Software Center: Theme 4

Customer Data and Ecosystem Driven Development
Theme 4: Projects

• Fast Customer Feedback In Large-Scale SE
  — Helena H. Olsson, Jan Bosch (PhD student: Aleksander Fabijan)

• Strategic Ecosystem Driven R&D Management
  — Helena H. Olsson, Jan Bosch

• Requirements engineering for large-scale agile system development
  — Eric Knauss, Rashidah Kasauili (PhD student) and Grischa Liebel (PhD student)

• Data-driven Continuous Evolution of Autonomous Systems (WASP)
  — Jan Bosch, Helena H. Olsson, Christian Berger (PhD student: David Issa Mattos)

• Unlocking User Value in IoT (IOTAP)
  — Helena H. Olsson and Jan Bosch
The HYPEX Model

The HYPEX model helps companies run feature experiments during development to continuously validate customer value. The model helps companies shorten the feedback loop to customers and adopt data-driven development practices.

- By continuously validating customer value, the HYPEX model helps companies in the feature *road-mapping and prioritization* process.
- By continuous experimentation and collection of customer data, the HYPEX model helps companies transition from opinions-based towards *data-driven development*.
- By enabling access to accurate customer data, the HYPEX model closes the ‘open loop’ between PdM and customers.


For more information please contact helena.holmstrom.olsson@mah.se and/or jan.bosch@chalmers.se
The QCD Model identifies qualitative and quantitative customer feedback techniques and helps companies select among these. The model helps companies continuously validate hypotheses and re-prioritize feature content pre-during and post-development.

- By treating requirements as hypotheses, the QCD model helps companies continuously validate customer value.
- By continuous validation of hypotheses, the QCD model enables re-prioritization of features also after development has started.
- By identifying qualitative and quantitative customer feedback techniques (CFT:s), the QCD model helps companies answer both ‘what’ and ‘how/why’ is customer value.


For more information please contact helena.holmstrom.olsson@mah.se and/or jan.bosch@chalmers.se
The TeLESM Model

The TeLESM model distinguishes between three types of ecosystems and identifies strategies for how to manage partners within each of these. The model helps companies in moving towards strategic management of their ecosystems.

- **TeLESM** distinguishes between the innovation, the differentiating and the commoditizing ecosystems and identifies strategies for managing each of these.
- **TeLESM** helps companies select the optimal strategies for managing each ecosystem.
- **TeLESM** helps companies identify when to transfer functionality between ecosystems to focus R&D resources on differentiating and innovative functionality.


For more information please contact helena.holmstrom.olsson@mah.se and/or jan.bosch@chalmers.se
The EDAX Model

The EDAX model defines development of autonomous systems as an integrated effort between R&D teams and the system itself. R&D teams build part of the functionality and the system experiments and adjusts its behaviors autonomously.

- The systems that we build today and in the future exhibit levels of autonomy that put new demands on SE practices.
- The EDAX model presents a method for systematically building autonomous systems that employ modern SE technology.
- The EDAX model defines three loops of data-driven adjustment of system behaviors.


For more information please contact jan.boschi@chalmers.se and/or helena.holmstrom.olsson@mah.se
The UDIT Model

The UDIT model helps companies assess two dimensions of IoT systems. Companies can use the model to: (1) Identify current state of their systems, (2) Identify desired state and (3) Identify the steps necessary to develop more advanced IoT systems.

- The IoT User Interface dimension identifies the format in which data is presented to users and how users interact with IoT systems.
- The IoT ecosystem dimension defines the level of which IoT systems interconnect with external systems.
- The UDIT model identifies the desired transition towards multi-source systems that require less interaction from the user.


For more information please contact helena.holmstrom.olsson@mah.se and/or jan.bosch@chalmers.se
Software Center

Fast Customer Feedback In Large-Scale SE

Reporting Workshop, December 8th, 2016, Gothenburg
Stairway to Heaven: ‘Data Dimension’

<table>
<thead>
<tr>
<th></th>
<th>Collection</th>
<th>Analysis</th>
<th>Reporting</th>
<th>Decision making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad-hoc</td>
<td>manual</td>
<td>manual</td>
<td>manual</td>
<td>manual</td>
</tr>
<tr>
<td>Collection</td>
<td>automated</td>
<td>manual</td>
<td>manual</td>
<td>manual</td>
</tr>
<tr>
<td>Automation</td>
<td>automated</td>
<td>automated</td>
<td>automated</td>
<td>supported</td>
</tr>
<tr>
<td>Data innovation</td>
<td>dynamic</td>
<td>dynamic</td>
<td>dynamic</td>
<td>supported</td>
</tr>
<tr>
<td>Evidence-based company</td>
<td>dynamic</td>
<td>dynamic</td>
<td>dynamic</td>
<td>automated</td>
</tr>
</tbody>
</table>
Project Goals

• Accelerate *data-driven development* practices and have companies increasingly benefit from the customer and product data they collect.

• Help companies transform from ad-hoc collection of data towards *evidence-based organizations* in which automated data collection and analysis informs decision-making practices.

• Develop *methods and techniques* for continuous validation of customer value.
Sprint 11: Partners and Activities

- Cross-company workshops
- Company-specific workshop
- Industry talks, keynotes, guest seminars
- SAAB project introduction
- Siemens (new project member)
“Featuritis”

Features / Functions Used in a Typical System

- **Often / Always Used**: 20%
- **Rarely / Never Used**: 64%
- **Sometimes**: 16%
- **Rarely**: 19%
- **Always**: 7%
- **Never**: 45%

*Standish Group Study Reported at XP2002 by Jim Johnson, Chairman*
What % of R&D for Commodity?
Strategic product goal

Feature: expected behavior ($B_{exp}$)

**Gap analysis**

- no gap ($B_{act} = B_{exp}$)
- relevant gap ($B_{act} \neq B_{exp}$)

**Experimentation**

- actual behavior ($B_{act}$)
- implement alternative MVF
- extend MVF
- abandon

**Business strategy and goals**

- Feature backlog

**Develop hypotheses**

- implement MVF
The QCD Model

Hypotheses backlog - Concepts - Ideas

Selection of hypothesis

Hypothesis

Selection of CFT

Customer Feedback Technique (CFT)

Product data database

Abandon

Deployed products

New hypotheses

CFT Data

Products in the field

The QCD Model
Qualitative data perishes in the hand-over between PO:s/PM:s UX specialists/software developers.

Development repeats data collection or develops the Product based on insufficient information.

UX and developer feedback on prototypes etc. is only used within the development phase.

Operational and performance data is not sufficiently shared with developers and system managers.

Hinders developers and system architects from designing optimal solutions customers.

Service, sales and operators of the product don’t understand the reason behind a configuration when solving a problem.
Feature Types

A – “Duty” features
Stakeholder: Regulators
Feature exposure: Low
Feedback: Regulatory requirements
Focus: Regulation compliance
Sales Impact: Low
Deployment frequency: One-off

B – “Wow” features
Stakeholder: Market/customers
Feature exposure: Low
Feedback: Market and customers analysis/reports
Focus: Product innovation
Sales Impact: High
Deployment frequency: Scheduled (regular)

C – “Checkbox” features
Stakeholder: Competitors
Feature Exposure: Low
Feedback: Competitor and customer analysis/review
Focus: System performance/operation
Sales Impact: None
Deployment frequency: Scheduled (frequent)

D – “Flow” features
Stakeholder: Customers
Feature Exposure: High
Feedback: Customer and product data
Focus: User value and innovation
Sales Impact: Indirect
Deployment frequency: Continuous

Satisfy
Commoditized
Differentiating
Maximize
Innovative
Development of the first version
Collecting feedback
Defining factors in F
Defining weights in W

Feature is deployed
Iterative improvement

Feature aging and interaction
Value equilibrium

Extensive maintenance and complexity costs
Cost of removal < negative feature value
Actual feature removal

Value peak

Feature Lifecycle
Sprint 11: Findings

- Value derived from customer and product data is **low**.
- Insights generated from data influence only **small** feature improvements and optimizations at the team level.
- Decisions concerning new product development and innovation fall back on **internal assumptions** on what constitutes customer value.
- The impact of experiments are **poor** and most companies fail in having data-driven development scale to inform high-level business and innovation.
- Accumulation of insights is difficult. Typically, companies have a **case-by-case understanding** of their experiments but no way to effectively generalize.
Sprint 11: Publications

- Olsson, H.H., and Bosch, J. (forthcoming). Towards Evidence-Based Development: Learnings From Embedded Systems, Online Games And Internet of Things. Accepted for publication in IEEE Software.

Conclusions

- Customer data is becoming increasingly important to help companies move away from opinions-based decision-making and instead adopt *data-driven development* practices.

- Collection and analysis of customer and product data is critical for *understanding product use* and take accurate decisions.

- To model feature value by defining *key metrics* helps companies avoid local sub-optimization and accelerate the impact of experiments.
Software Center

Strategic Ecosystem Driven R&D Management

Reporting workshop, December 8th, 2016.
### Stairway to Heaven: ‘Ecosystem Dimension’

<table>
<thead>
<tr>
<th>Levels</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internally focused</td>
<td>Do everything in-house unless it is really impossible</td>
</tr>
<tr>
<td>Ad-hoc ecosystem engagement</td>
<td>Individuals take ad-hoc decisions to engage with ecosystem partners, but local optimization</td>
</tr>
<tr>
<td>Tactical ecosystem engagement</td>
<td>Ecosystem engagement is centralized, but driven by tactical (rather than strategic) considerations</td>
</tr>
<tr>
<td>Strategic single ecosystem management</td>
<td>One of the ecosystem types is managed strategically</td>
</tr>
<tr>
<td>Strategic multi-ecosystem management</td>
<td>All three types (I, D, C) are managed strategically</td>
</tr>
</tbody>
</table>
Project Goals

• Help companies move from ad-hoc interactions with external stakeholders towards strategic management of the different ecosystems.

• Develop strategies that help companies better manage the innovation, the differentiation and the commodity ecosystem.

• Accelerate the adoption of alternative organizational models that emphasize empowerment and self-management in order to increase autonomy and competitiveness.
Sprint 11: Partners and Activities

- Cross-company workshops
- Company-specific workshop
- Delegation game sessions
- Industry talks, keynotes, guest seminars
- Tetra Pak project introduction
- Siemens (new project member)
TeLESM: Three Layer Ecosystem Strategy Model

Innovation ecosystem

- **internal**
  - Me-Myself-I Strategy
  - Be-My-Friend Strategy

- **collaborative**
  - Customer Co-Creation Strategy
  - Supplier Co-Creation Strategy
  - Peer Co-Creation Strategy
  - Expert Co-Creation Strategy

- **external**
  - Copy-Cat Strategy
  - Cherry-Picking Strategy
  - Orchestration Strategy
  - Supplier Strategy
  - Preferred Partner Strategy
  - Acquisition Strategy

Differentiating ecosystem

- **internal**
  - Increase Control Strategy
  - Incremental Change Strategy
  - Radical Change Strategy

- **collaborative**

- **external**

Commoditizing ecosystem

- **internal**
  - Rationalized in-sourcing
  - Push-Out Strategy

- **collaborative**
  - OSS Creation Strategy
  - Partnership Strategy
  - OEM partnerships

- **external**
  - COTS Adoption Strategy
  - OSS Integration Strategy
  - Outsourcing
Companies engage in different types of ecosystems in relation to development of innovative functionality, differentiating functionality and commodity functionality.

To distinguish between the different ecosystems is critical as these require fundamentally different strategies.

Companies that fail in distinguishing between the different ecosystems risk having resources tied up in commodity with the result that development of differentiating and innovative functionality suffers.

Effective ecosystem management requires the use of both collaborative and competitive strategies.

Ecosystems are dynamic in nature and change over time. This requires continuous and conscious transfer of functionality between ecosystems – and a constant assessment and evaluation of what strategies are used.
Results Sprint 11
(Empowered Organizations)
What I've learned is that unless it's an emergency, like a fire or brain surgery, hierarchy is not necessary and may be damaging. If you have a hierarchy, you're repeating the strengths and weaknesses of one person without allowing for the accumulative strength of a group.

Gloria Steinem
Hierarchical Organizations

**Strengths**
- Effective scaling
- Controlling many people from a central position
- Very efficient for repeatable tasks
- Harmonization of processes
- Globalization
- Handles low complexity situations well

**Weaknesses**
- Slow decision making processes
- Power driven by position; not capability
- Tendency to be internally focused
- Easily gravitates to politics
- Highly resistant to changes
- Challenged by high-complexity situations
Empowered Organizations: Principles

• **Self management**
  – Nobody is in command.
  – Coordination mechanisms, but no boss
  – Natural leadership leads to spontaneous, temporary hierarchies

• **Wholeness**
  – No acting to suit your boss/fit the culture
  – Be yourself at work

• **Evolutionary purpose**
  – No top-down strategy
  – Wisdom of the crowds
Empowered Organizations: Characteristics

• **Roles:** People can shoulder one or more roles, independent on place in the organization

• **Activities:** Coordinate the work of one or more roles

• **Advice process:** Everyone has complete autonomy to make decisions pertain to their role or roles. Stakeholders need to be asked for advice though. *Note: this is NOT consensus!*

• **Agreements:** People can negotiate agreements to coordinate work, agree on SLAs and other relevant factors. Agreements are entered voluntarily.

• **Evolution:** Roles, activities and agreements evolve constantly in mutual agreement
#1: Agile Software Development

- Empowered teams
- Voluntary commitment
- Coordination through communication (daily standups)
- Customer collaboration
- Team mission is to do ‘right by the customer’
#2: Holistic Organizations

- Book by Fredrik Laloux
- Studied 17 cases of holistic organizations
- Emphasizes self management, wholeness and evolutionary purpose

[Diagram showing the evolution from Tribal to Holistic organizations]
#3: Holacracy

<table>
<thead>
<tr>
<th>In Traditional Companies</th>
<th>With Holacracy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job descriptions</strong></td>
<td><strong>Roles</strong></td>
</tr>
<tr>
<td>Each person has exactly one job. Job descriptions are imprecise, rarely updated, and often irrelevant.</td>
<td>Roles are defined around the work, not people, and are updated regularly. People fill several roles.</td>
</tr>
<tr>
<td><strong>Delegated Authority</strong></td>
<td><strong>Distributed Authority</strong></td>
</tr>
<tr>
<td>Managers loosely delegate authority. Ultimately, their decision always trumps.</td>
<td>Authority is truly distributed to teams and roles. Decisions are made locally.</td>
</tr>
<tr>
<td><strong>Big Re-Orgs</strong></td>
<td><strong>Rapid Iterations</strong></td>
</tr>
<tr>
<td>The org structure is rarely revisited, mandated from the top.</td>
<td>The org structure is regularly updated via small iterations. Every team self-organizes.</td>
</tr>
<tr>
<td><strong>Office Politics</strong></td>
<td><strong>Transparent Rules</strong></td>
</tr>
<tr>
<td>Implicit rules slow down change and favor people “in the know”</td>
<td>Everyone is bound by the same rules, CEO included. Rules are visible to all.</td>
</tr>
</tbody>
</table>
#4: Exponential Organizations
Towards Empowered Organizations

From Traditional towards Empowered Organizations: How organizational functions operate at each step

<table>
<thead>
<tr>
<th>Culture</th>
<th>Traditional</th>
<th>Agile</th>
<th>Cross-functional</th>
<th>Self-managed</th>
<th>Empowered</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Mgmt.</td>
<td>Hierarchical</td>
<td>Hierarchical</td>
<td>Hierarchical</td>
<td>Hierarchical</td>
<td>Empowered</td>
</tr>
<tr>
<td>Inter-team (PdM/R&amp;D)</td>
<td>Hierarchical</td>
<td>Hierarchical</td>
<td>Empowered</td>
<td>Empowered</td>
<td>Empowered</td>
</tr>
<tr>
<td>Local (R&amp;D)</td>
<td>Hierarchical</td>
<td>Empowered</td>
<td>Empowered</td>
<td>Empowered</td>
<td>Empowered</td>
</tr>
</tbody>
</table>
Sprint 11: Publications


Related publications:


Conclusions

• Traditional **hierarchical organizations** have severe challenges meeting rapidly changing market and customer needs.

• Alternative organizational models are emerging addressing these challenges by focusing on **empowerment** and **autonomy** of teams.

• Companies adopting this paradigm shift early improve their competitiveness.
UseIT: ’Unlocking User Value in IoT’

’Internet of Things and People’ (IOTAP)
Malmö University

December 8th, 2016, Gothenburg.
Internet of Things and People (IoTaP)
We study how IoT systems *change* traditional user behaviors and how development of IoT systems *alter* current SE practices.

We develop methods and techniques that help companies identify *new user value* and *accelerate* their development of IoT systems.

We conduct *case study research* were we bring multiple companies together to share experiences and accumulate knowledge.
**UseIT: Research Goal**

Provide support for how to effectively *engineer and continuously improve* IoT systems that allow and support:

- New *user value*
- New *behaviors and interaction patterns*
- New *business value to monetize*

We provide *conceptual models and frameworks* that help assess current and desired state of IoT systems – and the transition forward.
The UDIT Model:
Map the current and desired state of your IOT products and services
Findings

• Companies **do not utilize the ecosystem** to the extent they could in order to create new user value.
• Companies focus their efforts and investments in one **vertical (internal)**, but struggle in how to involve with external partners.
• While value flows towards **customers** are well understood, value flows towards potential **business partners** are not.
• Few strategies for how to **align, orchestrate and manage** ecosystems to enhance user value by e.g. sharing of data and sensors exist.
• While technical and architectural solutions that support IoT ecosystems exist, **business models and incentives** do not.
Sprint 11: Publications

- Olsson, H.H., and Bosch, J. (forthcoming). Towards Evidence-Based Development: Learnings From Embedded Systems, Online Games And Internet of Things (Accepted for publication in IEEE Software).
Keynote Seminars

• Open keynote seminars (Malmö University)
  – Johan Eker, Ericsson Research Cloud Technology (May 9th, 2016): ’Merging IoT & Cloud & Everything in Between’.
  – Mats Melander, Tetra Pak (March 22nd, 2016): ’Digital Data and Equipment Performance at Tetra Pak’.
  – Mohammad Ali, Volvo Cars (September 30th, 2016): Self-driving cars development at Volvo Cars.
Thank you!

helena.holmstrom.olsson@mah.se