

THE SCIENCE OF LEAN SOFTWARE AND DEVOPS

ACCELERATE

Building and Scaling High Performing
Technology Organizations



Nicole Forsgren, PhD
Jez Humble *and* Gene Kim

IT Revolution
Portland, Oregon

PDF COMPANION TO THE AUDIO BOOK



25 NW 23rd Pl, Suite 6314
Portland, OR 97210

Copyright © 2018 by Nicole Forsgren, Jez Humble, and Gene Kim.
Chapter 16 Copyright © 2018 by Karen Whitley Bell and Steve Bell,
Lean IT Strategies, LLC.

All rights reserved, for information about permission

To reproduce selections from this book, write to
Permissions, IT Revolution Press, LLC, 25 NW 23rd Pl, Suite 6314, Portland, OR 97210

First Edition
Printed in the United States of America
22 21 20 19 18 1 2 3 4 5 6

Cover and book design by Devon Smith Creative, LLC

Library of Congress Catalog-in-Publication Data is available upon request.

ISBN: 978-1942788331
eBook ISBN: 978-194278355
Kindle ISBN: 978-194278362
Web PDF ISBN: 978-194278379

Publisher's note to readers: Although the authors and publisher have made every effort to ensure that the information in this book is correct, the authors and publisher do not assume and hereby disclaim any liability to any party for any loss, damage, or disruption caused by errors or omissions, whether such errors or omissions result from negligence, accident, or any other cause.

For information about special discounts for bulk purchases or for information on booking authors for an event, please visit our website at www.ITRevolution.com.

ACCELERATE

Figures

| | | |
|------|--|----|
| 2.1 | Software Delivery Performance | 1 |
| 2.2 | Year over Year Trends: Tempo | 2 |
| 2.3 | Year over Year Trends: Stability | 3 |
| 2.4 | Impacts of Software Delivery Performance | 4 |
| 3.1 | Likert-Type Questions for Measuring Culture | 4 |
| 3.2 | Westrum Organizational Culture's Outcomes | 5 |
| 3.3 | Westrum Organizational Culture's Drivers | 5 |
| 4.1 | Drivers of Continuous Delivery | 6 |
| 4.2 | Impacts of Continuous Delivery | 6 |
| 4.3 | Continuous Delivery Makes Work More Sustainable | 7 |
| 4.4 | New Work vs. Unplanned Work | 7 |
| 5.1 | Deploys per Developer per Day | 8 |
| 7.1 | Components of Lean Management | 8 |
| 7.2 | Impacts of Lean Management Practices | 9 |
| 8.1 | Components of Lean Product Management | 9 |
| 8.2 | Impacts of Lean Product Management | 10 |
| 9.1 | Impacts of Technical and Lean Practices on Work Life | 11 |
| 10.1 | Impacts of Technical and Lean Practices on Identity | 11 |
| 10.2 | Impacts of Technical and Lean Practices on Job Satisfaction | 12 |
| 10.3 | Gender Demographics in 2017 Study | 13 |
| 10.4 | Underrepresented Minority Demographics in 2017 Study | 14 |
| 11.1 | Impacts of Transformational Leadership on Technical and Lean Capabilities | 15 |

| | |
|--|----|
| 12.1 Spurious Correlation: Per Capita Cheese Consumption and Strangulation by Bedsheets | 15 |
| 16.1 Leadership Obeya (360-Degree Panorama) | 16 |
| 16.2 ING’s New Agile Organizational Model Has No Fixed Structure—It Constantly Evolves | 17 |
| 16.3 Stand-up and Catchball Rhythm | 18 |
| 16.4 High-Performance Team, Management, and Leadership Behaviors and Practices | 19 |
| A.1 Overall Research Program | 20 |
| B.1 Firmographics: Organization Size, Industry, Number of Servers in 2017 | 22 |

Tables

| | |
|---|----|
| 2.1 Design vs. Delivery | 23 |
| 2.2 Software Delivery Performance for 2016 | 23 |
| 2.3 Software Delivery Performance for 2017 | 24 |
| 3.1 Westrum’s Typology of Organizational Culture | 24 |
| 13.1 Westrum’s Typology of Organizational Culture | 25 |
| B.1 Manual Work Percentages | 25 |

Software Delivery Performance

Lead Time

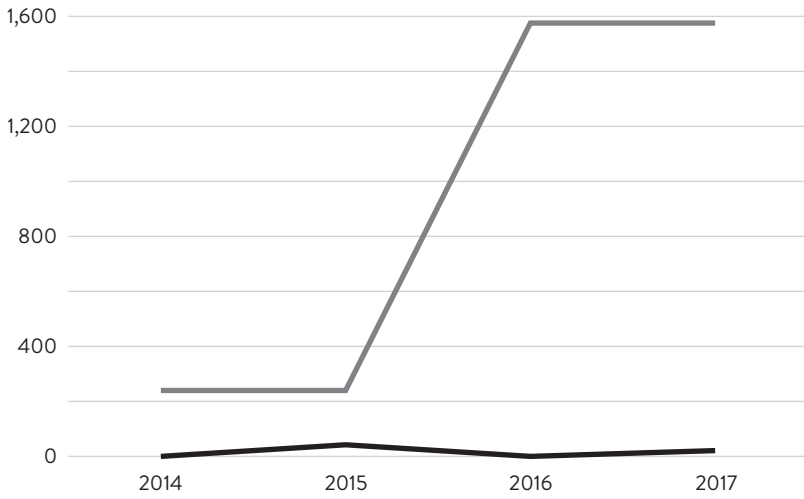
Deployment Frequency

Mean Time to Restore (MTTR)

Change Fail Percentage

Figure 2.1: Software Delivery Performance

DEPLOY FREQUENCY (# OF DEPLOYS PER YEAR)



CHANGE LEAD TIME (MINUTES)

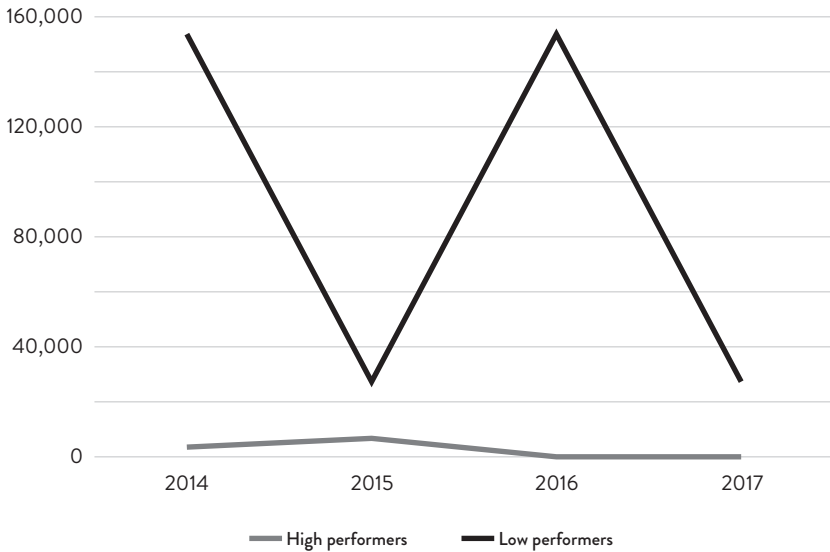
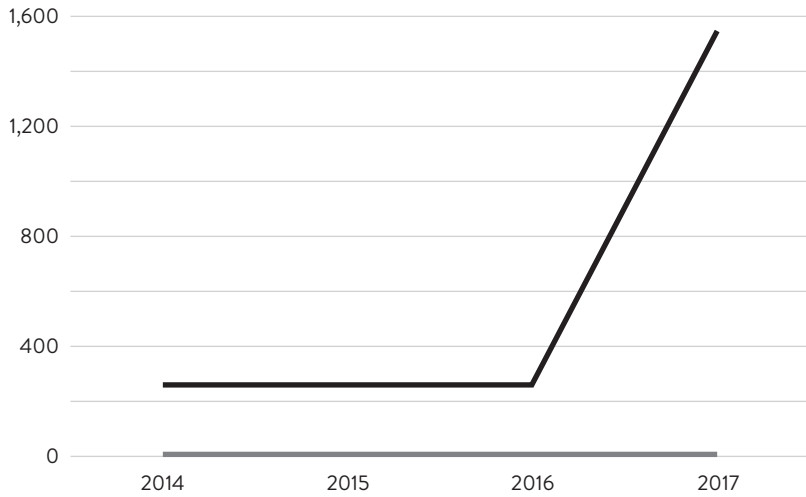


Figure 2.2: Year over Year Trends: Tempo

MEAN TIME TO RECOVERY (HOURS)



CHANGE FAILURE RATE (PERCENTAGE)

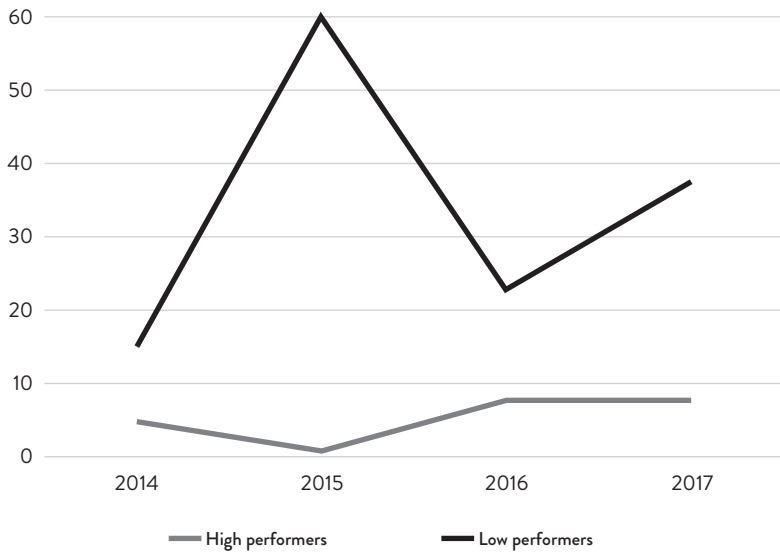


Figure 2.3: Year over Year Trends: Stability

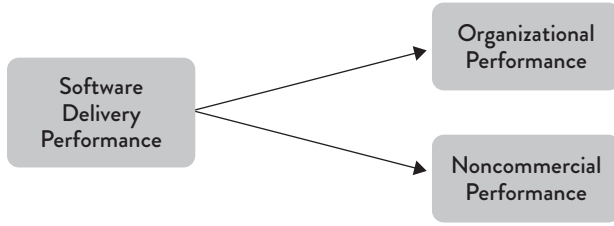


Figure 2.4: Impacts of Software Delivery Performance

| | Strongly disagree | Disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Agree | Strongly agree |
|---|-----------------------|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|-----------------------|
| Information actively sought. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Messengers are not punished when they deliver news of failures or other bad news. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Responsibilities are shared. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Cross-functional collaboration is encouraged and rewarded. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Failure causes inquiry. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| New ideas are welcomed. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Failures are treated primarily as opportunities to improve the system. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 3.1: Likert-Type Questions for Measuring Culture

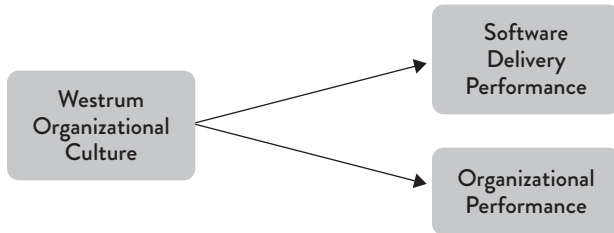


Figure 3.2: Westrum Organizational Culture's Outcomes

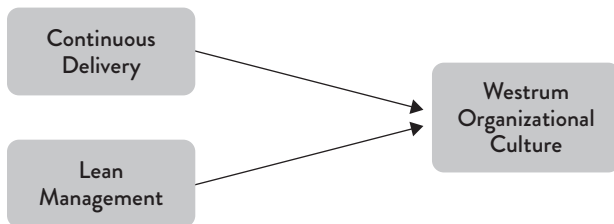


Figure 3.3: Westrum Organizational Culture's Drivers

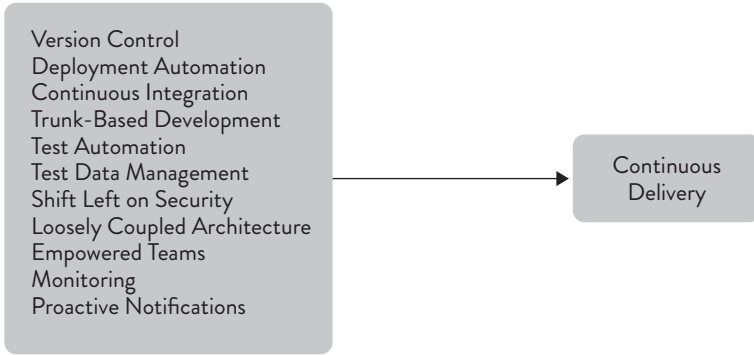


Figure 4.1: Drivers of Continuous Delivery

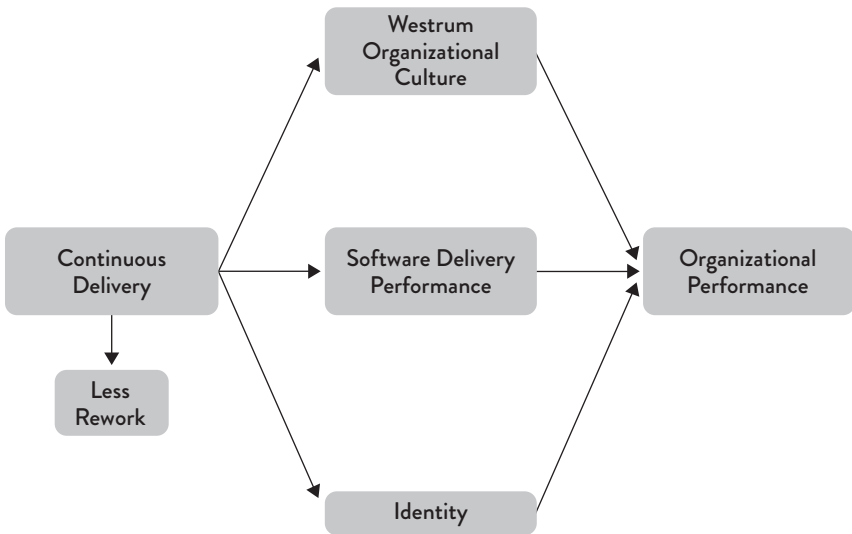


Figure 4.2: Impacts of Continuous Delivery

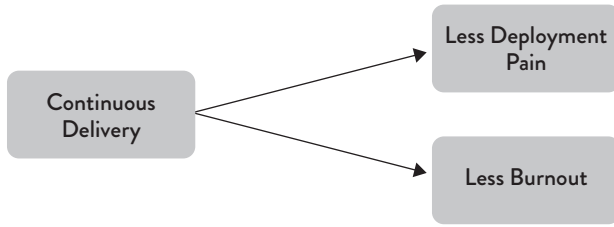


Figure 4.3: Continuous Delivery Makes Work More Sustainable

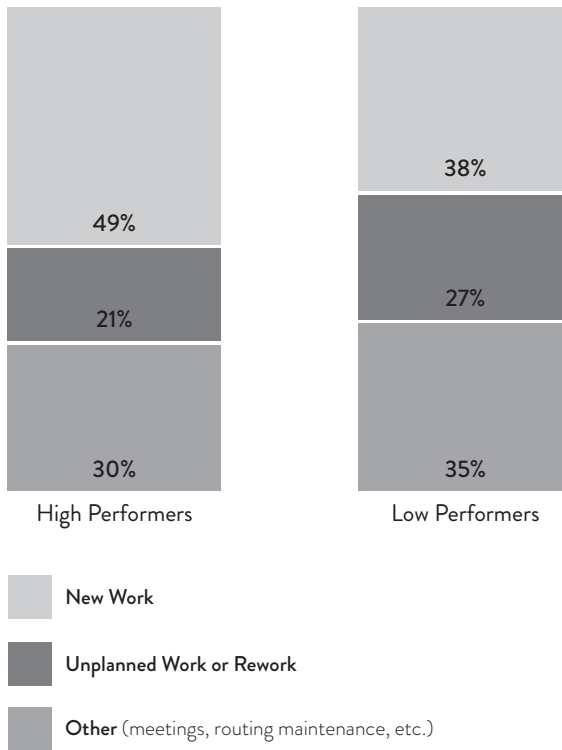


Figure 4.4: New Work vs. Unplanned Work

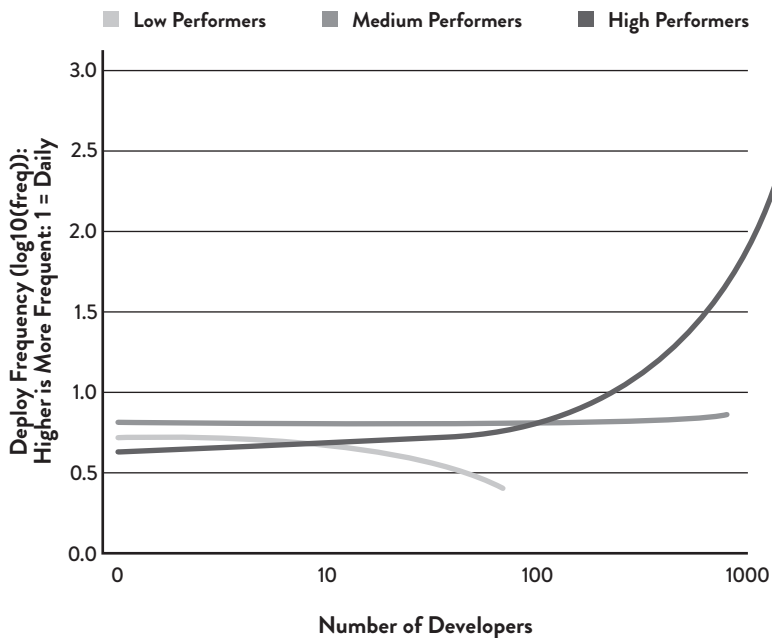


Figure 5.1: Deploys per Developer per Day

Lean Management
 Limit Work in Progress (WIP)
 Visual Management
 Feedback from Production
 Lightweight Change Approvals

Figure 7.1: Components of Lean Management

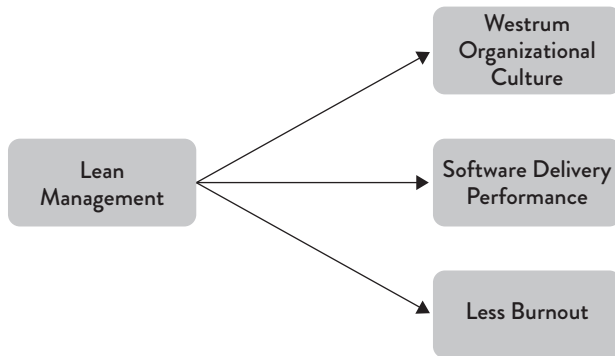


Figure 7.2: Impacts of Lean Management Practices

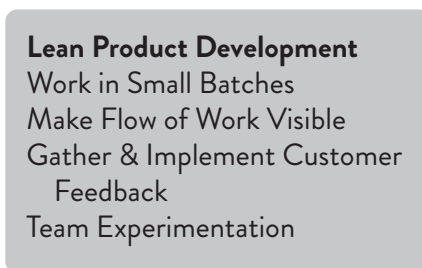


Figure 8.1: Components of Lean Management

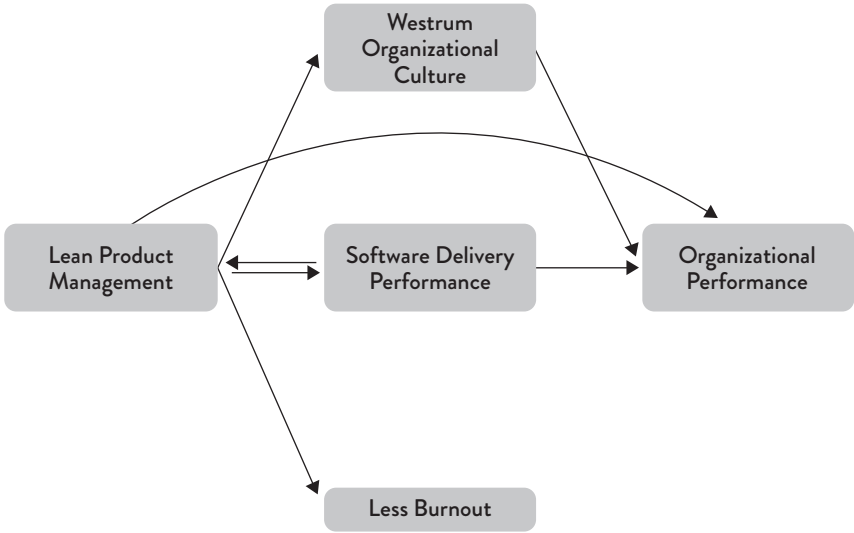


Figure 8.2: Impacts of Lean Product Management

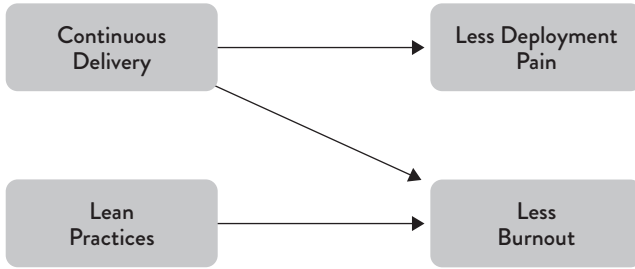


Figure 9.1: Impacts of Technical and Lean Practices on Work Life

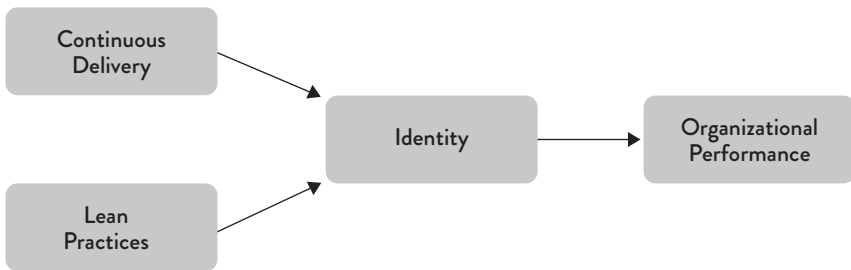


Figure 10.1: Impacts of Technical and Lean Practices on Identity



Figure 10.2: Impacts of Technical and Lean Practices on Job Satisfaction

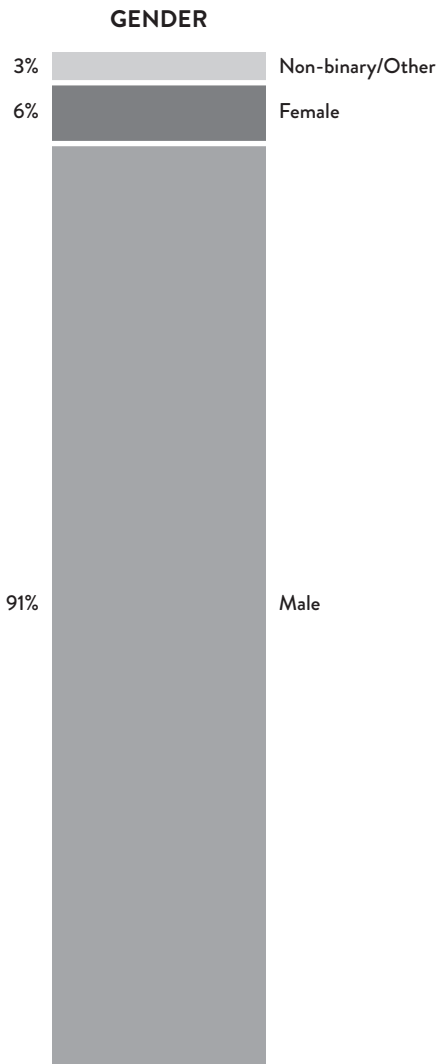


Figure 10.3: Gender Demographics in 2017 Study

**MEMBER OF
UNDERREPRESENTED
GROUP**

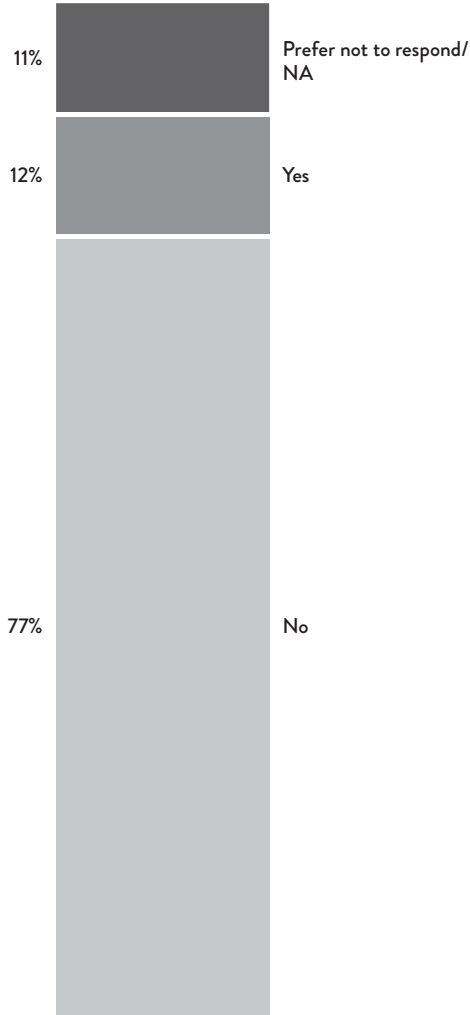


Figure 10.4: Underrepresented Minority Demographics in 2017 Study

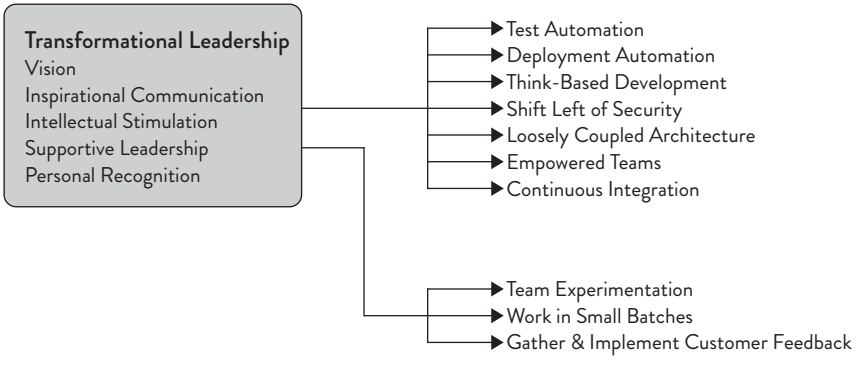


Figure 11.1: Impacts of Transformational Leadership on Technical and Lean Capabilities

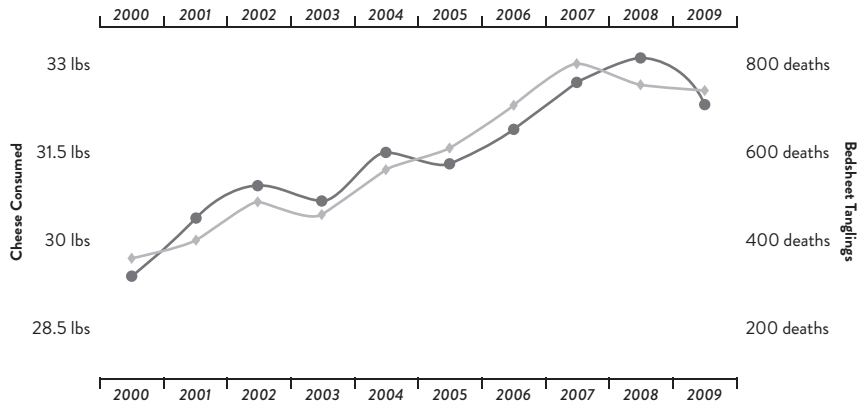
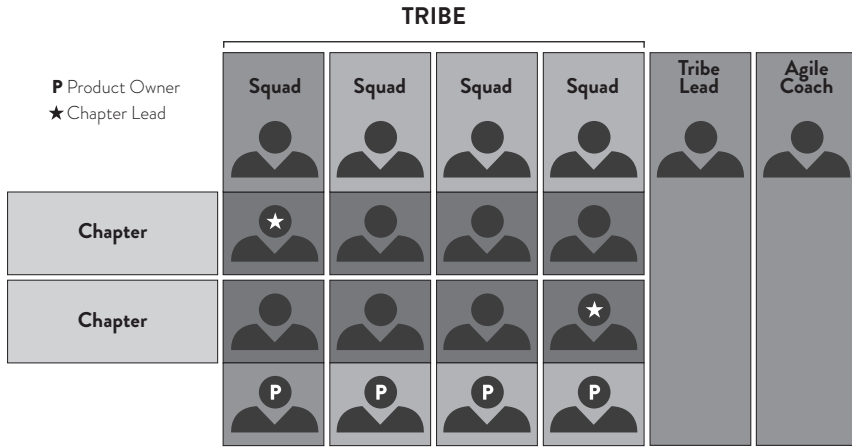


Figure 12.1: Spurious Correlation: Per Capita Cheese Consumption and Strangulation by Bedsheets



Figure 16.1: Leadership Obeya (360-Degree Panorama)



Tribe

(collection of squads with interconnected missions)

- Includes on average 150 people
- Empowers tribe lead to establish priorities, allocate budgets, and form interface with other tribes to ensure knowledge/insights are shared

Agile coach

- Coaches individual and squads to create high-performing teams

Squad

(basis of new Agile organization)

- Includes no more than 9 people; is self-steering and autonomous
- Comprises representatives of different functions working in single location
- Has end-to-end responsibility for achieving client-related objective
- Can change functional composition as mission evolves
- Is dismantled as soon as mission is executed

Product owner

(squad member, not its leader)

- Is responsible for coordinating squad activities
- Manages backlog, to-do lists, and priority setting

Chapter

(develops expertise and knowledge across squads)

Chapter lead

- Is responsible for one chapter
- Represents hierarchy for squad members (re: personal development, coaching, staffing, and performance management)

Figure 16.2: ING's New Agile Organizational Model Has No Fixed Structure—It Constantly Evolves. (Source ING)

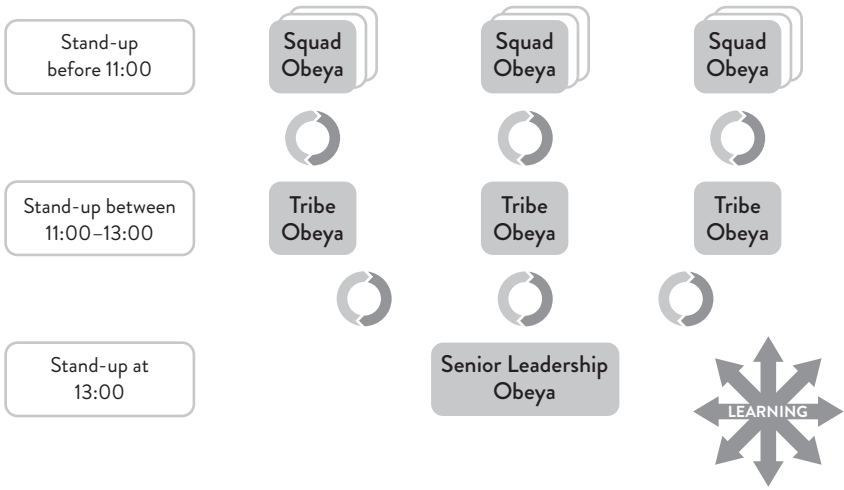


Figure 16.3: Stand-up and Catchball Rhythm

| | Team Practices | Management Practices | Leadership Practices |
|---|---|---|---|
| Culture | *Foster generative culture | *Foster generative culture | *Foster generative culture |
| | *Build quality in, continuously measure and monitor | *Focus on quality, protect teams to ensure quality | *Focus on quality, protect teams to ensure quality |
| | Focus on promoting organizational learning | Focus on promoting organizational learning | Focus on promoting organizational learning |
| | | *Provide teams with time for improvement and innovation | *Provide teams with time for improvement and innovation |
| Organizational Structure | | | *Align, measure, and manage to flow (matrixed, cross-functional value stream organization structure) |
| | | Establish small, cross-functional, multi-skilled teams; support bridging structures so teams can easily communicate and collaborate | Enable and support cross-skilling to reduce expert dependent bottlenecks and form communities of expertise |
| | | | Establish and support internal coaches and the appropriate infrastructure to scale and sustain them |
| Direct Learning and Alignment to Value | *Engage, learn from, and validate with customers (Gemba) | *Engage with and learn from customers and teams (Gemba) | *Engage with and learn from customers, teams, supply chain partners, and other stakeholders (Gemba) |
| | *Understand & visualize customer value, identify measurable targets for quality | *Understand & visualize customer value, identify measurable targets for quality | |
| | *Practice creativity as part of overall work | *Practice creativity as part of overall work, encourage team members to utilize this time to learn and innovate | *Budget for and allocate time for creativity (i.e., Google's 20% target) |
| Strategy Deployment | *Visualize team goals and targets, understand how these targets advance enterprise strategy | Help teams to set and visualize goals and targets, understand and communicate how these targets advance enterprise strategy (catchball) | Practice strategy deployment, visualize all goals and near-term targets, communicate this clearly to managers and help them set appropriate targets and initiatives |
| | *Actively monitor and visualize performance to goals/targets | *Actively monitor and visualize performance to goals/targets | *Actively monitor and visualize performance to goals/targets |
| | | | Eliminate unnecessary controls, invest instead in process quality and team autonomy and capability (*teams that reported no approval process or used peer review achieved higher software delivery performance) |

Figure 16.4: High-Performance Team, Management, and Leadership Behaviors and Practices (not a complete list, for a larger, downloadable version visit <https://bit.ly/high-perf-behaviors-practices>)

continued on next page

| | Team Practices | Management Practices | Leadership Practices |
|--|--|--|--|
| Improve Flow Through Analysis and Disciplined Problem Solving | Visualize & analyze workflow, identify obstacles to flow, (process/ value stream mapping & analysis); *understand the connection between the work they do and its positive impact on customers | Visualize and analyze workflow, identify obstacles to flow, (process/ value stream mapping & analysis), help teams understand how they support larger value stream | Visualize and analyze overall value stream flows (enterprise architecture), identify systemic obstacles to flow, prioritize and support mapping and analysis of lower-level supporting flows |
| | Prioritize obstacles to customer value and experience, and team targets and goals | Prioritize obstacles to customer value and experience, and team targets and goals | Prioritize systemic obstacles to flow |
| | Apply disciplined problem solving to prioritized problems, analyze to identify root causes | Apply disciplined problem solving to prioritized problems, analyze to identify root causes | Apply disciplined problem solving to complex systemic issues to identify strategic improvement themes and targets (strategy deployment), apply learning to update standard work |
| | Escalate cross-functional and systemic problems | Coordinate cross-functional problem solving, solve or escalate systemic problems | Cascade prioritized problem solving targets to the appropriate stakeholders through catchball PDCA |
| | Form hypotheses about root causes, design and conduct controlled experiments, measure results, communicate learnings, repeat if needed, incorporate improvements | Form hypotheses about root causes, design and conduct controlled experiments, measure results, communicate learnings, repeat if needed, incorporate improvements | Learn from organization-wide PDCA cycles, and repeat learning/ improvement cycles |
| Way of Work, Rhythm, & Routine | *Visualize, measure, and monitor workflow, monitor for deviations, respond to deviations appropriately | *Visualize, measure, and monitor workflow, monitor for deviations, respond to deviations appropriately | *Visualize, measure, and monitor workflow, monitor for deviations, respond to deviations appropriately |
| | *Break demand into small elements (MVP's) and release regularly and often | | |
| | *Visualize demand, WIP, and "done" (kanban) | *Visualize demand, WIP, and "done" (kanban) | *Visualize demand, WIP, and "done" (kanban) |
| | *Minimize and visualize WIP | *Minimize and visualize WIP | *Minimize and visualize WIP |
| | Prioritize demand to goals and targets | Prioritize demand to goals and targets | Prioritize demand to goals and targets |
| | Develop & practice team standard work (rhythm & routine) | Develop & practice team standard work (rhythm & routine) | Develop & practice team standard work (rhythm & routine) |
| | Conduct daily stand-ups with standard routine, escalate obstacles as needed (catchball) | Conduct daily stand-ups with team leads, standard routine, resolve or bridge/escalate obstacles as needed (catchball) | Conduct stand-ups with direct reports with standard routine on a regular cadence, resolve escalated obstacles (catchball) |
| | Support team and peer learning | Coach team members; support team learning | Coach managers, have your own coach |
| | Conduct regular cadence of retrospectives (work and way of work) | Conduct regular cadence of retrospectives (work and way of work) | Conduct regular cadence of retrospectives (work and way of work) |

Figure 16.4, cont.: High-Performance Team, Management, and Leadership Behaviors and Practices (not a complete list, for a larger, downloadable version visit <https://bit.ly/high-perf-behaviors-practices>)

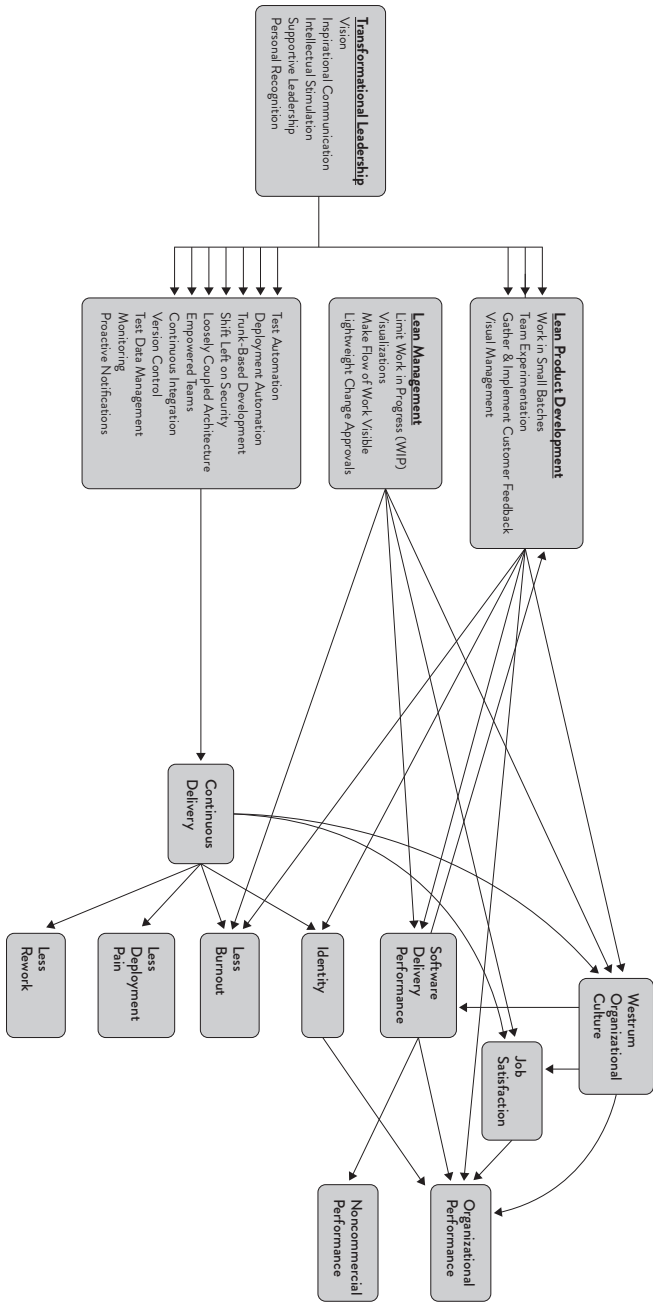
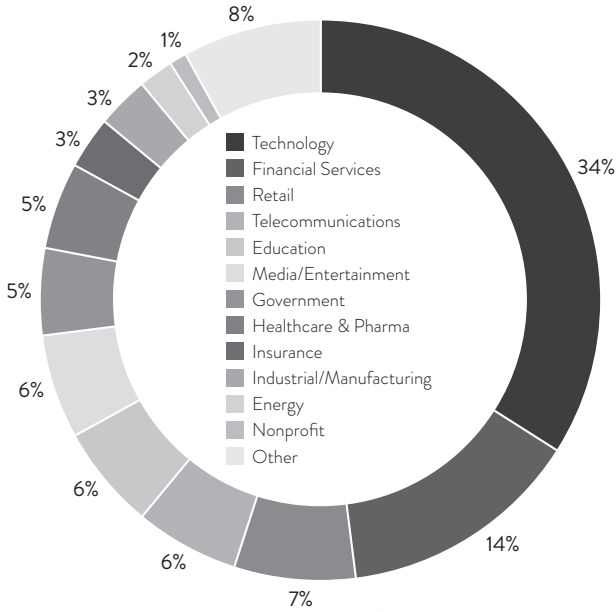
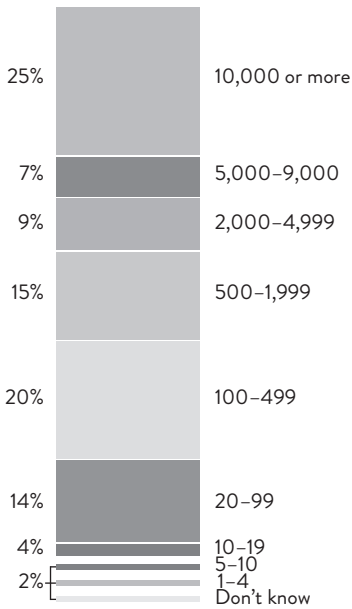


Figure A.1: Overall Research Program

DEMOGRAPHICS INDUSTRY



NUMBER OF EMPLOYEES



NUMBER OF SERVERS

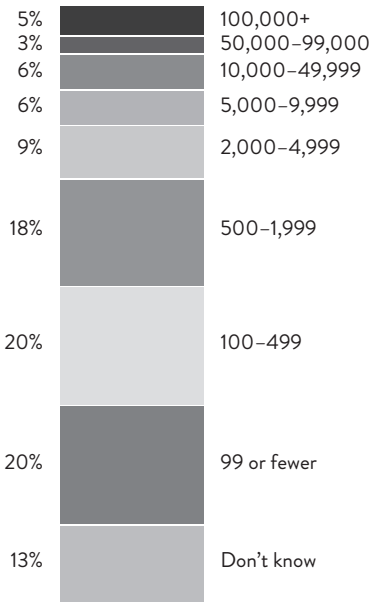


Figure B.1: Firmographics: Organization Size, Industry, Number of Servers in 2017

| Product Design and Development | Product Delivery (Build, Testing, Deployment) |
|---|--|
| Create new products and services that solve customer problems using hypothesis-driven delivery, modern UX, design thinking. | Enable fast flow from development to production and reliable releases by standardizing work, and reducing variability and batch sizes. |
| Feature design and implementation may require work that has never been performed before. | Integration, test, and deployment must be performed continuously as quickly as possible. |
| Estimates are highly uncertain. | Cycle times should be well-known and predictable. |
| Outcomes are highly variable. | Outcomes should have low variability. |

Table 2.1 Design vs. Delivery

| 2016 | High Performers | Medium Performers | Low Performers |
|-----------------------|--------------------------------------|--|--|
| Deployment Frequency | On demand (multiple deploys per day) | Between once per week and once per month | Between once per month and once every six months |
| Lead Time for Changes | Less than one hour | Between one week and one month | Between one month and six months |
| MTTR | Less than one hour | Less than one day | Less than one day* |
| Change Failure Rate | 0–15% | 1–45% | 6–30% |

Table 2.2 Software Delivery Performance for 2016

| 2017 | High Performers | Medium Performers | Low Performers |
|-----------------------|--------------------------------------|--|---|
| Deployment Frequency | On demand (multiple deploys per day) | Between once per week and once per month | Between once per week and once per month* |
| Lead Time for Changes | Less than one hour | Between one week and one month | Between one week and one month* |
| MTTR | Less than one hour | Less than one day | Between one day and one week |
| Change Failure Rate | 0–15% | 0–15% | 31–45% |

**Low performers were lower on average (at a statistically significant level) but had the same median as the medium performers.*

Table 2.3 Software Delivery Performance for 2017

| Pathological (Power-Oriented) | Bureaucratic (Rule-Oriented) | Generative (Performance-Oriented) |
|-------------------------------|------------------------------|-----------------------------------|
| Low cooperation | Modest cooperation | High cooperation |
| Messengers “shot” | Messengers neglected | Messengers trained |
| Responsibilities shirked | Narrow responsibilities | Risks are shared |
| Bridging discouraged | Bridging tolerated | Bridging encouraged |
| Failure leads to scapegoating | Failure leads to justice | Failure leads to inquiry |
| Novelty crushed | Novelty leads to problems | Novelty implemented |

Table 3.1 Westrum’s Typology of Organizational Culture

| Pathological (Power-Oriented) | Bureaucratic (Rule-Oriented) | Generative (Performance-Oriented) |
|--|---|--|
| Low cooperation | Modest cooperation | High cooperation |
| Messengers “shot” | Messengers neglected | Messengers trained |
| Responsibilities shirked | Narrow responsibilities | Risks are shared |
| Bridging discouraged | Bridging tolerated | Bridging encouraged |
| Failure leads to scapegoating | Failure leads to justice | Failure leads to enquiry |
| Novelty crushed | Novelty leads to problems | Novelty implemented |

Table 13.1 Westrum’s Typology of Organizational Culture

| Manual Work | High Performers | Medium Performers | Low Performers |
|--------------------------|------------------------|--------------------------|-----------------------|
| Configuration management | 28% | 47%* | 46%* |
| Testing | 35% | 51%* | 49%* |
| Deployments | 26% | 47% | 43% |
| Change approval process | 48% | 67% | 59% |

**Differences are not statistically significant between medium and low performers for configuration management and testing.*

Table B.1 Manual Work Percentages