

Technology, Media & Telecommunications Practice

Developer Velocity: How software excellence fuels business performance

The businesses that are achieving the greatest returns from their software investments are those willing to tackle entrenched cultural and structural barriers.

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With technology powering everything from how a business runs to the products and services it sells, companies in industries ranging from retail to manufacturing to banking are having to develop a range of new skill sets and capabilities. In addition to mastering the nuances of their industry, they need to excel first and foremost at developing software.

It's a big leap for many, yet a large number of businesses are working hard to make it. At the Goldman Sachs Group, for instance, computer engineers make up about one-quarter of the total workforce.¹ Within retail, software development is the fastest-growing job category.² Indeed, of the 20 million software engineers worldwide, more

than half are estimated to be working outside the technology industry, and that percentage is growing.

However, for the vast majority of businesses, these investments have not led to meaningful performance improvements. Launching a new product or feature can still take months. Leaders still struggle to scale promising sandbox innovations. We often hear CEOs, chief technology officers, and chief information officers lament that their software-development spending is a “black box.”

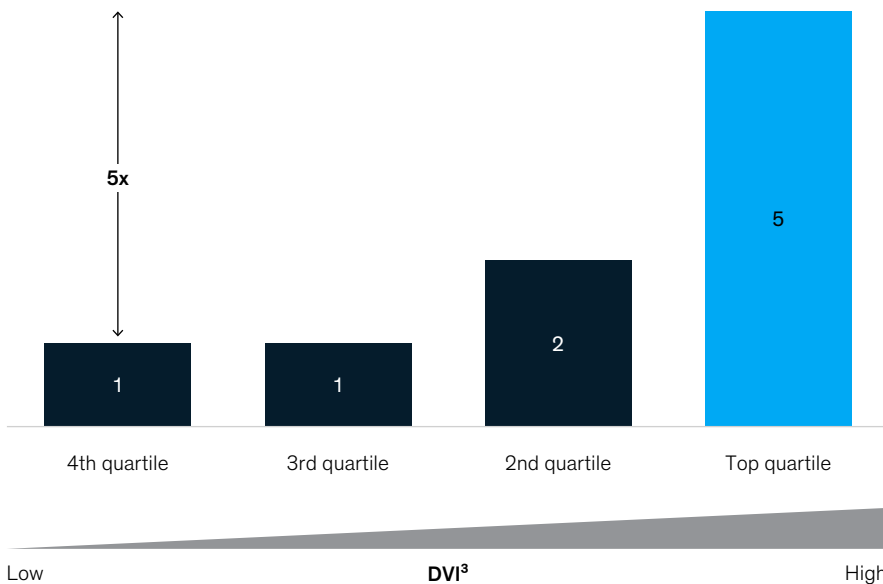
Improving business performance through software development comes down to empowering developers, creating the right environment for them

¹ Thomas Franck, “Computer engineers now make up a quarter of Goldman Sachs’ workforce,” CNBC, April 30, 2018, cnbc.com.
² LinkedIn Talent Blog, “Data reveals the fastest-growing job in retail (and it’s not sales),” blog entry by Sharqua Abdullah, April 19, 2018, business.linkedin.com.

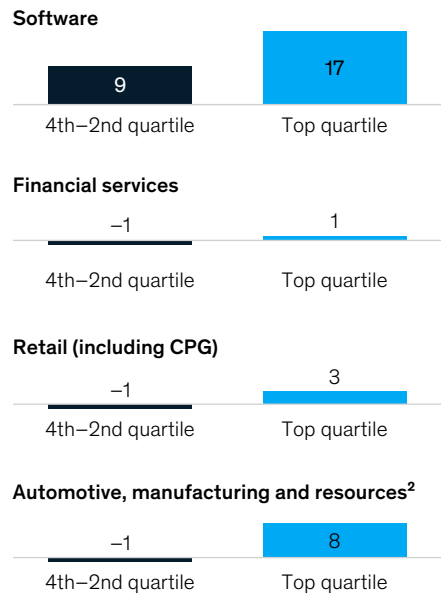
Exhibit 1

Companies in the top quartile of the Developer Velocity Index (DVI) outperform others in the market by four to five times.

Revenue CAGR¹ by DVI quartile, all companies,² 2014–18, n = 239, %



Select sectors, %²



¹ Compound annual growth rate.

² Includes companies and verticals with n>15 for available public data; n for verticals shown: software equals 25, financial services equals 30, manufacturing and resources equals 36; retail equals 44; companies were split into DVI quartiles based on DVI score and industry ranking.

³ Includes automotive, manufacturing, oil and gas, and energy.

Source: Capital IQ; Developer Velocity Survey

to innovate, and removing points of friction. Industry leaders refer to this capability as “Developer Velocity.” This goes beyond the definition of velocity as it relates to agile methodologies—meaning it is about not just speed but also unleashing the full potential of development talent.

To gain a more precise understanding of the factors that allow organizations to achieve Developer Velocity, we conducted an in-depth survey of senior executives at 440 large enterprises, more than 100 expert interviews, and extensive external research (see sidebar, “About the research”). As a result, we created what we call the Developer Velocity Index (DVI), which pinpoints the most critical factors (related to technology, working practices, and organizational enablement) in achieving Developer Velocity, as well as those that are not nearly as important as many executives and observers might believe.

What really does (and does not) account for business success

Our research reveals that top-quartile DVI scores correlate with 2014–18 revenue growth that is four to five times faster than bottom-quartile DVI scores (Exhibit 1). Top-quartile companies also have 60 percent higher total shareholder returns and 20 percent higher operating margins. In addition, top-quartile players appear to be more innovative, scoring 55 percent higher on innovation than bottom-quartile companies. These businesses also score higher on customer satisfaction, brand perception, and talent management (Exhibit 2).

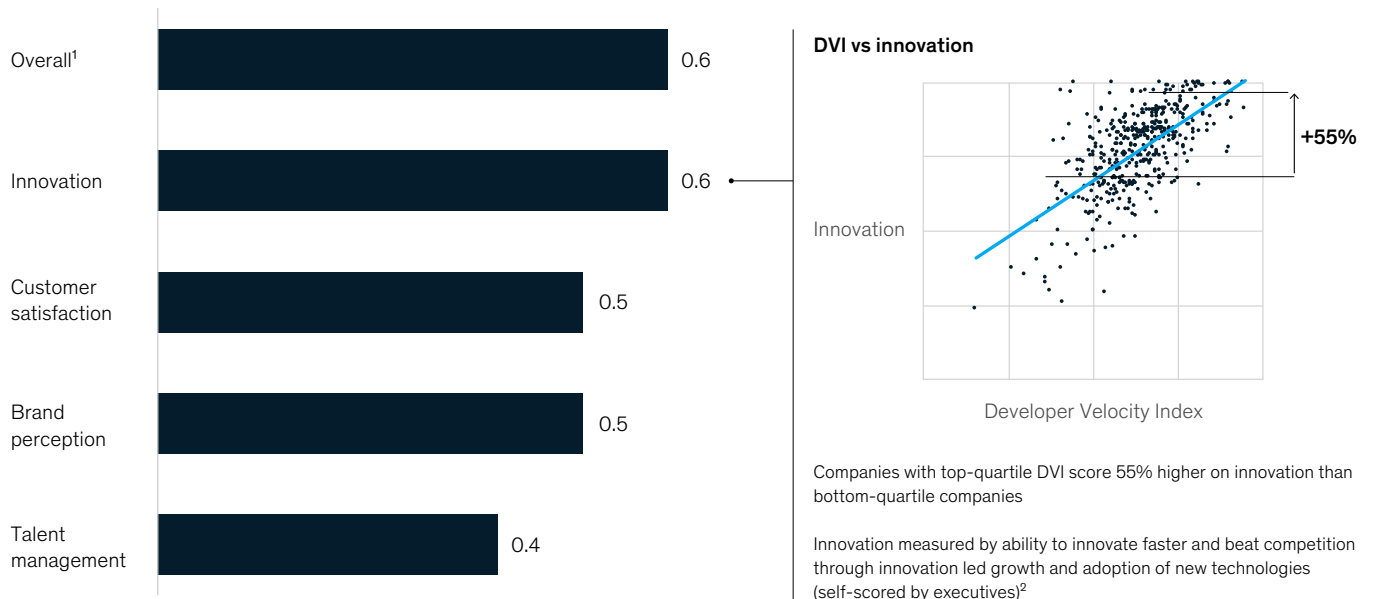
Similar patterns hold within specific industries and sectors. For example, top-quartile software companies saw revenue grow almost two times faster than other software companies in the same period. In financial services and retail, top-quartile

Exhibit 2

Top companies by Developer Velocity have an innovation edge.

Correlation between Developer Velocity Index (DVI) and key business performance indicators, n = 440

1=highest positive correlation, -1=highest negative correlation, 0.5+=strong correlation



¹ Average of innovation, customer satisfaction, brand perception, and talent management.

² Measured by an average of new technology adoption (level of adoption for artificial intelligence, machine-learning, Internet of Things, augmented and virtual reality, fifth generation, blockchain, digital twins, robotic process automation, edge computing, and autonomous physical devices) and McKinsey innovation quotient metrics (an organization’s innovation-led growth as well as innovation speed and perception relative to competitors).

Source: Developer Velocity Survey; expert interview

About the research

The Developer Velocity Index (DVI) takes into account 46 different drivers across 13 capability areas (exhibit). To develop and validate this list of drivers, we conducted interviews with more than 100 chief technology officers, chief information officers, and other senior engineering leaders. We then asked technology executives at 440 large organizations across 12 industries in nine countries to

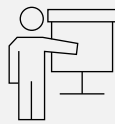
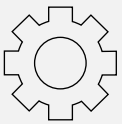
rate their company's performance. DVI scores are calculated as a weighted average of scores across the drivers, with equal weight given to the three broad categories—technology, working practices, and organizational enablement.

Our analysis examined the impact of DVI scores on revenue, total shareholder returns, and operating margin. We also

looked at four nonfinancial business-performance indicators: innovation, customer satisfaction, brand perception, and talent management. Finally, we ran statistical correlations of business performance against the various dimensions of Developer Velocity. We used the Johnson's Relative Weights analysis to quantify the relative importance of the correlated drivers of DVI scores.

Exhibit

Developer Velocity involves 46 different drivers across 13 dimensions.



Technology

Architecture

- Software architecture
- Data architecture

Infrastructure and platform

- Public cloud adoption (IaaS, PaaS¹)
- Infrastructure as code

Testing

- Test automation
- Test-driven development

Tools

- Planning tools
- Collaboration tools
- Development tools
- DevOps tools
- Low- or no-code tools
- AI assistance in development

Working practices

Engineering practices

- Technology debt management practices
- Coding guidelines
- Code reviews
- CI/CD practices²

Security and compliance

- Security practices
- Compliance practices

Open source and InnerSource

- Open-source usage and contribution
- InnerSource adoption

Agile team practices

- Work-in-progress management
- Agile ceremonies
- Definition of done

Organizational enablement

Team characteristics

- Autonomous scope
- Limited context switching
- Cross-functional teams
- Colocation of teams

Product management

- Product management capabilities
- Product telemetry
- Product vision
- Linkage between strategy and team metrics
- Rapid prototyping

Organizational agility

- Dependency management
- Funding mechanisms
- Portfolio management

Culture

- Psychological safety
- Collaboration and knowledge sharing
- Continuous improvement culture
- Servant leadership
- Culture of customer obsession

Talent management

- Incentives
- Capability building
- Recruiting
- Team health management
- Employee value proposition
- Engineering career paths

¹ Infrastructure as a Service, Platform as a Service.

² Continuous integration/continuous development.

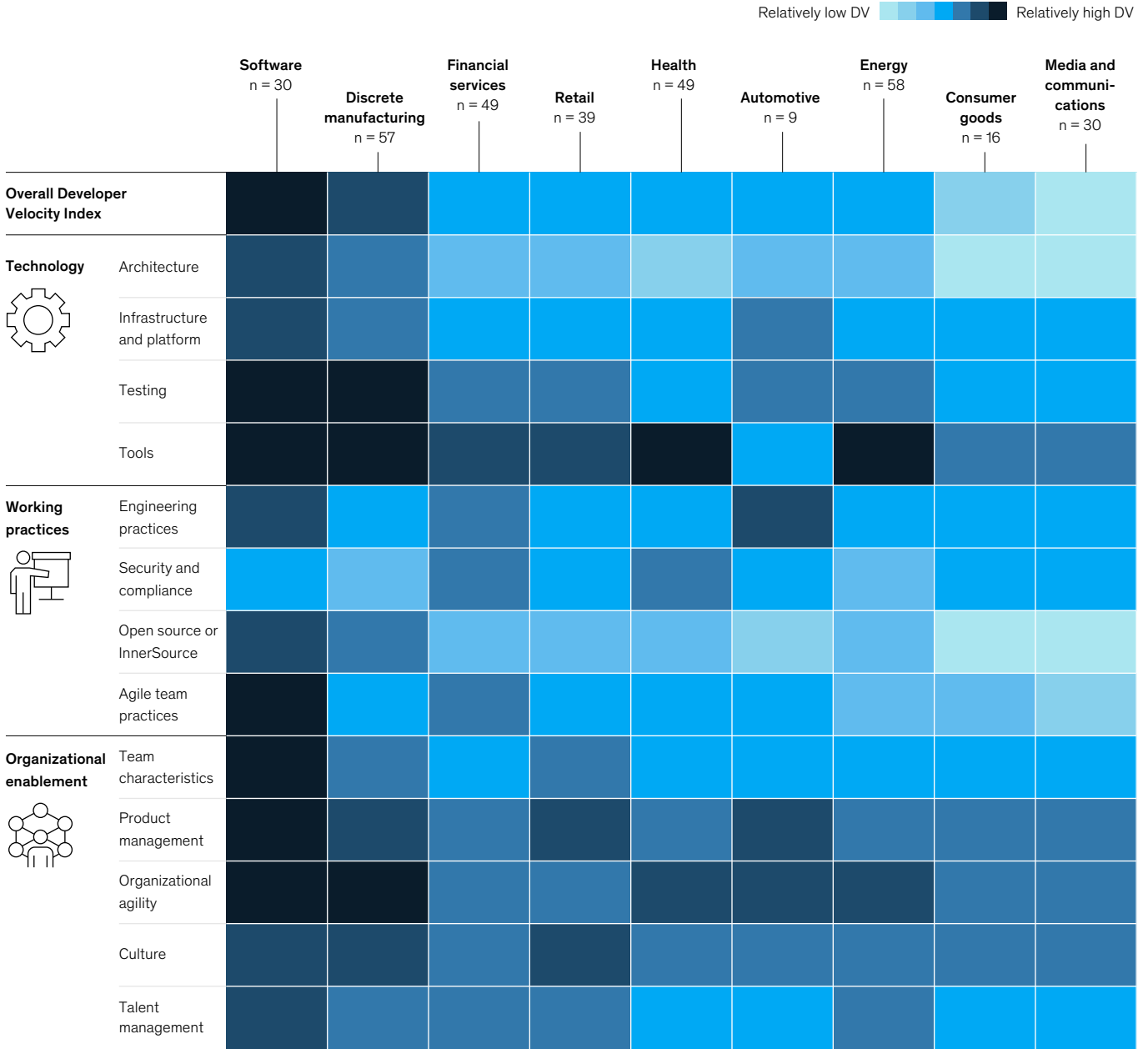
companies saw positive revenue growth while average revenue declined in the other quartiles.

While the link between Developer Velocity and business performance cuts across all industries,

not surprisingly, sectors that are more digitally mature—including software (naturally), discrete manufacturing, and financial services—have higher DVI scores overall (Exhibit 3).

Exhibit 3

Developer Velocity (DV) maturity varies widely across industries.



Source: Developer Velocity Survey; expert interview

To take it a step further, we analyzed 13 capabilities (composed of 46 individual performance drivers) to better understand the specific conditions that create high Developer Velocity. We found the four

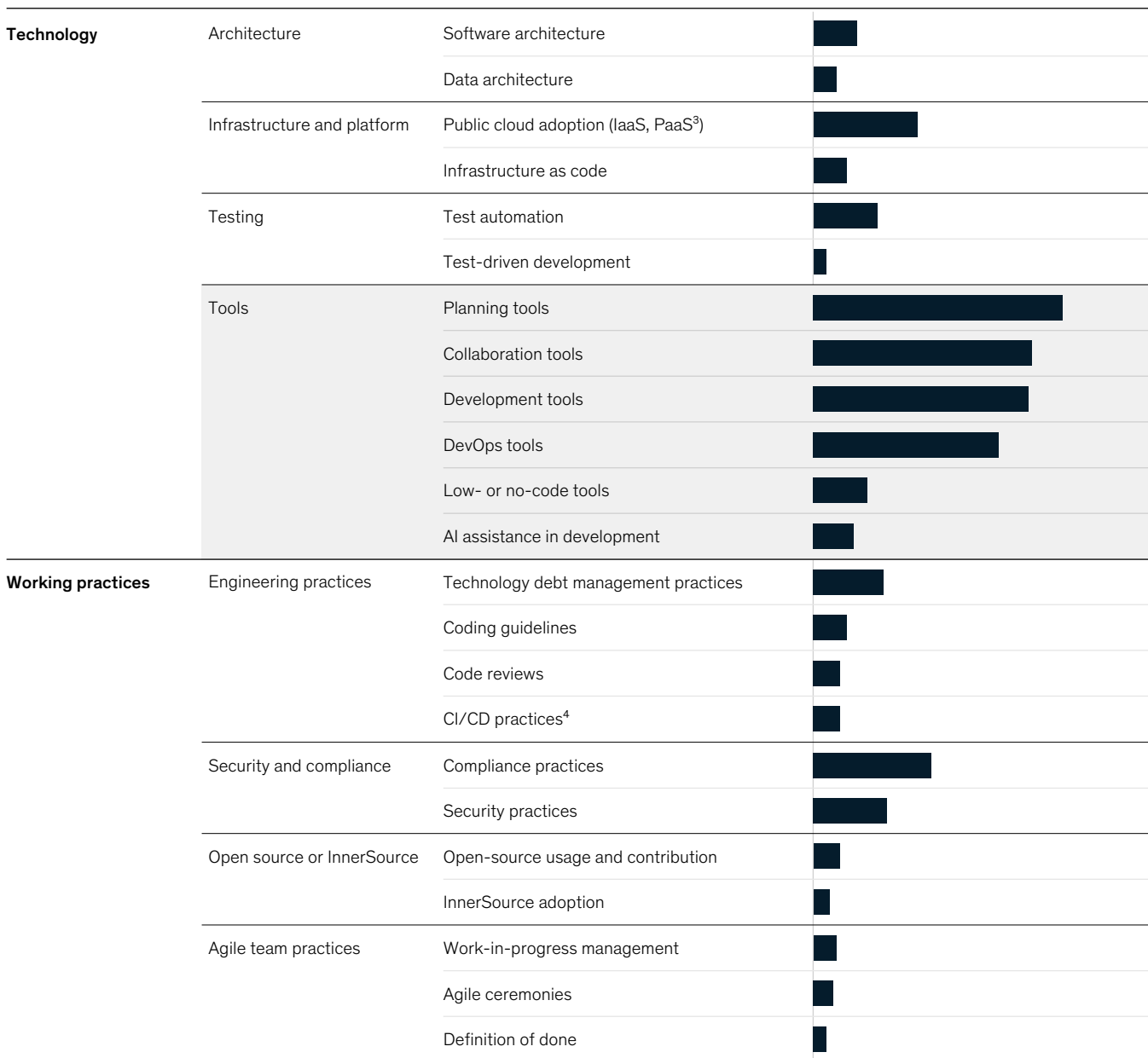
with the greatest impact on business performance are tools, culture, product management, and talent management (Exhibit 4). These four areas are also strongly correlated with each other—that is,

Exhibit 4

Tools, product management, culture, and talent management have the greatest impact on Developer Velocity and business performance.

Relative importance¹ to overall business performance indicators,² %

■ Foundational drivers, R² = 0.6, n = 440



¹ Calculated using Johnson's relative weights: percentage of importance is relative importance of driver on business outcomes. Higher percentage indicates a stronger impact on business performance.

² Average score for innovation, customer satisfaction, brand perception, and talent management.

³ Infrastructure as a Service, Platform as a Service.

⁴ Continuous integration/continuous development.

Exhibit 4 (continued)

Tools, product management, culture, and talent management have the greatest impact on Developer Velocity and business performance.

Relative importance¹ to overall business performance indicators,² %

■ Foundational drivers, R² = 0.6, n = 440



Source: Developer Velocity Survey; expert interview

top performers with high scores in one capability tend to also have high scores in the other three. The companies that have mastered Developer Velocity focus equally on empowering the developer, anticipating critical enablers, aligning investments with customer value, and minimizing barriers to productivity.

Interestingly, these findings fly in the face of conventional industry wisdom. For example, many of the business leaders we interviewed assumed agile ceremonies at a team level would be among the top enablers of software development. But while agile team practices are helpful (especially in lifting performance among third- and fourth-quartile players), our study finds they do not play an outsized role in advancing DVI scores beyond that.

The other outlier was developer tools. Our research shows that best-in-class tools are the top contributor to business success—enabling greater productivity, visibility, and coordination. Yet only 5 percent of executives recognized this link and ranked tools among their top-three software enablers. The underinvestment in tools across the development life cycle is one reason so many companies struggle with “black box” issues.

How to improve Developer Velocity

Why the disconnect between what leaders *think* drives software success and what actually does? One answer is that relatively few leaders understand the day-to-day developer experience. Another challenge is prioritizing investment among the large and diverse set of levers. Several actions can help address the four biggest factors in Developer Velocity: tools, culture, product management, and talent management.

Empowering developers with world-class tools

According to our research, best-in-class tools are the primary driver of Developer Velocity. Organizations with strong tools—for planning,

development (for example, integrated development environments), collaboration, and continuous integration and delivery—are 65 percent more innovative than bottom-quartile companies. The ability to access relevant tools for each stage of the software life cycle contributes to developer satisfaction and retention rates that are 47 percent higher for top-quartile companies compared with bottom-quartile performers.

Top-quartile companies give developers a degree of choice—usually between two and five options to account for different needs and preferences—but restrict ad hoc tools from being added. Leading companies also use tools to unleash Developer Velocity by investing in low-code and no-code platforms. These platforms enable the average business user to develop applications without any software experience, freeing up seasoned developers to focus on the most challenging tasks. For example, one pharmaceutical company grew its low-code platform base from eight users to 1,400 in just one year. Business users outside of IT are now building applications with thousands of monthly sessions. The companies in our survey that empower “citizen developers” in these sorts of ways score 33 percent higher on innovation compared with bottom-quartile companies.

Creating a culture that fosters psychological safety

Organizations that enable software teams to experiment, fail, and learn in a safe environment see consistently better results. Knowledge sharing, continuous improvement, a servant-leadership mindset (that is, managers viewing their role as empowering their teams to be successful rather than simply overseeing them), and a customer-centric philosophy are all correlated with superior business performance. But far and away the most important cultural attribute is psychological safety—a shared belief that risk-taking in the pursuit of innovative problem-solving is permitted and protected.

Organizations that enable software teams to experiment, fail, and learn in a safe environment see consistently better results.

Although most executives recognize the importance of psychological safety, only 20 percent believe their organization has succeeded in creating this culture. The chief information officer of a leading multinational bank told us that learning how to fail was the most difficult part of the company's transition to mobile banking.

Companies that perform best at this aspect of cultural change also invest in systems that can absorb and minimize the cost of failures. These investments include capabilities such as controlled releases, feature flags (the ability to turn features on and off without redeploying code), and automated rollbacks, as well as postmortems and retrospectives that allow teams to reflect constructively on what worked and what did not. A software leader at one top-quartile company said, "You need to implement safeguards in order to embrace failure, so we build contingencies as part of the software-development process. For example, we install a new version side by side with the stable version."

In addition to promoting psychological safety, companies with high DVI scores more frequently recognize employees for their achievements, publicly acknowledging individual and team efforts and rewarding outstanding contributions. They also build strong communities of practice through, for example, regular, brown-bag meetups on specific topics. And they create processes that allow teams

to engage more directly with the customer—for instance, through demos and site visits.

Creating a comprehensive product-management function

Product management means more than simply ensuring on-time and on-budget releases. It is about ensuring that the right products are built in the right ways to deliver a compelling customer experience.³ The importance of delivering this kind of experience is why the product-management function has become so critical over the past decade and why these capabilities rank as the third-leading driver of Developer Velocity.

Our research examined six dimensions of product management—customer experience, strategic skills, business acumen, technical skills, leadership skills, and organizational enablers (such as mechanisms that assist with strategic prioritization, funding, and the adoption of product telemetry). The results show that DVI scores are less sensitive to individual attributes and far more responsive to an integrated, balanced product-management function. The product-management team not only needs relevant business and market knowledge but also a strong technical background. Companies with above-average performance across the six dimensions have DVI scores 1.5 times higher than companies with top-quartile performance in just one or two dimensions. It is important to note that excellent product management is also not about the discrete

³ Ralph Breuer, Harald Fanderl, Tjark Freundt, Nicolas Maechler, Stefan Moritz, and Fransje van der Marel, "What matters in customer-experience transformations," July 2019, McKinsey.com.

product-management team; developers and other members of an agile team are increasingly wearing the product-manager hat to understand how their work is aligned with business priorities and customer needs.

Focusing talent management on the developer experience

The world of technology has long been fixated on the idea of rock-star developers: individuals capable of producing at ten times the rate of the average developer. While debate exists over the size of the exponential, there is little question that the most talented developers are engines of velocity in their own right. With developers and related roles in high demand, the challenge is how to attract and retain such talent and create the conditions that ensure their continued success. Our study found that the talent factors most correlated with high rates of Developer Velocity—in addition to the impact of tools on talent outcomes as discussed earlier—are incentives, multifaceted recruiting programs, a rich program of ongoing learning, well-defined engineering career paths, and an active measurement of team health.

Leading companies are resourceful when it comes to keeping software talent happy and motivated. One leading telecom company offers a wide range of skills certifications or “microbadges,” from beginner’s-level mobile development to machine learning. It also created a Developer University to provide developers with fresh learning opportunities and the chance to apply these skills in their workplace.

Best-in-class companies also recognize the role that team health plays in boosting productivity and retention. They take the pulse of their developer teams on a regular basis—for example, after every one or two sprints. Surveys, whiteboard notes, and visual dashboards provide instant feedback that teams can use to address issues and refine processes quickly. Comprehensive annual or biannual employee surveys augment the more

frequent check-ins, going deeper into topics such as shared vision, leadership, motivation, and incentives.

Beyond the foundations: Open-source and public-cloud adoption and a set of emerging drivers

While the four core drivers apply across the entire group of companies surveyed, a different driver emerged as the biggest differentiator for companies within the top quartile: open-source adoption. For organizations that already have a strong DVI score, open-source adoption acts as a major accelerator. The data show that top-quartile company adoption of open source has three times the impact on innovation as compared with companies in other quartiles. Top-quartile DVI companies are especially active adopters, scoring 36 percent higher on open-source adoption than the next quartile—the highest delta on any dimension studied. We found that building an open-source culture is about more than using open-source software within the code; it extends to encouraging contribution and participation in the open-source community as well as adopting a similar approach to how code is shared internally—that is, strong InnerSource adoption.

Another notable distinction is that DVI leaders are more advanced in managing open-source development securely. Many are using centralized security management and automated tools that can scan open-source components and remediate vulnerabilities before deployment. Compared with these leading adopters, less than 20 percent of companies are employing these advanced security measures.

Public-cloud adoption as a catalyst of Developer Velocity is especially strong for nonsoftware companies—public-cloud adoption has four times the impact on their business performance than it does for software companies. Developer Velocity benefits are also sharply correlated with the degree of adoption: companies in the top quartile

of public-cloud adoption have DVI scores that are 32 percent higher than companies in the bottom quartile. By comparison, a partial shift returns significantly less benefit: companies in the third quartile gain only a 2 percent DVI score advantage over the lowest adopters.

The analysis also identified emerging drivers with the potential to accelerate DVI scores over the next three to five years. Top-quartile companies are increasingly exploring the use of artificial intelligence (AI) and machine learning in developer tools. For example, some have begun using AI to perform aspects of pair programming (in which typically one developer writes code while another almost simultaneously reviews it), providing automated code reviews and using natural language processing in low-code tools. Additional areas

that executives believe will accelerate software innovation and impact in the future include increased usage of product telemetry to make product decisions and automation in detecting and remediating production issues.

Improving Developer Velocity is a journey, not a race. The businesses that are achieving the greatest returns from their software investment are those willing to tackle the entrenched cultural and structural barriers that are often the hardest and most nebulous to address. Companies that excel in providing the right tools, culture, product management, and talent management not only develop software faster but also deliver significantly stronger business outcomes.

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