DevOps Institute

upSkilling IT

GLOBAL REPORT | 2022

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Upskilling is a Professional and Organizational Imperative

Welcome by DevOps Institute CEO Jayne Groll

DevOps Institute's mission is to advance the Humans of DevOps by equipping them with Skills, Knowledge, Ideas and Learning (SKIL). Each year, we conduct an important community research project to help identify which human, process, functional and automation skills are considered must-have, nice-to-have and not as important. Now in its fourth year, I am pleased to welcome you to the data for Upskilling IT 2022.

With over 2,500 responses, the response to the Upskilling IT 2022 survey was overwhelming. Thank you to all who took the time to share their input. As a result, we produced four distinct reports this year – three for specific regions and one for a global perspective. We hope that you find these reports meaningful and relevant.

Now more than ever, professional development is an essential factor in both an individual's and organization's ability to meet the rapidly changing demands of a technology-driven world stage. The shelf life of existing skills is short. Starting an upskilling journey can be daunting for the professional and the enterprise. Year over year, we have seen subtle changes in the rise (or fall) of specific practices, functional areas, and automation considerations. We believe these changes reflect the times (such as the pandemic) and the increasing adoption of Agile, DevOps, Site Reliability Engineering (SRE), Cloud Native and Cybersecurity. One area has remained consistent – the need to focus on human skills with the same intent as technical skills.

Interestingly, the three key challenges to achieving digital transformation are virtually the same across the regions:

- Insufficient skilled resources (talent and skills gaps)
- Budget constraints
- Excessive manual work (known as toil)

It is clear from the data that the availability and retention of skilled, passionate, happy humans will be the deciding factor in adaptability and competitive advantage.

Last year, we had over 6,000 downloads of the 2021 Upskilling Report. I sincerely hope that the insights contained in this year's reports provide ongoing value to its readers.

4 things to do with this report

Understand the skill gaps within IT organizations today.

Review the top must-have skill categories.

Assess each skill category and see how you compare.

Take some action around your skill development.

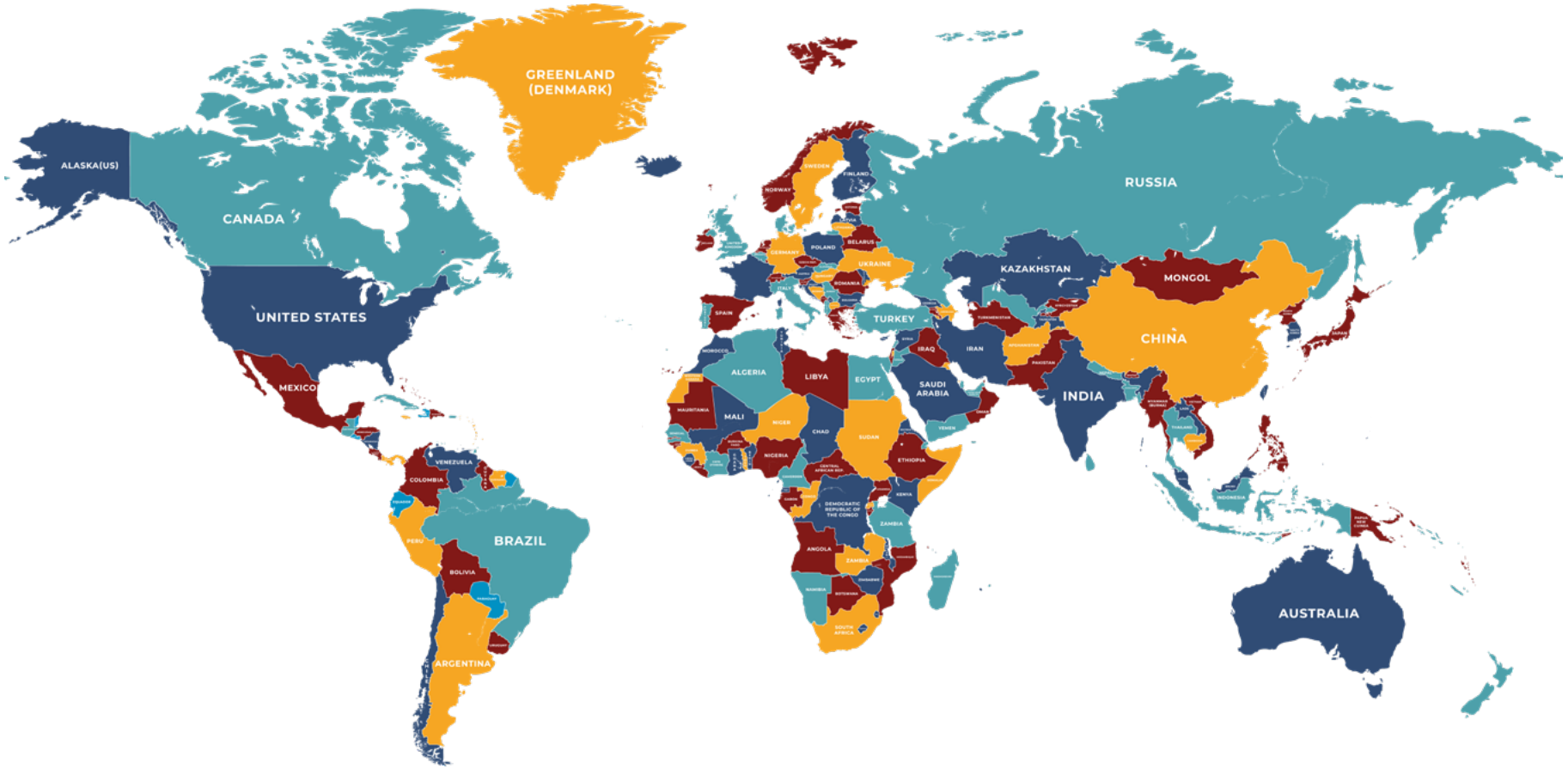
Demographics

2,476
Global Respondents

Over
58,000
Data Points

120
Countries Participated

4
Years Running



Contents

6 Executive Summary
7 Key Takeaways
8 Challenges That Shape IT Transformation
11 Insufficient IT Resources and IT Skill Gaps Across Key Capabilities are Dramatic
15 DevOps Remains a Driving Force in IT Transformation
17 Deep Dive Into the Top Five Must-Have IT Skill Capabilities
21 Process and Framework Skills Capability
26 Human Skill Capability
31 Technical Skills Capability
34 Automation Skills Capability
36 Leadership Skills Capability
38 The Truth About Upskilling in Global IT Organizations Today
40 Technical Debt… Yes, But One Must Also Address Talent Debt
44 Upskilling is a Professional and Organizational Imperative
46 The Upskilling IT Skill Wheel
50 References and Pointers
55 Author and Biographies
56 Index
57 Notes

Executive Summary

Currently, we see a variety of transformational challenges and changes such as skill gaps within organizations, labor shortages, the impact of automation on job roles, remote and hybrid working conditions, and continuous innovations in technology – to name a few. The question for IT leaders and individuals is: what can be done to help IT organizations, their teams and individuals survive and thrive? We argue that to thrive and remain competitive against this backdrop of changes and challenges requires fostering a culture of continuous learning and making upskilling and reskilling a top strategic priority. However, implementing a successful upskilling strategy requires a thorough understanding of what skills are needed today and what will be needed tomorrow in the near, middle, and long term.

A key part of an upskilling and reskilling strategy must be understanding the must-have skills. That is what we have set out to do here in this study for the fourth time with our research, but that is only half the battle. The second part is knowing how to develop the skills. This year, we found that fifty-two percent (52%) of our global respondents said that their organization has a formal upskilling (training) program. In comparison, only thirty-two percent (32%) indicated that they had one in our last year's research. Congratulations to those[1] who have initiated and are offering upskilling programs.

An upskilling strategy and making continuous learning part of the job helps organizations have the skills they need. In addition, an upskilling approach encourages individuals to grow and learn, and also enables organizations to leverage existing staff by reskilling to move into future-facing roles.

There are some excellent examples to learn from, such as companies like PwC and Salesforce. These organizations have successfully developed upskilling programs. For instance, PwC has created the Digital Fitness app[2] with training tools for various in-demand topics such as artificial intelligence, machine learning, and augmented reality. Employees and others can earn micro-degrees and certifications through the app, which is now available to the public. Another example is Salesforce and their Trailhead[3] digital upskilling program that allows learners to develop in-demand skills and earn credentials. To begin, participants select a career path (such as developer or data analyst) and then complete the "trail" for that career. These are some ideas for putting upskilling into practice, but first, it is essential to understand the key must-have skill capabilities and must-have skills. We are excited to share our research and findings with you.

Key Takeaways

1. Insufficient IT resource skills are a huge challenge across the globe. Forty percent (40%) of survey respondents said that the resource and skill shortage is one of their top three challenges today. Additional research shows dramatic skill shortages within the technology and IT area globally.

2. Addressing technical debt must be paired with addressing talent debt. While technical skills are a must-have skill priority, technology without human skills, will not accelerate innovation and transformation.

3. Upskilling is a professional and organizational imperative. Continuous learning must be foundational for leaders and individuals and requires a mind-shift across leaders and individuals.

Challenges That Shape IT Transformation

The average time a company is listed on the S&P 500 index is forecasted to shrink to 12 years by 2027[4]. About half of S&P 500 companies will be replaced at the current rate over the next 10 years. To avoid extinction, companies must dramatically increase the pace at which they develop, deploy, and enhance products and services. At the same time, they must continue to run their legacy systems — which generate today's revenue — at peak performance, all while improving security and reducing costs to meet competitive pressures.

IT Transformation is an Essential Prerequisite for Digital Transformation

The power of technology has or will change how a company operates, differentiates or gets ahead. In 2016, global overall IT spending was at $3.6 trillion, while predictions for 2022 are that global IT spending will be at $4.5 trillion, according to Gartner[5]. All levels of company executives realize that continuous technology innovation is key to their companies' survival and success. When it comes to creating a digital business, technology is one of the key pillars which must be addressed to bring desired changes. IT transformation and digital transformation are sometimes used interchangeably. Figure 1 below describes the similarities and differences between the two.

FIGURE 1

Culture, Automation, Lean, Metrics and Skills are Connecting IT and Digital Transformation

	IT Transformation	Digital Transformation
What is it?	IT transformation is the overhauling of IT system and infrastructure of an organization to improve overall efficiency and delivery capabilities.	Digital transformation is the process of using digital technology in all business areas, across human interactions and within processes and services to continually improve how organizations deliver value to their customers.
What is the Approach?	IT transformation is the modernizing of its information systems, infrastructure and operating models to improve productivity, decrease technical dept, increase velocity, flow, and the quality of what is developed and delivered.	Digital transformation involves people, processes, products, and the culture of an organization.
Who are the People Involved?	Mainly IT and some lines of business.	Entire organization.
Scope	Infrastructure, operating model, software, data management, processes, frameworks, way of working, automation.	Applies all of the digitial transformation aspects towards a digital business.
Metrics	IT KPIs (including organization and technology)	Business KPIs (including organization and technology)
Essential for Success	Culture, Automation, Lean, Metrics, Skills (CALMS)	Culture, Automation, Lean, Metrics, Skills (CALMS)

Source: DevOps Institute

Many IT organizations need to introduce new capabilities while refreshing their legacy capabilities to enable digital transformation. Unfortunately, the larger the company and its technology debt, the more difficult it is to introduce changes. The overall goal for many change initiatives is to improve efficiency, velocity, security and quality of services and products for sustaining competitiveness in the digital economy. Digital transformation can drive IT transformation, but it can also be the other way around.

> "In many enterprises there is an ongoing push-pull phenomenon that occurs between IT and the business. Sometimes IT experiments with new technical capabilities that are leveraged to achieve true business transformation. In other instances, the business has clear operational objectives and business leaders place demands on IT leaders to devise technical solutions that will enable those objectives to be achieved."
>
> Mark Settle, CIO

Insufficient IT Resources and IT Skill Gaps Across Key Capabilities are Dramatic

From a global perspective, the biggest challenge for IT organizations today is human talent. Additional research confirms this.

In our fourth annual Upskilling IT survey, we asked which top three challenges our survey respondents currently face within their IT organization. Here is what we found (see Figure 2):

By 2030, there will be a global human talent shortage of more than 85 million people, or roughly equivalent to the population of Germany. Left unchecked, in 2030 that talent shortage could result in about $8.5 trillion in unrealized annual revenues.

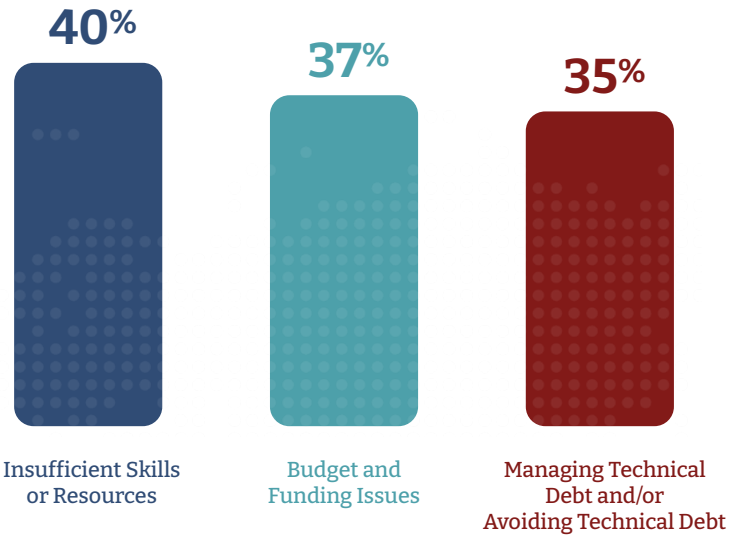
Only 29% of tech companies believe they have the right IT talent

There will be a global shortage of over 545K software developers by 2026

The great resignation: 4 Million Americans quit their job in July 2021

FIGURE 2

Top Three Challenges: Insufficient Skills Or Resources Are The Top Global Challenge For IT Organizations



QUESTION

What are the top three challenges your enterprise IT organization is currently facing?

N=1,875

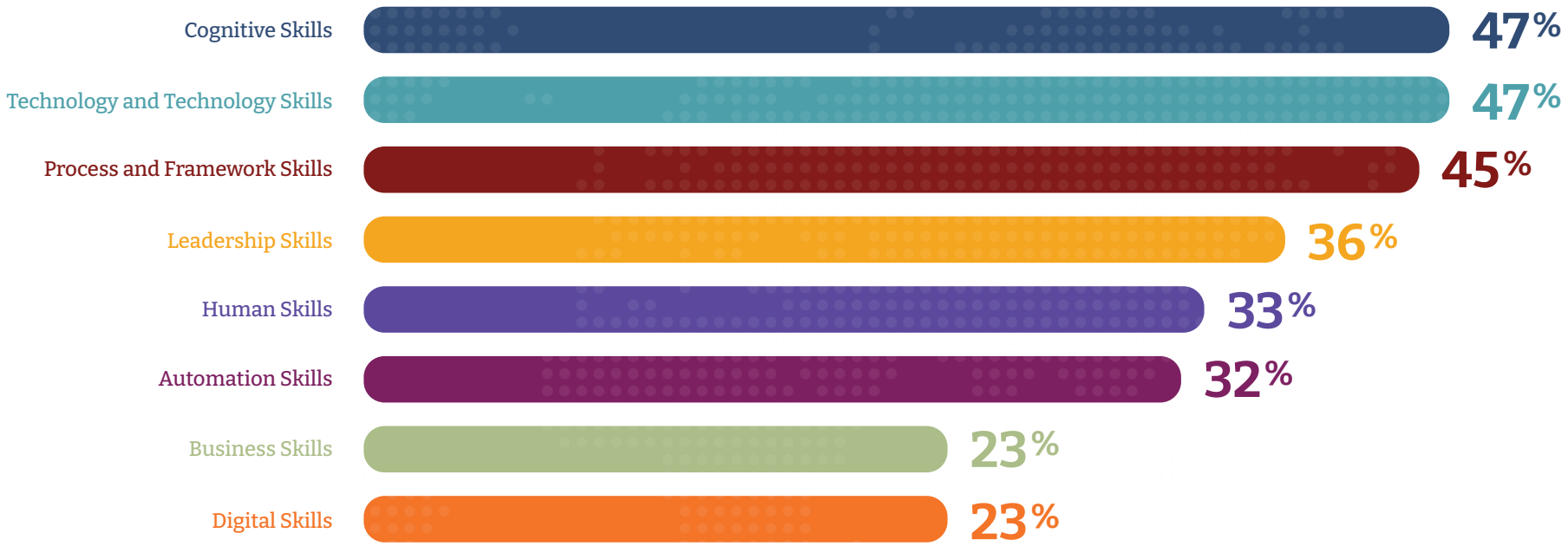
Insufficient resources and skill gaps are the top global challenge. From a worldwide perspective, forty percent of our respondents said that the resource and skill shortage is one of their top three challenges today. Additional research shows dramatic skill shortages within the technology and IT area globally.

Most acute skill gaps are around cognitive, technical, process, and framework skills. To identify skill gaps, we leverage eight skill capabilities that we have used for the past four years in our research. Our survey explored the position that business leaders and individuals had toward each relative to the gaps they are seeing (see Figure 3).

The global macro-regions rate the top three challenges almost the same. Upon examining the top three gaps in skill categories across the regions, we can see that the Asia Pacific rates insufficient skills and resources as the highest skill gap (see Figure 4).

FIGURE 3

The Top Global Skill Gaps Within IT Enterprises Today



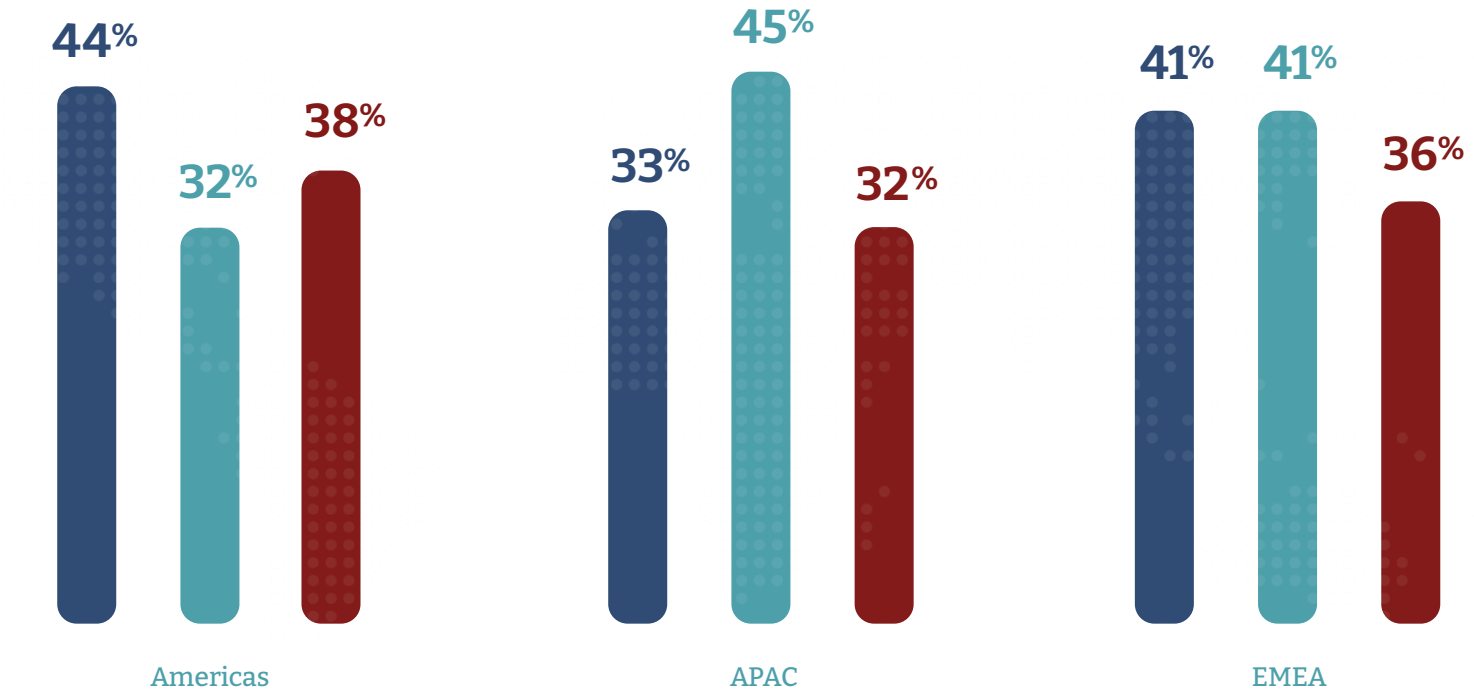
QUESTION

Recent research indicate skill shortages within IT enterprise organizations today and predict skill gaps in the future. In which of the following areas is your IT enterprise organization already experiencing skill gaps? (Select all that apply)

N=1,722

FIGURE 4

Regional Top 3 Challenges Vary Slightly



QUESTION

What are the TOP THREE challenges your enterprise IT organization is currently facing?

N= 1,875

...But Human Skills, Knowledge, and Abilities Will Make the Difference, Not Technologies

A study[6] conducted by the Center for Economics and Business Research finds that human capital represents a potential value of $1,215 trillion to the global economy. It is 2.33 times that of physical capital, including tangible assets like technology, real estate, and inventory. While there is much conversation about artificial intelligence, robots, machine learning, and many leaders believe[7] that technologies are the breakthrough, the truth is that technology might be significant. Still, without human skills, knowledge, and abilities, innovation does not just happen[7].

The Three Pillars of People, Process, and Technology

People, process, and technology (PPT) are the essential pillars of any organizational operating model. The PPT framework was developed in 1960 and describes how the three elements interact. Simply stated, people do the work, whereas people use processes to make work more efficient, and technology supports tasks and is used for automation.

While the pandemic has changed everything around us, the most significant impact was that it accelerated the somewhat fuzzy digital transformation[8] initiatives within public and private organizations. Digital transformation manifested itself in companies like Equifax, Monsanto and Mattel. The different ways[9] include improvements in customer experience, operational agility, culture and leadership, workforce enablement and digital technology integration.

> "While there needs to be balance among the three pillars, Mark Settle, seven time CIO says ` Doctrinal technologists believe that technology is the wellspring of IT's value, processes are nothing more than institutionalized administrivia that must be endured, and people are interchangeable piece parts required for the maintenance of technical systems. Experienced leaders – at some point in their careers – come to the realization that exactly the opposite is true...people first, processes second and technology third."
>
> Truth from the Valley: A Practical Primer on Future IT Management Trends, Book by Mark Settle

> "But while more people are talking more about digital transformation, it's pretty clear that most are missing the point. As sexy as it is to speculate about new technologies such as AI, robots, and the internet of things (IoT), the focus on technology can steer the conversation in a dangerous direction. Because when it comes to digital transformation, digital is not the answer. Transformation is ."
>
> Source: George Westerman is a principal research scientist with the MIT Initiative. His article[31] was top 5th report read in 2017.

DevOps Remains a Driving Force in IT Transformation

DevOps practices have had a pervasive impact on how IT organizations operate and how businesses succeed for over a decade. They will continue to do so in the future. Here is a short summary.

2008

Initial DevOps goals are to reduce silos and increase frequency and depth of interaction with business practitioners. In a nutshell, DevOps was coined when key thought leaders determined that there is a better way on how developers and IT operations professionals should work together. The siloed teams were concerned only with their fiefdoms, long hours, botched releases, and unhappy customers who were no longer able to sustain the demands of the business.

2009

Culture mattered, and continuous learning was highlighted as a key foundation of DevOps. Culture, transparency, communication, and collaboration between teams are important. However, the understanding that the software engineering culture that adopts continuous learning gave DevOps adoption another booster. Those who practice and understand DevOps know that it is (and requires) an organizational culture shift that emphasizes continuous learning and continuous improvement through team autonomy, fast feedback, high empathy and trust, and cross-team collaboration[10] (Forsgren et al., 2018).

2011

"Software is eating the world," wrote Marc Andreessen, co-founder and general partner of venture capital firm Andreessen Horowitz, in an essay[11] published in The Wall Street Journal in 2011. Software and with-it software engineering, the life cycle and how 'things' went from design to deployment became a big focus point. This gave another lift to the DevOps initiative, and many IT leaders set the goals towards a high-performing-engineering organization[10] (Forsgren et al., 2018). Multidisciplinary teams which manage the entire lifecycle of a product, understanding, automating and managing the workflow rose in importance. Developers and operation teams work together with a greater understanding of end-user requirements and needs.

2015

Chief Digital Officer to lead the effort: McKinsey[12] pointed out that the chief digital officer position (CDO) is increasingly becoming a leadership role. Some sources[13] estimated that the number of people in CDO roles doubled from 2013 to nearly 1,000 in 2014, and the number of global CDOs will double again in 2015, to some 2,000 CDOs.

2016

Forrester Digital Transformation Forum. While the history of digital transformation[14] started in the 1940s, a key event was this[15] forum where the digital experience was first coined, and organizations started to put in place Agile teams and DevOps became even more important as the velocity and quality of software and applications delivered are a key metric for an improved digital experience.

2020

Pandemic accelerates the digital economy. The transformation to digital business was accelerated in 2020 by the worldwide pandemic, which changed the speed at which digital services were made available. According to McKinsey's study[16] in July 2020, 899 C-level and senior executives reported that they moved 20 to 25 times faster than they thought possible on implementing online purchasing/services for their customers. In our 2021 Upskilling[1] report, we also found that 23% said that they expanded the DevOps team(s) in the midst of the pandemic.

2022

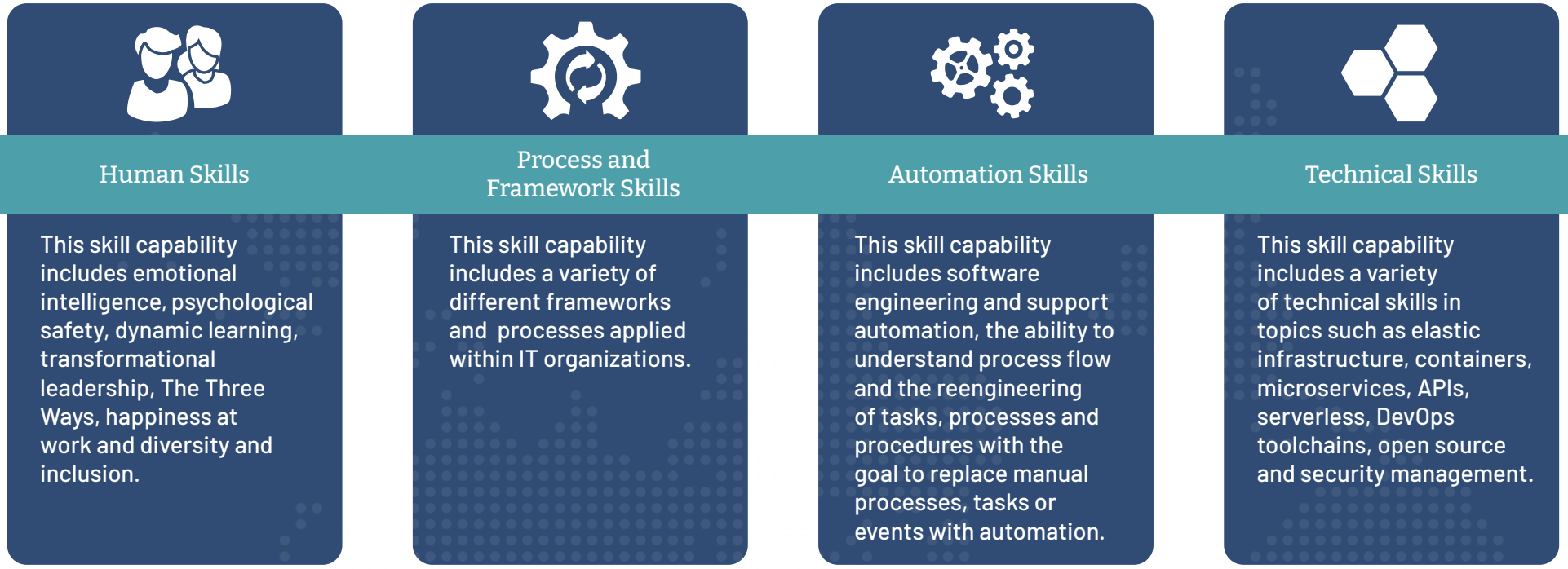
Digital Transformation spending continues past pandemic. According to IDG, 89% of all companies have already adopted a digital-first business strategy or plan to do so, and about 70% of companies either have a digital transformation strategy in place or are working on one. Forrester suggests that only 21% of companies believe they've completed their digital transformation. The ownership or sponsorship of digital transformation lies most often with the CIOs (28%), with CEOs increasingly playing a leadership role (23%) and 65% of global gross domestic product is expected to be digitalized by 2022.

Deep Dive Into the Top Five Must-Have IT Skill Capabilities

The IT skill capabilities are powerful categories essential for developing the skills, knowledge, and abilities of individuals and teams. They are the starting point for developing an organization or individual upskilling roadmap to enable the greatest chance of success within your organization or anywhere else in leading and evolving IT organizations. While we have used these same skill capabilities over the past four years (see Figure 5), this year we added leadership skills, business skills, cognitive skills and digital skills (see Figure 6).

FIGURE 5

IT Skill Capabilities

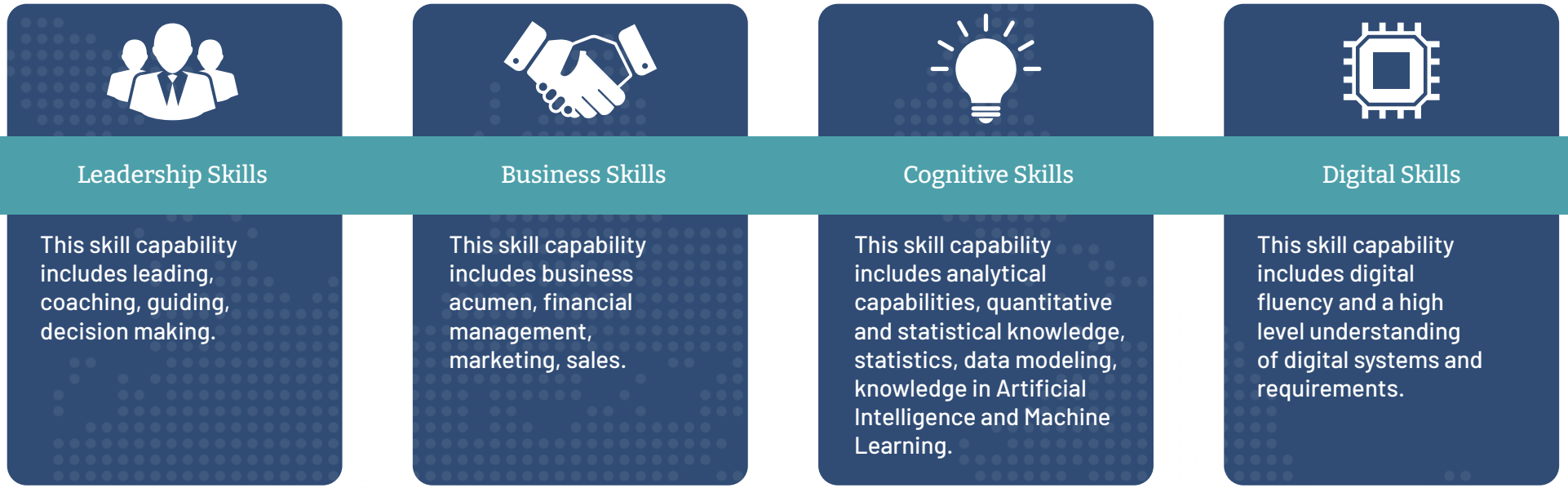


SOURCE

DevOps Institute

FIGURE 6

Additional IT Skill Capabilities



SOURCE

DevOps Institute

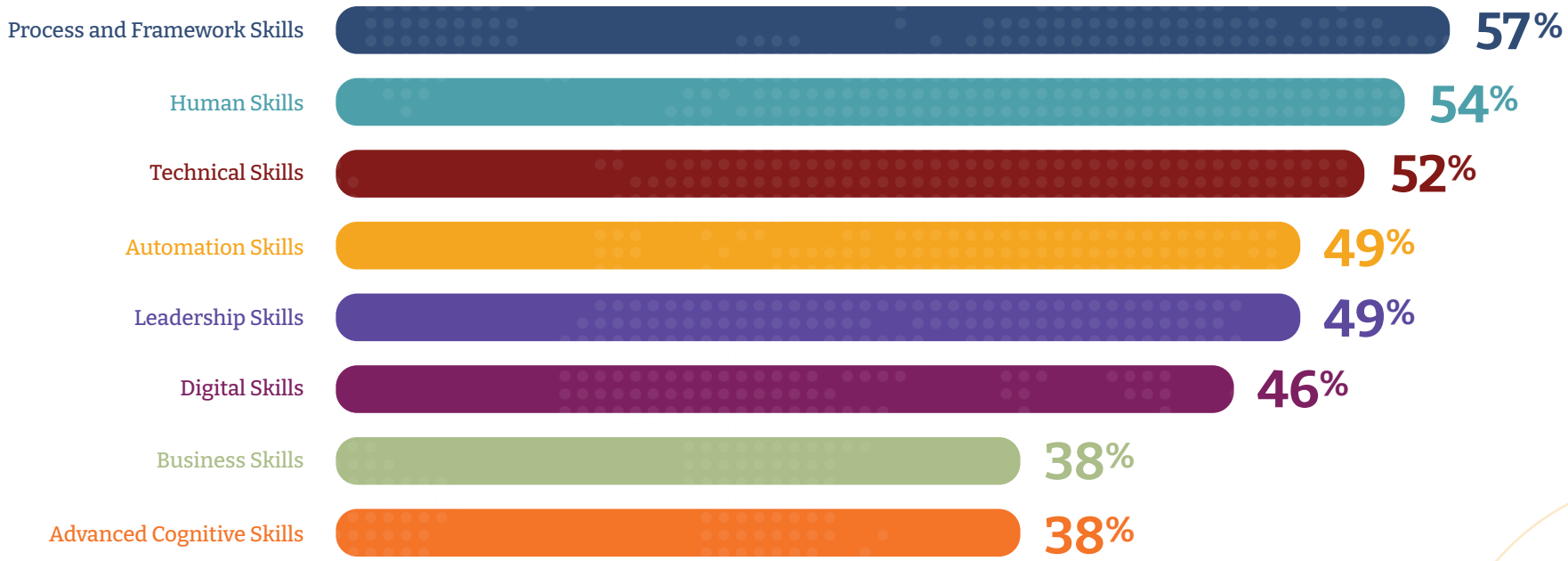
Upon examining the priorities across the skill capabilities, our survey data shows that the essential combination of skill capabilities for a successful IT transformation is (see Figure 7):

The Top Five Global Skill Capabilities

1. Process and Framework Skills
2. Human Skills
3. Technical Skills
4. Automation and Automation Tool Knowledge
5. Leadership Skills

FIGURE 7

Essential IT Must-Have Skill Capabilities for IT Organizations



QUESTION

How would you rate the importance of the following major skill categories for modern IT enterprise organizations in the future? (Select less important, important, critical)

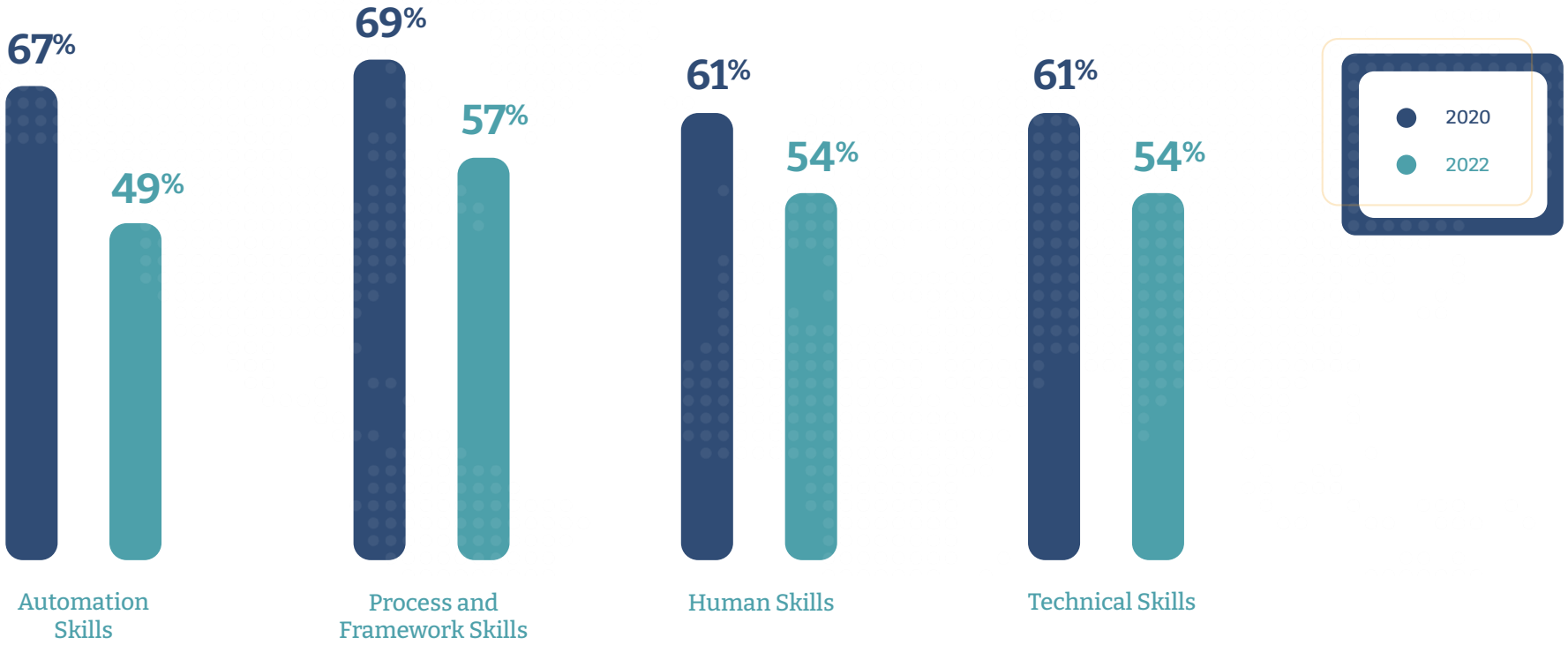
N= 1,789

Differences on the Importance of Must-Have Skill Capabilities Pre and Post Pandemic

The comparison of the skill capabilities on pre vs post pandemic priorities can be found in Figure 8. There seems to be a dramatic change in the across-the-board reduction in the designation of must-have skills. While caveats apply to interpret the results, we suspect that organizations are becoming less demanding in their hiring practices for must-have skills due to the shortage of skills in the post pandemic world.

FIGURE 8

Pre and Post Pandemic Must-Have IT Skill Capabilities



QUESTION

How would you rate the importance of the following major skill categories for modern IT enterprise organizations in the future?(Select less important, important, critical)

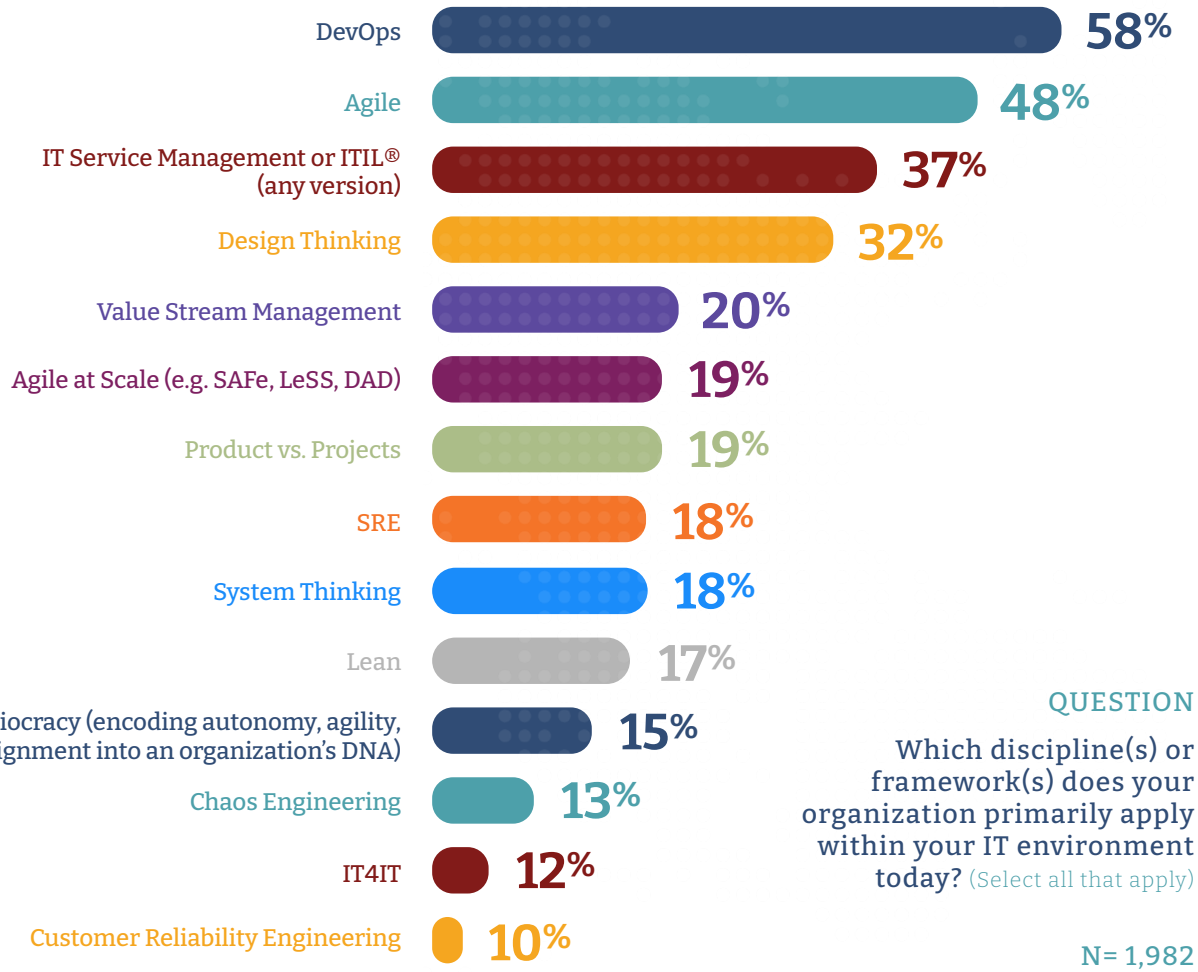
N= 1,789

Process and Framework Skills Capability

According to Gartner[17], an "information and technology (I&T) operating model represents how an organization orchestrates its I&T capabilities to achieve its strategic objectives". The continuous drive to accelerate, improve, and introduce new products and services to the market forces traditional IT organizations to update their operating models. While modern organizations such as Netflix started with modern operational models like DevOps and Agile, traditional IT organizations are also changing their operational models. Different operational frameworks are adopted (e.g., Agile, DevOps, ITIL) in various ways and at different levels within the IT organization (or beyond). This combination leads to a fused IT operating model leveraging various frameworks and processes (see Figure 9).

FIGURE 9

The Fused IT Operating Model:
Comprised of a Mix of Process and Frameworks



QUESTION

Which discipline(s) or framework(s) does your organization primarily apply within your IT environment today? (Select all that apply)

N= 1,982

DevOps and Agile Remain the Cornerstones of IT Operating Models

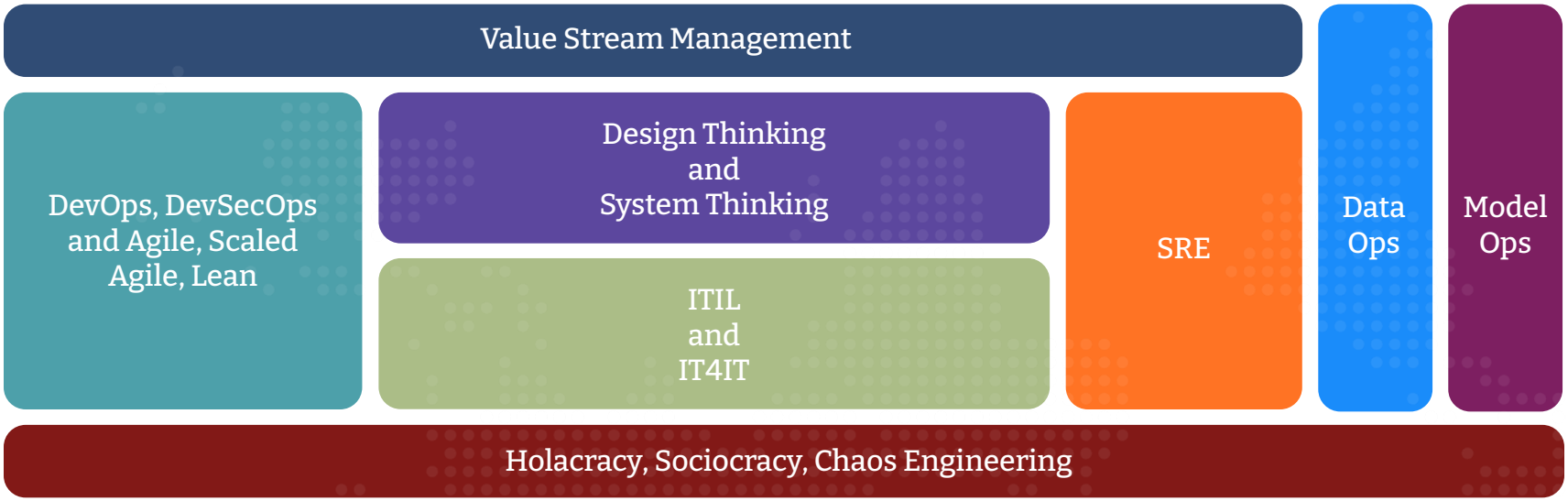
Fifty-seven percent (57%) of survey respondents selected process and framework skills as the most important must-have skill capability.

Almost all these different processes and frameworks focus on aiding IT teams with improvements on velocity, quality, and security within their products and solutions. There is not one perfect operational framework but rather the combination of them all which together form a fused IT operating model.

A combination of powerful operational frameworks shapes the operating model of the future. The top five must-have processes and frameworks within IT enterprises in the future are DevOps and DevSecOps, Agile, Site Reliability Engineering (SRE), Design Thinking and System Thinking and ITIL. The largest portions are attributed to DevOps and Agile, which have received the highest must-have votes (see Figure 10a).

FIGURE 10a

Conceptual Model: The Must-Have Operating Models (aka Process and Frameworks) of the Future



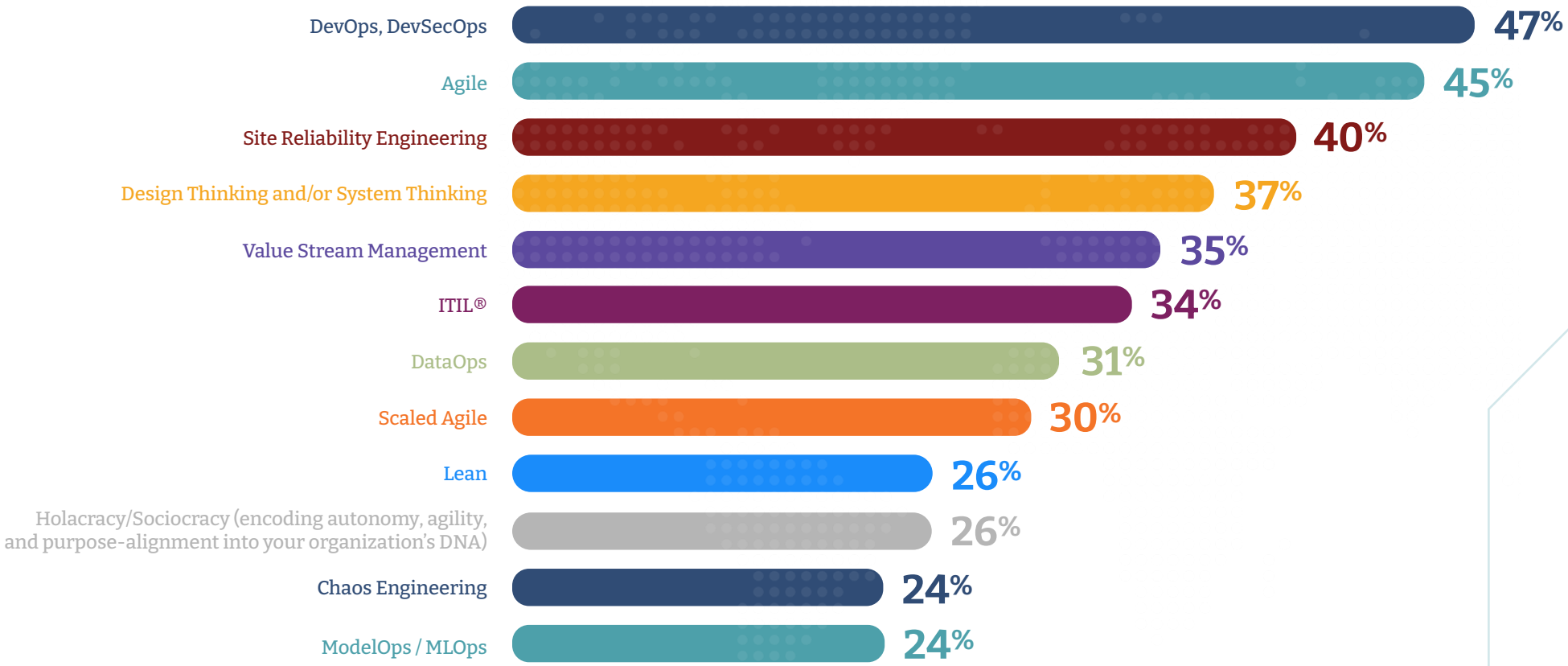
QUESTION

How would you rate the importance of the following operating models within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,512

FIGURE 10b

The Must-Have Operating Models (aka Process and Frameworks) of the Future



QUESTION

How would you rate the importance of the following operating models within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,512

Value Stream Management (VSM) is an important must-have framework. 35% of respondents voted Value Stream Management as a must-have framework, compared to 39% in 2021. Leveraging VSM involves looking at an entire value stream from initial value stream mapping to understanding how to continually reduce waste and produce effective flow across the different processes. This capability requires making processes visible, analyzing bottlenecks, and requires big picture thinking. Research[18] from the Value Stream Management Consortium describes some challenges and the current state of VSM in more depth.

SRE as an operational framework is a must-have for 40% of respondents. This operational model balances the work of IT operations teams between automation and troubleshooting, all to improve across a wide area of topics in a continuous way. Last year, 47% of respondents voted for SRE as a must-have framework. As chaos engineering is a subset of SRE, we assume that some of the must-have votes shifted there.

DevOps and DevSecOps are coming together. Beyond achieving software velocity, DevOps is driving opportunities to provide improvements across the entire software delivery value stream for fast and continuous feedback. Combined with security, 47% of our survey respondents said that both DevOps and DevSecOps are critical must-have operational models.

The relationship between DevOps and Security is improving. We asked to describe the relationship between DevOps and Security. Forty-six percent (46%) of respondents said there is tight collaboration between the two teams in their organizations, with regular joint meetings and well-used channels. Twenty-eight percent (28%) said there was some collaboration. Six percent (6%) said security is completely embedded into DevOps, with one team supporting both DevOps and Security.

> "In a world of escalating threats and increasingly ramped up compliance requirements, transparency collaboration and context among development, operations, and security teams is absolutely critical."
>
> David DeSanto,
> GitLab VP of Product

> "Chaos Engineering shifts our focus to what is critical - being 100% prepared for outages, regardless of the cause. Software systems have become so complex that it is impossible to develop a test case for every scenario. With chaos engineering, we instead learn how to sustain site reliability so an end-user never knows an outage occurs. Sorting out root-cause analysis happens later."
>
> David DeSanto,
> GitLab VP of Product

New methods and practices are rising as a must-have operational model. We checked for Chaos Engineering, DataOps, and ModelOps as we saw these best practices or new operational models become part or subsets of existing ways of working. All three received high votes for being critical. Gartner[19] predicts that 40% of organizations will adopt Chaos Engineering by 2023.

ITIL is the fourth most important operating model. When we asked our survey respondents how they would rate the importance of ITIL as an operational model within the IT enterprise organization in the future, 34% rated it as a must-have.

"Enterprise AI programs have evolved through several phases over the last 5-6 years, and each phase has brought new challenges. In the first wave, the challenge was to automate data science and saw great improvements in AI development tools. In the second wave, the challenge was to get models from development into production, and saw significant investments in MLOps to help with the handoff of models from data science teams in business units to IT. As enterprise AI matures and enters the 3rd wave, with a rapidly growing number of models making more and more business decisions, the challenge has now shifted to AI governance and accountability. This is driving the need for ModelOps - the enterprise capability that standardizes, automates and governs AI at enterprise speed and scale."

Stu Bailey, Co-founder and Chief Enterprise AI Architect, ModelOp

"ITIL continues to provide important guidance on how to effectively manage technology-based services. ITIL is least valuable when it is imposed as a standard, and most valuable when it is used as input – along with appropriate approaches, standards, frameworks and methodologies – to craft strategies, business models and operating models that will make organizations successful in a world that is becoming increasingly digital. Those using ITIL will do well to consider the full range of practices, and not limit themselves to the focus of operational ITSM, such as incident, problem, change, and request management."

David Cannon, Executive Vice President, nfiniti3

Human Skill Capability

The Human Skill Capability Ranks as the Second Highest Must-Have Skill Capability, but Gaps Exist

Fifty-four percent (54%) of survey respondents said human skills are a must-have skill capability.

Human skills are how we think and who we are, and how we interact with and navigate through situations with others. The recruitment market is on fire for individuals with technical skills, and technology changes are happening at an accelerating pace. But what is essential to remember is that it takes humans with high learnability and curiosity to leverage new technologies, operating models, or whatever comes next. Here is what we know:

Opinions differ on which skills are important. While most experts agree on the need for human skills in any team, opinions vary greatly on which skills are essential. We asked our survey takers how they would rate the importance of a variety of human skills within the IT enterprise organization in the future. We found that the following human skills are essential must-have skills for the IT enterprise organization in the future (see Figure 11). These must-have human skills will help you explore what areas to start developing or coaching within your teams. Our human skills heat map also will guide you in planning for human skill education and training. For details on what is included in each of the human skill categories in details, please refer to Appendix A.

Be aware of skill gaps. To find out where there are skill gaps within the human skill capability, we asked our survey respondents to select the top three human skill gaps that are most apparent within their IT enterprise organization today. According to our survey respondents, the top five human skill gaps are personal value commitment, collaboration and cooperation, creativity and entrepreneurship, interpersonal skills and flexibility and adaptability (see Figure 12). Figure 13 compares the human skill gaps with the must-have human skills. While collaboration and cooperation are ranked as the top human must-have skills, the highest skill gap across all global survey respondents is within both.

Leaders selected problem-solving, diversity and inclusion as their top five must-have skills. In analyzing the difference between how leaders and individual contributors answer how they would rate the importance of a variety of human skills, we found that leaders are putting more emphasis on problem-solving, diversity and inclusion (see Figure 14).

FIGURE 11

Global Must-Have Human Skills Heat Map

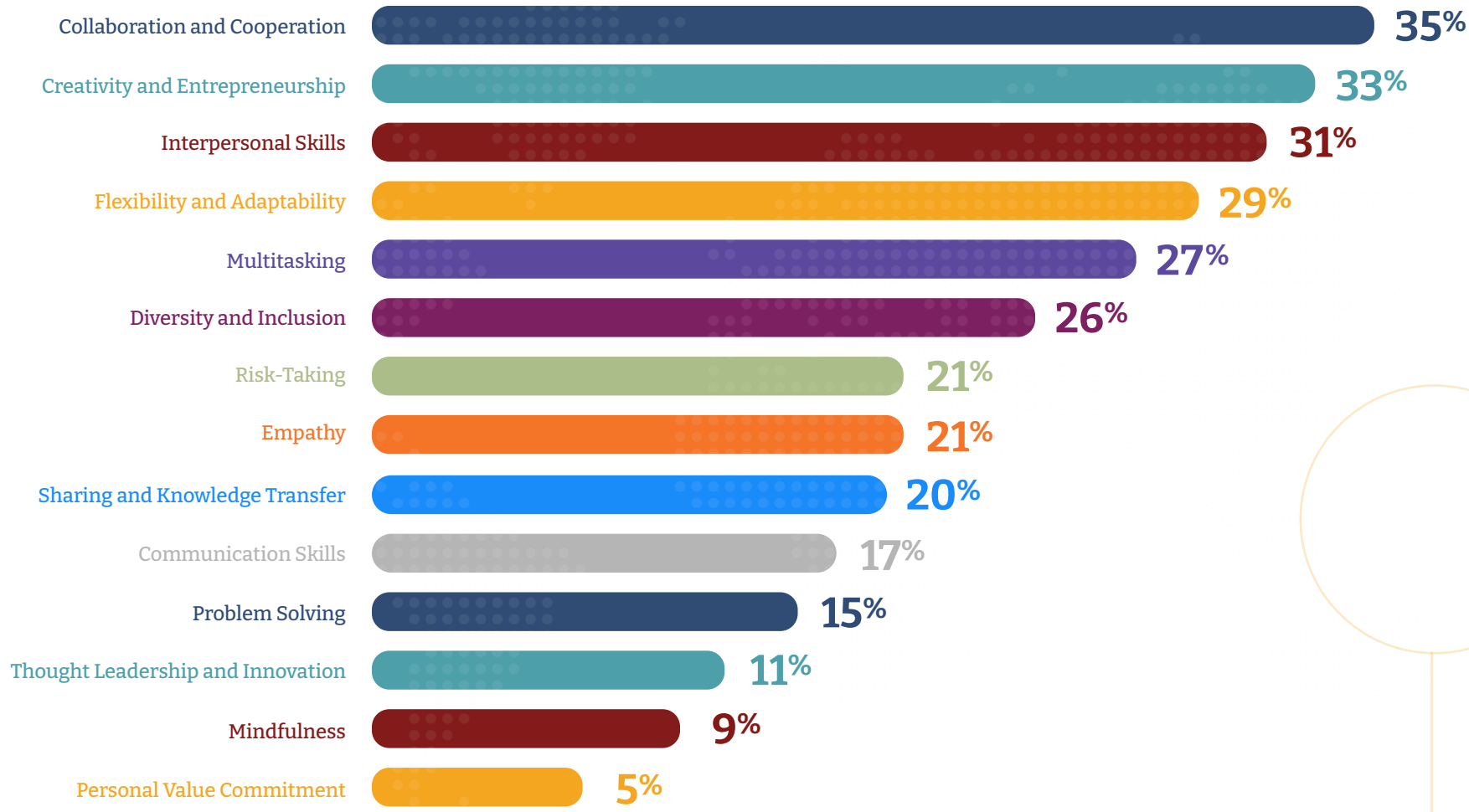
QUESTION

How would you rate the importance of the following human skills within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,547

FIGURE 12

The Biggest Human Skill Gaps: Collaboration and Cooperation, Creativity and Entrepreneurship and Interpersonal Skills



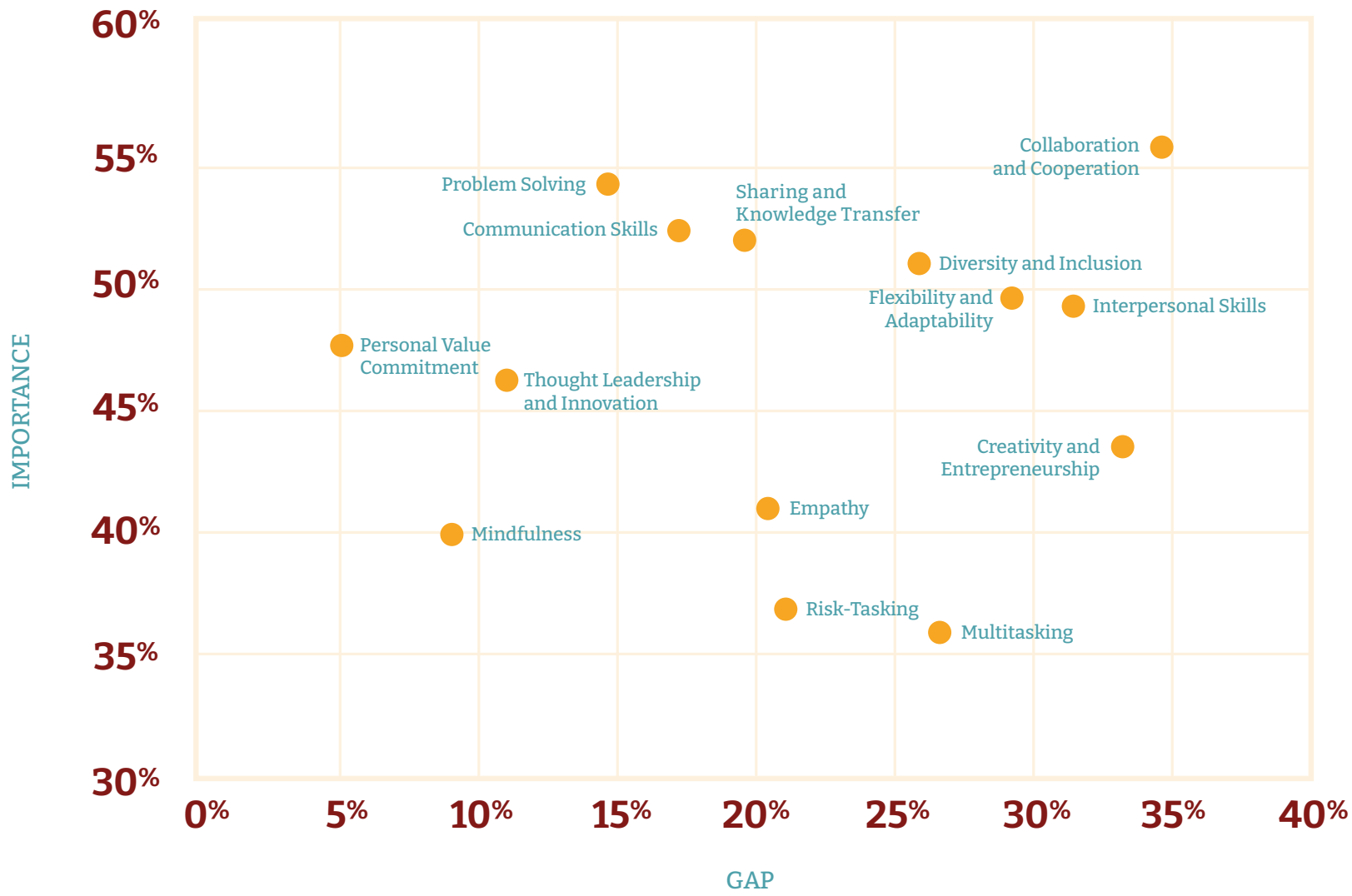
QUESTION

Select the TOP THREE human skill gaps that are most apparent within your IT enterprise organization today.

N= 1,627

FIGURE 13

Important Human Must-Have Skills vs. Human Skill Gaps



QUESTION

How would you rate the importance of the following human skills within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,654

QUESTION

Select the TOP THREE human skill gaps that are most apparent within your IT enterprise organization today.

N= 1,627

FIGURE 14

Leaders Look for Problem Solving and Diversity and Inclusion Skills

QUESTION

How would you rate the importance of the following major skill categories for modern IT enterprise organizations in the future? (Select less important, important, critical)

N= 1,789

Technical Skills Capability

Leverage Technical Skills to Unlock Potential for Innovations

Fifty-two percent (52%) of survey respondents selected technical skills as the third must-have skill capability.

When researching the priorities of CIOs, CFOs, and their business partners across a variety of sources, we found the following trends:

The technology predictions from different market research vendors align. Market research firms such as Gartner, Forrester, and IDC agree on the continued growth of cloud, containers, smart infrastructure, security, hyper-automation, artificial intelligence and machine learning, and security, just to name a few. In line with these predictions are the growth plans across these topics in 2022. Additionally, 59% of global CIOs[20] say that tech budgets have increased for 2022 and will be back at pre pandemic levels to ensure the availability of technology for innovation (See Figure 15).

Disruptive technical skills pay more. As Burning Glass[21] defined, disruptive means that these skills are high value and not everyone has them. To the delight of those who possess these skills, it puts upward pressure on salaries. While employers need people with such skills, they also need to pay premiums for individuals having them. The average salary premiums for disruptive skills areas range between $4,200 to $25,000 in 2020.

Technology without skills is meaningless, but organizations do a good job matching tech to skill needs. Clearly, technologies and automation are critical success factors for any successful transformation. Imagine the technology without the actual skills to leverage them - meaningless! Leading organizations are evolving their workforce development strategies based on the strategic goals of the business. Sixty-nine percent (69%) of our survey respondents confirm that they match the skill needs to the business outcome they want to achieve, or they predict which skills are required by evaluating the current skill level within a team.

Don´t get overwhelmed by the vast number of technical skills. From our DevOps Institute community members, we know that many of them are overwhelmed by which technical skills they should expand on. Are you one of these people? Does the very thought of which skills to develop, e.g., data analytics, coding, software development, and cloud computing, make you nervous? If so, you're not alone. We asked our survey respondents which are the must-have skills around technology. We found the must-have technical skills for the IT enterprise are: understanding cybersecurity, modern compute technologies such as serverless, microservices, container orchestration and application technologies (see Figure 16).

Leaders and individual contributors are mostly aligned on the top must-have technical skills. When analyzing the difference between how leaders and individual contributors answer how they would rate the importance of a variety of technical skills, we found no differences (see Figure 17).

FIGURE 15

Security and Improving IT Operations and Systems are Among the Top Activities CIOs are Currently Focusing On

SOURCE

State of CIO 2022, Foundry

FIGURE 16

Top 5 Must-Have Technical Skills

QUESTION

How would you rate the importance of the following technical skills within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,580

FIGURE 17

Leaders and Individual Contributors Agree On Top 5 Must-Have Technical Skills

Automation Skills Capability

Automation Takes Humans Away from Mundane Tasks

Forty-nine percent (49%) of survey respondents selected automation skills as the fourth must-have skill capability.

IT operational excellence defines the "what" of IT transformations, while the technologies define "how" you will get there. But that is only half of the story as there are many tasks, events and processes within IT and the business which can be automated. As we move into this category, we are only focusing on automation within IT and other automation topics such as hyper-automation or business process automation are out of scope.

Automation will provide efficiency. Automation is a critical undertaking as it enables, changes, and adopts how IT and other business units operate. Processes, tasks, and decisions are key targets for automation work. The outcome of automation is to get work done faster, free up staff to focus on more innovative topics, and eliminate human errors.

Automation is a subset of innovation. Automation accelerates the delivery of IT infrastructure and applications by automating manual processes. The potential applications of automation are nearly infinite. We had selected 25 automation technologies and asked our survey respondents to rate their importance for individuals in terms of which ones are critical must-haves of these automation tools within the IT enterprise organization of the future.

Continuous everything is the future. Automation across software and applications can be done during the plan, design, test, code, deploy, release, and monitor stages. The automation goals should be to reduce technical debt, increase velocity and incorporate security for quality and reliability. The completeness and sequence of these phases can be compromised, but it is essential that there is an automation path throughout these sequences. Organizations have many tools. The adoption of the different IT automation tools varies. The point here is not which IT automation tools to implement, but rather to get a perspective on which are a must-have or critical automation skill or knowledge one should possess. Figure 18 shows the top five must-have automation skills.

FIGURE 18

Top 5 Automation Must-Have Skills: Continuous Everything

QUESTION

How would you rate the importance of being familiar with the following IT Automation tools within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,498

Leadership Skills Capability

Autonomous Teams Require Leaders that Lead - Not Manage

For the first time in our research, we have introduced the category of leadership skills. From our global data, we have learned that leadership skills are the fifth must-have skill capability.

Forty-nine percent (49%) of our survey takers rated the leadership skill category as a must-have skill capability. Here are a few things to consider:

Modern organizations are enabling autonomous teams. Autonomous teams are several staff members who typically self-organize to accomplish various tasks. These teams have complete independence over what they do, including decision-making around who, what, when, where and why. They typically govern and control themselves, allocate resources, hire, train and terminate. They have complete responsibility for a product or service.

Autonomous teams must have some rules. Typically, there are a variety of guardrails set by the autonomous team in conjunction with its human leader. These guardrails or rules enable the team members' safety and guard some critical items.

Autonomous teams need leaders instead of managers. While these teams manage themselves, the more distributed and self-managed a team is, the more important it is that all the members enhance their leadership skills. When we asked for the critical must-have skills of a leader, we found that diplomacy, empowerment and trust-building are must-have skills (see Figure 19).

FIGURE 19

Must-Have Leadership Skills: Diplomacy, Empowerment and Trust Building are Key When Establishing and Leading Autonomous Teams

QUESTION

How would you rate the importance of the following leadership skills within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,141

The Truth About Upskilling in Global IT Organizations Today

The following are important findings to highlight from our study and other research.

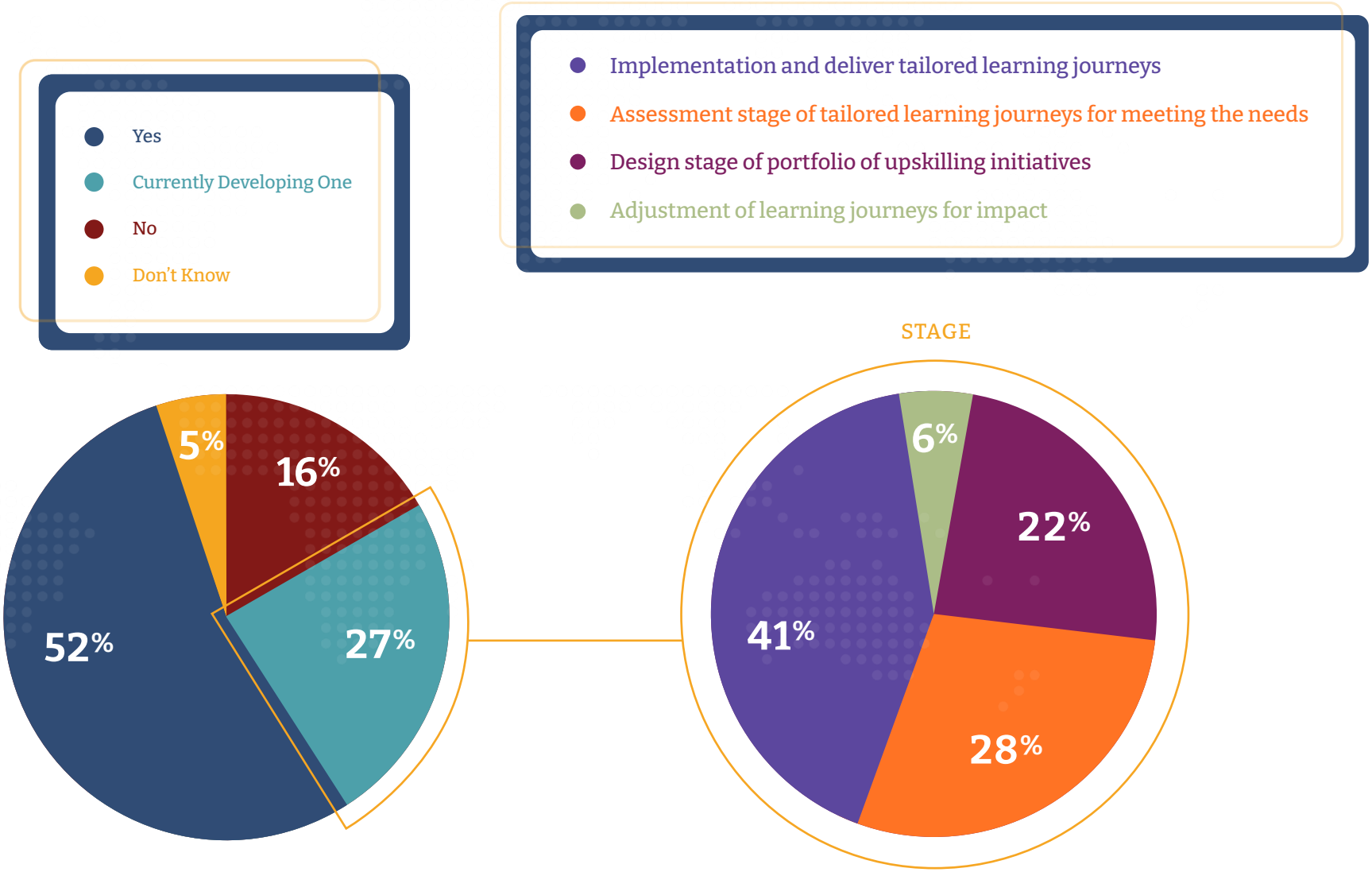
The majority of IT enterprise managers hire for technical skills. When asked what internal or external hiring option was preferred, 50% of respondents look for technical skills, whereas only 33% of respondents look for human skills.

Only 52% of IT enterprise organizations have a formal upskilling program. Twenty-seven percent (27%) are currently developing one, and upon further probing the stage of the upskilling program, we found that most of them are still in the assessment and design stage (50%) (see Figure 20).

The barriers to skill development are a mixed bag. When we asked, "What would you say are the current barriers to skill development within your organization? We found that lack of time (53%), lack of budget (47%), lack of offerings (32%), upskilling not a top priority for leadership (20%), and emphasis on hiring instead of upskilling (19%) as some excuses. For those resilient IT individuals eager for training, the predominant model for funding is that IT enterprise organizations either refund the employee for the training cost or an established but limited budget can be leveraged.

FIGURE 20

52% of Global IT Enterprise Organizations Have an Upskilling Program Today



QUESTION

Does your organization have a formal upskilling (training) program for IT team members?

N= 1,142

QUESTION

At what stage is the upskilling program today?

N= 1,142

Technical Debt… Yes, But One Must Also Address Talent Debt

IT leaders talk incessantly about technical debt and devise complicated, expensive, multiyear plans to remediate technical debt within their systems. Ironically, the people who built and maintained these systems are becoming increasingly less useful to their organizations as well, but IT leaders devote much less time and effort to remediating their talent deficiencies and limitations (Settle, 2016)[22]. If the pipeline of new talent entering the IT industry can't keep up with rising demand and rising retirements, then upskilling is the only viable talent debt remediation strategy.

> ""If we don't continue to learn we should acknowledge we reached our peak. But if we do commit ourselves to an ongoing learning mentality, we discover two things: (a) there is always something of great value to learn and (b) even the sky is not a limit for us to grow. We are boundless.' and that's exactly the mentality that drives innovation."
>
> Ori Mor, Chief Business Officer and Founder of Wi-Charge

Additionally, employee demographics, expectations, and current situations will impact productivity in the long run. Here are some of the ongoing changes which are happening:

Work-life balance or life-work balance? The term "work-life balance" or 'life-work balance' has been around for a while, but it has gained popularity due to the two-year work from home experience during the pandemic. Employers have been putting in a tremendous effort trying to determine the best way to appeal to millennial workers.

FUN FACTS

Did you know that Helsinki, Finland has the best work-life balance?

If you want to find out more

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The gig economy keeps growing: One of the phenomena that's less widely discussed is the 'gig economy' mentality in which highly skilled individuals are either (1) less interested in long term employment with a single employer, so they engage in contract work or freelancing with several companies, or (2) very susceptible to alternative offers of employment. The growth of the gig economy is projected[23] to rise to $455 billion U.S. dollars by 2023.

The 'Great Resignation' is not a one-time event. The so-called 'Great Resignation' is not a one-time event, but an anticipatory sign of a permanent rise in employee churn levels as knowledge workers can apply for jobs anywhere in the U.S. or the world.

The desire for work with a purpose. As millennials will comprise 75% of the workforce in 2025, it is essential to understand their philosophy and thinking. Research shows that they emphasize corporate social responsibility, have a great reverence for the environment, place higher worth on delivering value, and are adept at building communities around shared interests.

Minimize wasting employee's time. Additionally, it's equally important to drive engagement through minimizing time wasted at work – unnecessary rules, meetings, processes, etc. Employees like working in places where they can exercise their skills and not get caught up in process/ administrative overhead. This is an arena that company management actively controls and can make a difference.

A hybrid work environment is here to stay. In a recent survey[24] conducted by Riverbed, 94% of the respondents agree that a hybrid work environment helps recruit talent and remain competitive in the future.

Continuous Learning Principles to Extend Knowledge, Expand Capabilities and Enhance Skills

Successful enterprises are, by definition, continuous learning organizations, as Peter Senge pointed out in his seminal book 'The Fifth Discipline.' Their success depends on deeply held beliefs and behaviors that underscore the importance of learning within lines of business, functional departments, and individual staff members.

Continuous learning is an enterprise-wide survival skill. Technology has become far too adept at eliminating repetitive, rule-based work. Employees at all stages of their career must develop a visceral compulsion about expanding their knowledge, ability, and skills for their professional advancement and their professional survival. There is a difference between knowledge, ability, and skill. In too many cases, these three are mixed up and confused. Figure 21 describes the differences and the effects. Continuous learning is also essential for innovation.

Upskilling should be an ongoing activity where individuals, no matter which role, seek to improve their knowledge, abilities, and skills.

FIGURE 21

Knowledge, Ability and Skill are Not the Same: See Their Meaning Here

	Meaning	Effect
Knowledge	Contextual awareness of a topic.	You understand something well.
Ability	A trait needed to accomplish something.	Innate or learned ability.
Skill	Talents developed through upskilling.	You learned and can implement it for a result.

DevOps Engineers Example of Skills, Knowledge and Ability

A DevOps Engineer, for example, must have knowledge of various automation, software engineering and operation principles. The same DevOps professional should possess the ability to collaborate and communicate, conceptualize, analyse and problem solve. That DevOps Engineer must also exhibit the skills to identify toil, recognize issues and trends and implement technologies such as cloud and containers

Upskilling is a Professional and Organizational Imperative

Make Every Day at Work an Upskilling Experience:

- **Make your upskilling journey intentional.** Many think about upskilling narrowly to enhance or expand their technical skills. The breadth and depth of skills range beyond technical. Individuals should think more broadly and intentionally about the breadth of the Global IT Skill Wheel presented in Figure 22.
- **Getting on the shortlist means having a good chance of getting the job.** Survey respondents indicated that their number one hiring criteria are technical skills, but in many instances those are just 'table stakes' – they might get individuals to a second interview or on a shortlist. Still, they don't get you the job. The other skills are the determining factor in who gets the job offer in many instances.
- **Don't just think about now; think beyond now.** From your current perspective as an employee, upskilling is imperative not just to keep your current job or receive additional compensation, but to prepare and position yourself for the next job you want.
- **Be more thoughtful and holistic about the training you receive via your jobs.** Formal instructional training is not the only form of training. In many instances, it's the least effective because students rarely return to their jobs and immediately employ all the knowledge/skills they've just received.
- **Leadership experience and business knowledge will expand your career opportunities.** Individuals who extend their business and leadership accomplishments might have a better ability to progress in their careers. While people may want technical skills today, business knowledge and leadership experiences may be more important for the job you will seek five years from now.
- **Invite feedback on your job performance to target development needs.** Don't wait for your supervisor, team member, or business customer to provide feedback on how you are doing. Invite others to give you feedback. Once others know that you welcome feedback, you will receive more of it. Feedback is a key mechanism for measuring skill development and targeting development needs.

A study[25] conducted by Salesforce in April 2021 found 72% of workers claim they'd be more engaged with work if their company increased investments in training, while 69% believe they would be happier with their work. But there is more to an upskilling imperative beyond keeping employees happy about the amount of training they receive.

Leaders Must Extend Their Mindset from Training Towards Continuous Learning:

- **Leaders must adopt a continuous learning frame of mind and not just allocate a budget for training activities.** While there is importance in establishing a budget to ensure key training is happening, continuous learning should be part of an individual's job. On-the-job work experience is one of the best forms of training. This on-the-job work experience requires that work assignments are presented to employees as learning opportunities. For example, being asked to lead a distributed project is a tremendous opportunity to up level an individual leadership skill if presented and perceived as a great upskilling opportunity.

- **Leaders must provide powerful learning experiences through continuous feedback.** If management can identify, monitor, and provide feedback upon the developmental opportunities associated with a particular assignment or activity, then that assignment can be a powerful learning experience. It's largely a matter of how a leader or supervisor frames and presents the assignment and the employee's attitude in receiving it. Continuous feedback should be given and not just a one-time communication every year during the annual performance review.

The Upskilling IT Skill Wheel

To foster broad and intentional upskilling, DevOps Institute created the Global IT Skill Wheel. Recognizing your (or your teams') unique experience, expertise, examples of execution, and various tolerances for exploration should be complemented with the different must-have skill capabilities within our Global IT Skill Wheel (see Figure 22). Use this skill wheel to:

1. **Reflect on your current experience and expertise.** Think about your experiences (breadth), expertise (depth), and the tangible execution examples you have gained throughout your current or previous positions or during past product journeys and engagements. Take this inventory and compare it to the skill capabilities and must-have skills to examine where you already have sufficient experience and expertise or where you could improve.

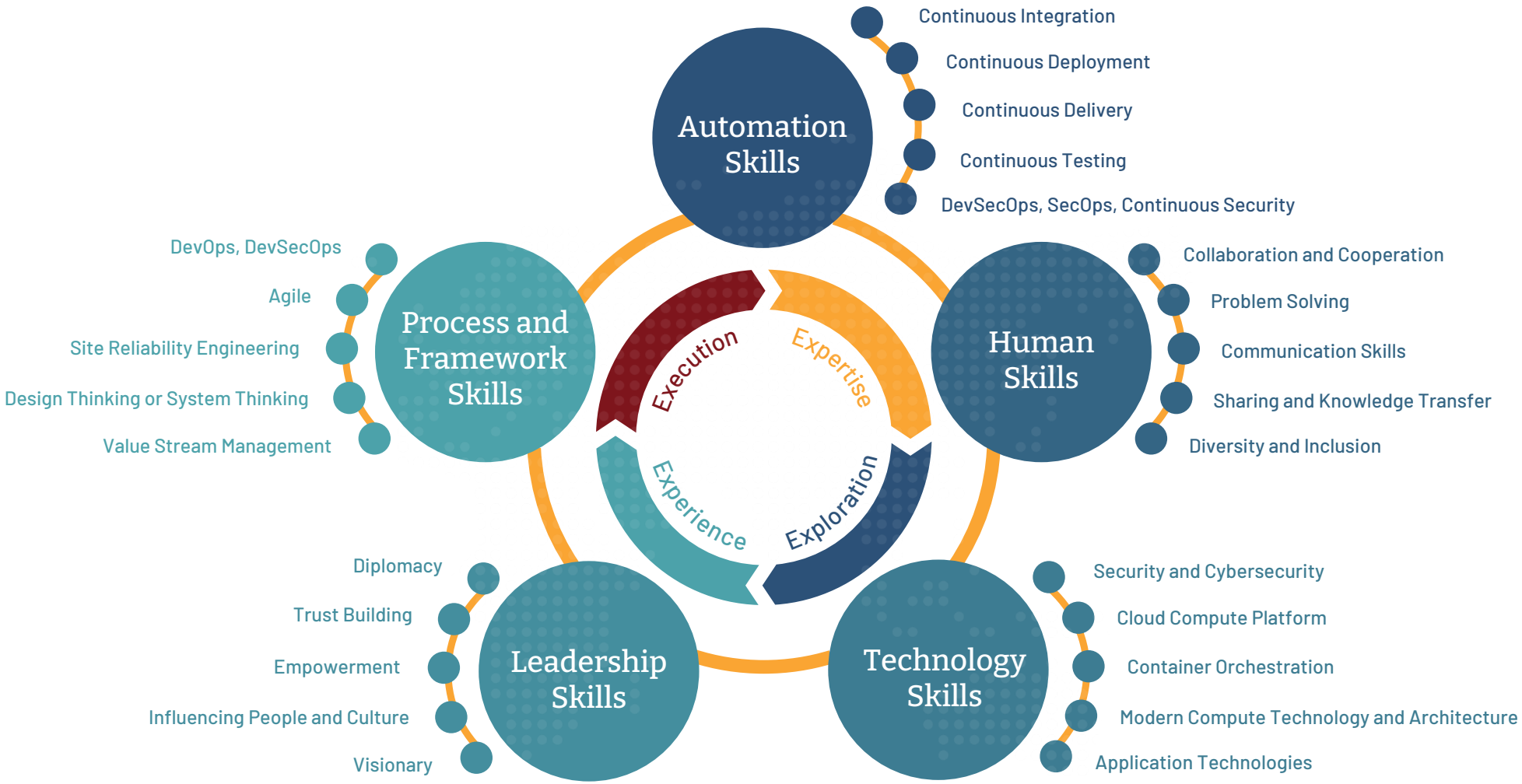
2. **Understand where you have made an impact through your ability to execute.** List some key tangible achievements and contributions you have made throughout your upskilling journey. These could be specific results, improvements, or other achievements. Include where you influenced results or outcomes, as these are also important.

3. **Understand your willingness to explore and change.** Now reflect on your motivations and where you see yourself today and in the future. Are you comfortable with the current experience, expertise, and contributions you have made to your team and your organization? Are there opportunities where you could add additional value or take on a different role? Try to capture and understand your tolerance for exploration and ability to change, which will make it easier if you want to explore other opportunities or roles. Your willingness and ability to be flexible in expanding, learning, and acquiring new skills are essential in the current and future transformation of IT and the business.

The figures in the Appendix intended as a backdrop for the Global Upskilling IT 2022 Report.
We also have created three regional sub reports around the different skill capabilities.
The regions covered are the Americas, EMEA and Asia Pacific.

FIGURE 22

Global Skill Wheel:
Top 5 Skill Capabilities and Top 5 Skills



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Research Methodology

The Global Upskilling IT 2022 Report is the fourth report capturing the perspectives of individuals that are involved in recruiting, hiring, or working within IT enterprise organizations. We set out to understand the must-have, nice-to-have, and optional skills within key skill categories. After extensive research around skill capabilities, we determined the following skill categories from the previous years. Still, we added a few additional capabilities due to advances in digital transformations: automation, human skills, technical skills, process skills, framework knowledge, business skills, leadership skills, digital skills, and cognitive skills. The target population for this survey was the community of IT practitioners, hiring managers, team leaders, consultants, human resources, and other individuals who are familiar with the different frameworks such as DevOps, SRE, and Agile. We targeted all industry verticals and all company sizes. We promoted the survey via online promotions, short research webinars, social media, presentations during major events, press releases, and our networks. We designed our survey questions with input from various team members and industry experts. We tested our survey questions extensively to ensure good constructs, and we leveraged SurveyMonkey Enterprise as our survey and design instrument. We collected primary data from our survey respondents. Our goal was to achieve a sample size of 2,500 individual responses targeting key geographic areas such as the Americas, EMEA, and the Asia Pacific region. The survey was open from July 2021 until December 2022. We received 2,476 responses.

Interviews

We also leveraged personal interviews as a complementary research method to provide additional in-depth details. The interview scripts consist of brief but open questions. The results from the interviews are not generalizable because of the subjectivity of the data obtained. On the other hand, their flexible format contributed to a deeper explanation and understanding and allowed us to augment our report with interesting details.

Instrument Design

For this research, the writer designed one questionnaire script and one brief interview script. The questionnaire for the survey takers from the companies consisted of 29 closed questions related to DevOps skill priorities and importance within their teams or jobs. The first part of the survey focused on the key skill domains and detailed skills within the domains–the second part of the questions focused on DevOps topologies, hiring situations, and challenges. The last part of the questionnaire consisted of demographic questions related to company size, region, the professional role of the participants, and the IT environment.
If you have questions on our survey methodology, please contact: customerservice@devopsinstitute.com.

Sponsors

The DevOps Institute extends a special thank you to the following partners for helping make this year's survey possible: Platinum Sponsors GitLab, Palo Alto Networks, Gold Sponsor Rancher, and Supporters Cycloid, The Linux Foundation, LLPA, LPI, Service Desk Institute, Taub Solutions, NTUC Learning Hub, DDLS, and Narada Code.

Acknowledgments

DevOps Institute would like to thank the many people who have provided their thoughts, ideas, inputs, and guidance on this year's report. This work is not possible without including and connecting with subject-matter experts, partners, and friends worldwide. We are incredibly grateful to them for their willingness to share, collaborate, discuss, critique, and contribute to this report. We also want to thank a few individuals who went above and beyond to help us with the survey and the publication of the report: Julia Pape, Jaida Olvera, Mark Settle, Karen Skiles, Ingrid Sides, Luke Sneddon, and Christina Majic. And finally, a huge thank you to all the people who have completed our survey, which is the foundation of our work.

Demographics

We had a total of 2,476 global survey respondents with good distribution across the globe, across verticals and enterprises. We also had a good representation of organizations with a hybrid infrastructure environment and modern infrastructures. Our survey respondents came from the key roles within IT organizations.

APPENDIX A

Collaboration and Cooperation	Includes working with others to achieve common goals
Problem Solving	Includes showing good judgment, focus on the right thing, high quality decision making, accept feedback to strengthen further improvement
Communication	Includes the effective communication across functional and leadership stakeholders
Sharing and Knowledge Transfer	Includes effective transfer of acquired knowledge to others
Diversity and Inclusion	Includes the accommodation and inclusion of multiple lifestyles and needs, and to accept the viewpoints and expertise of others
Flexibility and Adaptability	Includes adapting easily to change, remaining flexible and open to change
Interpersonal Skills	Includes communication, relationship building, listening
Personal Value Commitment	Includes trustworthiness, respect of others, ethics, integrity
Thought Leadership and Innovation	Includes knowledge on industry innovation, trends and practices, ability to accelerate adoption of best practices
Creativity and Entrepreneurship	Includes taking responsibility of new ideas and solutions to solve problems, energy, passion
Empathy	Includes understanding and taking different backgrounds, ideas and styles into consideration when working
Mindfulness	Includes attention and awareness of self and others, non-judgmental, curios and kindness

APPENDIX A (continued)

Risk-Taking	Includes making decisions taking risks into consideration, possibly without supervision
Multitasking	Includes the ability to focus resources and activities on multiple tasks while achieving key goals and/or desired results
Customer Experience Skills	Includes an understanding of how customers interact with the business
Product	Is defined as the thinking of "building the right thing, the right way"
Strategic Thinking	Includes comprehensive and holistic thinking, developing a bigger paradigm
Leadership Skills	Includes capability to lead and motivate others
Goals	Include ownership, self-development, achievement orientation
Business Acumen	Includes seeking and working for and with the business to solve business problems

Top 5 Global Additional Human Skills

QUESTION

How would you rate the importance of the following additional human skills within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,547

Top 5 Global Technical Skills

QUESTION

How would you rate the importance of the following technical skills within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,580

Top 5 Global Leadership Skills

QUESTION

How would you rate the importance of the following leadership skills within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1,141

Top 5 Global Automation Tools Must-Have Skills

QUESTION

How would you rate the importance of being familiar with the following IT Automation tools within the IT enterprise organization in the future? (Select less important, important, critical)

N= 1498

APPENDIX C

Similar Skill Gaps Among the Regions, Except APAC Does Not Perceive a Skill Gap in Human Skills

REGION	TOP 5 SKILL CAPABILITY GAPS
Global	Cognitive Skills Technical Skills Process and Framework Skills Leadership Skills Human Skills
EMEA	Technical Skills Cognitive Skills Process and Framework Skills Leadership Skills Human Skills
Americas	Cognitive Skills Technical Skills Process and Framework Skills Human Skills Leadership Skills
APAC	Process and Framework Skills Cognitive Skills Technical Skills Leadership Skills Automation Skills

Eveline Oehrlich
Chief Research Officer,
DevOps Institute

Mark Settle
CIO

Author and Biographies

Eveline Oehrlich is Chief Research Officer at the DevOps Institute. As former VP and Research Director at Forrester Research, Eveline led and conducted research around a variety of topics including DevOps, Digital Operational Excellence, Cognitive Intelligence and Application Performance Management for 12 years. She is the author of many research papers and thought leadership pieces and a well-known presenter and speaker. She has more than 25 years of experience in IT. Her passion is to help companies transform their IT organization, processes and tools towards high performing teams, enabling their business partners to achieve better business results. She has helped some of the largest enterprises across the world to adopt new strategies, workflows and automation within their journey towards a digital business.

Mark Settle is a seven-time CIO, three-time CIO 100 award winner and two-time book author. His most recent book is *"Truth from the Valley, A Practical Primer on IT Management for the Next Decade."*

Index

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Notes

1. Nearly two-thirds (63%) believe in five years, technology will be their **firm's greatest source of competitive advantage. More than two-thirds (87%) believe technology will create greater value in the future than people. Nearly half (44%) believe robotics, automation, and AI will make people "largely irrelevant" in the future of work.**

2. **When asked to rank what their organization's top five assets will likely be in five years, the company's workforce did not even make the list. Instead CEOs named (in order): Technology (product, customer channels), R&D/Innovation, Product/Service, Brand, and Real Estate (offices, factories, land).**

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