Towards a New Digital Business Operating System

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The World Has Never Been Better!

- There is (much!) less **poverty**
  - Extreme poverty (less than $1.25/day) dropped from 29% to 9% of the world population in 30 years

- We’re **living longer!**
  - Global life expectancy has gone from 47 in 1950 to 70 in 2011 (50% improvement!)

- There are much fewer **war deaths**
  - Number of war deaths dropped from 300 per 100,000 people (WWII) to less than 1 currently

- There’s less racism, sexism, and other forms of **discrimination** in the world
  - 20 percent decline in observable gender inequalities from 1995 to 2011.

Role of Digital Technology

• Mobile & smart phones
  – Virtually EVERYONE in the world has one

• Internet access
  – 3.174 billion people (44%)

• Optimization through data availability
  – 2.5 billion gigabytes (GB) of data was generated every day in 2012

• Everything is/will soon be connected
  – 50 billion connected devices in 2020
How many companies that were on the list in 2000 are still on the list in 2014?

52% of the Fortune 500 firms since 2000 are gone.
Disruption Is The New Normal

- Jim Collins (Built to last): Companies last, on average, 30 15 10 years on the Fortune 500 list. And that time period is decreasing
- Main cause: Companies fail to innovate and to build new core capabilities

Digitalization Is The New Disruptor!
Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.

- Gartner
Digitalization

The Strategic Building Blocks of Digital Transformation

Digital customer experience:
- Digitally enhanced products
- Data-driven services
- Digital services
- Software products

Digitization of core business:
- Sales, channels, and marketing
- Research and development
- Manufacturing and supply chain management
- HR, finance, and support

Digital capabilities:
- Agile organization, IT, and development
- Systems and technology platforms
- Analytics and data integration
- Digital partner ecosystem

Digital transformation accelerators:
- Start-up incubation, venture capital, and prototyping
- Lighthouses and bold M&A moves
- Digital redesign process by process
- Digital program and change management

Source: BCG analysis.
Three Key Take-Aways

• Increasing **SPEED** trumps ANY other improvement R&D can provide to the company – the goal is **continuous deployment** of new functionality

• Effective use of **DATA** from customers and products as well as the **ECOSYSTEMS** around your systems and services in the field are the next areas to exploit and monetize

• We are moving towards a new business operating mechanism focused on **EMPOWERMENT** and **autonomy**
Overview

• Vem är jag? Wie ben ik? Who am I?
• Trends in Industry
• Towards a New Business Operating System
  – Speed
  – Data
  – Ecosystems
  – Empowerment
• Conclusion
**Mission:** Improve the *digitalization* capability of the European Software-Intensive industry with an order of magnitude

**Theme:** Fast, continuous deployment of customer value

**Success:** Academic excellence

**Success:** Industrial impact
Research Themes

Application Domain Themes

Shared public/partner funding
- Autonomous Systems
- Internet of Things
- System of Systems
  - WASP
  - IOTAP

Predominantly partner funding
- Continuous Delivery
- Continuous Architecture
- Metrics
- Customer Data and Ecosystems

Technology Themes
Some Online Companies

- Booking.com
- Spotify
- Rovio
- Klarna
- King
- Microsoft
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Gartner 2018 Technology Hype Cycle

As of August 2018

Plateau will be reached:
- less than 2 years
- 2 to 5 years
- 5 to 10 years
- more than 10 years
- obsolete before plateau

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Software Drives Everything

Self-Driving Cars
Robots
Gripen Drone
3D Cement Printing
The Cycle of Innovation

- Ideas
- LEARN
- Data
- BUILD
- MEASURE
- Product

Flow: Ideas → LEARN → Data → BUILD → MEASURE → Ideas
Length of Innovation Cycle

Car Platform: 10-15 years
Length of Innovation Cycle

Car: 3-4 years
Length of Innovation Cycle

Car Software: 1-5 days
10x every ~7 years
Volvo XC 90
50 Terabytes of data are created every second
Google receives over 4,000,000 search queries.

Facebook users share 2,460,000 pieces of content.

Skype users connect for 23,300 hours.

Yelp users post 26,380 reviews.

Apple users download 48,000 apps.

Pandora users listen to 61,141 hours of music.

Amazon makes $83,000 in online sales.

Instagram users post 216,000 new photos.

Twitter users tweet 277,000 times.

Vine users share 3,472 images.

Pinterest users pin 8,333 videos.

YouTube users upload 72 hours of new video.

Email users send 204,000,000 messages.

Every minute of the day:

The global internet population grew 143% from 2011-2013 and now represents 2.4 billion people.
Emerging companies highlight importance of user contribution and social connectedness

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1M users</td>
<td>~6 years</td>
<td>30 months</td>
<td>10 months</td>
<td>?</td>
</tr>
<tr>
<td>50M users</td>
<td>N/A</td>
<td>~80 months</td>
<td>~44 months</td>
<td>~1 month</td>
</tr>
</tbody>
</table>

Level of User Contribution

Value Creation Shifts

Trend: Need for Speed
Need for Speed in R&D – An Example

- Company X: R&D is 10% of revenue, e.g. 100M$ for a 1B$ product
- New product development cycle: 12 months

- Alternative 1: improve efficiency of development with 10%
  - 10 M$ reduction in development cost
- Alternative 2: reduce development cycle with 10%
  - 100M$ add to top line revenue (product starts to sell 1.2 months earlier)

No efficiency improvement will outperform cycle time reduction
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3LPM: Three Layer Product Model

- **Innovation and experimentation layer**
  - Optimize for maximum number of experiments

- **Differentiating functionality layer**
  - Optimize for maximum customer value

- **Commoditizing transition interface**

- **Commoditized functionality layer**
  - Optimize for minimizing total cost of ownership

- **New-product transition interface**

- **Ecosystem partners**
  - Over time, products lose competitiveness
  - Platform becomes competitive disadvantage

- **Challenges**
  - Each layer releases independently
  - Each layer optimizes different metrics
  - R&D efforts focus on highly differentiating functionality

**Architecture refactoring process**

**Productize**

**Commoditize**
How do I expand my innovation funnel?

How do I deliver innovations to market faster?

How do I know that what I'm building provides value to customers?

How do I identify commoditization of functionality?

How do I minimize total cost of ownership for commodity functionality?

How do I organize for operating in this model?
A New Business Operating System

- Focus on differentiation
- Empower teams
- Instrument and measure
- Focus on differentiation
- Speed
- Data
- Empowerment
- Ecosystem
Stairway to Heaven: Speed

Traditional Development

R&D Organization All Agile

Continuous Integration

Continuous Deployment

R&D as an Innovation System

Sales & mrkt

Prod. mgmt.

Cust. Sup.

Cust. sup.

Release

Release

V&V

V&V

V&V

R&D teams

R&D teams

R&D teams

R&D teams
Feedback Cycles

- Development cycle
- Requirements cycle
- Quality assurance cycle
- Governance cycle
- Deployment cycle
- Value creation cycle
Feedback Cycles and Speed

<table>
<thead>
<tr>
<th></th>
<th>Traditional</th>
<th>Agile</th>
<th>CI</th>
<th>CD</th>
<th>Inno System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development</td>
<td>Long</td>
<td>Sprint</td>
<td>Sprint</td>
<td>Sprint</td>
<td>Sprint</td>
</tr>
<tr>
<td>Requirements</td>
<td>Long</td>
<td>Sprint</td>
<td>Sprint (internal)</td>
<td>Sprint (external)</td>
<td>Sprint</td>
</tr>
<tr>
<td>Quality assurance</td>
<td>Long</td>
<td>Long</td>
<td>Sprint (internal)</td>
<td>Sprint (external)</td>
<td>Sprint (external)</td>
</tr>
<tr>
<td>Governance</td>
<td>Long</td>
<td>Long</td>
<td>Sprint</td>
<td>Sprint</td>
<td>Sprint</td>
</tr>
<tr>
<td>Deployment</td>
<td>Long</td>
<td>Long</td>
<td>Long</td>
<td>Sprint</td>
<td>Sprint</td>
</tr>
<tr>
<td>Value creation</td>
<td>Long</td>
<td>Long</td>
<td>Long</td>
<td>Long</td>
<td>Sprint</td>
</tr>
</tbody>
</table>

Slow: opinion-based; sprint: data-driven
Dependencies
Unawareness
Duplication - reuse
Temporal properties - behavior
Non uniformity - Policies

Cause of ATD generation

Causes

CLASSES OF ATD

Duplicated activities
New code
Adaptation of existing code
Testing
Bug Fixing
Finding hidden problems
Understanding

PHENOMENA (EFFECTS)

“Double” effort
Repeated wrapping
Contagious ATD
Big deliveries involving many developers
Quality issues
Hidden ATD
Non-completed refactoring
Wrong estimation of effort
Confusion
Lack of familiarity and experience

EXTRA-ACTIVITIES

Continuous Delivery Model

- Requests for new functionality
- Feature backlog
- Governance team
- Single code base
- Automated product derivation
- Product 1
- Product 2
- Product 3
- Product n

- Architect team
- Refactoring & runway backlog
- Defect backlog
- Product configuration files
## Stairway to Heaven: Data

<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>
“Featuritis”

Features / Functions Used in a Typical System

- Often / Always Used: 20%
- Occasionally Used: 16%
- Always 7%
- Rarely 19%
- Never 45%

Standish Group Study Reported at XP2002 by Jim Johnson, Chairman
Our Research ...
The HYPEX Model

Strategic product goal

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

Gap analysis

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

Develop hypotheses

- implement MVF
- implement alternative MVF
- extend MVF
- abandon

Product

Experimentation

Feature backlog

Business strategy and goals
Holistic DevOps Framework

Requirements driven development
- Regulatory features
- Competitor parity features
- Commodity features

Outcome/data driven development
- Value hypothesis
- New “flow” features
- Innovation

AI driven development
- Minimize prediction errors
- Many points in data set
- Combinatorial explosion of alternatives

Continuous deployment
Behavior data
System in operation

AI component
SW component
Continuous deployment
Behavior data
Why Software Engineering For Deep Learning?

Engineering Challenges for DL Systems

## Stairway to Heaven: Ecosystems

<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>
3LPM: Three Layer Product Model

What % of R&D for Commodity?
Innovation ecosystem

- **Who:** Customers, 3rd party developers, suppliers
- **What:** Development of new functionality
- **Why:** Share/minimize innovation costs/risks
- **When:** High market uncertainty
- **How:** Open innovation, co-opetition, partnerships
- **Mechanisms:** Product platforming, idea competitions, customer involvement, collaborative design, innovation networks etc.

Differentiating ecosystem

- **Who:** Keystone player
- **What:** Optimization and extension of existing functionality
- **Why:** Turn innovations into core product offerings, keep internal control over value-adding functionality, optimize for maximum customer value
- **When:** When innovative functionality have proven valuable for customers
- **How:** Innovation transfer, R&D management, monetizing strategies
- **Mechanisms:** Data-driven development, patents, contracts, licenses etc.

Commoditizing ecosystem

- **Who:** Suppliers, competitors, developers
- **What:** Reduce efforts related to old, non value-adding functionality
- **Why:** Share/minimize maintenance costs
- **When:** Functionality that has become so integral to the product that it no longer offers customer value
- **How:** OSS, COTS, inner source, standardization, shared supplier
- **Mechanisms:** Open platforms and API’s, connecting services etc.
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
  - Complementing Strategy
- External
  - Platform Control Strategy

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
company hierarchy:

- sociopaths
- clueless
- losers
Empowered Organizations

<table>
<thead>
<tr>
<th></th>
<th>Traditional</th>
<th>Agile</th>
<th>Cross-functional</th>
<th>Self-managed</th>
<th>Empowered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culture</td>
<td>Hierarchical</td>
<td>Hierarchical</td>
<td>Hierarchical</td>
<td>Hierarchical</td>
<td>Empowered</td>
</tr>
<tr>
<td>General Mgmt.</td>
<td>Hierarchical</td>
<td>Hierarchical</td>
<td>Hierarchical</td>
<td>Empowered</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>
## Hierarchical Organizations

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Effective scaling</td>
<td>• Slow decision making processes</td>
</tr>
<tr>
<td>• Controlling many people from a central position</td>
<td>• Power driven by position; not capability</td>
</tr>
<tr>
<td>• Very efficient for repeatable tasks</td>
<td>• Tendency to be internally focused</td>
</tr>
<tr>
<td>• Harmonization of processes</td>
<td>• Easily gravitates to politics</td>
</tr>
<tr>
<td>• Globalization</td>
<td>• Highly resistant to changes</td>
</tr>
<tr>
<td>• Handles low complexity situations well</td>
<td>• Challenged by high-complexity situations</td>
</tr>
</tbody>
</table>
Employee Engagement

**U.S. Employee Engagement, 2013 vs. 2014**

<table>
<thead>
<tr>
<th>% Employees</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaged</td>
<td>29.6</td>
<td>31.5</td>
</tr>
<tr>
<td>Not engaged</td>
<td>51.5</td>
<td>51.0</td>
</tr>
<tr>
<td>Actively disengaged</td>
<td>18.8</td>
<td>17.5</td>
</tr>
</tbody>
</table>

GALLUP

**U.S. Employee Engagement, by Generation**

<table>
<thead>
<tr>
<th>% Employees engaged</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millennials</td>
<td>27.5</td>
<td>28.9</td>
</tr>
<tr>
<td>Generation X</td>
<td>29.6</td>
<td>32.2</td>
</tr>
<tr>
<td>Baby boomers</td>
<td>30.9</td>
<td>32.7</td>
</tr>
<tr>
<td>Traditionalists</td>
<td>38.3</td>
<td>42.2</td>
</tr>
</tbody>
</table>

GALLUP

**Sweden (2013)**

- Engaged: 16%
- Not engaged: 73%
- Actively disengaged: 11%

Gallup uppskattar att oengagerade medarbetare kostar USA varje minst 450 miljarder dollar varje år. Tyskland går miste om minst 151 miljarder och Storbritannien 83 miljarder.
Empowerment: 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
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 pertaining 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.
Examples

• Agile software development
• Holistic organizations
• Holacracy
• Exponential organizations
Empowerment

• **Principles** over *Orders*
• **Personal leadership** over *Leader – Follower*
• **Trust** over *Audits*
• **Customer first** over *Organization structure first*
• **Team appointed managers** over *Manager appointed teams*
• **Diversity** over *Homogeneity*
• **Agility** over *Long-term planning*
• **Emergent strategy** over *Top-down strategy*
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“In the future, all companies will be software companies”

George F. Colony (CEO Forrester Research)
Conclusions

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- Effective use of **DATA** from customers and products as well as the **ECOSYSTEMS** around your systems and services in the field are the next areas to exploit and monetize.

- We are moving towards a new business operating mechanism focused on **EMPOWERMENT** and **autonomy**.
Learn More?

- *Speed, Data, and Ecosystems: Excelling in a Software-Driven World* by Jan Bosch
- *Impactful Software: Business-driven Refactoring, Platforms and Ecosystems* by Jan Bosch