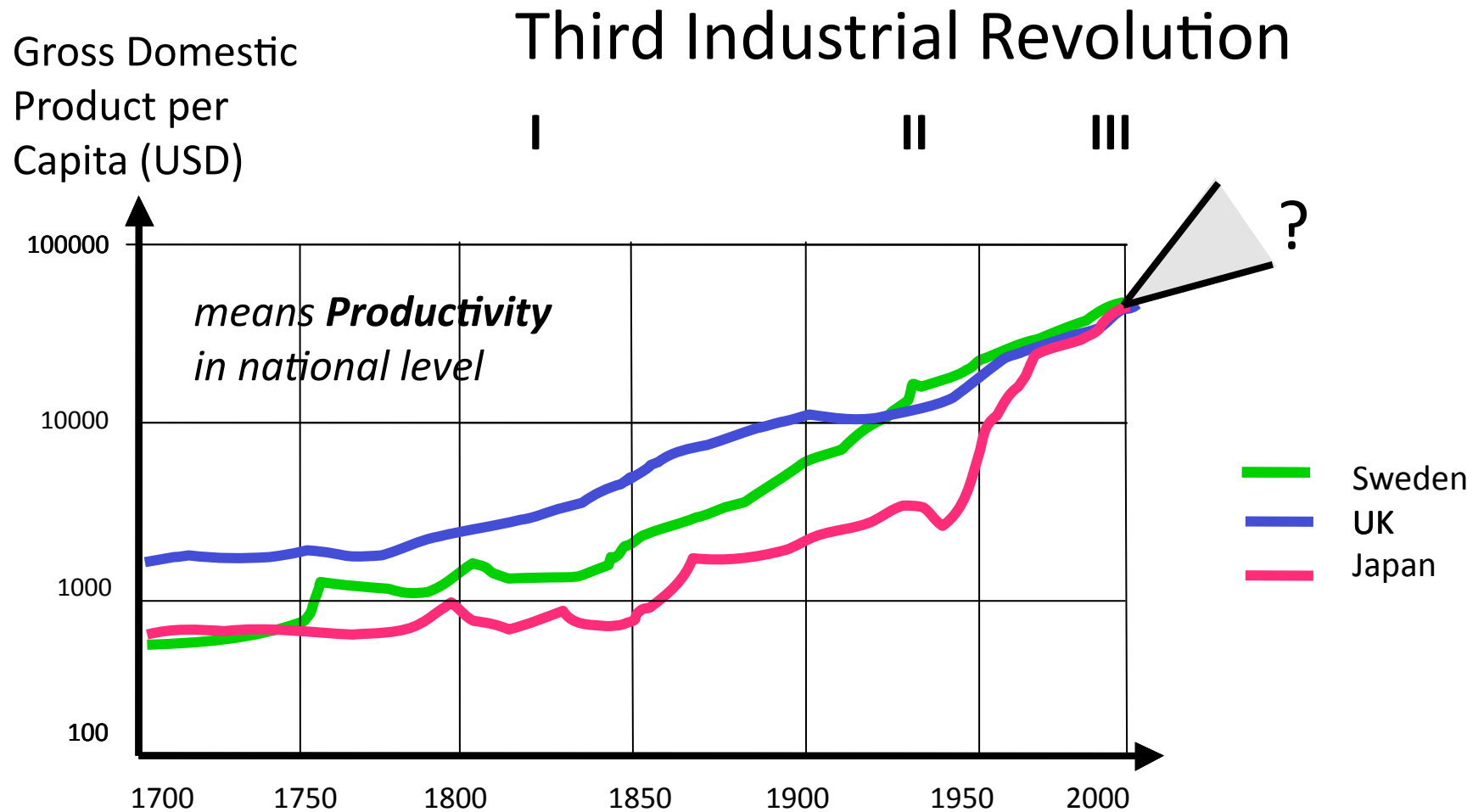
References

Personal Insight

- Telecom Software Development (VTT, 1983-)
- First Internet Router in the World 1985 in VTT
- GSM software for Nokia 1986 (-1991, 5 years)
- Mobile Services development for Telecom Finland 1991-1997, Protocols were developed in PFUR, Moscow
- Mobile Services and 3G in HUT 1995-2002
- Service Productivity Research in ETLA 2002 →

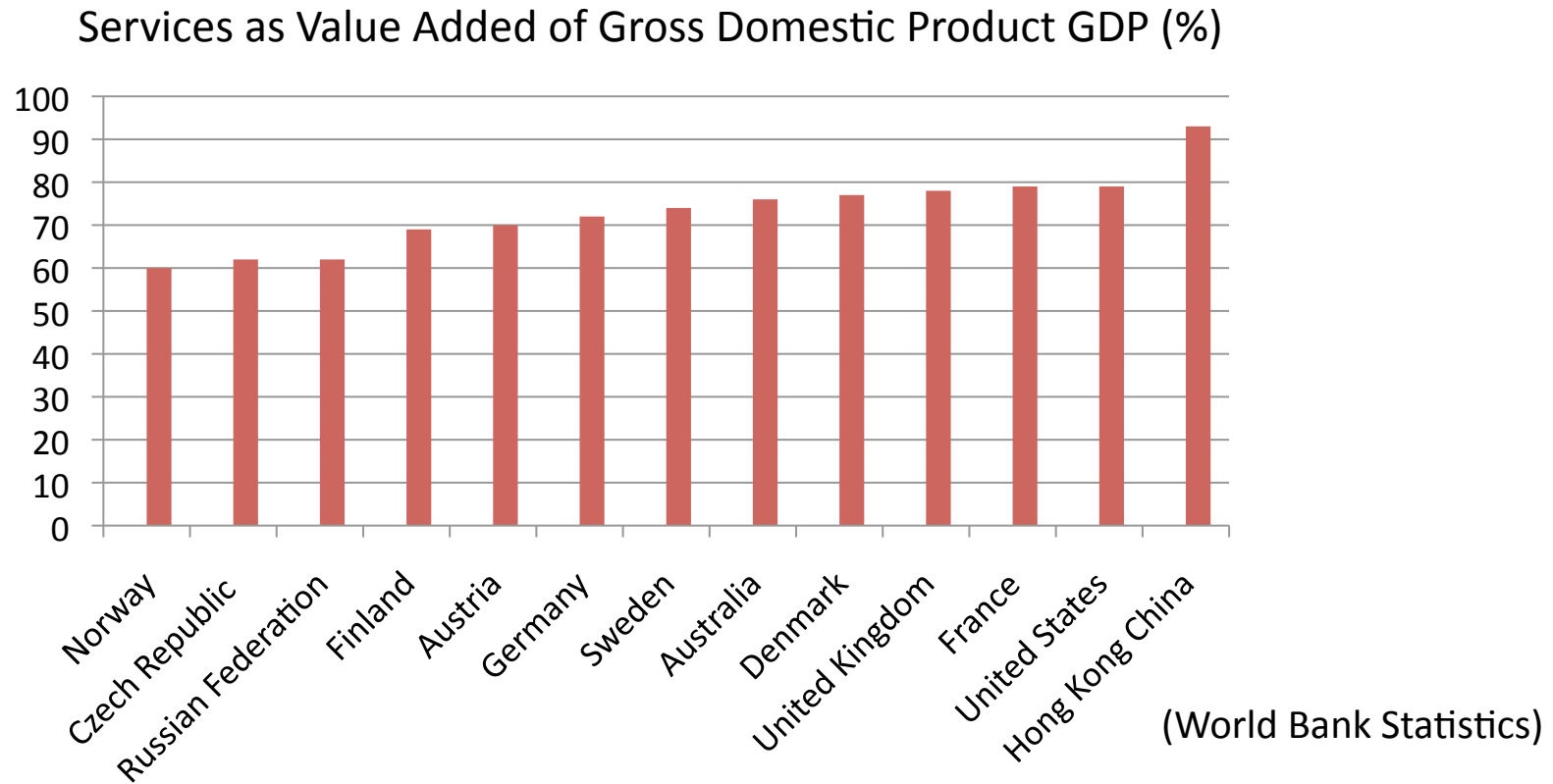
Service Process Engineering

Service revolution



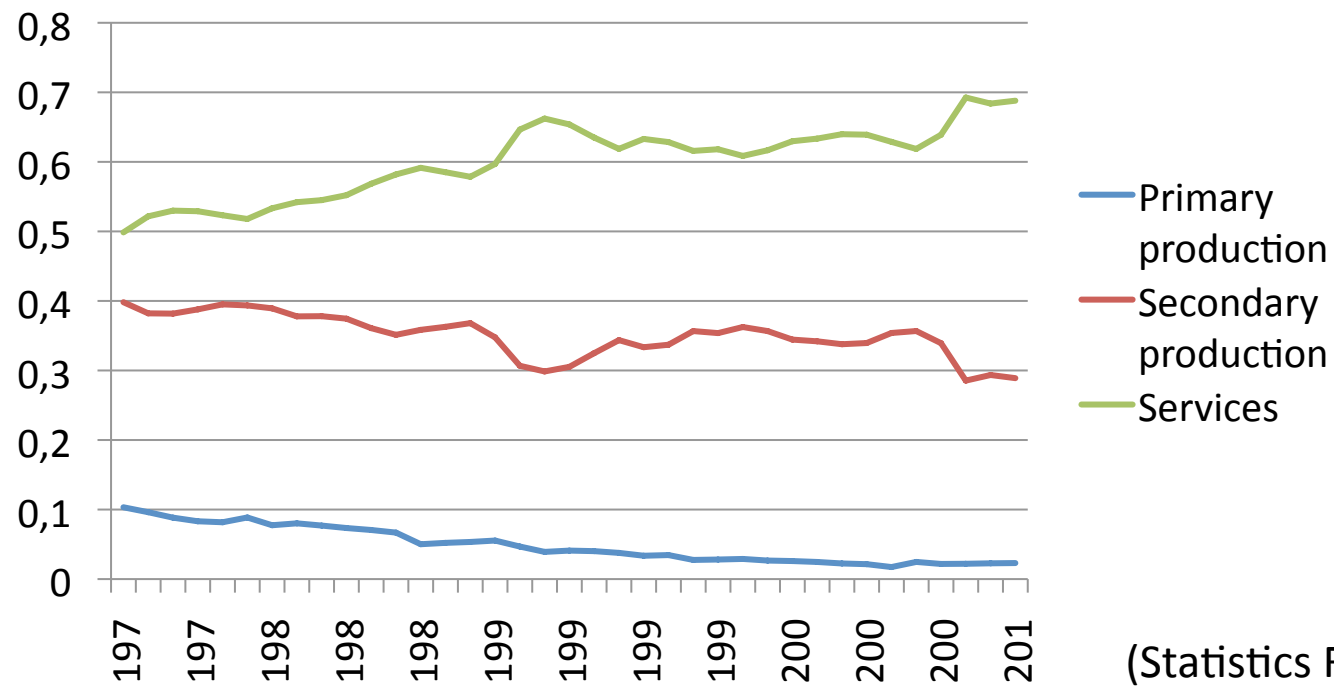
Service revolution

Services include wholesale and retail trade, transport, government, financial, professional, and personal services such as education, health care, and real estate services.



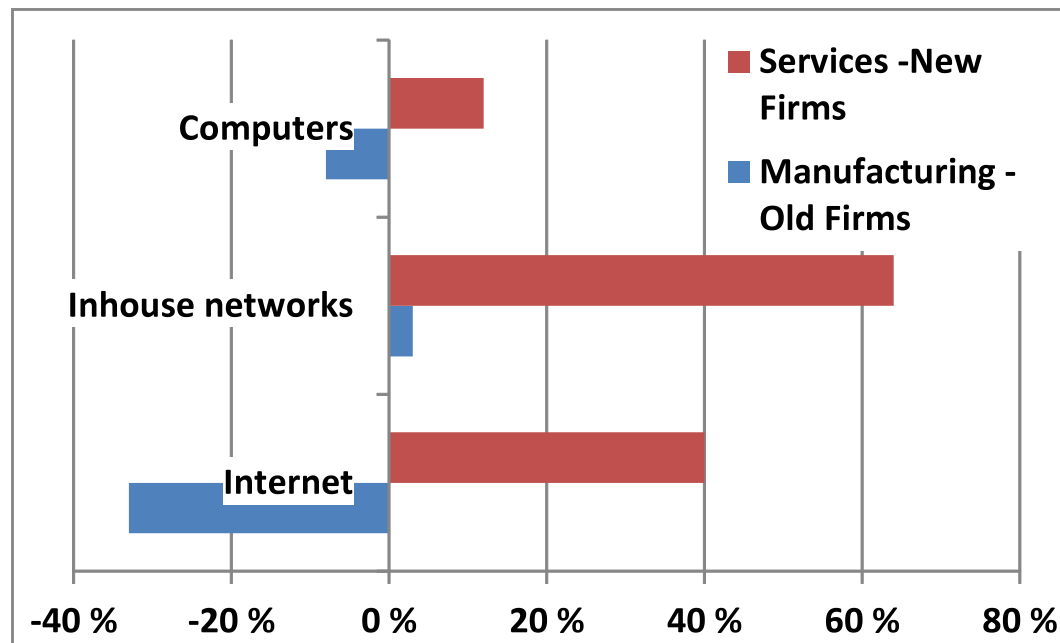
Service revolution

Value Added in Finnish GDP in current prices



(Statistics Finland)

How did our research start



(Figures are extracted from Maliranta - Rouvinen 2003 and 2004 and are based on Finnish Industrial Statistics 2003)

Labour productivity effect based on ICT investments in firms:

Productivity increase from IT was 8-18% but from Mobility 40%

Some firms obtained very large productivity improvements from ICT investments – *What and how did they do?*

Service Productivity micro-level research started in ETLA in 2002.

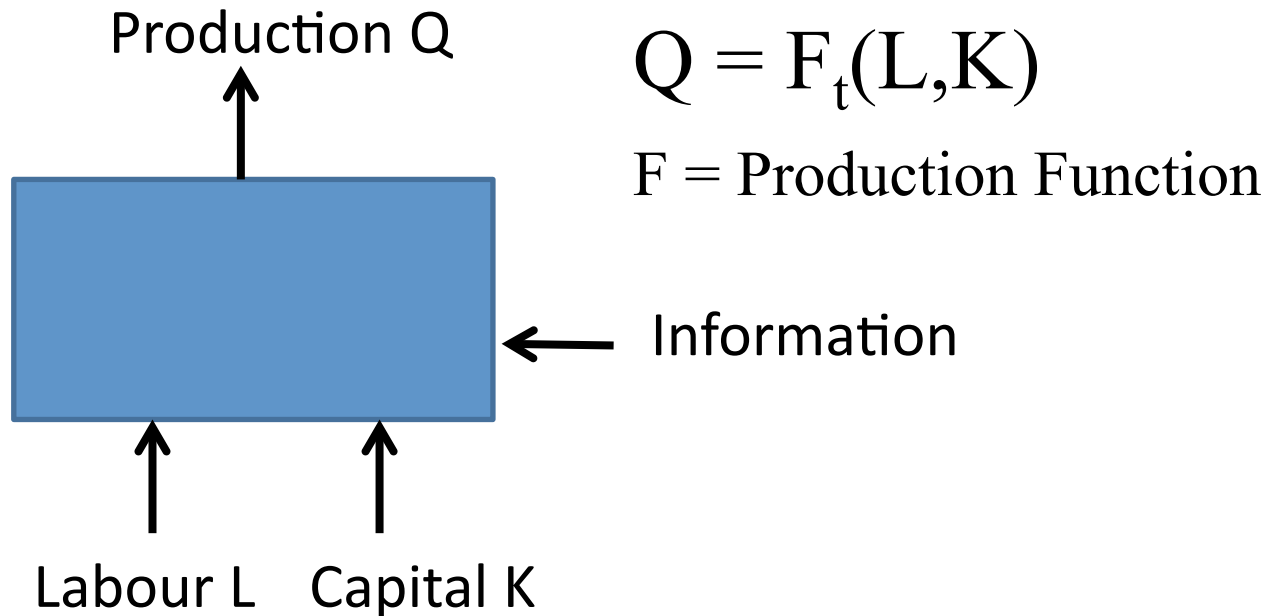
Service Process Engineering

- ***Service Process Engineering*** is a science for methods, tools and practices for development, implementation and improvement of services
- Improvement of services by Information and Communication Technologies (ICT) is divided into
 - **Automated services** (70%) – Rely on ICT or other technologies to deliver services that have been codified, digitized, and made available, e.g. banking and e-commerce
 - **Hybrid services** (50%) – Rely on a combination of humans and electronic tools to deliver services, e.g. insurance and travel
 - **Augmented irreducible services** (17%) – Rely on humans to deliver services, e.g. health and social care

(Modified from Zysman et al. 2010)

Why Service Process Engineering is problematic

Productivity improvement



Productivity = Output/Input e.g. = Q/L or Q/K ..

where output and input are in quantities or euros

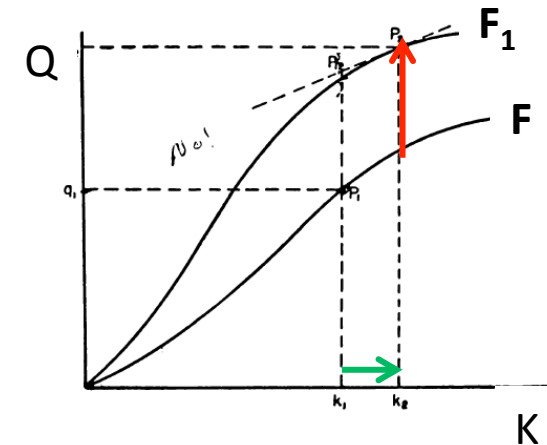
National economy: Output = Value Added, Input = Labour hours worked

Firm: Output = Profit + Labour cost, Input = Labour hours

Productivity improvement

$$\Delta Q \leq \Delta L \text{ \& } \Delta K \text{ \& } \Delta F$$

$\uparrow$ $\uparrow$ $\uparrow$ $\uparrow$
 % change % change % change % change
 in output in labour in capital of F
 input input over time



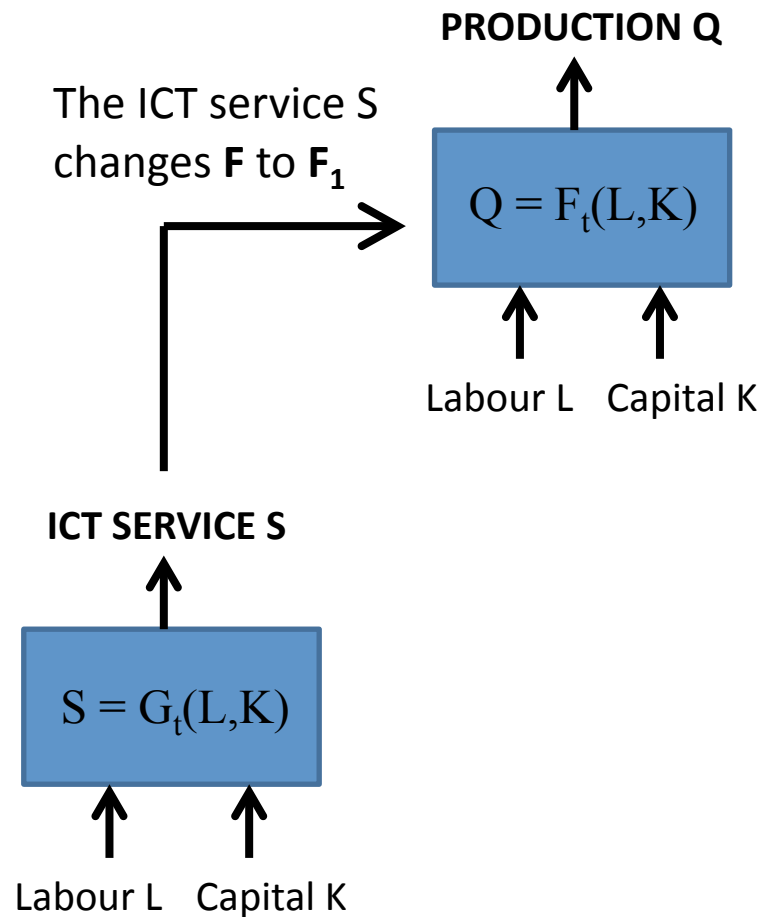
ΔF = Change in Production Function “F -> F₁”
 = Multi-factor productivity MFP
 = Total factor productivity TFP
 = Solow residual (1957)
 = Technological change
 = “Measure of ignorance”

Solow 1957: 87,5% of the increase of labour productivity has been attributable to technological change.

Productivity improvement

- Multi Factor Productivity (MFP) or *the change of production function* explains most of labour productivity improvement (Solow 1957).
- Production function = "Black Box" includes organisation, processes, ICT, innovations.. *Innovation* = production function change (New combinations, Schumpeter 1939).
- Production function behaviour and structures can be studied in "micro" (firm) or "nano" (process) level.
- In National Accounts the *value added and output of services are problematic*. Hence e.g. the productivity of health, social, education and other services cannot be evaluated well from statistics.
- This is because the service output is customer related and the customers have an effect on the service:

Service productivity problem

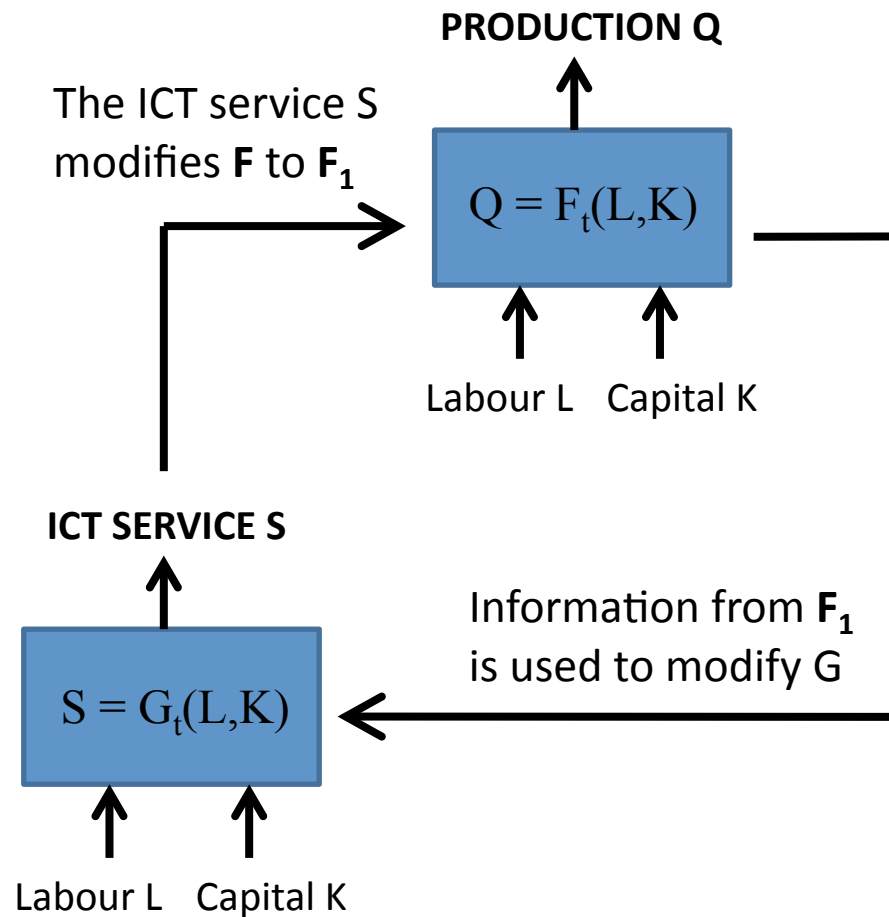


The new ICT service S improves the Production Function from F to F_1 but also creates costs.

This change $F \rightarrow F_1$ is the benefit of the service S.

But difficulties arise:

Service productivity problem



Problem: Information from production function F is used in Service S to modify G

This cannot be solved without using **Process Systems**:

Old: F

New1: G and F_1

New2: G_1 and F_1

New3: G_1 and F_2 ..

How service improvements can
be analyzed

3VPM (Three ViewPoint Model)

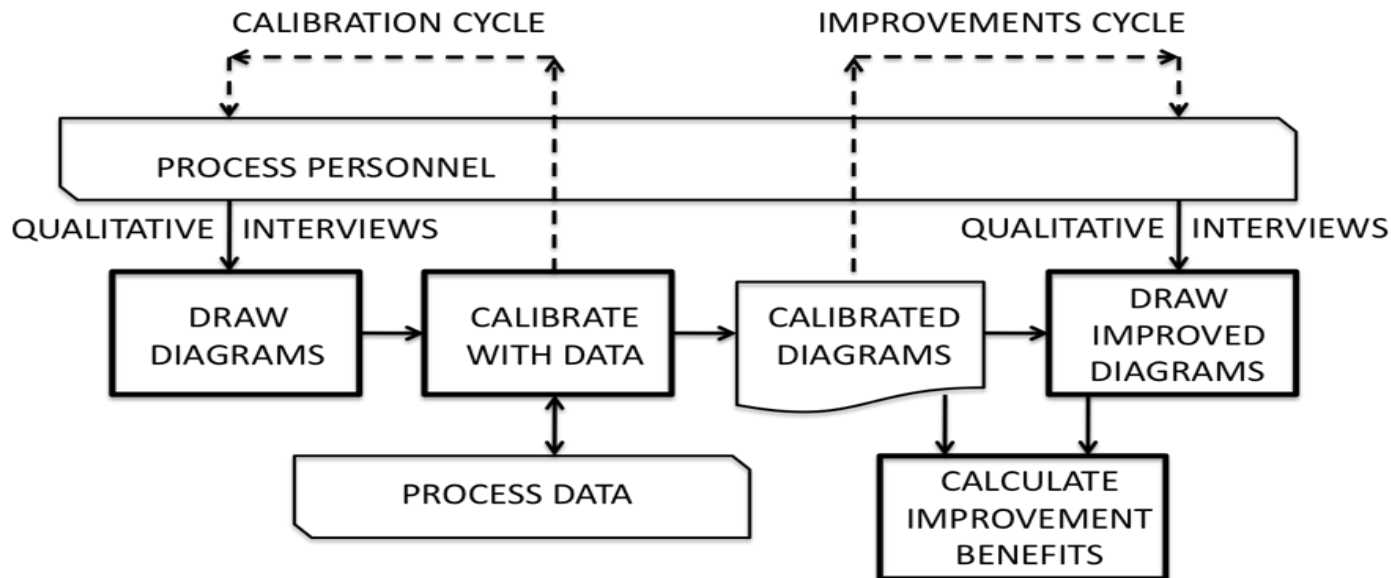
We analyze and improve ***process systems***, which include service and production processes by applying the following three viewpoints:

1. The Model of the system of interacting processes
 - Collect model data by interviews and measurements
 - Draw the logical process diagrams (Model M of the original system)
 - Find improvements enabled by new ways of doing things, new resource allocations, new ICT systems etc. (New improved production functions with system models $M_1, M_2, \dots$)
2. The Performance of the original and the improved systems
 - Calculate performance improvements by new production functions
3. The costs (and values) of the original and the improved systems
 - Calculate financial improvements by new production functions

$$\text{3VPM} = \text{Model} + \text{Performance} + \text{Cost}$$

3VPM analysis

Services can be modelled either by interviewing the personnel or by measuring .
The obtained model M is validated by calibrating it to the real system data.
Many service problems have been discovered when the model does not yield to calibration.



3VPM analysis

- Let us have an original system with model M , which specifies the events served in the system, the structure S of activities in system, the resources R available for performing the activities and internal parameters x , such as teams of resources, routing of events etc.
- Let us develop the system to obtain (improved) models $M_1, M_2, \dots$
- The problem is to find out performance and financial improvements when the model M is changed to $M_1, M_2, \dots$
- *Incremental change*: We change internal parameters x but keep the structure S and resources R unchanged; assume that M_1 represents incremental change
- *Radical change*: We change the system structure S or the resources R available; assume that M_2 represents radical change

3VPM analysis

- Let us denote $M_{S,\lambda,R}(x)$ as the model M with structure S, system input λ and set of resources R (external parameters) and vector of internal parameters x
- Let x' (correspondingly x'_j) be optimal value of x that maximizes the throughput of the system: $M'_{S,\lambda,R}(x')$ (correspondingly $M'_{j,S,\lambda,R}(x'_j)$)
- The improvements from old M to new M_1 for customer class c intensity in activity n and resource class l utilization are

$$\Delta\lambda_{cn} = \lambda_{cn}(M'_{1,S,\lambda,R}(x'_1)) - \lambda_{cn}(M'_{S,\lambda,R}(x'))$$

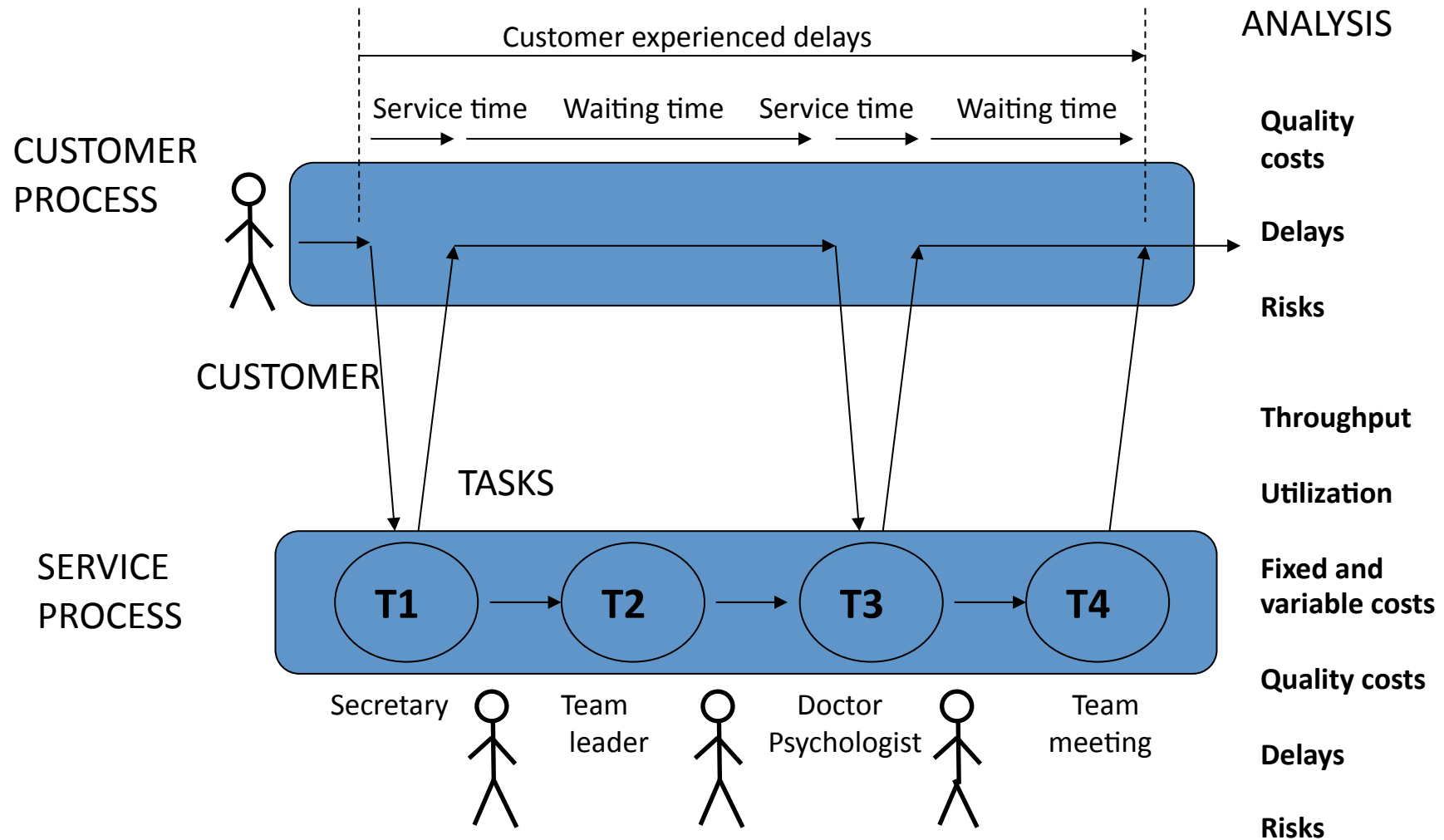
$$\Delta\rho_l = \rho_l(M'_{1,S,\lambda,R}(x'_1)) - \rho_l(M'_{S,\lambda,R}(x'))$$

- Let S' and R' be the new structure and resources in M_2 , then e.g.

$$\Delta\lambda_{cn} = \lambda_{cn}(M'_{2,S',\lambda,R'}(x'_2)) - \lambda_{cn}(M'_{S,\lambda,R}(x'))$$

Example 1: Developing the process system

“Intake to mental care” (Reijers)



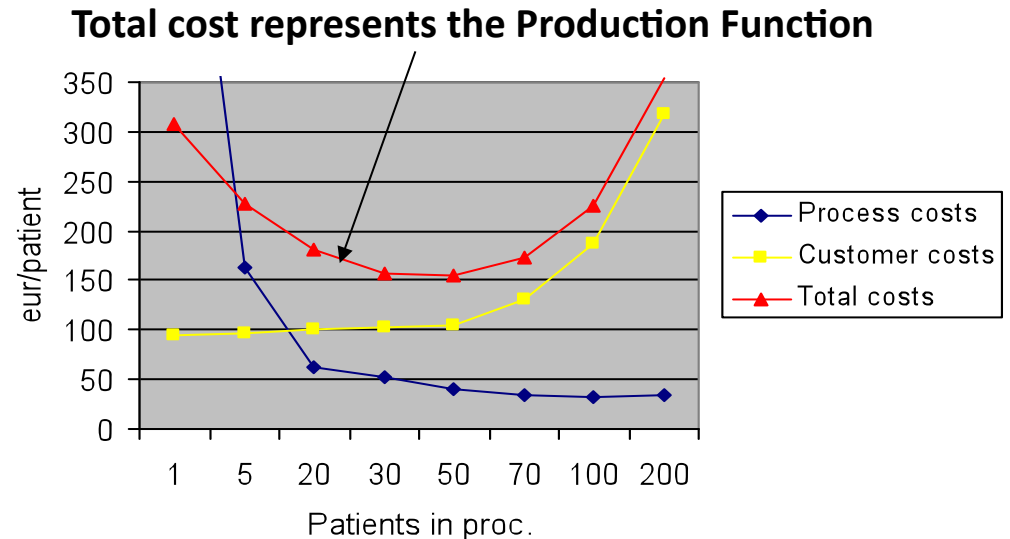
Example 1: Developing the process system

- The system consists of two interacting processes: The customer process and the service process.
- We improve the system by following changes:
 - We develop the example by first taking into use an ICT application with which the team leader can choose the intake doctor and psychologist without the weekly team meeting (T2).
 - We add resources (one more psychologist) in the critical task (T3) and as a result the cost per patient decreases and the throughput increases.
- We calculate the Production Functions of the original and the improved systems with 3VPM:

Example 1: Developing the process system

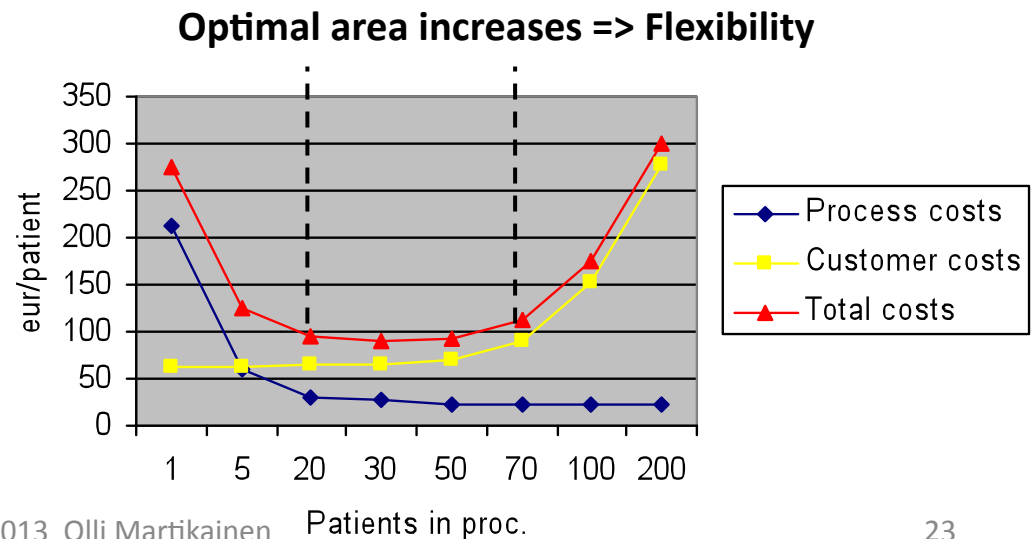
Original system

The costs of the service and customer processes were high.

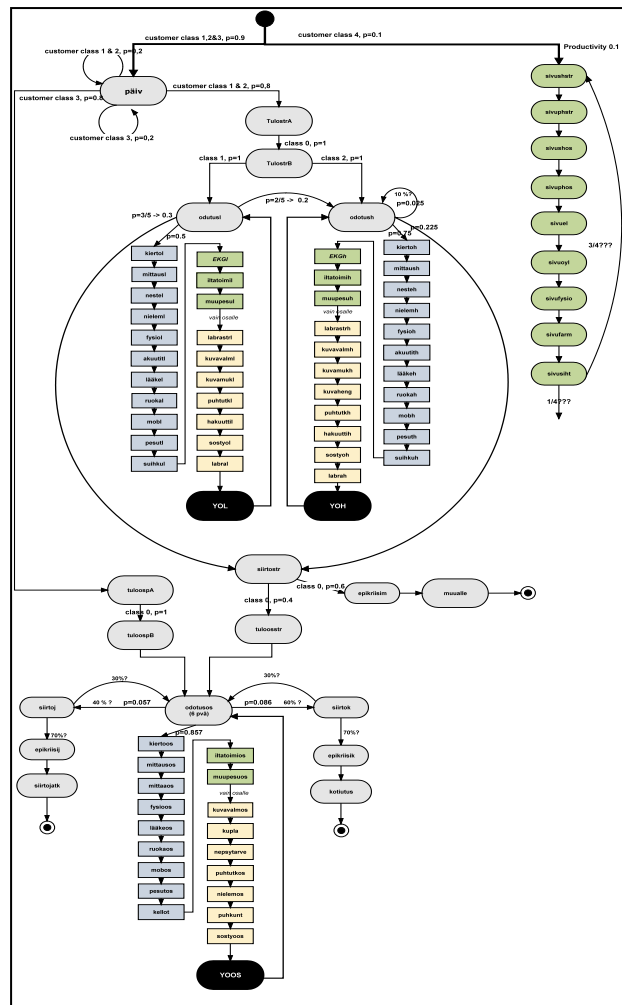


Improved system

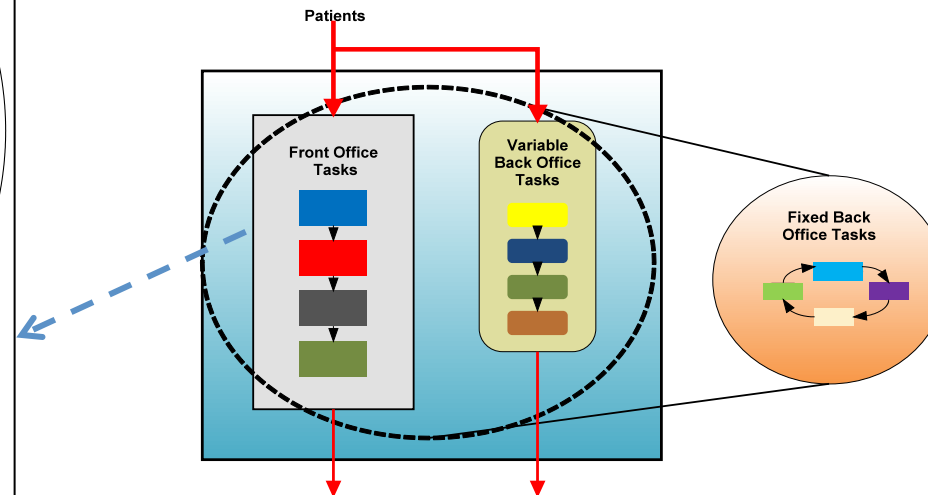
In the optimal area the total costs of the processes decreased over 30%, the throughput doubled and the waiting times decreased 35%.



Example 2: HUCH Stroke Unit



Analyzed with interviews and 3VPM method modelling (Martikainen – Halonen, 2011)

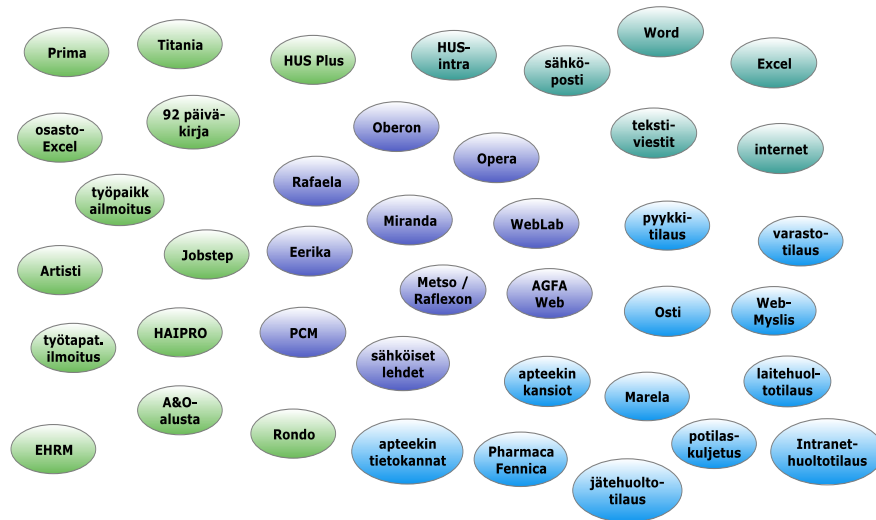


COMPLICATED REALITY –

HUCH Department-92 processes were more complicated than any of the 50 processes studied in 2006-2011 including industry: There were 13 professional groups working in 21 altering teams.

Example 2: HUCH Stroke Unit

More than 40 IT systems are used in data collection and services ordering. The fragmented systems decrease the productivity of the personnel.



Most important time critical patient data is still shared in paper documents.

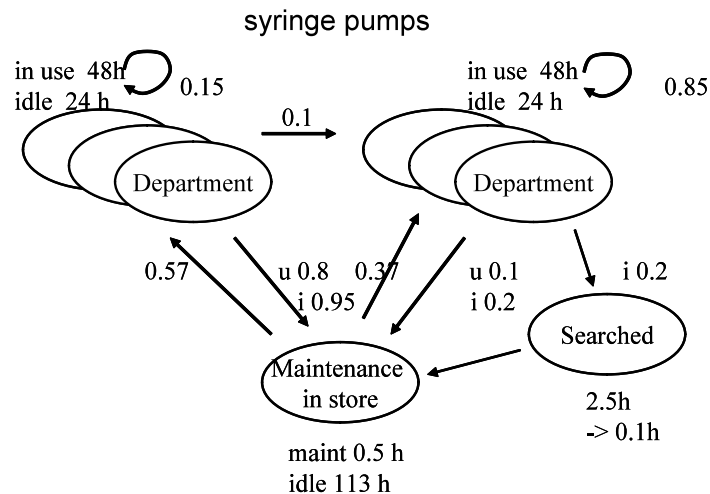
No communication support
between personnel.

The processes are optimal with respect to external parameters but the external parameters are far from optimal.

Example 3: Kyoto University Hospital

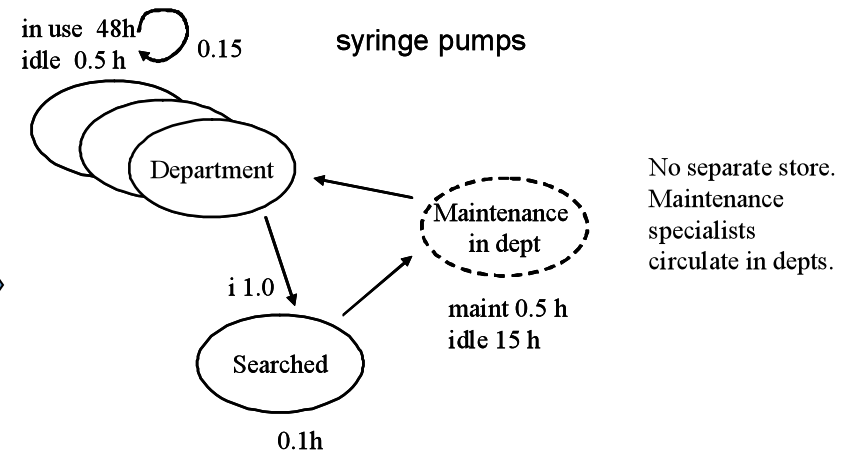
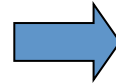
- Wireless location service
 - Medical equipment searching and service process
 - The equipment (EKG, EEG and Baxter pumps) belong to departments but may move to other departments with patients (they may be lost and search is needed)
 - The equipment have to be returned to Technical department for service and calibration after usage
 - Process analyzed before and after the wireless location identification service
 - Obtained process improvements in equipment usage 18% (incremental change) and 50% (radical change)
 - Published in ISMICT conference 2007

Example 3: Kyoto University Hospital



Incremental change: idle pumps are searched each hour and returned immediately to lab =>
Amount of needed equipment 300 -> 245

All equipment are taken to service in Technical department.
Incremental change: Location data is used to detect lost equipment =>
18% less equipment needed



Radical change: Idle pumps are maintained in departments and free pumps are taken into use from nearest dept without store =>
Amount of needed equipment 300 -> 150

Radical change: Location data used to detect all equipment and service technicians visit the departments (technicians are now mobile) =>
50% less equipment needed

Productivity as self service

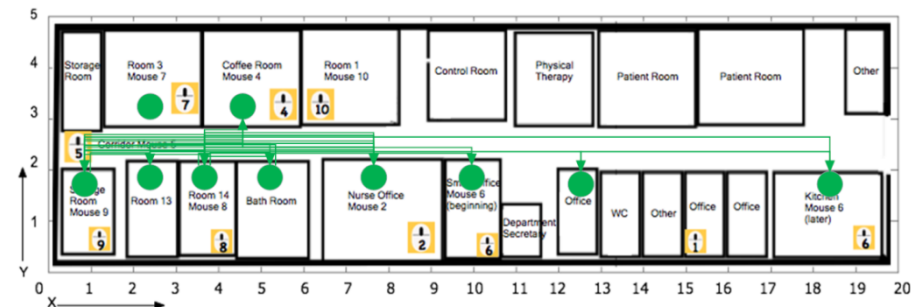
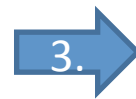
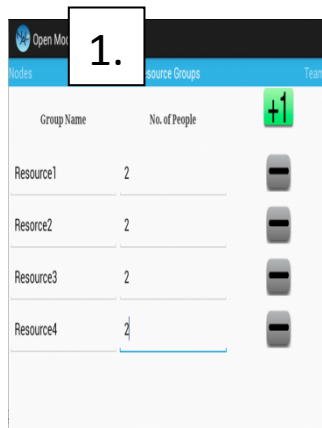
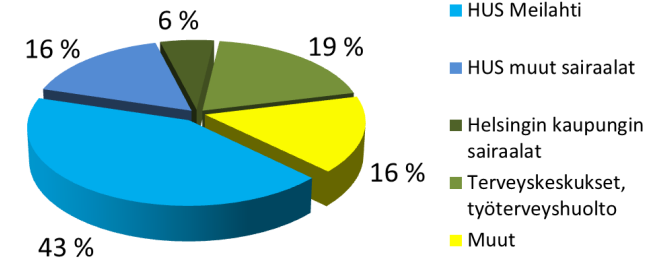
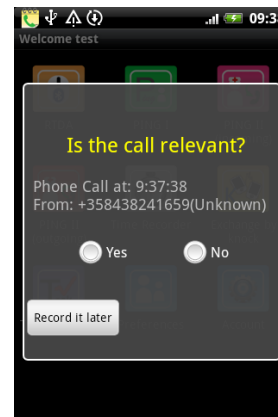
Productivity as self service

- Smart phones were used to measure the workflow processes of the personnel in HUTC Department-92
- The personnel started to innovate with the phones:
 - Could we communicate with other team members
 - Could we reserve therapy rooms for patients
 - Could we store and forward clinical measurement data
- The requirements presented by doctors, nurses, physiotherapists and support personnel were quite different
- Our project develops Mobile Applications for the personnel to improve their work and the improvements are analyzed
- These applications can be targeted to different professional users and downloaded from the web

Productivity as self service

Available Mobile Applications:

1. Mobile 3VPM calculator
2. Data for Doctor on Call
3. Task Recording for Nurse
4. Automatic Workflow Generation (in testing)
5. Task Guidance for Doctor (in development)



Productivity as self service

- Customer perspective
 - Mobile applications enable customers to access service data
 - Customers become service partners instead of service targets
- Personnel perspective
 - Different mobile applications are available to different professional groups
 - Personal work processes and work quality can be improved
 - Data related to process tasks can be accessed on the mobile device
 - Team work and safety can be improved
 - Best practices and applications can be shared via social media
- Management perspective
 - Optimal resource and team structures improve productivity
 - Overload situations in processes can be avoided
 - Process integration can be improved
 - Process data can be integrated in IT systems and vice versa
 - New personnel oriented incentive systems can be developed

References

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