PROJECT TO PRODUCT

HOW TO SURVIVE AND THRIVE IN THE AGE OF DIGITAL DISRUPTION WITH THE FLOW FRAMEWORK

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PROJECT TO PRODUCT

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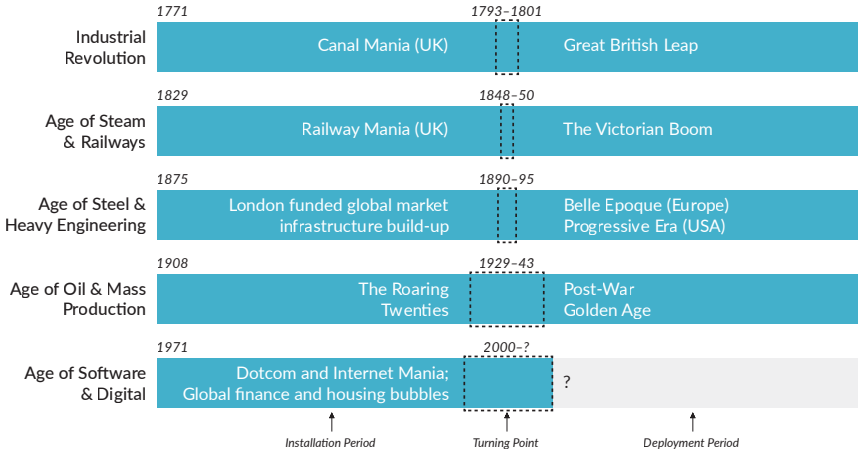


Figure 0.1: Technological Revolutions and the Age of Software.

Flow Framework™

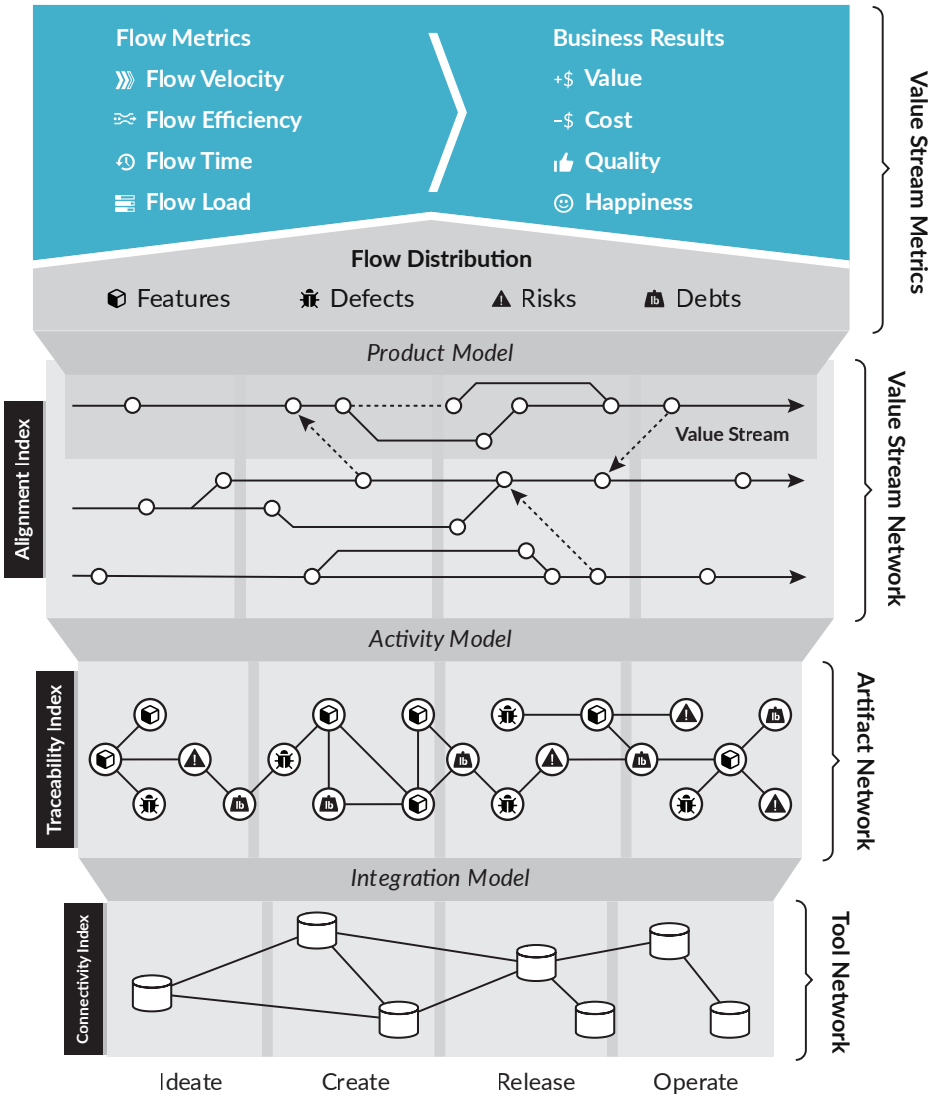
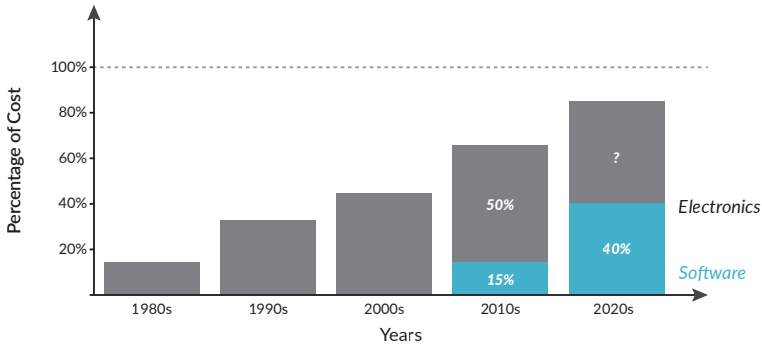


Figure 1.1: The BMW Group Leipzig Plant Central Building (with permission of the BMW Group)



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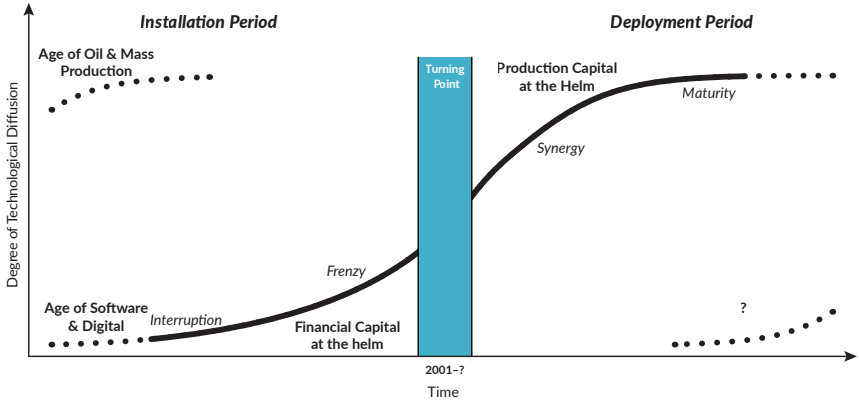


Figure 1.3: From Installation Period to Deployment Period

Installation-Deployment	Age	New Technological Systems	New Infrastructure	Triggering Innovations	Managerial Innovations
1771–1829	Industrial Revolution	Water-powered mechanization	Canals, turnpike roads, sailing ships	Arkwright's Cromford Mill (1771)	Factory Systems, entrepreneurship, partnerships
1829–1873	Age of Steam & Railways	Steam-powered mechanization and transport	Railways, telegraph, steam ships	Liverpool-Manchester Railway (1831)	Joint stock companies, subcontracting
1875–1918	Age of Steel and Heavy Engineering	Electrification of equipment and transport	Steel railways, steel ships, global telegraph	Carnegie's steel plant (1875)	Professional management systems, giant firms Taylorism
1908–1974	Age of Oil & Mass Production	Motorization of transport and economy	Radio, motorways, airports	Ford's Highland Park assembly line (1913)	Mass production and consumption, Fordism, Lean
1971–?	Age of Software & Digital	Digitization of the economy	Internet, software, cloud computing	Intel microprocessor (1971)	Networks, platforms, venture capital

Table 1.1: Technological Revolutions

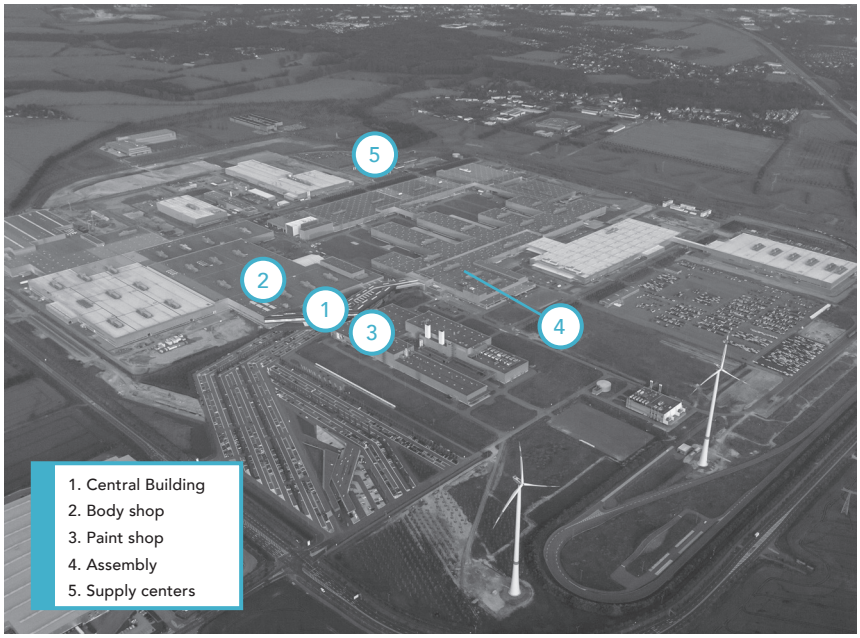


Figure 2.1: The BMW Group Leipzig Plant
(with permission of the BMW Group)

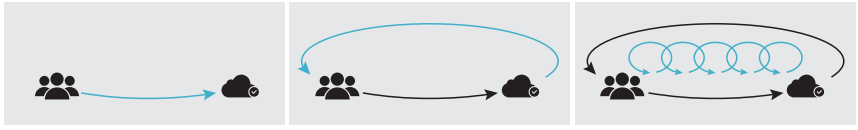


Figure 2.2 : The Three Ways of DevOps

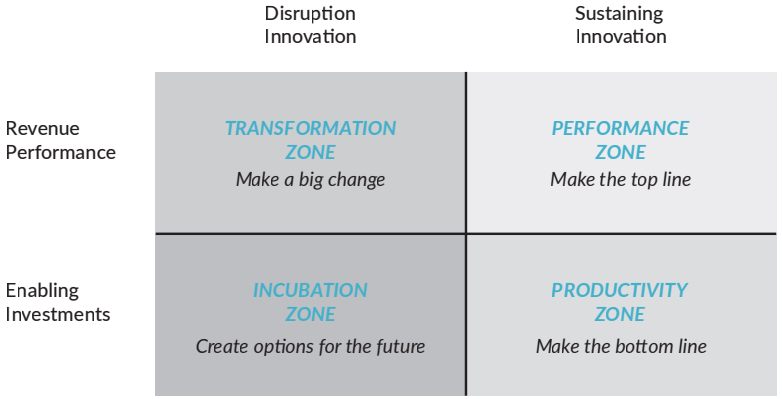
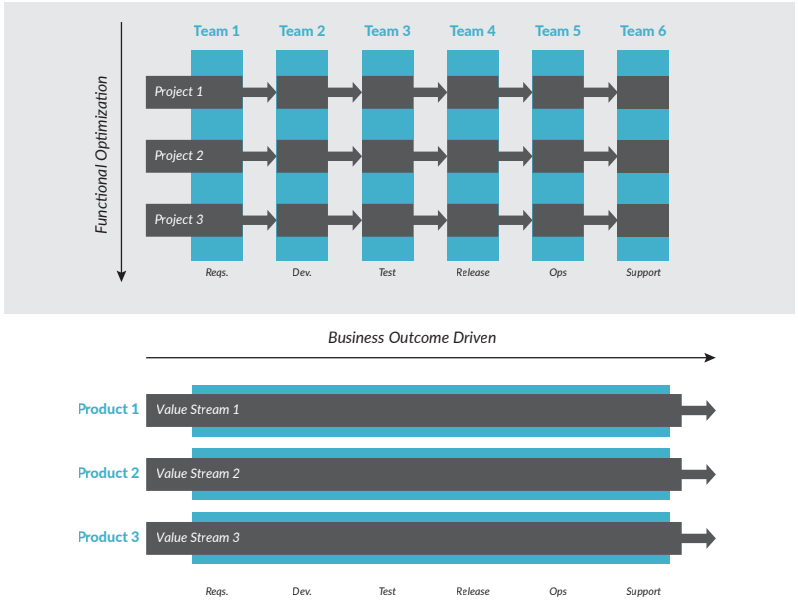


Figure 2.3: Zone Management

	Project-Oriented Management	Product-Oriented Management
Budgeting	Funding of milestones, pre-defined at project scoping. New budget requires creation of a new project.	Funding of product value streams based on business results. New budget allocation based on demand. Incentive to deliver incremental results.
Time Frames	Term of the project (e.g., one year). Defined end date. Not focused on the maintenance/health after the project ends.	Life cycle of the product (multiple years), includes ongoing health/maintenance activities through end of life.
Success	Cost center approach. Measured to being on time and on budget. Capitalization of development results in large projects. Business incentivised to ask for everything they might need up front.	Profit center approach. Measured in business objectives and outcomes met (e.g., revenue). Focus on incremental value delivery and regular checkpoint.
Risk	Delivery risks, such as product/market fit, is maximized by forcing all learning, specification, and strategic decision making to occur up front.	Risk is spread across the time frame and iterations of the project. This creates option value, such as terminating the project if delivery assumptions were incorrect or pivoting if strategic opportunities arise.
Teams	Bring people to the work: allocated up front, people often span multiple projects, frequent churn and re-assignment.	Bring work to the people: stable, incrementally adjusted, cross-functional teams assigned to one value stream.
Prioritization	PPM and project plan driven. Focus on requirements delivery. Projects drive waterfall orientation.	Roadmap and hypothesis testing driven. Focus on feature and business value delivery. Products drive Agile orientation.
Visibility	IT is a black box. PMOs create complex mapping and obscurity.	Direct mapping to business outcomes, enabling transparency.

Table 2.1: Project-Oriented Management vs. Product-Oriented Management



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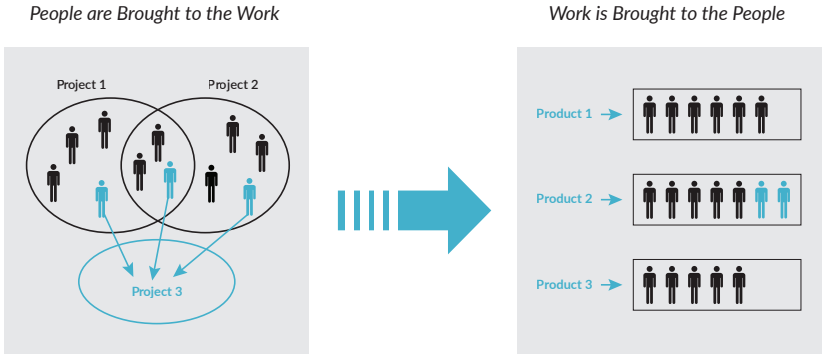


Figure 2.5: Bringing the People to the Work vs. Work to the People

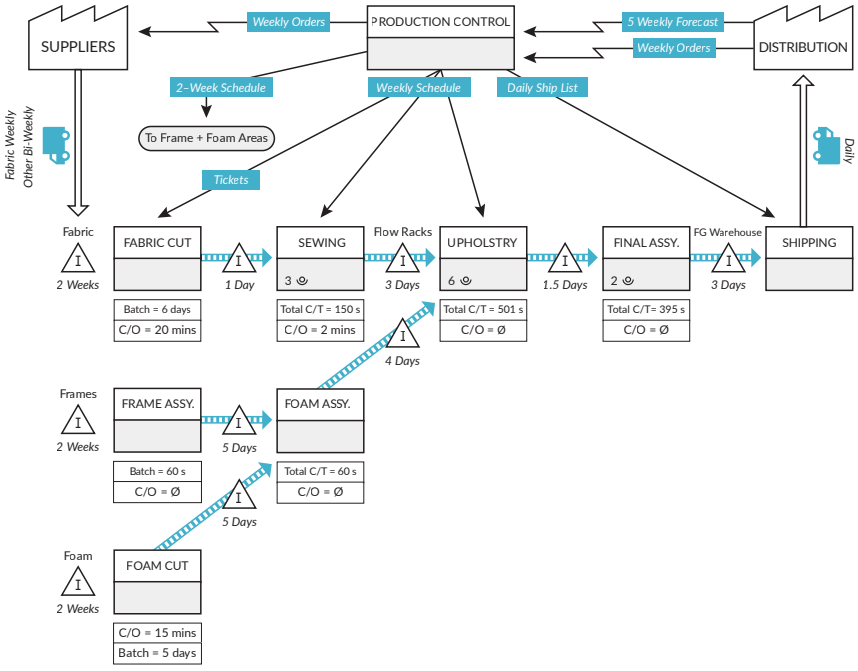


Figure 3.1: Manufacturing Value Stream Map

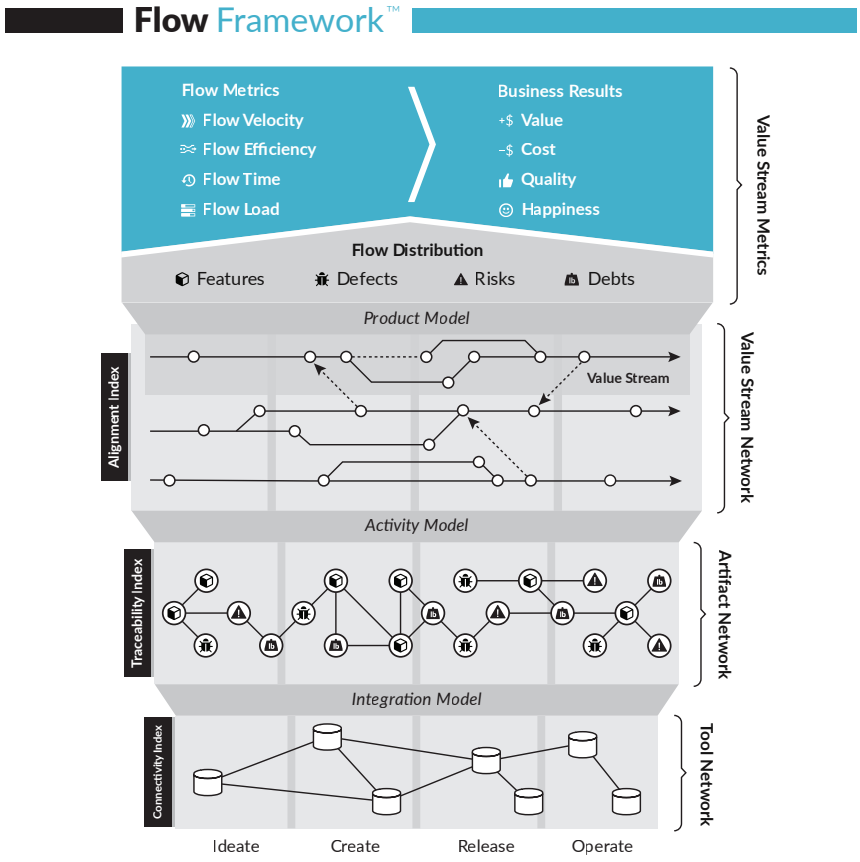
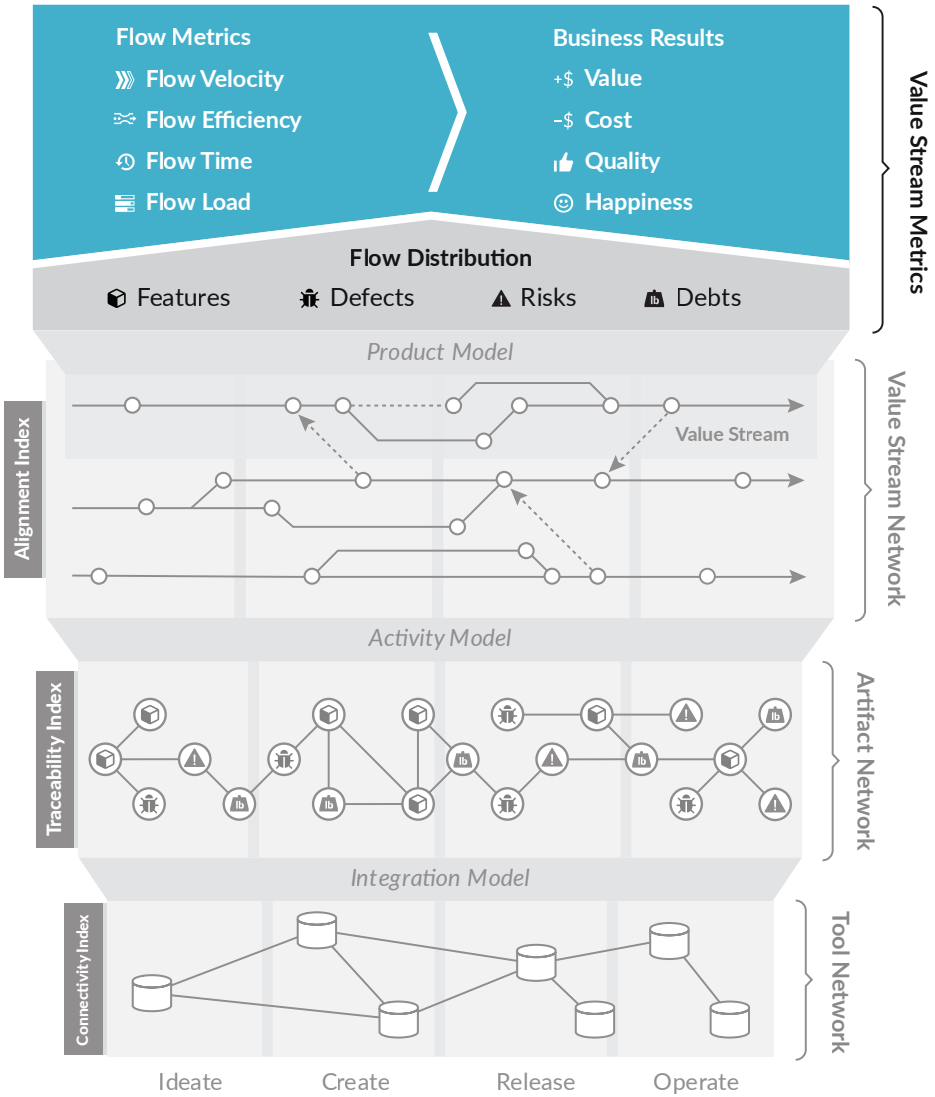


Figure 3.2: The Flow Framework

Flow Items	Delivers	Pulled By	Description	Example artifacts
Features	New business value	Customers	New value added to drive a business result; visible to the customer	Epic, user story, requirement
Defects	Quality	Customers	Fixes for quality problems that affect the customer experience	Bug, problem, incident, change
Risks	Security, governance, compliance	Security and risk officers	Work to address security, privacy, and compliance exposures	Vulnerability, regulatory requirement
Debts	Removal of impediments to future delivery	Architects	Improvement of the software architecture and operational architecture	API addition, refactoring, infrastructure automation

Table 3.1: Flow Items

Flow Framework™



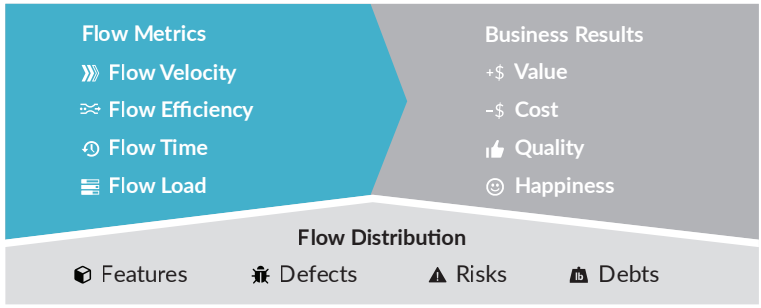
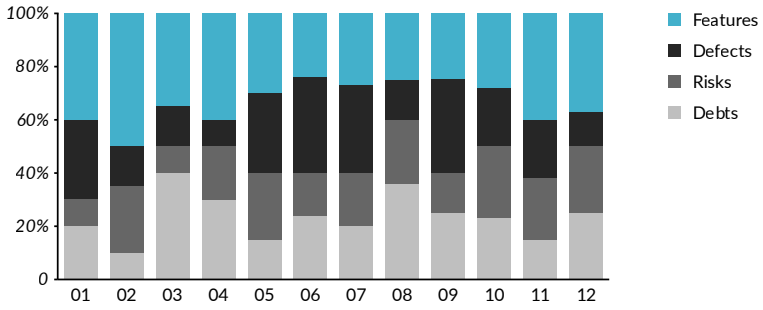


Figure 4.1: Flow Metrics



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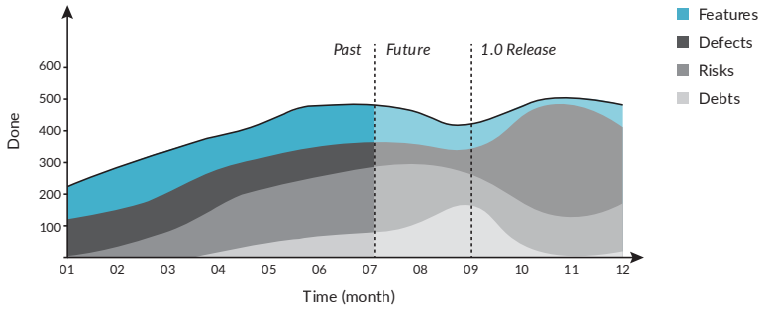


Figure 4.3: Flow Distribution Timeline

Flow Metric	Description	Example
Flow Distribution	Mutually Exclusive and Comprehensively Exhaustive (MECE) allocation of flow items in a particular flow state across a measure of time.	Proportion of each flow unit actively being worked on in a particular sprint.
Flow Velocity	Number of flow items done in a given time.	Debts resolved for a particular release.
Flow Time	Time elapsed from when a flow item enters the value stream (flow state = active) to when it is released to the customer (flow state = done).	Time it takes to deliver a new feature to a customer from when the feature is accepted.
Flow Load	Number of flow items with flow state as active or waiting, (i.e., work in progress [WIP]).	Flow load that exceeds a certain threshold adversely impacts flow velocity.
Flow Efficiency	The proportion of time flow items are actively worked on to the total time elapsed.	Flow efficiency decreases when dependencies cause teams to wait on others.

Table 4.1: Flow Metrics

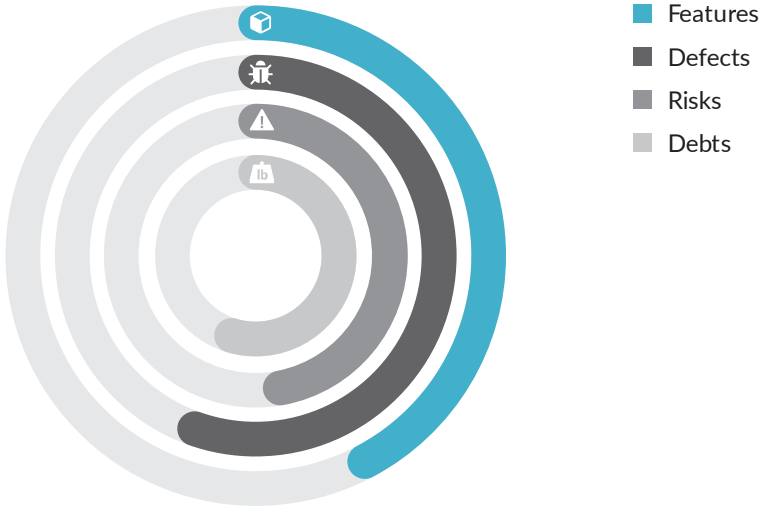


Figure 4.4: Sample Flow Velocity Dashboard

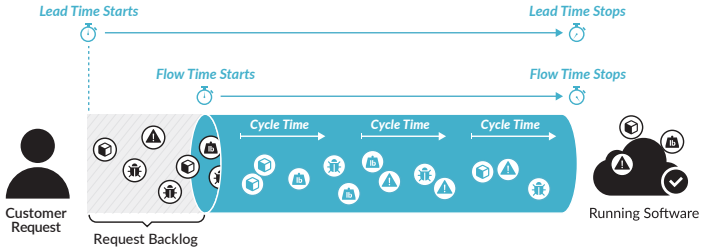
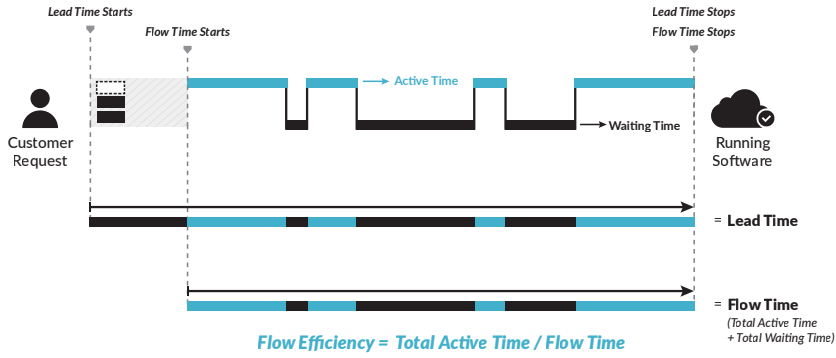


Figure 4.5: Comparison of Lead Time, Flow Time, and Cycle Time



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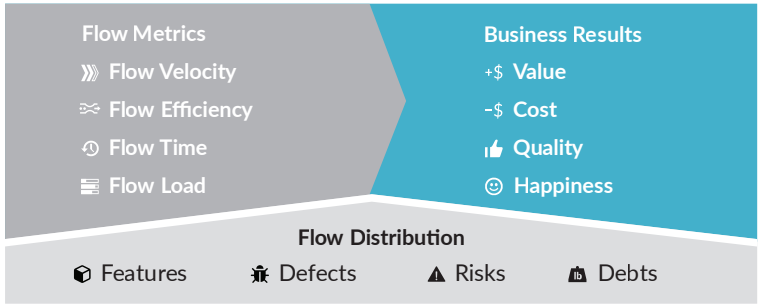

Figure 5.1: Connecting Flow Metrics to Business Results

Business Result	Measures	Examples
Value	Benefit to the business produced by the value stream.	Revenue, monthly recurring revenue, annual contract value, monthly active users.
Cost	Cost of the value stream to the business.	Cost of all staff, operations, and infrastructure supporting the value stream. FTEs assigned to the value stream.
Quality	Quality of the product produced by the value stream as perceived by a customer.	Escaped defects, tickets filed, renewal rate, expansion rate, Net Promoter Score (NPS).
Happiness	Engagement of the staff working on the value stream.	Employee Net Promoter Score (eNPS), employee engagement.

Table 5.1: Business Results Metrics

Figure 5.2: Sample Value Stream Dashboard

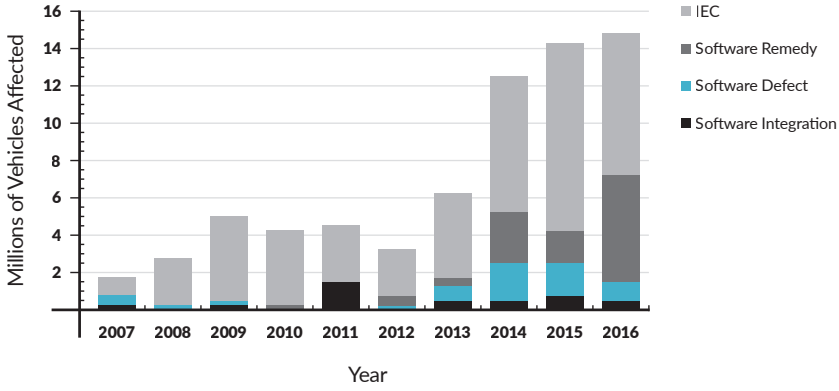

Figure 6.1: Recalls of Electronic Car Components in the United States[3]

Contains data for BMW, Daimler AG, FCA, Ford, General Motors, Honda, Hyundai, Kia Toyota, Volkswagen, and Volvo. Identified from data set updated through 2016. Excludes Takata Inflator recall campaigns.

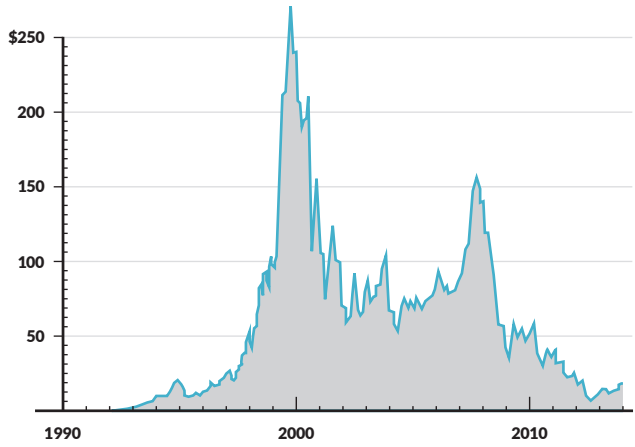

Figure 6.2: The Rise and Fall of Nokia

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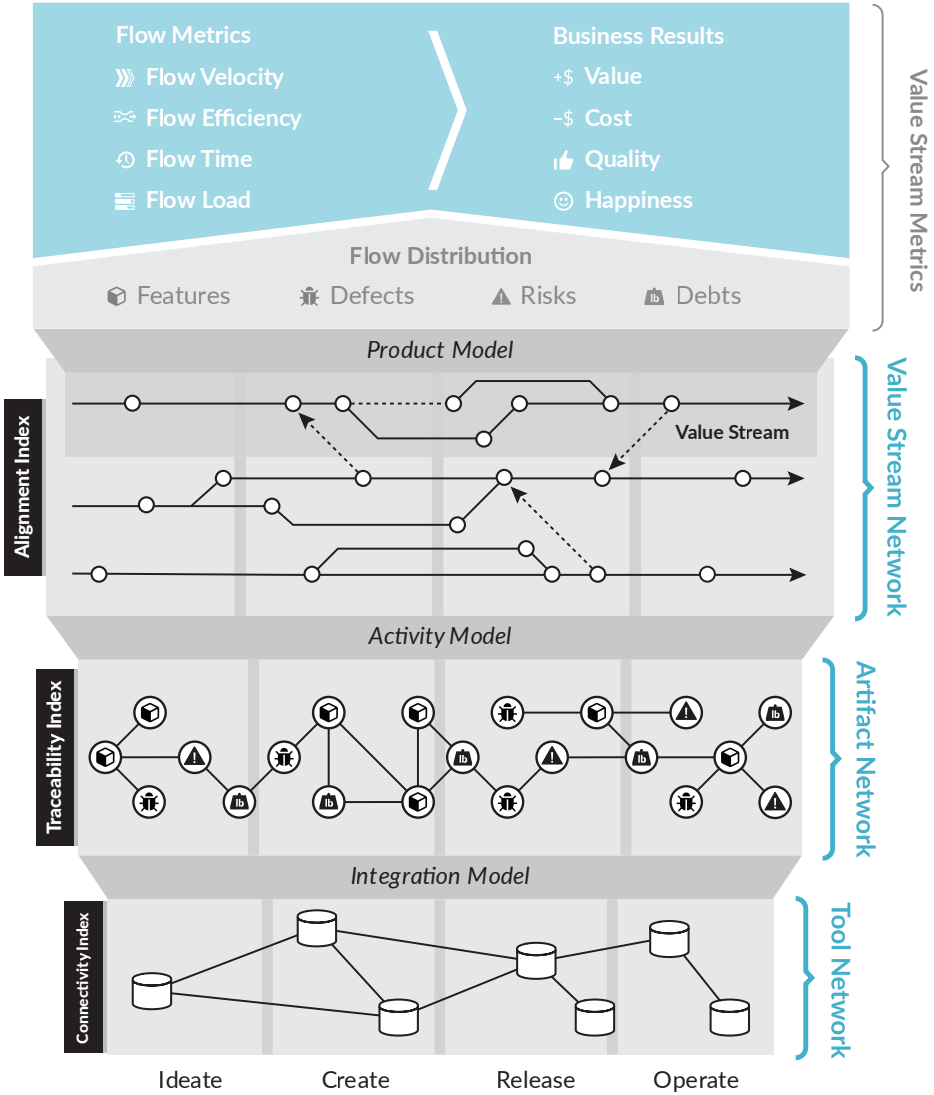


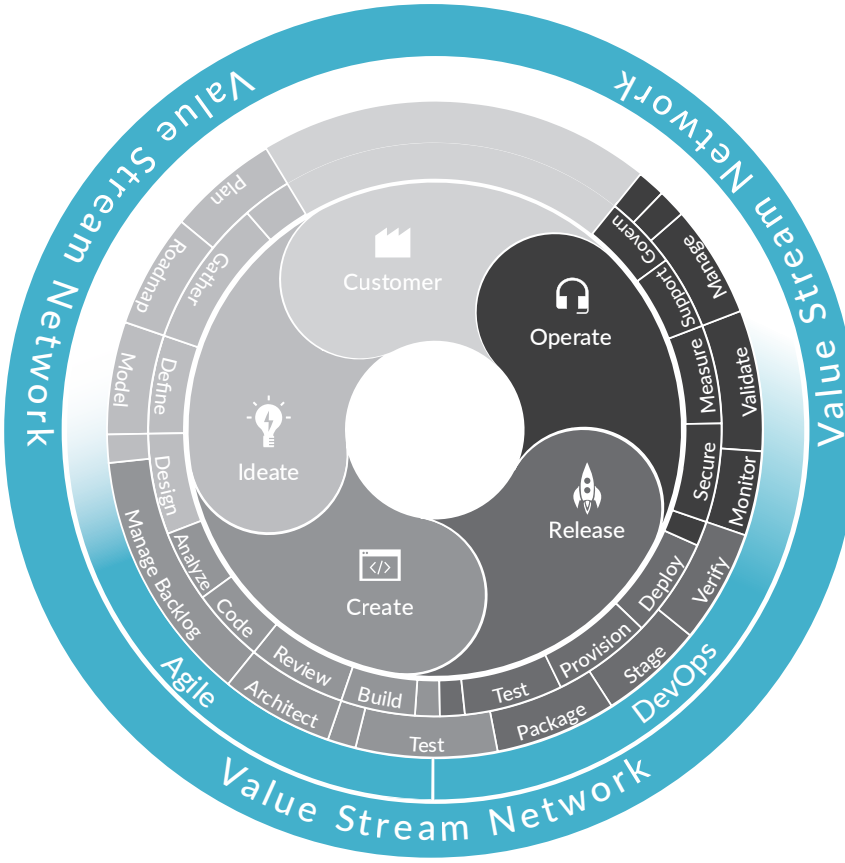


Figure 8.1: Agile and DevOps Tool Roles and Specialization

Dimension	Description	Example
Features	The more demanding the application domain, the more complex the feature set and the larger the number of specialists and specialized tools there may need to be.	A car infotainment system is fundamentally more complex in terms of features than an entire streaming service UI such as Netflix, as it contains both media playback and car functions.
Products	The number of products an organization needs to support, both internal and external.	Startups may have a small number of external products and no internal products. A large IT organization may have hundreds or thousands of each.
Partners	The more business partners exist, whether within lines of business or external, the more complex the resulting set of value streams.	Partners may require use of their own specialists or tools, and those need to be connected to the overall delivery process.
Markets	Each market or market segment can require a new edition or configuration of the software, increasing complexity.	If an organization sells both business-to-consumer and business-to-business, it may need two separate support channels connected to multiple value streams.
Platforms	Development and cloud platforms tend to be tightly coupled to delivery tools and require or encourage use of those tools.	Choosing Microsoft Azure as a hosting platform adds the corresponding tools to the tool chain, as the Java ecosystem tools tend not to be tailored for Azure.

Table 8.1: Dimensions of Scale

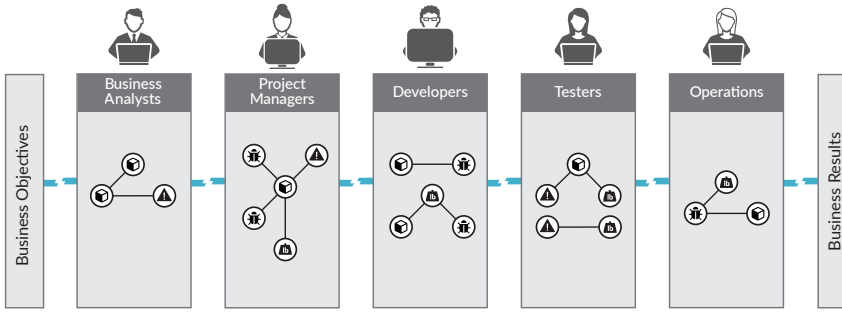


Figure 8.2: Fragmented Value Streams

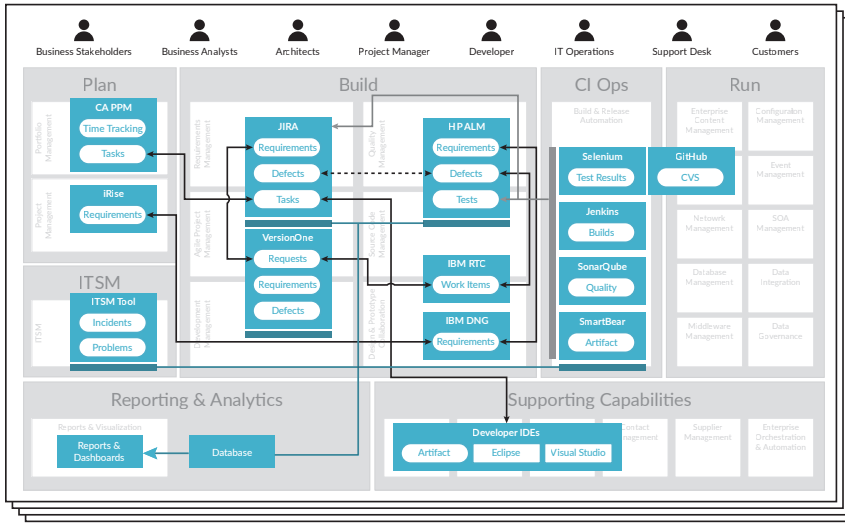


Figure 8.3: Value Stream Integration Diagrams

Type of Tool	Tool Usages Reported
Agile Planning	194
Application life cycle management	259
Change or workflow management	9
Content management	9
Enterprise modeling	1
Issue tracker	8
IT service management	133
Project portfolio management	77
Requirements management	79
Sales	1
Security	2
Test management	28

Table 8.2: Types of Tools Used

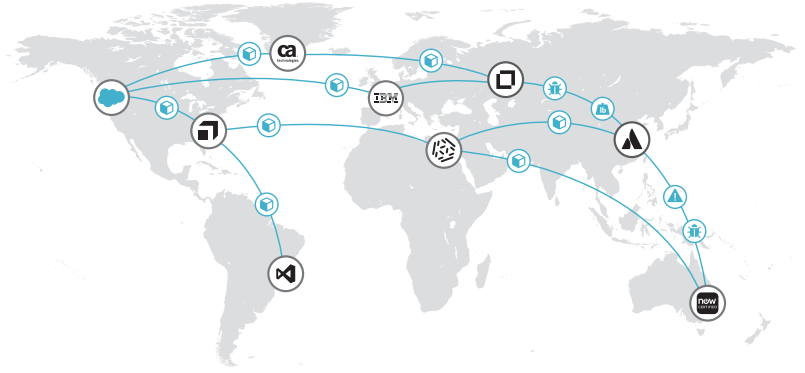


Figure 9.1: More Like an Airline Network

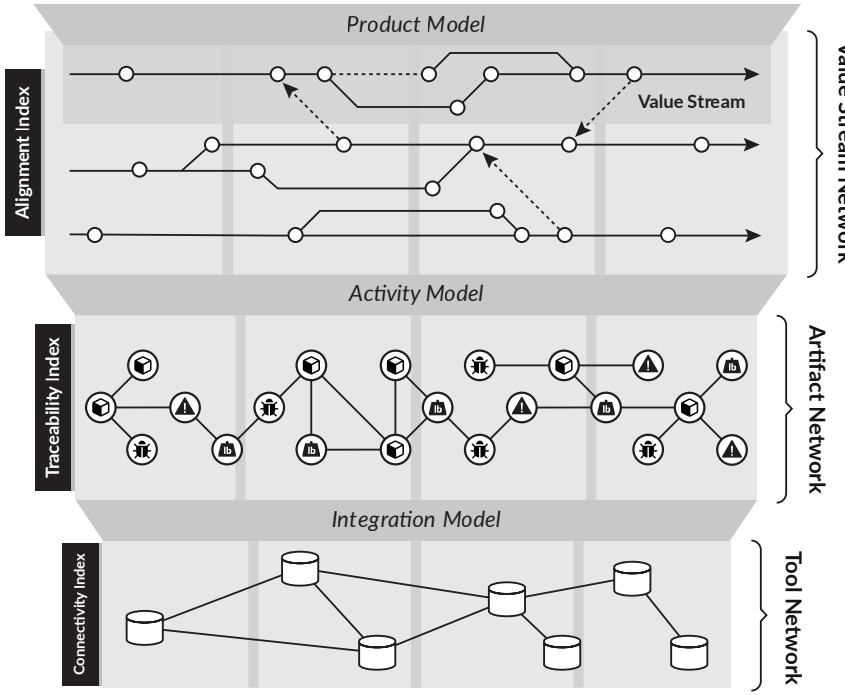


Figure 9.2: Value Stream Network

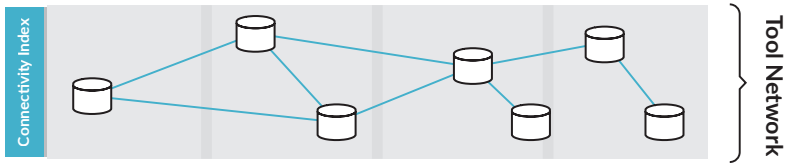


Figure 9.3: The Tool Network

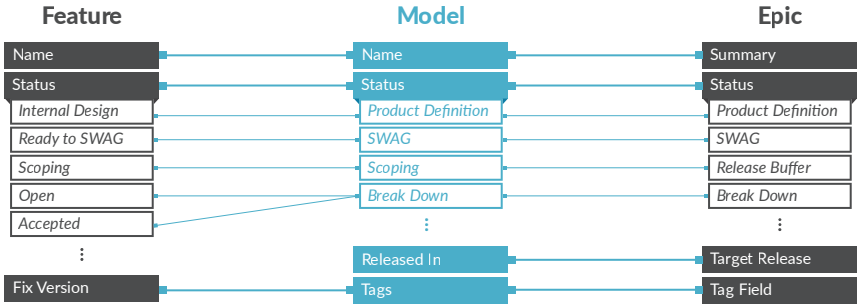


Figure 9.4: Integration Model Field Mapping

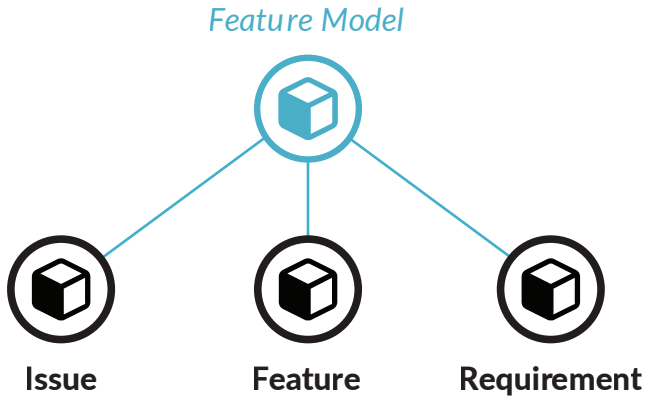


Figure 9.5: Integration Model Artifact Mapping

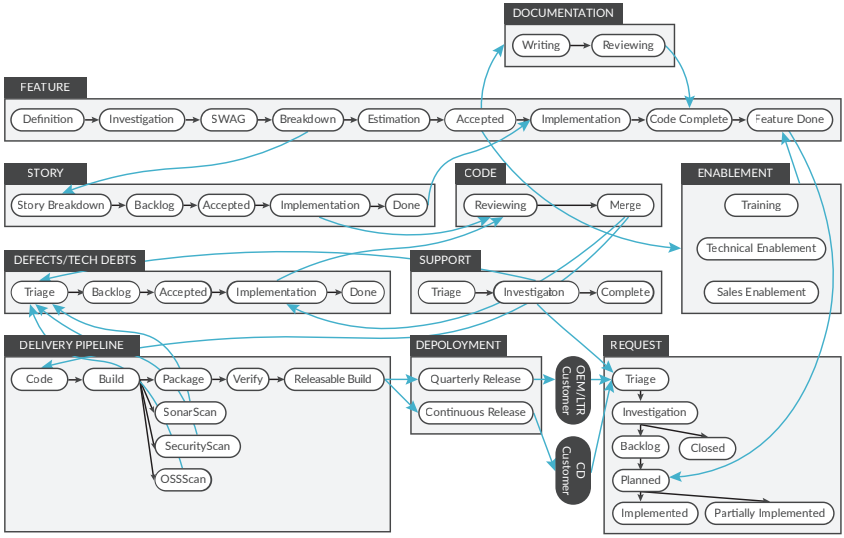


Figure 9.6: Sample Artifacts and Workflow States Corresponding to Activity Mode

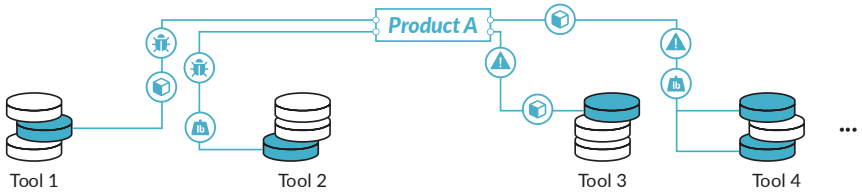
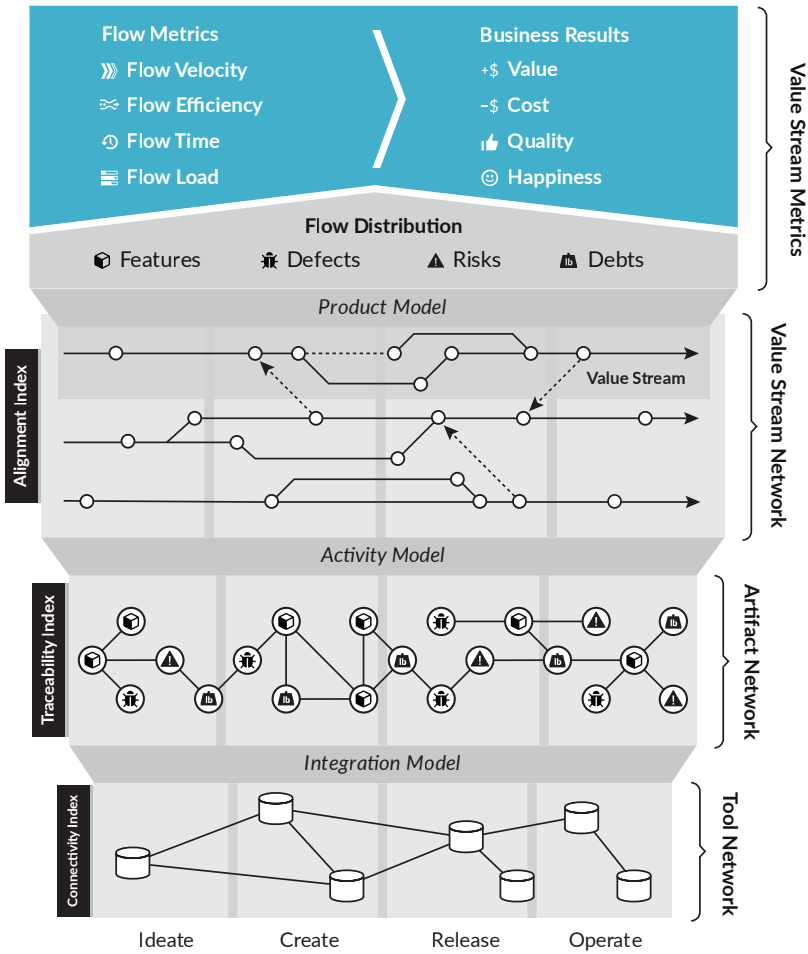
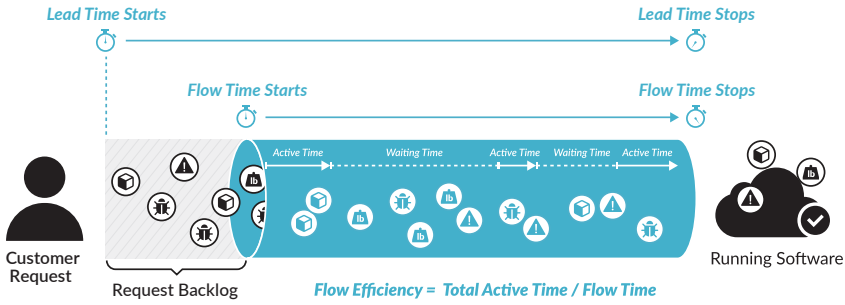


Figure 9.7: The Product Model

QUICK REFERENCE FIGURES

Flow Framework™





Comparison of Lead Time, Flow Time, and Cycle Time

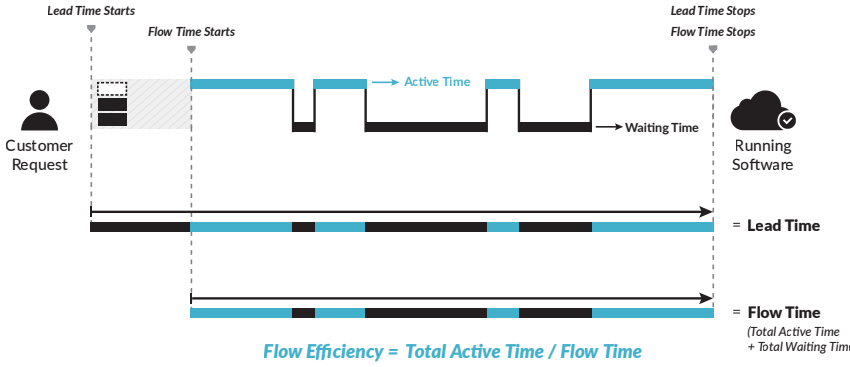
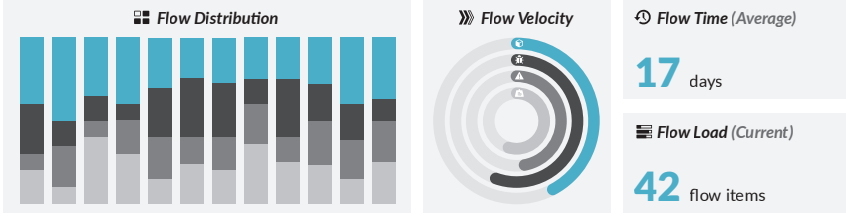


Illustration of Flow Efficiency

Hub

External Customer: Fortune 500 (GA)



Sample Flow Metrics Dashboard

GLOSSARY

Activity Model: identifies each of the specific activities performed in the value stream and maps those to the concrete workflow states defined by the Integration Model. In addition, it maps these activities to the four flow states, enabling a consistent way of measuring flow across all artifacts.

Age of Mass Production: the technological revolution which occurred between 1908 and 1974 and was marked by advances in the mass production of goods, motorization of transport, oil, gas, synthetic materials, motorways, airports, and airlines.

Age of Software: the current technological revolution, which began in 1971, and is marked by advances in microprocessors, telecommunication, the internet, and software.

Agile: Agile software development is a group of methodologies based on iterative development, where requirements and solutions evolve through the collaboration of self-organizing, cross-functional teams and their customers and end users.

alignment index: the ratio of artifact containers connected to a product value stream relative to all artifact containers across the tool network; this determines the portion of the delivery organization that is aligned to products versus projects.

artifact: a unit of work or delivery defined by one or more tools in the tool network. Artifacts have different types, such as work item, user story, test, or release, which are defined by the artifact schemas in the

tools. These types can be instantiated; for example, ten specific user stories can be created for a particular release. Artifacts can be mapped to the more abstract flow units using the integration model.

artifact network: the full network of instantiated artifacts that span the Value Stream Network. The network is connected through artifact relationships, e.g., a requirement may be related to multiple user stories, change sets, and releases.

Business Model disruption: the most profound of Geoffrey Moore's three types of disruption, and one that an established business typically cannot recover from.

connectivity index: the ratio of tool repositories and artifact containers in the tool network that have been integrated to those that have not. The lower the Connectivity Index, the less meaningful the flow metrics are, as the metrics are based on end-to-end flow. For example, flow time cannot be measured without connectivity between the customer request system through to deployment system.

cost center: a department or other unit within an organization to which costs may be charged for accounting purposes; for example, a human resources department. Unlike a profit center, cost centers only contribute to a company's profitability indirectly.

Creative Destruction: the process of industrial mutation, associated with Joseph Schumpeter, that revolutionizes the economy through new innovations and new businesses disrupting and displacing established ones.

Cynefin framework: provides a taxonomy of decision-making contexts, including *obvious*, *complicated*, *complex*, and *chaotic*.

Deployment Period: the period in a technological revolution, following the Installation Period and the Turning Point, where companies that master the means of production earn increasingly larger portions of the economy and the new infrastructure.

digital disruption: the process of established businesses being negatively affected by software-centric companies who displace the

entrenched business models with digital offerings. For example, film photography companies like Kodak are being disrupted by digital photography, including via mobile devices.

Extreme Programming: an early flavor of Agile software development that advocates frequent releases in short development cycles.

feature team: a long-lived, cross-functional team that completes end-to-end customer features one by one; core part of the LeSS framework.

First Way of DevOps: flow, as presented in *The DevOps Handbook*.

flow distribution: the proportion of each flow item type within a value stream. The proportion is tracked and adjusted depending on the needs of each product value stream to maximize the business value delivered through that value stream.

flow efficiency: the proportion of time flow items actively worked on to the total time elapsed. This can be used to identify inefficiencies such as overly long wait time for particular flow items.

Flow Framework: a framework for managing software delivery that is focused on measuring and optimizing the flow of business value through product-oriented software value streams that are correlated to business results.

flow item: a unit of business value pulled by a stakeholder through a product's value stream. The four flow items are features, defects, risks and debts.

flow load: number of flow items in a value stream with the flow state of active or waiting. This is analogous to a flow item–based measure of work in progress (WIP) in the value stream. Overly high flow load tends to result in inefficiencies and lead to reduced flow velocity or increased flow time.

flow states: the generic workflow state of a flow item in the value stream. The four flow states are: new, waiting, active, and done. These states are mapped from the concrete workflow states used by a tool, such as "Completed" or "Waiting for Review," using the Activity Model.

flow time: time elapsed from when a flow item enters the value stream (flow state = active) to when it is released to the customer (flow state = done). This corresponds to the total time from when the flow item enters the value stream (i.e., work was started) to when it is completed (i.e., deployed to the customer or end user).

flow velocity: number of flow items completed (i.e., flow state = done) in a given time period.

Incubation Zone: one of Geoffrey Moore's four investment zones where fast growing products and offerings can be incubated prior to producing a material amount of revenue.

Infrastructure Model disruption: involves changes to how customers access a given product or offering. The least disruptive of Geoffrey Moore's three types of disruption and the easiest to adapt an existing business to.

Installation Period: the beginning of a new technological revolution. Marked by large amounts of financial capital, such as venture capital, being deployed to leverage the new technological system that has formed a critical mass of technology, companies, and access to capital that disrupts the organizations that were established in the previous technological revolution.

Integration Model: defines how artifacts flow between one tool and another by mapping the related artifact types to a common artifact model. This enables artifacts, which tend to span multiple tools, to flow through the value stream by having their states synchronized or otherwise integrated.

Kondratiev waves: described as long cycles of economic expansion, stagnation, and recession that result from technological innovation and entrepreneurship.

Lean: a methodology for software development based on Lean manufacturing.

Operating Model disruption: disruptions that rely on changing the relationship of the consumer with the business. One of Geoffrey

Moore's three types of disruption that requires more change from a business to address than the Infrastructure Model Disruption.

Performance Zone: focused on the top line of the business, including the main drivers of revenue; one of Geoffrey Moore's four investment zones.

primary sector: economic sector involving resource extraction from the planet; one of four economic sectors defined by Zoltan Kenessey.

product: a collection of software features and functionality that delivers value to a customer or user. Products can be delivered through multiple mechanisms, e.g., downloadable software, software as a service (SaaS). Products can be external facing, sold to customers; internal facing, such as billing systems; or developer facing, such as a software development toolkit.

Product Model: provides a mapping between the existing artifact containment structure present in the tool network and the product-oriented value streams that are aligned to business value delivery. This enables measuring and tracking all activity, flow metrics, and business results per product.

product value stream: all of the activities spanning all artifacts and tools involved in delivering a specific software product to an internal or external customer.

product-oriented management: management technique that focuses on the continuous delivery of business value through products consumed by internal or external customers.

project-oriented management: management methodology that focuses on the delivery of projects according to a set of milestones, resources, and budget criteria.

production capital: capital that it is controlled by companies producing goods and services; in contrast to capital that is controlled by financial institutions.

Productivity Zone: focused on making the bottom line; one of Geoffrey Moore's four investment zones.

quaternary sector: economic sector involving knowledge work; one of four economic sectors defined by Zoltan Kenessey.

Second Way of DevOps: feedback, as presented in *The DevOps Handbook*.

secondary sector: economic sector involving processing and manufacturing; one of four economic sectors defined by Zoltan Kenessey.

software flow: the activities involved in producing business value along a software value stream.

technical debt: cost of software rework that needs to be incurred at a future time, often coming from a simpler solution being done to complete work instead of applying a better approach that would take longer to complete.

tertiary sector: economic sector involving services; one of four economic sectors defined by Zoltan Kenessey.

Third Way of DevOps: continuous learning, as presented in The DevOps Handbook.

time thieves: the five sources of waste in enterprise value streams as outline by Dominica DeGrandis in *Making Work Visible*.

tool network: the bottom most layer of the Flow Framework, within which the nodes are tools and the links between them are lines of cross-tool integrations.

toolchain: a set of distinct software development tools that are connected, either in a linear chain or a tool network.

traceability index: the measure of artifact connection breadth and depth relative to artifact type. The higher the index, the more connected the artifacts are, enabling improved reporting and visibility.

Transformation Zone: the place in an organization where Incubation Zone products and initiatives can be scaled to a meaningful size for the organization; one of Geoffrey Moore's four investment zones.

value stream: the end-to-end set of activities performed to deliver value to a customer for a product or service. At larger organizations, a value stream tends to span multiple teams, specialists, processes, and tools.

value stream metrics: metrics that measure each value stream within an organization in order for that organization to have a way of correlating software production metrics to business outcomes.

Value Stream Network: the network formed by the connections within and between software value streams. The nodes in this network are the teams of people and other processing units that create business value by working on, processing, and creating artifacts that correspond, either directly or indirectly, to one of the four flow items. Each node corresponds to a particular activity within the value stream, such as development, design, or support. The edges are the connections between the people, processes, and tools along which the flow items progress, from business objective or initiative through to running software. The network can be represented as a directed graph, which can contain cycles. The Value Stream Network is the top of the three network layers and is produced from the tool network and artifact network.

work item: an artifact that encompasses a unit of work to be delivered in the value stream, e.g., a user story or task.

Zone Management: a framework from transforming, modernizing, and reengineering a business created by Geoffrey Moore.

NOTES

Introduction: The Turning Point

1. Carlota Perez, *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages* (Cheltenham, UK: Edward Elgar, 2003), 5.
2. Perez, *Technological Revolutions and Financial Capital*, 114.
3. Adapted from Perez, *Technological Revolutions and Financial Capital*, 78.
4. Scott D. Anthony, S. Patrick Vinguerie, Evan I. Schwartz, and John Van Landeghem, "2018 Corporate Longevity Forecast: Creative Destruction is Accelerating," Innosight website, accessed on June 22, 2018, https://www.innosight.com/insight/creative-destruction/.
5. Mik Kersten, "Mining the Ground Truth of Enterprise Toolchains," *IEEE Software* 35, no. 3 (2018): 12–17.
6. Gene Kim, Patrick Debois, John Willis, and Jez Humble, *The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations* (Portland, OR: IT Revolution, 2016), 114.
7. "Digital Taylorism: A Modern Version of 'Scientific Management' Threatens to Dehumanise the Workplace," *The Economist*, September 10, 2015, https://www.economist.com/business/2015/09/10/digital-taylorism.

Part I: Introduction

1. Robert N. Charette, "This Car Runs on Code," *IEEE Spectrum*, February 1, 2009, https://spectrum.ieee.org/transportation/systems/this-car-runs-on-code.
2. Michael Sheetz, "Technology Killing Off Corporate America: Average Life Span of Companies Under 20 Years," *CNBC*, August 24, 2018, https://www.cnbc.com/2017/08/24/technology-killing-off -corporations-average-lifespan-of-company-under-20-years.html.

Chapter 1

1. Matthew Garrahan, "Google and Facebook Dominance Forecast to Rise," *Financial Times*, December 3, 2017, https://www.ft.com/content/cf362186-d840-11e7-a039-c64b1c09b482.
2. Lauren Thomas, "Amazon Grabbed 4 Percent of all US Retail Sales in 2017, New Study Says," *CNBC*, January 3, 2018, https://www.cnbc.com/2018/01/03/amazon-grabbed-4-percent-of-all-us-retail-sales-in-2017-new-study.html.
3. Lily Hay Newman, "6 Fresh Horrors from the Equifax CEO's Congressional Hearing," *Wired*, October 3, 2017, https://www.wired.com/story/equifax-ceo-congress-testimony.
4. Andreas Bubenzer-Paim, "Why No Industry is Safe From Tech Disruption," *Forbes*, November 7, 2017, https://www.forbes.com/sites/forbestechcouncil/2017/11/07/why-no-industry-is-safe-from-tech-disruption/#5f8a995530d3.
5. Brian Solis and Aubrey Littleton, "The 2017 State of Digital Transformation," Altimeter, October 2017, https://marketing.prophet.com/acton/media/33865/altimeter—the-2017-state-of-digital-transformation.
6. Gene Kim, personal communication with Mik Kersten, 2017.
7. Alan Kay, as quoted in Erika Andersen, "Great Leaders Don't Predict the Future—They Invent It," *Forbes*, July 10, 2013, https://www.forbes.com/sites/erikaandersen/2013/07/10/great-leaders-dont-predict-the-future-they-invent-it/#275484926840.
8. Jeff Dunn, "Tesla is Valued as High as Ford and GM—But That has Nothing to do with What It's Done so Far," *Business Insider*, April 11, 2017, http://www.businessinsider.com/tesla-value-vs-ford-gm -chart-2017-4.
9. "The Future has Begun," BMW website, accessed June 22, 2018, https://www.bmwgroup.com/en/next100.html.
10. Edward Taylor and Ilona Wissenbach, "Exclusive—At 100, BMW Sees Radical New Future in World of Driverless Cars," *Reuters*, March 3, 2016, https://www.reuters.com/article/autoshow-geneva-software/exclusive-at-100-bmw-sees-radical-new-future-in-world-of-driverless-cars-idUSKCN0W60HP.
11. Zoltan Kenessey, "The Primary, Secondary, Tertiary and Quaternary Sectors of the Economy," *The Review of Income and Wealth: Journal of the International Association*, 1987, http://www.roiw.org/1987/359.pdf.
12. Cade Metz, "Google is 2 Billion Lines of Code—And it's All in One Place," *Wired*, September 16, 2015, https://www.wired.com/2015/09/google-2-billion-lines-codeand-one-place.
13. Charette, "This Car Runs on Code."
14. "Bosch Plans More than 20,000 Hires," Bosch press release, March 24, 2015, https://www.bosch-presse.de/pressportal/de/en/bosch-plans-more-than-20000-hires-98560.html.

15. Ashley Rodriguez, "Netflix Was Born Out of This Grad-School Math Problem," *Quartz*, February 28, 2017, https://qz.com/921205/netflix-ceo-reed-hastings-predicted-the-future-of-video-from-considering-this-grad-school-math-problem/.
16. Marc Andreessen, "Why Software is Eating the World," *Wall Street Journal*, August 20, 2011, https://www.wsj.com/articles/SB10001424053111903480904576512250915629460.
17. therealheisenberg, "'Greedy Bastards': Amazon, Whole Foods Deal 'Changes Everything,'" *Heisenberg Report*, June 16, 2017, https://heisenbergreport.com/2017/06/16/greedy-bastards-amazon-whole-foods-deal-changes-everything/.
18. Geoffrey Moore, *Zone to Win: Organizing to Compete in an Age of Disruption*, iBook edition (New York: Diversion Publishing, 2015), Chapter 2.
19. Moore, *Zone to Win*, Chapter 1.
20. "Catherine Bessant," Bank of America website, https://newsroom.bankofamerica.com/cathy-bessant.
21. Jean Baptise Su, "The Global Fintech Landscape Reaches Over 1000 Companies," *Forbes*, September 28, 2016, https://www.forbes.com/sites/jeanbaptiste/2016/09/28/the-global-fintech-landscape-reaches-over-1000-companies-105b-in-funding-867b-in-value-report/#de39e1f26f3d.
22. Joseph Schumpeter, *Capitalism, Socialism and Democracy*, Third Edition (New York: Harper Perennial Modern Classics, 2008), 81.
23. Perez, *Technological Revolutions and Financial Capital*, 37.
24. "Catch the Wave: The Long Cycles of Industrial Innovation are Becoming Shorter," *The Economist*, February 18, 1999, https://www.economist.com/node/186628.
25. Jerry Neumann, "The Deployment Age," *The Reaction Wheel: Jerry Neumann's Blog*, October 14 2015, http://reactionwheel.net/2015/10/the-deployment-age.html.
26. Perez, *Technological Revolutions and Financial Capital*, 11; Chris Freeman and Francisco Louçã, *As Time Goes By: From the Industrial Revolution to the Information Revolution* (Oxford: Oxford University Press, 2001).
27. Perez, *Technological Revolutions and Financial Capital*, 11.
28. Perez, *Technological Revolutions and Financial Capital*, 37.
29. Carlota Perez, personal communication/unpublished interview with Mik Kersten, April 18, 2018.
30. Adapted from Perez, *Technological Revolutions and Financial Capital*, 11; Freeman and Louçã, *As Time Goes By*.
31. "Jawbone is the Second Costliest VC-Backed Startup Death Ever," *CBInsights*, July 12, 2017, https://www.cbinsights.com/research/jawbone-second-costliest-startup-fail.
32. Steven Levy, "The Inside Story Behind Pebble's Demise," *Wired*, December 12, 2016, https://www.wired.com/2016/12/the-inside -story-behind-pebbles-demise.

33. Steve Toth, "66 Facebook Acquisitions—The Complete List (2018)," *TechWyse*, January 4, 2018, https://www.techwyse.com/blog/infographics/facebook-acquisitions-the-complete-list-infographic.
34. Mik Kersten and Gail C. Murphy, "Using Task Context to Improve Programmer Productivity," *Proceedings of the 14th ACM SIGSOFT International Symposium on Foundations of Software Engineering* (November 5–11, 2006): 1–11, https://www.tasktop.com/sites/default/files/2006-11-task-context-fse.pdf.
35. Kersten and Murphy, "Using Task Context to Improve Programmer Productivity," 1–11.
36. Brian Palmer, "How Did Detroit Become Motor City," *Slate*, February 29, 2012, http://www.slate.com/articles/news_and_politics/explainer/2012/02/why_are_all_the_big_american_car_companies_based_in_michigan_.html.

Chapter 2

1. Bob Parker, "Modeling the Future Enterprise: People, Purpose and Profit," *Infor*, January 10, 2018, http://blogs.infor.com/insights/2018/01/modeling-the-future-enterprise-people-purpose-and-profit.html.
2. Bernard Marr, "What Everyone Must Know About Industry 4.0," *Forbes*, June 20, 2016, https://www.forbes.com/sites/bernardmarr/2016/06/20/what-everyone-must-know-about-industry-4-0/#37319d2a795f.
3. Horatiu Boeriu, "BMW Celebrates 1.5 Billion Cars Built at Leipzig Plant," *BMW BLOG*, October 26, 2014, http://www.bmwblog.com/2014/10/26/bmw-celebrates-1-5-million-cars-built-leipzig-plant/.
4. "The Nokia Test," *LeanAgileTraining.com*, December 2, 2007, https://www.leanagiletraining.com/better-agile/the-nokia-test.
5. James Surowiecki, "Where Nokia Went Wrong," *The New Yorker*, September 3, 2013, https://www.newyorker.com/business/currency/where-nokia-went-wrong.
6. Kent Beck with Cynthia Andres, *Extreme Programming Explained: Embrace Change*, Second Edition (Boston, MA: Addison-Wesley, November 16, 2004), 85.
7. Eliyahu M. Goldratt and Jeff Cox, *The Goal: A Process of Ongoing Improvement*, (New York: Routledge, 1984) Kindle location 2626 and 6575.
8. Kim, Debois, Willis, and Humble, *The DevOps Handbook*, 1.
9. Mik Kersten, "How to Guarantee Failure in Your Agile DevOps Transformation," Tasktop blog, June 24, 2016, https://www.tasktop.com/blog/how-to-guarantee-failure-in-your-agile-devops-transformation/.
10. Jason Del Rey, "This is the Jeff Bezos Playbook for Preventing Amazon's Demise," *Recode*, April 12, 2017, https://www.recode.net/2017/4/12/15274220/jeff-bezos-amazon-shareholders-letter-day-2-disagree-and-commit.
11. "World Class Supplier Quality," Boeing website, accessed July 27, 2018, http://787updates.newairplane.com/787-Suppliers/World-Class-Supplier-Quality.

12. "World Class Supplier Quality," Boeing website, accessed July 27, 2018, http://787updates.newairplane.com/787-Suppliers/World-Class-Supplier-Quality.
13. Gail Murphy, personal communication with Mik Kersten, 1997.
14. Mike Sinnett, "787 No-Bleed Wystems: Saving Fuel and Enhancing Operational Efficiencies," *AERO Magazine*, 2007, https://www.boeing.com/commercial/aeromagazine/articles/qtr_4_07/AERO_Q407.pdf.
15. Bill Rigby and Tim Hepher, "Brake Software Latest Threat to Boeing 787," *Reuters*, July 15, 2008, https://www.reuters.com/article/us-airshow-boeing-787/brake-software-latest-threat -to-boeing-787-idUSL155973002000.
16. Anonymous, personal communication with Mik Kersten, 2008.
17. Rigby and Hepher, "Brake Software Latest Threat."
18. Rigby and Hepher, "Brake Software Latest Threat."
19. Rigby and Hepher, "Brake Software Latest Threat."
20. Rigby and Hepher, "Brake Software Latest Threat."
21. Mary Poppendieck, "The Cost Center Trap," *The Lean Mindset* blog, November 5, 2017, http://www.leanessays.com/2017/11/the-cost-center-trap.html.
22. Jason Paur, "Boeing 747 Gets an Efficiency Makeover to Challenged A380," *Wired*, January 10, 2010, https://www.wired.com/2010/01/boeing-747-gets-an-efficient-makeover-to-challenge-a380.
23. Donald Reinertsen, *The Principles of Product Development Flow: Second Generation Lean Product Development* (Redondo Beach, CA: Celeritas, 2009), Kindle location 177.
24. Moore, *Zone to Win*, Chapter 2.
25. Moore, *Zone to Win*, Chapter 2.
26. Scott Span, "Happy People = Higher Profits: Lessons from Henry Ford in Business and Leadership," *Tolero Solutions*, accessed on May 24, 2018, http://www.tolerosolutions.com/happy-people-higher-profits-lessons-from-henry-ford-in-business-leadershi.
27. John Willis, "The Andon Cord," IT Revolution blog, October 15, 2015, https://itrevolution.com/kata/.
28. David J. Snowden and Mary E. Boone, "A Leader's Framework for Decision Making," *Harvard Business Review*, November 2007, https://hbr.org/2007/11/a-leaders-framework-for-decision-making.
29. Bruce W. Tuckman, "Developmental Sequence in Small Groups," *Psychological Bulletin* 63, no. 6 (1965): 384–399.
30. Marc Löffler, "Watermelon Reporting," *DZone*, August 8, 2011, https://dzone.com/articles/watermelon-reporting.

Chapter 3

1. Scott Galloway, *The Four: The Hidden DNA of Amazon, Apple, Facebook, and Google* (New York, NY: Random House, 2017), 28.

2. James Womack and Daniel Jones, *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Third Edition (New York: Free Press, 2003), 10.
3. Womack and Jones, *Lean Thinking*, 10.
4. Mike Rother and John Shook, *Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA* (Cambridge, MA: Lean Enterprise Institute, 2003), 3.
5. Kersten, "Mining the Ground Truth of Enterprise Toolchains."
6. John Allspaw, "How Your Systems Keep Running Day after Day," Keynote Address at DevOps Enterprise Summit 2017, San Francisco, November 15, 2017.
7. Philippe Kruchten, Robert Nord, and Ipek Ozkaya, "Technical Debt: From Metaphor to Theory and Practice," *IEEE Software* 29, no. 6 (2012), 18–21.
8. Kaimar Karu, *ITIL and DevOps—Getting Started* (Axelos, 2007).
9. Dean Leffingwell, *SAFe 4.0 Distilled: Applying the Scaled Agile Framework for Lean Software and Systems Engineering* (Boston, MA: Addison-Wesley, 2017), 243.

PART II

Chapter 4

1. Perez, *Technological Revolutions and Financial Capital*, ix.
2. Steve Coley, "Enduring Ideas: The Three Horizons of Growth," *McKinsey Quarterly*, December 2009, https://www.mckinsey.com/business-functions-functions/strategy-and-corporate-finance/our-insights/enduring-ideas-the-three-horizons-of-growth.
3. Fred P. Brooks, Jr., *The Mythical Man-Month: Essays on Software Engineering* (Boston, MA: Addison-Wesley, 1995).
4. Margaret Rouse, "Agile Velocity," *TechTarget*, July 2013, https://whatis.techtarget.com/definition/Agile-velocity.
5. Leffingwell, *SAFe 4.0 Distilled*, 95.
6. Nicole Forsgren, PhD, Jez Humble, Gene Kim, *Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations* (Portland, OR: IT Revolution Press, 2018), 11
7. Tara Hamilton-Whitaker, "Agile Estimation and the Cone of Uncertainty," *Agile 101*, August 18, 2009, https://agile101.wordpress.com/tag/t-shirt-sizing/.
8. Margaret Rouse, "Law of Large Numbers," TechTarget, Decem- ber 2012, https://whatis.techtarget.com/definition/law-of-large-numbers.
9. Frederic Paul, "Gene Kim Explains 'Why DevOps Matters,'" *New Relic*, June 24, 2015, https://blog.newrelic.com/2015/06/24/gene-kim-why-devops-matters/.
10. Dominica DeGrandis, *Making Work Visible: Exposing Time Theft to Optimize Work and Flow* (Portland, OR: IT Revolution, 2017), 142.
11. Carmen DeArdo, "On the Evolution of Agile to DevOps," *CIO Review*, accessed on June 26, 2018, https://devops.cioreview.com/cxoinsight/on-the-evolution-of-agile-to-devops-nid-26383-cid-99.html.

12. DeGrandis, *Making Work Visible*, 8–15.
13. Reinertsen, *The Principles of Product Development Flow*, Kindle location 1192.
14. Reinertsen, *The Principles of Product Development Flow*, Kindle location 147.
15. Eliyahu M. Goldratt, "Standing on the Shoulders of Giants," as featured in *The Goal: A Process of Ongoing Improvement*, Kindle edition (Great Barrington, MA: North River Press, 1992), Kindle location 6293.
16. Reinertsen, *The Principles of Product Development Flow*, Kindle location 1030.
17. DeGrandis, *Making Work Visible*, 141–154.

Chapter 5

1. Camilla Knudsen and Alister Doyle, "Norway Powers Ahead (Electrically): Over Half New Car Sales Now Electric or Hybrid," *Reuters*, January 3, 2018, https://www.reuters.com/article/us-environment-norway-autos/norway-powers-ahead-over-half-new-car-sales-now-electric-or-hybrid-idUSKBN1ES0WC.
2. "BMW Expands Leipzig Factory to 200 BMW i Models Daily", *Eletrive*, May 24, 2018, https://www.electrive.com/2018/05/24/bmw-expands-leipzig-factory-to-200-bmw-i-models-daily.
3. Bruce Baggaley, "Costing by Value Stream," *Journal of Cost Management* 18, no. 3 (May/June 2013), 24–30.
4. Reinertsen, *The Principles of Product Development Flow*, Kindle location 177.
5. Nicole Forsgren, Jez Humble, Gene Kim, Alanna Brown, and Nigel Kersten, *2017 State of DevOps Report* (Puppet, 2018), https://puppet.com/resources/whitepaper/state-of-devops-report.
6. Daniel Pink, Drive: *The Surprising Truth About What Motivates Us* (New York: Riverhead Books, 2011), 1–10.
7. Forsgren, Humble, Kim, *Accelerate*, 102.
8. Fred Reichheld, *The Ultimate Question 2.0 (Revised and Expanded Edition): How Net Promoter Companies Thrive in a Customer-Driven World* (Boston, MA: Harvard Business School Press, 2011), Kindle location 2182.

Chapter 6

1. Charette, "This Car Runs on Code."
2. Charette, "This Car Runs on Code."
3. Neil Steinkamp, *Industry Insights for the Road Ahead: 2016 Automotive Warranty & Recall Report*, (Stout Rissus Ross, Inc, 2016), https://www.stoutadvisory.com/insights/report/2016-automotive-warranty-recall-report.
4. Steinkamp, *Industry Insights for the Road Ahead*.
5. History.com Staff "Automobile History," History Channel website, 2010, https://www.history.com/topics/automobiles.

6. John Hunter, "Deming's 14 Points for Management," *The W. Edwards Deming Institute Blog*, April 15, 2013, https://blog.deming.org/2013/04/demings-14-points-for-management.
7. "Computer Aided Engineering at BMW, Powered by High Performance Computing 2nd," Slideshare.net, posted by Fujitsu Global, November 19, 2015, slide 29, https://www.slideshare.net/FujitsuTS/computer-aided-engineering-at-bmw-powered-by-high-performance-computing-2nd.
8. Viktor Reklaitis, "How the Number of Data Breaches is Soaring—In One Chart," *MarketWatch*, May 25, 2018, https://www.marketwatch.com/story/how-the-number-of-data-breaches-is-soaring-in-one-chart-2018-02-26.
9. Joan Weiner, "Despite Cyberattacks at JPMorgan, Home Depot and Target, Many Millenials Aren't Worried About Being Hacked," *The Washington Post,* October 8, 2014, https://www.washingtonpost.com/blogs/she-the-people/wp/2014/10/08/despite-cyberattacks-at-jpmorgan-home-depot-and-target-many-millennials-arent-worried-about-being-hacked/?noredirect=on&utm_terms=.97579f2f101c.
10. Erica R. Hendry, "How the Equifax Hack Happened, According to its CEO," *PBS News Hour*, October 3, 2017, https://www.pbs.org/newshour/nation/equifax-hack-happened-according-ceo.
11. Lily Hay Newman, "6 Fresh Horrors from the Equifax CEO's Congressional Hearing," *Wall Street Journal*, October 3, 2017, https://www.wired.com/story/equifax-ceo-congress-testimony.
12. Lorenzo Franceshi-Bicchierai, "Equifax was Warned," *Motherboard*, October 26, 2018, https://motherboard.vice.com/en_us/article/ne3bv7/equifax-breach-social-security-numbers-researcher-warning.
13. Tom Kranzit, "Nokia Completes Symbian," *CNET*, December 2, 2008, https://www.cnet.com/news/nokia-completes-symbian-acquisition.
14. Ward Cunningham, "The WyCash Portfolio Management System," *OOPSLA 1992*, March 26, 1992, http://c2.com/doc/oopsla92.html.
15. Steve O'Hear, "Nokia buys Symbian, Opens Fire on Android, Windows Mobile and iPhone," *Last100*, June 24, 2008, http://www.last100.com/2008/06/24/nokia-buys-symbian-opens-fire-on-google-android-and-iphone/.
16. Shira Ovide, "Deal is Easy Part for Microsoft and Nokia," *Wall Street Journal*, September 3, 2018, https://www.wsj.com/articlesmicrosoft-buys-nokia-mobile-business-in-7-billion-deal-1378188311.
17. "Microsoft to Acquire Nokia's Devices and Services Business, License Nokia's Patents and Mapping Services," Microsoft website, September 3, 2013, https://news.microsoft.com/2013/09/03/microsoft-to-acquire-nokias-devices-services-business-license-nokias-patents-and-mapping-services/.
18. Chris Ziegler, "Nokia CEO Stephan Elop Rallies Troops in Brutally Honest 'Burning Platform' Memo (Update: It's Real!)," *Engadget*, August 2, 2011,

https://www.engadget.com/2011/02/08/nokia-ceo-stephe-elop-rallies-troops-in-brutally-honest-burnin.

19. Philip Michaels, "Jobs: OS 9 is Dead, Long Live OS X," *Macworld*, May 1, 2002, https://www.macworld.com/article/1001445/06wwdc.html.
20. "The Internet Tidal Wave," *Letters of Note*, July 22, 2011, http://www.lettersofnote.com/2011/07/internet-tidal-wave.html.
21. Bill Gates, "Memo from Bill Gates," *Microsoft*, January 11, 2012, https://news.microsoft.com/2012/01/11/memo-from-bill-gates.
22. "Microsoft Promises End to 'DLL Hell,'" *CNet*, March 7, 2003, https://www.cnet.com/news/microsoft-promises-end-to-dll-hell/.
23. David Bank, "Borland Charges Microsoft Stole Away Its Employees," *The Wall Street Journal*, May 8, 1997, https://www.wsj.com/articles/SB863034062733665000.
24. Rene Te-Strote, personal communication/unpublished interview with Mik Kersten, April 20, 2017.
25. Stephen O'Grady, *The New Kingmakers: How Developers Conquered the World* (Sebastopol, CA: O'Reilly Media, 2013), 5.

PART III

1. "Agile at Microsoft," YouTube video, 41:04, posted by Microsoft Visual Studio, October 2, 2017, https://www.youtube.com/watch?v =-LvCJpnNljU.
3. Forsgren, Humble, and Kim, *Accelerate*, 66.

Chapter 7

1. History.com staff, "Automobile History."
2. Alex Davies, "Telsa Ramps up Model 3 Production and Predicts Profits this Fall," *Wired*, May 2, 2018, https://www.wired.com/story/tesla-model-3-production-profitability.
3. Womack and Jones, *Lean Thinking*, Chapter 11.
4. Mik Kersten and Gail C. Murphy, "Mylar: A Degree-of-Interest Model for IDEs," *Proceedings of the 4th International Conference on Aspect-Oriented Software Development* (March 14–18, 2005): 159–168.
5. Mik Kersten, "Lessons Learned from 10 Years of Application Lifecyle Management," *InfoQ*, December 24, 2015, https://www.infoq.com/articles/lessons-application-lifecycle.

Chapter 8

1. Mik Kersten, "Mik Kersten Keynote on the Future of ALM: Developing in the Social Code Graph (EclipseCon 2012)," YouTube video, 47:55, posted by Tasktop, April 10, 2012, https://www.youtube.com/watch?v=WBwyAyvneNo.

2. Nicole Forsgren, PhD, and Mik Kersten, PhD, "DevOps Metrics: Your Biggest Mistake Might be Collecting the Wrong Data," *ACM Queue* 15, no. 6 (2017), https://queue.acm.org/detail.cfm?id=3182626.
3. Kersten, "Mining the Ground Truth of Enterprise Toolchains," 12–17.
4. Perez, *Technological Revolutions and Financial Capital*, 114.
5. Danny Palmer, "What is GDPR? Everything You Need to Know About the New General Data Protection Regulations," *ZDNet*, May 23, 2018, https://www.zdnet.com/article/gdpr-an-executive -guide-to-what-you-need-to-know.
6. Rachel Potvin and Josh Levenber, "Why Google Stores Billions of Lines of Code in a Single Repository," *Communications of the ACM* 59, no. 7 (2016): 78–87, https://cacm.acm.org/magazines/2016/7/204032-why-google-stores-billions-of-lines-of-code-in-a-single-repository/fulltext.
7. Internal Tasktop Report, unpublished, 2018.
8. "Life Expectancy," *Wikipedia*, last modified June 20, 2018, https://en.wikipedia.org/wiki/Life_expectancy.
9. "Careers in Medicine," Association of American Medical Colleges website, accessed August 23, 2018, http://www.aamc.org/cim/speciality/exploreoptions/list/.
10. General Stanley McChrystal, *Team of Teams: New Rules of Engagement for a Complex World* (New York: Portfolio, 2015), iBook Chapter 6.
11. "Study Suggests Medical Errors Now Third Leading Cause of Death in the U.S.," *Johns Hopkins Medicine*, May 3, 2016, https://www.hopkinsmedicine.org/news/media/releases/study_suggests_medical_errors_now_third_leading_cause_of_death_in_the_us.
12. "Supplier Management," BMW Group website, accessed July 1, 2018, https://www.bmwgroup.com/en/responsibility/supply-chain-management.html.

Chapter 9

1. Reinertsen, *The Principles of Product Development Flow*, Kindle location 391.
2. Gary Gruver and Tommy Mouser, *Leading the Transformation: Applying Agile and DevOps Principles at Scale* (Portland, OR: IT Revolution, 2015), 20–25.
3. Goldratt and Cox, *The Goal*, Kindle location 2626 and 6575.
4. "Metcalfe's Law," *Wikipedia*, last updated June 15, 2018, https://en.wikipedia.org/wiki/Metcalfe%27s_law.
5. Christopher Condo and Diego LoGiudice, *Elevate Agile-Plus-DevOps with Value Stream Management*, Forrester Research, Inc., May 11, 2018.
6. Anonymous, personal communication with Mik Kersten, 2017.
7. Carliss Baldwin, Kim B. Clark, Carliss Y. Baldwin, *The Option Value of Modularity in Design* (Boston, MA: Harvard Business School, 2002).
8. DeGrandis, *Making Work Visible*, 1.
9. Reinertsen, *The Principles of Product Development Flow*, Kindle location 132.

10. DeGrandis, *Making Work Visible*, 17.
11. DeGrandis, *Making Work Visible*, 25.
12. DeGrandis, *Making Work Visible*, 39.
13. Fred Lambery, "BMW to Increase "BMW i' Electric Vehicle Production by 54%," *electrek*, May 25, 2018, http://electrek.co/2018/05/25/bmw-i-electric-vehicle-production/.

Conclusion

1. Sarah Ponczek and Rick Clough, "GE Kicked Out of Dow, the Last 19th Century Member Removed," *Bloomberg*, June 19, 2018, updated on June 20, 2018, https://www.bloomberg.com/news/articles/2018-06-19/ge-gets-kicked-out-of-dow-the-last-19th-century-member-removed.
2. Mark J. Perry, "Fortune 500 Firms 1955 v. 2017: Only 60 Remain, Thanks to the Creative Destruction That Fuels Economic Prosperity," *AEIdeas*, October 20, 2017, http://www.aei.org/publication/fortune-500-firms-1955-v-2017-only-12-remain-thanks-to-the-creative-destruction-that-fuels-economic-prosperity/.
3. Scott D. Anthony, S. Patrick Viguerie, Evan I Schwartz, and John Van Dandeghem, *2018 Corporate Longevity Forecast: Creative Destruction is Accelerating*, accessed August 15, 2018, https://www.innosight.com/insight/creative-destruction/
4. Carlota Perez, personal communication with Mik Kersten, June 27, 2018.
5. Douglas K. Smith and Robert C. Alexander, *Fumbling the Future: How Xerox Invented, Then Ignored, the First Personal Computer* (Bloomington, IN: iUniverse, Inc., 1999).
6. Perez, *Technological Revolutions and Financial Capital*, 114.

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Dr. Mik Kersten started his career as a Research Scientist at Xerox PARC where he created the first aspect-oriented development environment. He then pioneered the integration of development tools with Agile and DevOps as part of his Computer Science PhD at the University of British Columbia. Founding Tasktop out of that research, Mik has written over one million lines of open-source code that are still in use today, and he has brought seven successful open-source and commercial products to market.

Mik's experiences working with some of the largest digital transformations in the world has led him to identify the critical disconnect between business leaders and technologists. Since then, Mik has been working on creating new tools and a new framework for connecting software value stream networks and enabling the shift from project to product.

Mik lives with his family in Vancouver, Canada, and travels globally, sharing his vision for transforming how software is built.