Embracing modernization:
From technical debt to growth

DXC LEADING EDGE

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In 2023, DXC Leading Edge embarked on a journey to uncover the pulse of the business world. We asked 750 executives from across the globe about a challenge that's preventing them from shaping the future: technical debt. This is what they told us.

Information and technology executives deal with the notion of technical debt (tech debt) every day. It's a notion because it's an implied cost, not a tangible one. But tech debt has far-reaching implications for an organization. Yesterday's solutions may have worked in the moment but fail to hold up well over time. While different from obsolescence or depreciation, tech debt can be far more disruptive to an organization's success and even stock price.

The potential harm in outdated technology — or technology that is ill-suited to a current need — can be measured in billions for most large enterprises.

Any executive's blood runs cold to think that 20% – 40% of the value of their entire tech estate before depreciation may be tied up in technical debt.[i] In a landmark 2023 survey of 750 C-suite information and technology executives commissioned by DXC Leading Edge, only five respondents said that tech debt wasn't on their risk register. The other 745 indicated it is explicitly listed or is a subset of another line item. Leaders recognize that tech debt limits an organization's ability to adapt to change.

These pockets of outdated tech, code, practices or ways of working are obstacles in other ways as well. They block the path to innovation, with 46% of IT executives noting they "very often encounter restrictions" or that "tech debt has a dramatic effect" on their organization's ability to pursue digital transform or grow (**Figure 1**).

Organizations do not set out to create technical debt. Yet, when a particular course of action meets with forces inside and outside the organization, they coalesce, and boom! Tech debt expresses itself in value-destroying ways. It tends to be a series of trade-offs that lead to suboptimization that becomes increasingly hard to undo. But the problem does not have to persist in this way. There is a silver-lining view to tech debt: modernization.

This report discusses how leadership teams can understand and reframe tech debt from a problem that needs to be solved to something that needs to be tackled as part of modernization efforts. We make the case that this debt needs to be dealt with robustly by uniting CIOs and CTOs with their counterparts across the enterprise. We explore tech debt through the lenses of organizational incentives — and demonstrate that, to corral and control it, organizational architecture and performance management are essential. Prioritizing and addressing these areas is step one on the path to better serving customers and stakeholders.

We close with a detailed four-step prescriptive plan to pay down today's debt and discourage it in the future.

Tech debt inhibits transformation and growth

46% of CIOs, VPs and tech executives indicated tech debt was closely linked to their ability to pursue digital initiatives

Q.P2. How closely linked do you see tech debt and your organization's ability to pursue digital transformation and growth? (Top 2 boxes)

Figure 1. Tech debt's effect on transformation and growth

Reframing tech debt

The term tech debt carries negative connotations of burden and risk. It often implies that things were not done right due to constraints on time, budget or skills. Organizations might try to put numbers on it by estimating how big an investment is needed to resolve the debt and get things exactly right. But what does "right" mean in this context?

There are situations where the answer seems clear. For example, if you do not install security patches on time, not only have you accrued tech debt; you have exposed your organization and its ecosystem to security risks from third parties, which could carry significant liability.

But it's not always clear where tech debt starts. For instance, is it tech debt if your company uses code in a beta test that is not as efficient as desired, but enables a new function to be tested? Often, the answer is no.

A startup trying to assess a market opportunity may find that low-fidelity code is acceptable for the present. This approach helps a company with limited resources enter the market, build a revenue stream and learn at a fast pace. In a manner similar to how financial debt often underpins business expansion efforts, tech debt can be a manageable short-term solution on the path to making large technological investments possible. But, as with financial debt, simply paying off the interest and not the capital is a low-cost strategy only up until a certain point. Suboptimal code or outdated systems might be acceptable for short-term goals, but they can become problematic when external factors change rapidly.

The impact of tech debt lies in its ability to hinder an organization's adaptability. Few people would complain about weathered but functional solutions if they are still fit for purpose. However, as two examples in the U.S. show, rapid changes in the external environment can render even once-perfect solutions problematic.

First up, an airline's crew assignment app — with a well-known yet small weakness — failed when the busiest travel season of the year bumped up against winter storms during an extreme set of delays and reschedules.[ii] The result left hundreds of thousands stranded and triggered losses of $800 million.

On the heels of that came an outage at the Federal Aviation Administration, which grounded and canceled flights, shining a bright light on the antiquated technology supporting air travel. This went well beyond outdated software and hardware sitting at the heart of business systems and choices made around growth, bureaucracy and maintenance. A U.S. news outlet referred to it as a "brittle system," where there are far more points of failure than are obvious and that these are "just the latest manifestation of a longstanding and enormously complicated issue."[iii]

The language used to describe tech debt can be unwieldy and inconsistent. That may contribute to organizational inaction because it is all too easy for people across the business to ignore it or relegate tech debt to a tech team problem.[iv] But that would be a mistake. It is imperative that organizations adapt the language they use around it to convey not just urgency, but the need for concrete and quantifiable action.

Dealing with **tech debt** involves reframing it as **modernization** in service to the demands of *increasingly sophisticated users.*

"The [airline's] tech debt … led to a fragile system that could not be updated to handle more than baseline levels of traffic, forcing the company to resort to manual solutions when a crisis occurred."[v]

Risk comes from every direction these days.

For one U.S. airline, an investment of over $1 billion in customer experience improvements was grounded by an outdated scheduling app that many acknowledged as a weakness.[vi]

When an intense weather system meets an archaic app, a perfect storm occurs.

- **Failure to modernize crew scheduling systems** — among other issues — left hundreds of thousands stranded
- CX investments are great, but **operations failures can do extreme damage to customer satisfaction**
- Lesson learned: **Don't leave your back end underserved**

Tech debtors

Tech debt is an erroneous moniker. In fact, tech debt encompasses infrastructure, applications, UX, data and process debt as well as knowledge debt resulting from diminishing systemic intelligence and ineffective management. These may be better understood as organizational debt (**Figure 2**).

When organizations acknowledge these various forms of debt, they gain a clearer understanding of the challenges they face. Opening the aperture can reveal an underbelly of nontechnical factors that contribute to an organization's deficit of adaptability.

Accounting for **infrastructure debt** versus **application debt**, for example, teases out the threads of precisely where IT debt is accumulating. **UX debt**, when an organization provides an outdated experience that requires modernization, can sit near marketing and sales departments and may not be thought of traditionally as tech debt. It may fly under the radar of a solely technically focused assessment.

Data debt exists when organizational data is inconsistent, corrupt or false. The modernization of data management is a priority for 38% of survey respondents — the second-highest priority for surveyed businesses overall. Better measurement and automation have brought far more data points and process metadata into the organization, but understanding, capturing and using it effectively can be challenging. In our research, we encountered a company where managers were using a workaround for a timesheet system to meet their KPIs. This worked well for everyone (and kept the authors of the

timesheet system in sweet oblivion) until the company's board of directors decided to automate work estimation based on past data. Data debt suddenly materialized — and the organization found itself seeking creative measures to overcome it.

Process debt spreads its tendrils across the organization. It lurks where inefficiencies, waste and redundancies accumulate in workflows and handoffs. Point automations (as opposed to process reengineering) enable inertia to infiltrate culturally across the organization; disconnects across departments become less detectable. Knowledge is lost, as fewer and fewer people understand broader procedural arcs.

And that brings us to **knowledge debt** — the knowledge loss associated with tech debt actions, often invisible to management. DXC Leading Edge research confirms this: Knowledge barriers are deemed moderate to severe for two-thirds (66%) of all surveyed businesses in their modernization journeys. According to our research, executives find similarly pressing issues in cultural and expertise barriers. These represent 69% and 61% of respondents, respectively.

The challenges often trace back to one word: inertia.

Dealing with organizational debt requires a shift in mindset. Building flexibility within the organization and empowering people to prioritize and understand debt's impact is essential. This transition from debt to modernization is an ongoing process that demands constant, iterative management. The bonus: It moves the conversation from tech debt to org debt, owned by all executives, not just IT.

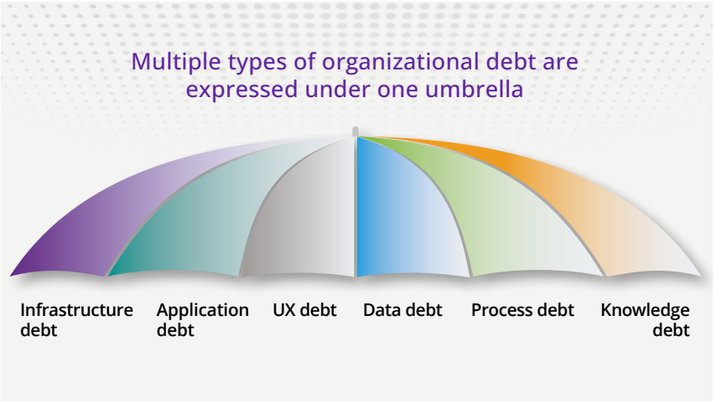

Figure 2. Different types of organizational debt. *"Debt" represents a capability gap between existing older technology and the modern optimal actions it's hindering.*

Organizations can and should redefine their approach to tech debt and view it as part of the modernization process. Understanding that tech debt arises from various trade-offs and suboptimal decisions allows leaders to tackle it more effectively. At least some of yesterday's efficiency plays are likely to turn up as tomorrow's tech debt. It's worth noting that most of the considerations in Figure 3 are not centered on IT but business needs.

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Even with reframing the conversation from tech debt to org debt, organizations must establish an enterprise-wide focus on their systems, as depicted in **Figure 3**. When a company positions itself further right (toward, for instance, greater efficiency), it can result in less flexibility to revise a decision. In selecting a leftward position (focused more on innovation), an organization tends toward Agile approaches and greater adaptability. These can come at a higher cost if not managed effectively. As projects move from left to right, from greater levels of customization to greater levels of commoditization, there is a risk that future events may require changes that become increasingly hard to make.

Modernization is an ongoing process, not a project with a defined end.

Linking adaptability to modernization's future focus is fundamental. To focus modernization on customer or architecture-based improvements and discourage adding more org debt, consider Agile development and increasing agility in the business. Sprints focus and prioritize delivery, allowing consistent reevaluation of what's needed. In this mindset, modernization is an ongoing process, not a project with a defined end.

Considerations for technology-driven organizations; when tech debt becomes org debt

Organizations are more dependent on tech than ever. That's why technical debt is no longer the provenance of IT but an organizational issue. Yet, the decisions that drive debt are made on a continuum and affected by many factors. Determining where you are and where you want to be requires considering multiple dimensions and how you engineer in options for flexibility. There are industry dependencies, commercial implications and, of course, financial implications. There is no right answer; it's about what the organization needs for success.

If you had a slider to indicate where you are in each dimension, would it be where you wanted to be? What are your current and optimal positions?

- Competitive posture
- Governance
- Operating model
- Common organization position

Illustrative set of discussion elements — not exhaustive. Positional placement via case study review and analysis.

Organizational focus

Function and flexibility — Operations and day-to-day management

Left-side attributes are generally exhibited by younger companies and those with a digital-first approach, as they tend to own fewer assets and have less rigid organizational structures. There is greater comfort with (or at least expectation of) change. **The right-side** approach is focused on operational optimization, automation and cost control. Leaders must operationalize well, so the goal is to stabilize the right side and then move left.

Incentive structure

Rewards reduce the cost of change — Rewards reduce the cost of operations

Left-side attributes focus on reducing the cost of change, enabling increased innovation and decreasing time to market. Incentive exists to take risks early in the process as change is enabled. **Right-side** attributes address reducing the cost of operations, allowing an increase in scale without a loss of consistency. Change becomes harder as you move right on the continuum.

Commercial model

Revenue generation enabled through multiple models, platforms, customizable — Revenue generation through core interaction models, often siloed

A commercial model focused on revenue from traditional products, services and customer segments is a **right-side** attribute. However, when you bring in flexibility to facilitate relationships between and across providers through platforms, this represents more **left-side** attributes. The faster a company can change go-to-market to match market needs, the further left they are (and the more flexible their model is).

Supply chain management

Adaptability in scope and contracting — Contract and vendor lock-in, focus on exclusivity

Recent global events demonstrate the fragility of supply chains, yet key challenges remain. For instance, adding more supplier options may increase resilience but also price. **Right-side** attributes include lock-in contracts that prevent new entrants but pose other risks, especially in needed semiconductors and rare-earth minerals. *We need new ways to think about contracting, especially beyond "just in time."*

New product/program management

Experimentation without vision and plan, continuous MVP — Discovering gaps or breakage too late in the process

Understanding how people, process and technology come together in revenue-producing programs is at the heart of IT's role. Yet, many others are involved in specifying requirements and dictating delivery. Many leaders find it challenging to move away from traditional delivery and success metrics. Agile and digital life-cycle management require new ways of working and measuring results. *Engineering in flexibility to allow componentization is an upfront activity with less-defined outcomes.*

Financing

Continuous cash infusion — OPEX — Early investment, longer payouts, CAPEX

For many industries, planning is still a CAPEX focus, as OPEX has unpredictable variability. However, the **left-side** media industry is OPEX-oriented and was able to move toward digital more quickly and iteratively. Yet OPEX-driven industries struggle with "big number" shifts, like 5G, where payback periods extend beyond investor appetite. The **right-side** energy industry is highly CAPEX-focused.

Frequency of change

Responsive to markets and conditions — Continuity prioritized, "change lockdowns"

There's a tension that exists around core systems where change is discouraged — especially at the most central layers, such as core banking systems, insurance operations systems and manufacturing planning systems. The challenge is determining where, when and how much to change. You can't force the environment to match your needs. Here, **right-side** industries often include insurance and financial services — yet closely related fintech and insurtech have differentiated themselves as **left-side** industries.

Defensive postures

Market-sensing prevention, scenario testing and action plans — Restrictive policies that may discourage opportunities and partnering; reactive to market

Risk management, compliance and security policies are procedural approaches to protect and defend value. As many states, countries and regions develop new taxes, legislation and incentives (sustainability, trade, data privacy), examining and estimating impact of change vectors becomes important. *Changing a policy may be easy, but reorienting and educating people is not.*

Figure 3. Innovation vs. efficiency

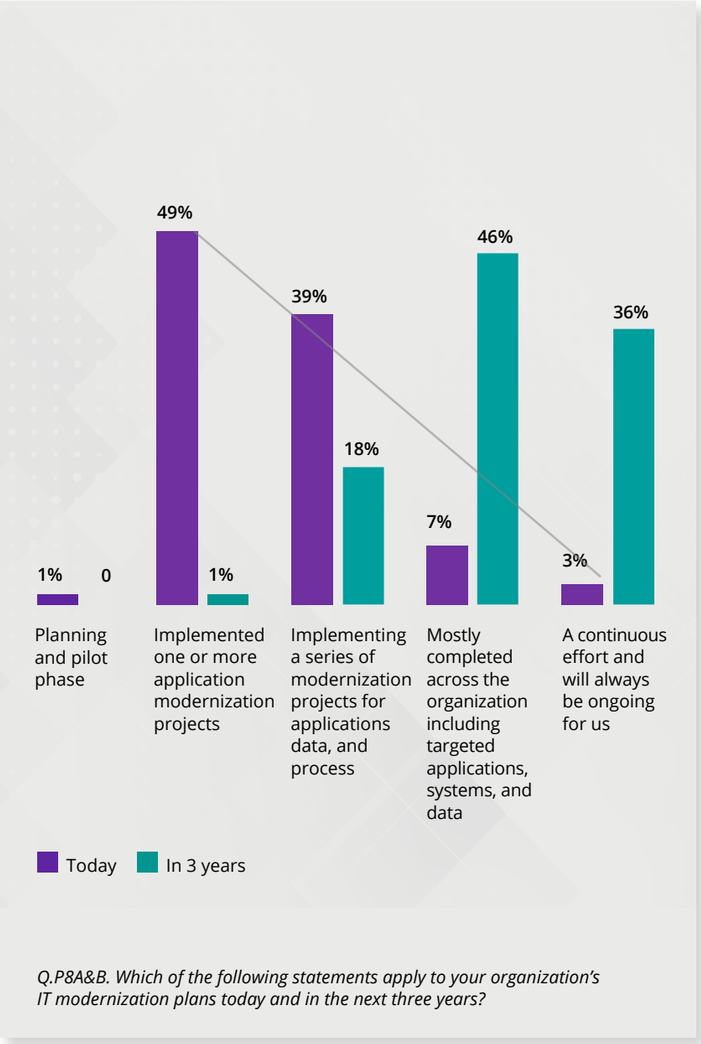

Figure 4. Modernization plans: Where organizations expect to be in 3 years.
Most executives expect to be mostly done with IT modernization in 3 years.

Only 36% of IT leaders we surveyed recognized this (**Figure 4**).

Contrast that with the 46% of respondents who anticipate that their "modernization efforts will be mostly complete across the organization" within the next 3 years. These IT leaders are missing the point that org debt requires constant iterative management.

It remains impossible to predict and prepare for the myriad gray or black swan events that might expose debt in its various forms. That's why building flexibility and adaptability in organizations and their people can protect them from tech debt disruptions.

There are dangers of not factoring in constant change. When executives — especially those removed from day-to-day IT operations — misunderstand how org debt occurs, they can unintentionally increase it, while increasing resource drain across the organization.

There's also the danger of stifling a team's desire to innovate. When resources aren't engaged, it can lead to higher turnover, accelerating knowledge loss. As debt becomes harder and harder to manage, more valuable time is dedicated to supporting it, not solving it.

It is interesting, having established that technical debt is owned by the organization, that IT leadership is still seen to shoulder the burden. There is some recognition that business leaders in the C-suite and senior management share responsibility, but more than 7 in 10 respondents felt that CIOs and CTOs are responsible for dealing with tech debt in their organization.

As organizations balance the baked-in tension between adaptability and efficiency, debt tends to insinuate itself.[vii] Fragmented, federated governance has been identified as a key barrier to resolving issues; it adds to org debt.[viii] Good, global governance and management start with people. Modernization is no different. People are the first line of defense against org debt. Debt can cascade dramatically if they are not considered in the operations and execution of modernization.

It's absolutely true that well-executed IT stewardship will bring a considered approach to org debt. Yet, it should not all be on IT. Every executive's objectives should encourage across-the-business understanding and action toward managing org debt.

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Ensuring collaboration across departments is key. It is an effective way to start tackling the more insidious, slippery aspects of knowledge and cultural debt. Whether information isolation is simply the nature of a particular role or a result of individual intentions, teams might not even realize that knowledge is lost over time."[ix] A lack of collaboration also can cause silos — that dreaded sphere where all manner of debt can easily accrue.

Preventing org debt is impossible. It is compounded by the rapid pace of technology evolution. Leaders across the organization have a duty to keep up with developments. That extends to understanding the impacts of decisions on technology and business.

The C-suite stating that they "did not know" is not a stance that clears tech debt; being a champion for modernization is.

Managing perceptions

The need for the C-suite to be a champion of modernization is illustrated by the example of a newly installed CEO of a traditional automotive company, who knew it was imperative to improve the quality of the company's cars. But he couldn't address that elephant in the room right away. Only after several high-profile issues came to light could he challenge the norm, explicitly prioritizing updates and improvements over the development of new things. He acknowledged that the quality issues did not arise over one or two years; fixing them would take time.

This is a valuable example of political calculus from an org debt perspective. We can assume that leadership was aware of quality challenges, yet they chose to prioritize shareholder needs — namely, profitability and dividends. Difficult choices.

This example illustrates how leadership must balance multiple outcomes in their modernization efforts. Survey respondents indicated that improving operating margins (69%) and increasing revenue (68%) were the top two desired outcomes for their modernization projects (**Figure 5**). (See appendix for more on desired outcomes by industry.)

Yet, modernization is not always pursued with a single eye on profits, a lesson perhaps learned by the automotive company. Instead, most tech leaders factor in a range of positive outcomes when it comes to measuring success.

Consider the example of a multinational retailer whose ability to conduct e-commerce was becoming untenable. Business continuity is one of the reasons org debt often accrues — and a key reason for dealing with it.

Having grown through acquisitions, the retailer needed to migrate multiple legacy platforms to a unified, cloud-native solution — without any disruption to business. The retailer consulted Luxoft, a DXC Technology Company, for help.

The desired improvements were focused on maintaining revenue streams during the transition and increasing customer satisfaction. The existing solution had to be modernized using the retailer's own e-commerce division. However, the organization was bleeding staff, leaving systems and application knowledge in short supply. (See appendix for a list of barriers to addressing org debt in retail and other industries.)

Several low-scalability choke points needed to be addressed. Redundant calls weighed down speed and processing. Increasing flexibility in fulfillment was a global priority. The solution was a cloud-ready e-commerce system that could improve time to market, with mobile gateways and business logic as scalable components. The Luxoft team and the retailer updated and optimized the system in multiple stages. The first significant change was to decouple key systems for commerce, loyalty and search, building instead a microservices platform allowing those services to evolve, scale and be refined individually. Next, they took a data-as-a-product approach to decouple data from transactions and aggregate them for cross-functional usage, security purposes and resilience across platforms. This approach allowed tasks to be automated in new order processing, order status retrieval and tracking, while providing accurate delivery estimates for consumers.

When done right, alleviating org debt with effective modernization can be a win for the whole company.

In a vastly different industry, one where end-of-support systems present a major operational risk, a health insurer needed to modernize its aging systems to avoid an impact on quality of care. With 80 million customers, the insurer needed flexibility in its infrastructure, which required migration to cloud. While migrating workloads, the insurer also needed to modernize or replace critical software, which would provide flexibility, stronger disaster recovery capabilities and higher availability. In turn, it would optimize connected workflows and improve capabilities for the insurer's medical specialists, facilitating better claims processing for patients. Luxoft's solution for the insurer built in sprints, reduced costs, enabled knowledge transfer across teams and improved business continuity.

When org debt is acknowledged and managed, improvements happen across the IT estate and across the business at large.

Desired business outcomes

69%

of respondents indicated that **improving operating margins** was the top desired outcome for their modernization efforts

The rest of the top 5 are:

- **68%** increasing revenue
- **67%** improving employee satisfaction
- **66%** improving customer retention
- **66%** focused on addressing regulatory compliance

Q.P11. How important are the following outcomes in measuring the success of modernization projects in your organization?

Figure 5. Top desired outcomes of modernization efforts

External expectations and the snowball effect

As much as well-executed modernization delivers wide-ranging benefits, DXC Leading Edge's conversations also unearthed instances of leaders using debt-inducing approaches in maximizing existing assets and minimizing operational expenditures. It was particularly visible in how they procured software, doubling down on CAPEX-friendly tactics (with an initial big investment that becomes an asset with potentially lower maintenance) rather than OPEX-friendly ones (ongoing cost, no asset).

"Make the investment, amortize and move on," is one prominent philosophy. However, such an approach can have a pernicious impact on organizational debt.

An upfront-heavy, CAPEX-friendly approach enables the bulk of costs to receive preferential accounting. These sizable projects often center on serving the needs of increasingly sophisticated users. Once customization starts, however, the desire to rapidly move toward efficiency and the low-maintenance period encourages trade-offs. There's also a potential double whammy: where higher-than-expected design and implementation costs leave less budget available for maintenance over time.

OPEX, despite having a recurring potential to control org debt, will incur costs over time, seemingly showing an increase in ongoing cost. The ability to continuously adjust a product/program/platform toward market conditions through digital life-cycle management allows greater flexibility and functional fit. This Agile development approach drives teams to evolutions (small frequent changes owned by the development team) — not revolutions (large-scale decisions owned by the management team).

When a development team continuously updates technology/products/solutions to meet market needs, then fewer large trade-offs are needed, as these are reengineered to modern standards regularly. But what happens if OPEX is not built in?

As shown in **Figure 6**, a seemingly innocent trade-off is often met by a bigger trade-off in a future iteration. As debt accrues atop debt, the snowball gets bigger, resulting in terminal toxicity. Loss of knowledge occurs over time as debt impacts people and processes.

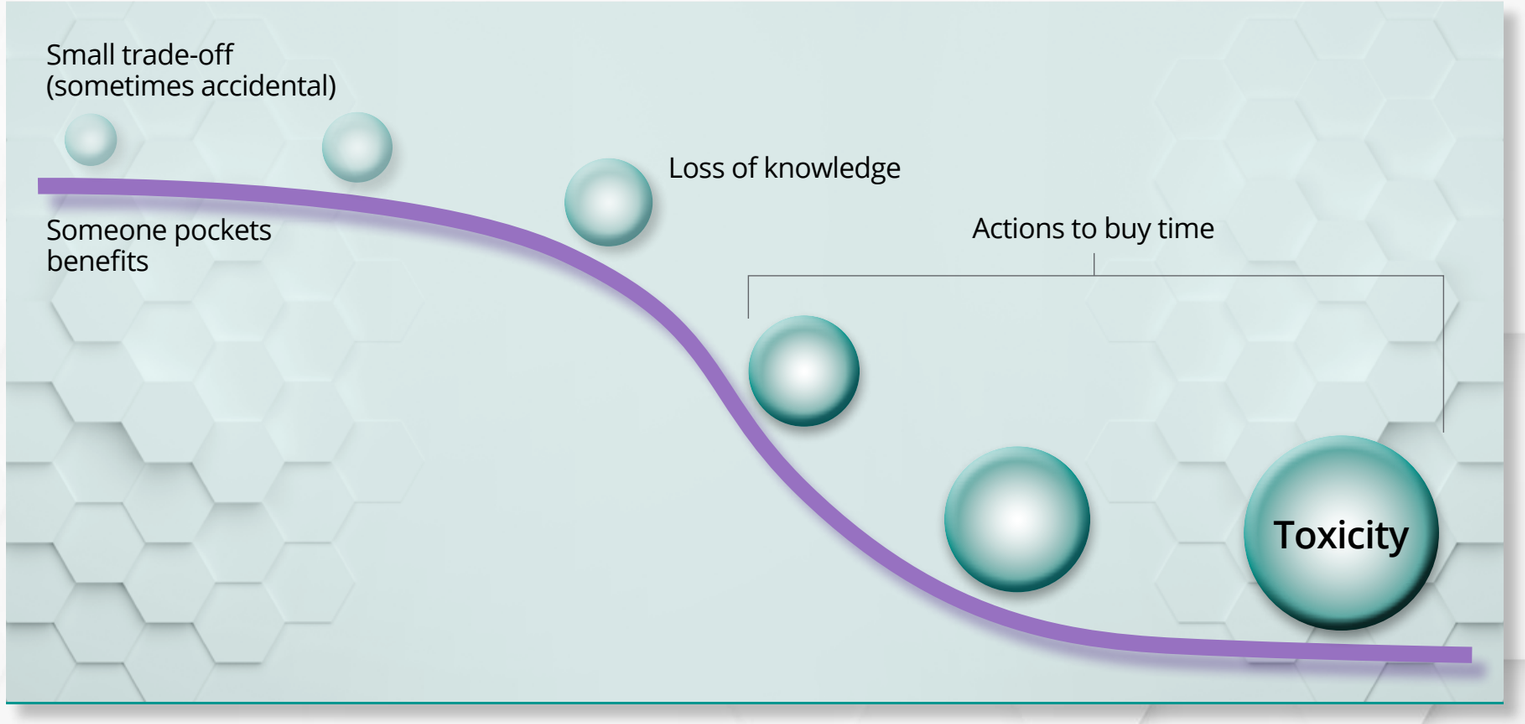


Figure 6. The march to toxicity

This kind of cultural and knowledge debt is accretive — it happens in slow doses. Still, survey respondents were clear that there are barriers to progress that hinder modernization efforts in their organizations; 47% of respondents scored knowledge barriers as very or extremely significant, and 38% did so for cultural barriers (**Figure 7**). (See appendix for all six primary barriers broken down by industry.)

Businesses that have rebounded from seemingly irrecoverable situations have one thing in common: Their debt was measured and verbalized. The importance of articulating debt cannot be overemphasized.

DXC Leading Edge's research indicates that platform-led transformation creates an environment for constant learning, change and subsequent evolution, with manifold benefits including reframing how org debt is contained and reduced.

Platform-led transformation extends modernization of the technology estate beyond, for example, an upgrade to cloud, to an entire rethink of how work, data and change flow through the organization and ecosystems beyond. This is crucial for keeping organizations' processes relevant and preventing them from becoming extinct.

Rethinking digital platforms as change agents in a software-defined world (dxc.com)

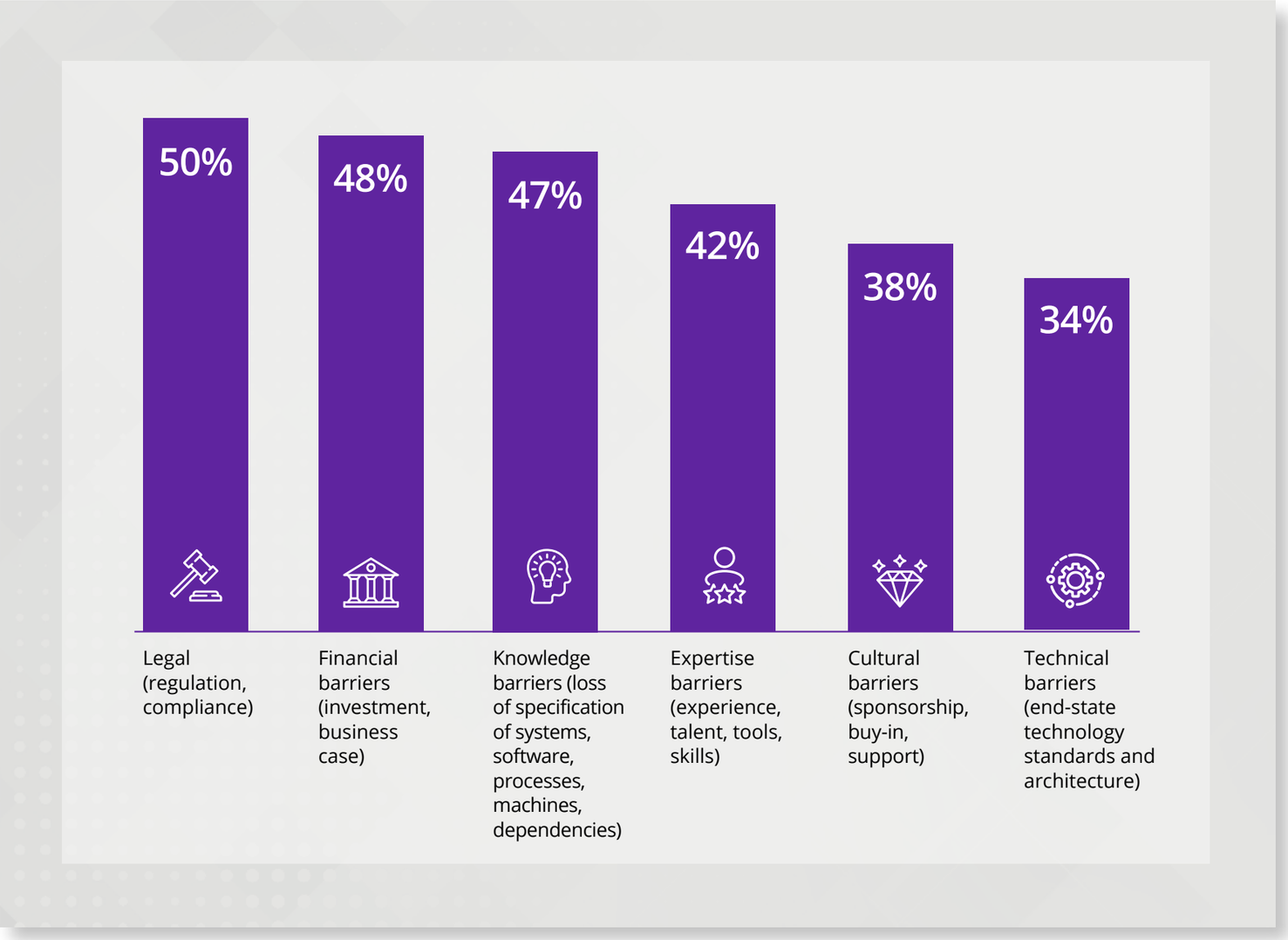


Figure 7. Barriers to modernization

Why org debt is a zero-sum game: Who's winning and who's losing?

Org debt is not an inherently bad thing. It serves a purpose and is a normal side effect of making any investment. Especially early on, org debt provides an advantage for someone in the enterprise.

Sometimes leaders may reap rewards — such as bonuses — for not spending on systems; it's challenging to make the case to invest in a new technology when the existing solution is only slightly outdated. Sometimes it's shareholders, who are rewarded with dividends or higher stock value when business spending is cut. Parties who collect the benefits of org debt extend to customers as well (see below). Finally, there are times when a particular unit is able to make a business case work because the IT function will overoptimize the cloud for them.

One of our interviewees realized that he was subsidizing one of his customers. The customer refused to migrate to the newer version of an API, so the legacy version was maintained just for them. Over time, as knowledge was lost and resources turned over, the cost of supporting that customer inexorably climbed.

Often, debt is beneficial for a different group of resources from those who will be responsible for repaying the debt later. Someone gets the cake; someone else pays the bill. It's universally agreed that the one benefiting is in the business. Yet the one responsible for repaying the debt — according to nearly 3 in 4 of those surveyed — is the CIO and/or the CTO. The percentage is even higher in the public sector (83%).

Why is that so? Without adequate governance, those who benefit will always aim for maximum resources, because they are not accountable for the consequences.

Debt challenges can also be framed in terms of human costs. As digital infrastructure company Splunk usefully phrases it: "Ultimately, uncontrolled tech debt can create a vicious cycle that leads to dissatisfied workers, higher turnover and a range of negative business outcomes."[x]

Employee turnover and attrition, while never desirable, are of urgent concern as employers globally struggle with attracting and retaining talent, especially in the IT sector. Employee satisfaction is a significant marker for tech leaders in assessing the success of modernization efforts. This speaks to the value of people across the whole organization. And talent is not just an HR issue, as IT leaders need to focus on how they can help keep employees satisfied, too. After all, it is people who create debt and people who manage it.

Turning back to the survey, 67% of leaders indicated that employee satisfaction was "very important" or "extremely important," while employee productivity was ranked in the top two by 64% of respondents. Employee retention was selected in the top range by 63% of the leaders (**Figure 8**). (See appendix for a full list of priorities by industry.)

When planning or implementing modernization projects, how important are the following business objectives?

Percentage of respondents selecting one of the top 2 boxes
(4 = very important, 5 = extremely important)

Figure 8. Business objectives of modernization

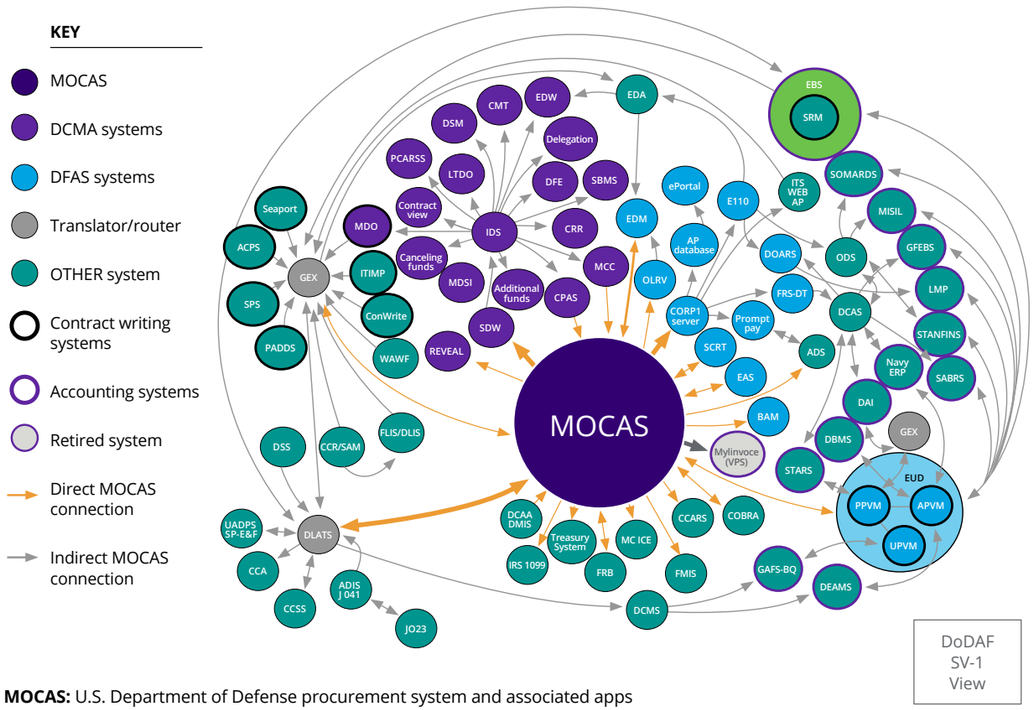
Hiding in plain sight: Where to watch for org debt

Org debt is a challenge driven by the rapid expansion of cloud and the explosion of new technologies and software. IT decisions made in prior years (or sometimes months) are at odds with the future direction of parts of the business or tech estate. It is difficult to assess when a piece of tech used for a crucial business process is outdated or simply in need of a modification. Preventing a snowball effect requires seeing a small tech wrinkle and understanding whether it can become a much larger tech rift in the organization.

So, it comes down to understanding where legacy tech interacts with newer tech in a suboptimal fashion that can worsen over time. The organization can continue to layer on workarounds, do the hard reengineering or refactoring work on its systems, or sit out adding new technology. It's not surprising that companies opt for option A.

While many examples exist of large-scale tech debt in action, among the finest is MOCAS (Mechanization of Contract Administration Services), a system used by the U.S. government to manage contracts and contractors. When it was built in the 1960s, it was a better mousetrap than the systems that government agencies had, so plenty rushed to adopt it. It became a victim of that success when more functions or services were added. Each subsequent change made it harder to remove the system. (See MOCAS case study.) Over time, a strategic advantage became a strategic weakness.

U.S. government MOCAS system interfaces



MOCAS: U.S. Department of Defense procurement system and associated apps

Case study: MOCAS

MOCAS (Mechanization of Contract Administration Services) is a central system used by the U.S. government to manage contracts and contractors. It supports post-award administration and contract payment.

Built in the 1960s, MOCAS received its last significant technical upgrade in the 1980s. As of 2019, there were no specific plans to retire the system, even though it was supposed to have been retired in 2002.[xi]

To understand the system's longevity, consider this illustration of MOCAS' position in an ecosystem of apps — an ecosystem it has helped create. Some of those apps were developed as separate apps, plug-ins and services around MOCAS, because MOCAS itself was too difficult to change.

Any attempts today to introduce changes to the ecosystem would be extremely difficult and would likely cause a cascade of issues. While MOCAS is an extreme example of small trade-offs leading to much bigger trade-offs, it illustrates a psychological effect that is pervasive across organizations: People tend to work *around* problems.

The race to the cloud — especially more efficient and versatile public clouds — exacerbated the complications. What was once hidden behind the organization's walls now required layers of new approaches to interact. Older software and modern hardware don't mix well; on-premises and cloud-native solutions suffer some "oil and water" problems as well. Newer, smarter interface layers were needed. Many vendors were not capable of dealing with this complexity.

Modernization, when done properly, flattens tech debt and fuels business performance. DXC Technology's work in this arena with over 600 customers has allowed us to understand the complexity, risks, performance issues, costs and sustainability challenges our customers consider in developing modernization strategies.

We asked IT executives on which organizational domain they were focusing their modernization efforts. The answers vary tremendously by industry (see appendix for a breakdown by industry), but when we look across the industries, eight core activities predominate (**Figure 9**).

A host of modernization techniques exist beyond retire and replace: encapsulation, replatforming, rehosting, refactoring and rewriting, to name a few. The trick is aligning the modernization approach to the organization and the desired benefits, then to the needs of the new technology.

Automation and robotic process execution

Automation took spots 3 and 4 among the most common modernization activities, as organizations seek to reduce their operational costs by automating certain processes or process steps. However, the efficiency bump is a result of a trade-off. The automation solution/layer carries its own know-how, vulnerabilities and procedures that bring complexity.

Over time, the automation layer can accrue its own debt, except now, to pay it off, one must orchestrate across the different layers. And without adequate historical records — including *why* something was done, not just *what* was done — the risk of losing knowledge can begin to erode benefits.

Making it work: Robotic process automation can indeed increase efficiency, and free some resources (money and, most important, people's attention), so that the organization obtains the desired benefits case. Central to achieving this is focusing on process redesign before automation, especially in hand-offs, sources, target systems and data design. Without a comprehensive (often nontechnical) process redesign, some automation efforts just reach mediocrity faster — and miss their longer-range benefits case.

When modernizing, what activities are at the top of the list?

Architecture still tops the list, but it's a very tight grouping.

Building cloud-native systems is the driving force behind replacement (the second most selected).

Activities 3 and 4 both concern automation, whether for preparation or retooling processes.

Digital products and pipelines are in the final position.

Q.P7. Which of the following activities are included in your modernization projects?

1. Modify the architecture
2. Replace with net new applications/platforms
3. Enable automation criteria and approaches
4. Change the workflow/process to enable automation
5. Improve the user interaction
6. Change the target platform (e.g., lift and shift to the cloud)
7. Change the technology components; add new capabilities
8. Reinvent the processes to support digital products and pipelines

Figure 9. Eight core modernization activities

Compatibility layers

It is increasingly difficult to find talent to maintain mainframes, so the need to modernize them is pressing. Some organizations use a compatibility layer — a solution that can tick the "migration to the cloud" checkbox — to seemingly resolve the talent problem. However, this resolution is partial at best, because knowledge about these business apps is still eroding, while the entire setup grows more complex. Instead of three layers (users, apps and mainframes), we now have four (users, apps, compatibility layer and cloud).

Making it work: Compatibility layers should be seen as temporary solutions to org debt — a short-term debt that is leveraged and then paid off quickly. This can help organizations to save on resources, including time, but those savings should be reinvested into restoring adaptability.

Outsourcing

More than 6 in 10 tech leaders surveyed (63%) claimed that they find business users pursuing external vendors to create workarounds or standalone apps when the IT department cannot be responsive enough. This remains a popular solution when internal capabilities are not agile enough. It also becomes a primary tactic when some systems become harder to support, due to cost, talent shortages or organizational focus.

Seems practical enough — but it's not. If IT leaders outsourced the business architecture and, with it, knowledge about what systems are being used and how, that intellectual property diminishes in value rapidly. It means introducing any changes or updates can require expensive business reverse engineering with detailed investigation of what systems existed and how they could be changed, and mitigating undesired, unpredictable side effects.

If the outsourcing partner doesn't understand and manage the essentiality of those processes — keeping them documented, current and continuously evaluated for refactoring or rewriting — then expect the situation to deteriorate.

Skills backfill using large language models

In 2020, the governor of the U.S. state of New Jersey sought volunteers to work on an overloaded critical system. Specifically, he needed volunteers with skills to work on 40-year-old COBOL applications.[xii] The state didn't have these resources and couldn't find enough people familiar with what some younger IT professionals thought was an archaic programming language.

Fast-forward to today, when it's possible to ask a large language model to either assist a programmer with light skills or carry on those programming tasks with little to no supervision. The question remains: Should this be done? Potential hallucinations (where the model presents flawed/false content as true) and quality issues might deter many executives. So, it bears risk, which may be significant. Longer term, the answer should be no. The goal is to prevent any semblance to the Greek myth of Sisyphus pushing his boulder up a hill, having to repeat the act eternally.

Making it work: Choosing the right partner is crucial. While much analysis is done upfront in these contracts, the devil is in the details. This goes beyond keeping documentation current. Some partners have extensive experience reducing tech debt — even during migrations. In DXC's experience, we have seen 39% cost savings from technical debt reduction for customers, while being able to retire 37% of redundant applications (**Figure 10**).

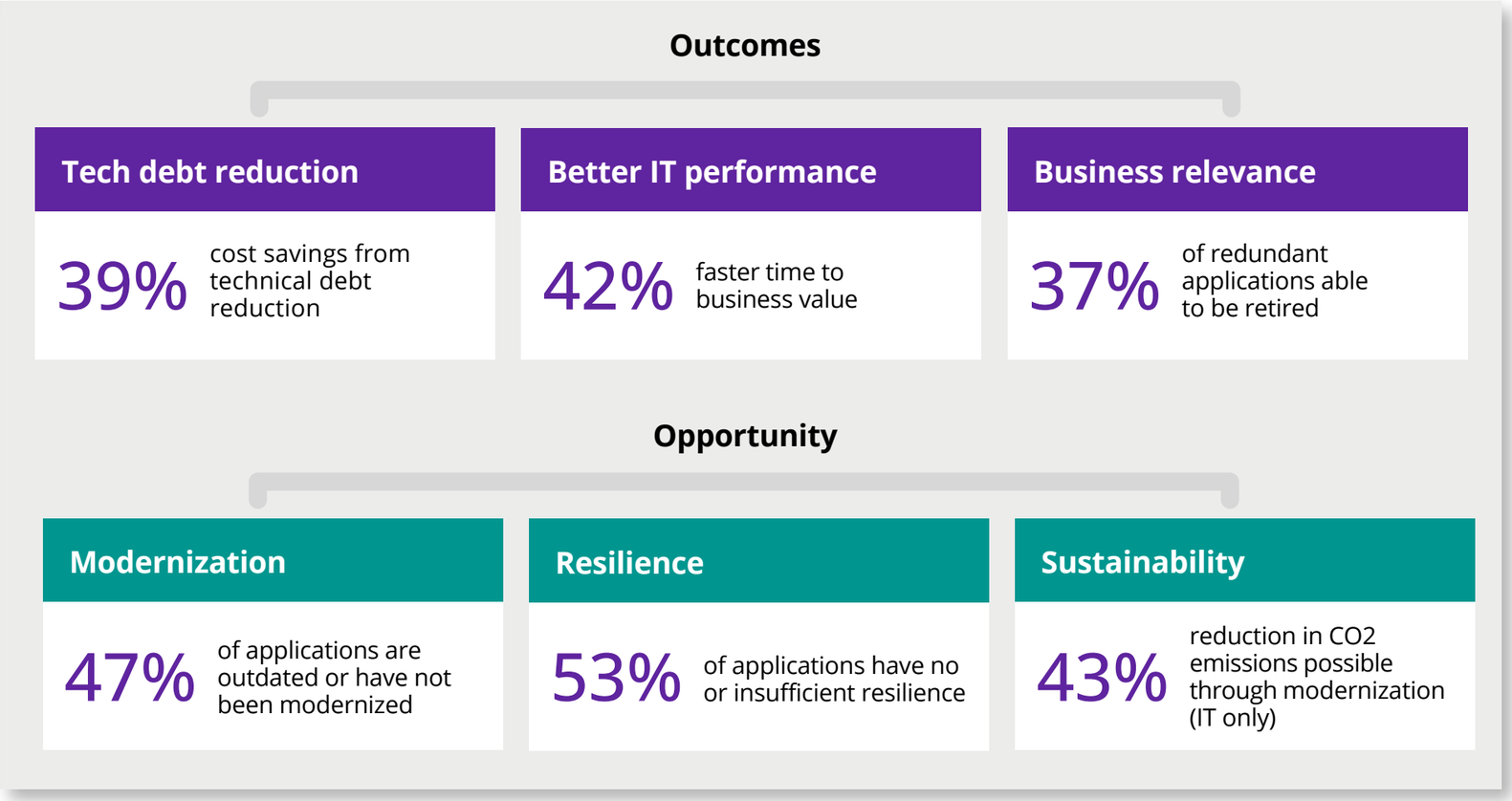


Figure 10. Outcomes vs. opportunity. *Increasing digitization of organizations unlocks business agility. Yet rising tech debt hampers that agility. DXC's approach to modernization flattens tech debt and fuels business performance.*

Source: DXC Applications Intelligence Engine. Percentages shown are averages.

Self-repeating spiral

If corporate IT does not satisfy the expectations of business lines, they will procure the software from somewhere else. This familiar situation marks the beginning of a cycle that reinforces org debt.

Figure 11 illustrates how this can become a repeating pattern that can also encourage silos. It is not desirable for multiple business lines to act independently and build their own IT capabilities (1), with duplication and little economy of scale (2). If this creates significant enough challenges to the organization, IT functions will be centralized (3). This is highly likely to make the IT department less responsive (4), because it increases maintenance work, usually without an associated business context. Business units will get increasingly frustrated with the quality of services they receive, and they will eventually start procuring solutions elsewhere on their own (5). This sets off the entire cycle again. This negative cycle is completely reactive. It stems from attempts to make current predicaments more bearable.

However, the pattern can be interrupted. IT departments can be educated and motivated to spot innovation happening early and spread it early throughout the entire organization.

In these circumstances, enforced centralization does not happen, the IT department does not become overwhelmed, and the organization does not accrue more tech debt.

The core of this approach is to enable innovation close to the front of the business, because the potential needs are there, and to refine it. If appropriate, it can then be expanded to other business lines. The ability to allow and facilitate this is an important IT department capability, and is the seed of a platform-based operating model, because a set of standard capabilities and solutions enables flexibility in the business.

Working in an open, collaborative and decentralized platform-based manner is something that most IT leaders recognize as essential to modernizing their enterprise, with 78% agreeing that "modernization helps increase our ability to pursue platform-based business and collaborative ecosystems."

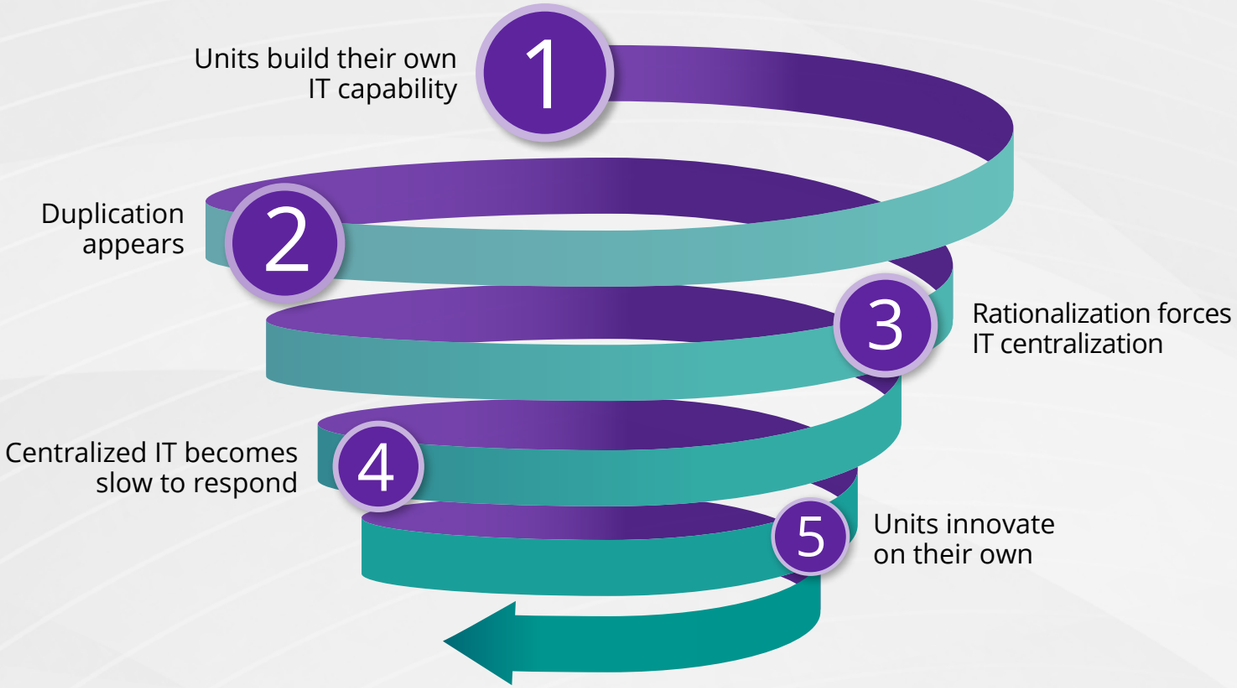


Figure 11. The self-repeating pattern

Taking action

Organizations need to change alongside their environments. Org debt is primarily a result of delaying adaptation to an ever-evolving environment. Accordingly, resolutions are centered on restoring the organization's ability to accommodate change.

While this report is replete with examples, cautionary tales and market perspectives (including the industry detail in appendix), there are four prescriptive steps to take now (**Figure 12**).

Figure 12. Four steps for clearing org debt

1. Reframe org debt as modernization

Clearly articulating org debt is a way to ensure clarity of vision on the modernization path. The mind shift toward future focus is essential. This is an appropriate time for candid executive conversations when taking stock of what you have.

Complete an honest inventory of your tech estate.

Set aside enough time to document and probe challenge areas.

Be as consistent as possible in evaluation criteria and metrics.

Examine and score risks, but don't stop there. Consider real-world scenarios that drive volatility (cyberattack, weather disruption, competitor action) to pressure-test your situation.

Include your teams and your partners in a skills assessment so you have a good idea of where knowledge is held and might be leaky. Determine what systems are at risk.

2. Define opportunities

The first step in defining modernization opportunities: expand the circle beyond IT accountability. The CIO and CTO will lead modernization, but the entire executive team is responsible for its success. In this arena, the CFO is likely to be among your best advocates. "Capital M" modernization actions should be considered corporate strategy or strategic plan activities, and those are often the purview of the CFO. Coordination between the business side and technical arm of the organization is crucial. CTOs and CIOs are uniquely positioned to communicate org debt effectively to the C-suite and wider business stakeholders, with the CFO's support. As the survey shows, CIOs and CTOs are already thinking about the cross-organizational benefits of IT modernization, especially when it comes to employees. Making the case clearly and convincingly to enable effective collaboration is the next step for these leaders.

Set objectives and understand where value accrues. (We recommend Wardley Maps.)

Define and align on trade-offs. It's not just about developing the early initiatives but maintaining a modern, adaptable tech estate over time.

Figure out what's sucking value out of your organization — the entanglements where systems, software or solution approaches have hidden costs or connections. Define who benefits from specific approaches and whether leadership agrees with that approach.

Determine where you should stop reengineering what you have. Use the Wardley Map to define specific areas in which to invest — and where to outsource. Highlight key areas that benefit from adaptation or require flexibility. Consider where and how efficiency delivers benefits, but create check-ins over time to prevent loss of fidelity.

3. Clear your barriers

Our research has indicated that every industry has a unique profile. We'd expect that each company will as well. So, clearing your barriers is a matter of defining them in light of your inventory and your Wardley Maps.

Use your industry profile as a baseline and modify it for your organization's needs. Additional barriers may apply to your unique circumstances.

Create a plan to clear your barriers and develop resilience. Focus on:
1. Knowledge capture and maintenance
2. Engineering for adaptability and reusability

Set, expect and reward good, thoughtful behavior. Stakeholder management and governance rely on honest, open and frequent communication about business strategies, tactics and the technologies supporting them. A published set of principles can provide guidance.

4. Organize for execution

Having shifted the conversation, defined the barriers and gained alignment (and acknowledged that this is no small feat), you can focus on the desired objectives and impact of the activities. We've started with the premise that **modernization** is in service to the demands of *increasingly sophisticated users*.

How do you serve increasingly enabled customers?
How do you serve your upcoming products/services?
How do you give yourself a hedge against downside risk?

Focus on "hard impacts" — the economic, legal or compliance-driven improvements that are more clearly understood by the leadership team. Environmental, social and governance (ESG) actions fall in here, as do requirements for privacy, data sovereignty and others.

Address the "soft impacts" — the organizational and especially technology-led team culture, knowledge capture and development. Organizing resources that can contribute expertise to Agile, platform, product and offering teams is critical.

Modernization is an ongoing process, not a single project with an end date. It is a collaborative process that involves not just the IT circle but the entire organization. Accordingly, when it is done properly, the benefits are felt across the whole business. From cost savings to carbon reduction, to making employees' work lives smoother, there's a business case to be made across every arm of an organization. When org debt is viewed clearly and articulated fully, it can be flattened, understood and managed thoughtfully as part of the balance sheet of a healthy business.

The organization's focus should be on resilient, flexible design that allows progress and efficiency to coexist. This minimizes technical debt and enables organizational agility.

Appendix: Key survey responses by industry

Introduction

This appendix provides a set of industry viewpoints for many of the core questions in our tech debt/modernization survey research. The reason for including this is simple: "the lie of averages." When numbers are aggregated, nuance can often be lost. To inform debate, this appendix calls out insights where industry viewpoints vary greatly. A version of specific findings for the 10 industry groupings we've detailed is available upon request through the DXC Consulting industry teams (see QR code on back page of this report).

Section 1: Industries, tech debt and innovation

The connection between tech debt and the ability to pursue digital transformation varies across industries, according to how survey respondents selected the top two options (where technical debt is "deeply" or "significantly" linked to digital transformation and growth).

Most organizations find technical debt inhibits their ability to transform or innovate

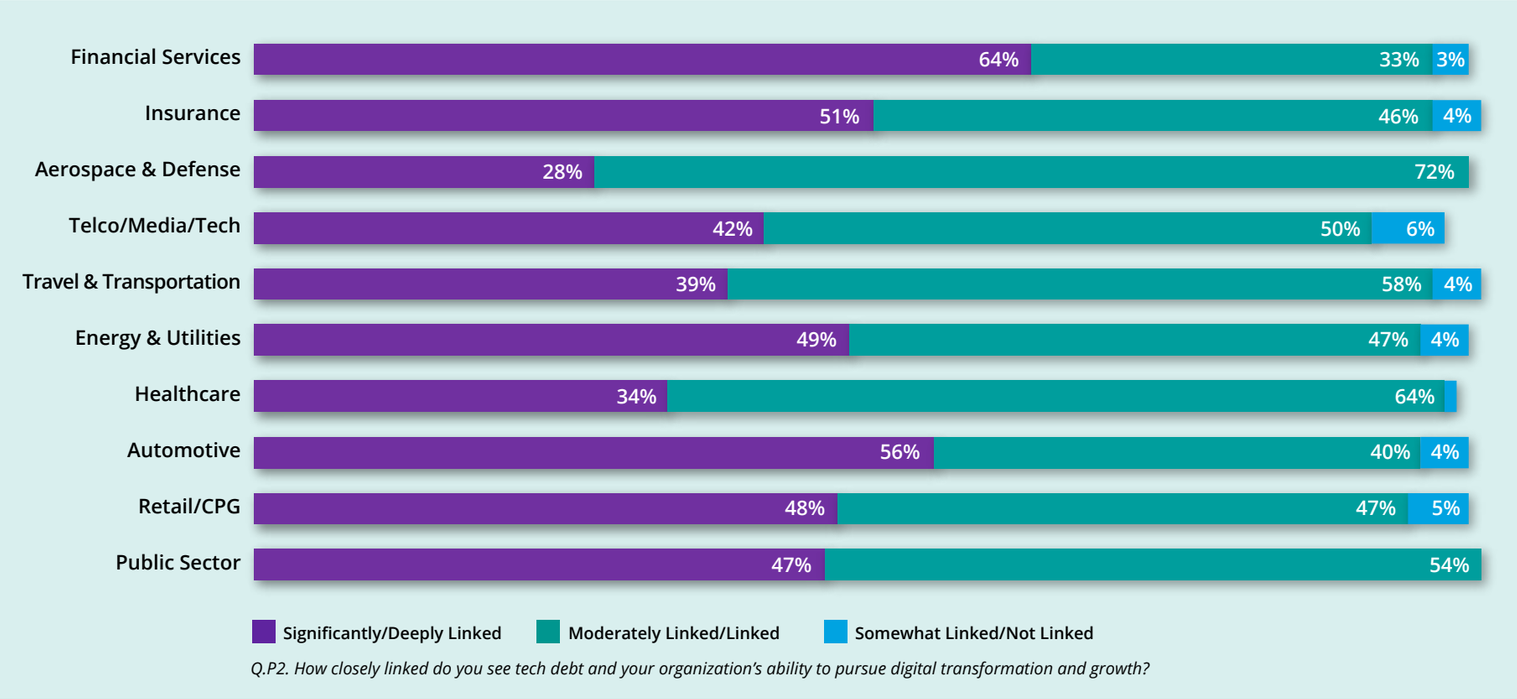


Figure A1. Technical debt and its effect on transformation and growth (responses by industry)

When we examine the percentage of those who said it has a greater impact, there were twice as many (or nearly so) in the financial services and automotive industries as in the aerospace and defense and healthcare industries (**Figure A1**). While financial services respondents tended to score themselves in the upper ranges of questions more frequently, the research hypothesis anticipated this. Financial services is both highly regulated and facing disruption from fintech competition and consolidation among traditional players.

In that light, the digitization of automobiles (and the factories that produce them) is contributing to similar challenges. While each vehicle has dozens to hundreds of sensors, the factories that produce them are also becoming increasingly digitized. For those in the automotive industry, this is not surprising. However, for those of us not in the industry, it can seem breathtaking that Tesla can release software daily to at least some of its vehicles. The business change needed to match that speed, capability and frequency of updates may seem daunting.

At the other end of the spectrum are the aerospace and defense and healthcare industries. Healthcare might be seen as having made significant digital progress recently with the setup of online clinics, services and support structures as an outcome of the pandemic. Aerospace and defense results may be partially a function of Russian aggression against Ukraine. However, neither of these theses quite adequately explains the outsized difference between these two industries and the rest of the pack.

Section 2: Tech debt on the risk register

We address in the report that less than 1% of the sample indicated tech debt was not on their board's risk register. Yet, articulating it directly was still not seen as vital. In fact, financial services was in position 1 and automotive in position 3, as expected (**Figure A2**). In validating the risk profiles with customers and executives as part of our process, the results for financial services make sense. For the same reason discussed in the prior section, results for automotive also make sense.

Energy and utilities results were also in line with expectations. In the U.S., the need to put forth a rate case to regulators would mean the articulation of named risks. In other geographies, greater proliferation of digital technologies working across IT and OT create increasing risks across the portfolio. Digitization in this industry goes well beyond customer-facing tech but includes core business operations and physical plants in several areas, from automated load balancing to platforms for energy arbitrage and countless other potential points of value.

The irony of the travel and transportation industry having not yet quantified its tech debt, despite multiple recent high-profile incidents of value destruction and loss of public trust, is not lost on the authors.

Figure A2. Tech debt and the risk register (responses by industry)

If 99% of information executives know there's a problem, why is the risk not better — or more specifically — articulated?

Maybe because the name "tech debt" is so stigmatizing.

Plenty of CEOs see tech debt as depreciation. The challenge in that view is that many systems have debt that impacts multiple functions and can be exceptionally difficult — and risky — to extricate the organization from.

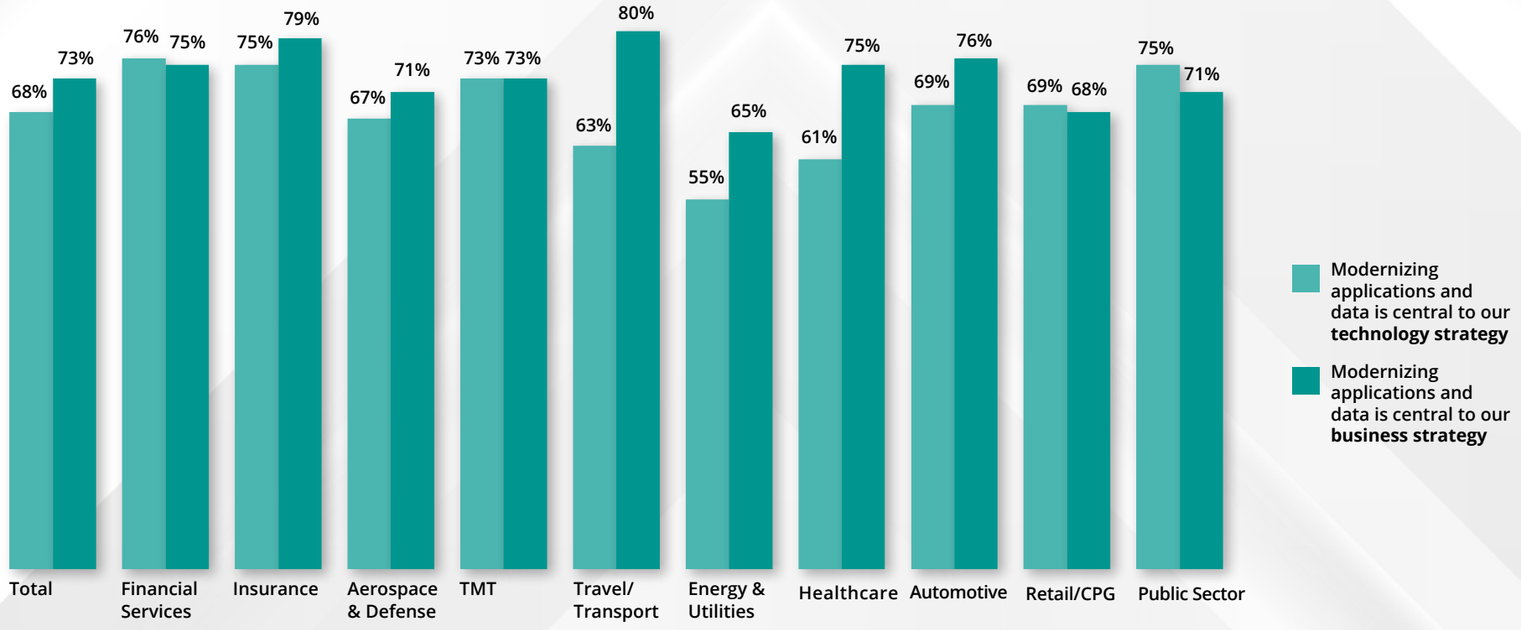
Q.P1. Is tech debt reflected on your corporate risk register in some form?

Section 3: Modernization: Business, tech or both?

In most industries, modernization is deemed a business strategy nearly as often as it's deemed a tech strategy (**Figure A3**). This parity is pointed out in the "tech debtors" section of the report. Yet, the divergence is strongest in travel and transportation, where there seems to be a growing recognition of modernization issues, as well as the fact that IT alone cannot solve them.

Energy and utilities, where the gap is 10 percentage points in favor of business strategy, is anomalous, as is healthcare. The digital transformation of these industries is so central to their continued changes that the gap we see in who's accountable (next figure) presents a bit of a conundrum.

Is modernization a business strategy or a tech strategy? The answer is both.



Often, modernization tasks — and the tech debt they're ameliorating — are perceived as belonging to IT, executed as part of a technology strategy.

However, the responses of IT leaders tell us they perceive modernization as a business strategy equally, if not more so.

That begs the question: Why is the benefit to creating tech debt held by the business when the need to pay down or pay off that debt is held by IT?

Q.P5. To what extent do you agree with the following statements about the role of modernization in your organization? 3 = Agree, and 4 = Strongly agree

Figure A3. Modernization: Business or tech strategy? (responses by industry)

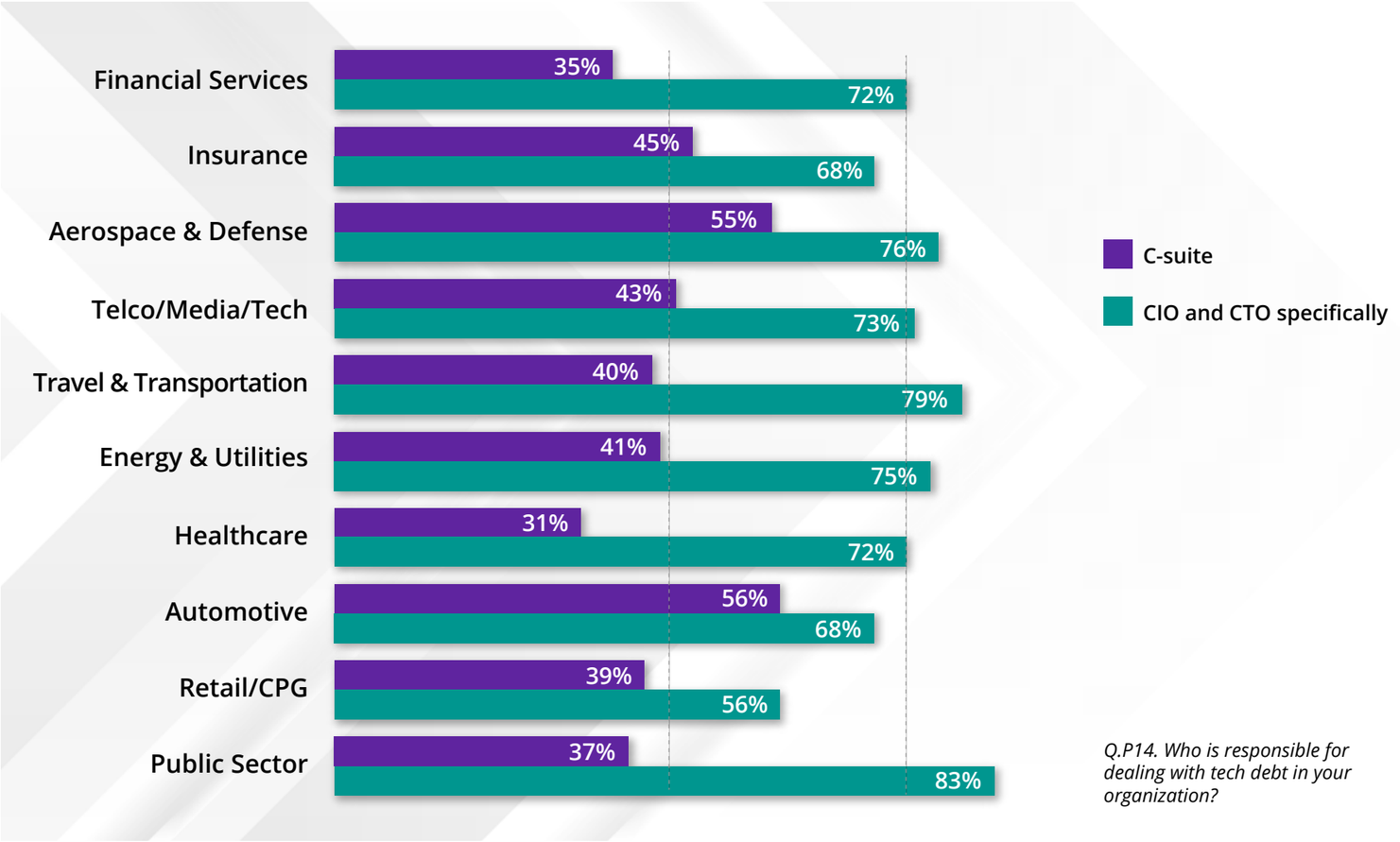
Section 4: Who's accountable?

In this study and in DXC Technology's podcast with analyst firm IDC, senior researcher and expert mapper Krzysztof Daniel describes how "who gets the cake" is different from "who pays for the cake." The cake is the benefit of the debt — as debt is always incurred in someone's favor, or it would not exist. In four of the 10 industries surveyed (financial services, travel and transportation, healthcare, and the public sector), roughly twice as many respondents indicated debt is IT's job rather than that of the entire C-suite (**Figure A4**). IT, no matter how heroic the CIO or CTO may be, cannot swoop in to save an organization from tech debt without the C-suite working directly with it. Prioritization of tech debt means another strategic project might not be attended to. So, amelioration or remediation should be recognized as a collaborative effort.

This points to the need for a shift in IT's role to that of tech educator as much as tech specifier and implementer. For industries such as energy and utilities and telco/media/tech, technology is enabling vastly different business, commercial and operating models. This presents the opportunity for new types of conversations. It should be noted that evangelizing tech is not the same as educating. Detailed, honest conversations about inhibitors, expenses and risks are needed, and IT will continue to be seen as a black box or walled fortress until these organizational needs are met.

There were industries where the ratio was closer: insurance, aerospace and defense, and automotive. The latter two are more heavily oriented toward manufacturing, where operations — and the COO in particular — works more closely with IT every day.

In insurance, core operational systems — most notably around claims (and embedded field operations, in the case of natural/environmental disaster) — require a higher level of C-suite alignment on a regular basis.



Q.P14. Who is responsible for dealing with tech debt in your organization?

Figure A4. Who's responsible for tech debt: The industry perspective

Section 5: Why modernize — the industry lens

The desire to change the employee experience is a reflection of the challenges in talent retention. These exist across the tech estate, but notably in security. As IT professionals look for chances to work on newer tech, with more impact on and to the business, changing the employee experience requires more than just lip service. The top 3 business objectives of modernization identified by respondents in different industries is shown in **Figure A5**. This view represents industry priorities as opposed to aggregated priorities for all industries.

For instance, air traffic controllers are in tremendously short supply and have been for decades.[1] In healthcare, the "total supply of RNs decreased by more than 100,000 from 2020 to 2021 — the largest drop than ever observed over the past four decades. A significant number of nurses leaving the workforce were under the age of 35, and most were employed in hospitals."[2] Utilities have been losing lineworkers since the early 2000s.[3] In the early days, the main cause was retirement. However, as with nurses and air traffic controllers, the demands of lineworkers are immense. Systems are increasingly strained from pandemics, natural disasters and other external forces and cannot bear the weight of being short-staffed and not tuned to today's technology.

Architectural flexibility, which shows up as the top business objective in six of the 10 industries, reflects a change in how business will be done — vis-à-vis platforms, microservices, AI and automation.

So while individual priorities vary by industry, it's also worth looking at the underlying causes for these selections. No one can dispute the need for advanced security in transportation systems, energy and utilities, and aerospace and defense. In fact, we'd be surprised not to see that. But looking for the fundamental reasons for the shift is important in moving beyond objectives to strategies.

*While **architecture flexibility** floated to the top, **agility and employee experience** figured heavily.*

Financial Services	Insurance	Aerospace & Defense	Telco/Media/Technology	Travel & Transportation
More architecture flexibility	**More architecture flexibility**	Increased security	**More architecture flexibility**	**Improved employee experience**
Growth	Improved employee experience	More architecture flexibility	Improved employee experience	Increased business agility
Improved employee experience	Increased business agility	Cost-reduction benefits	Cost-reduction benefits	Increased security

Energy & Utilities	Healthcare	Automotive	Retail/CPG	Public Sector
Improved employee experience	**More architecture flexibility**	**More architecture flexibility**	**Increased business agility**	**More architecture flexibility**
Increased business agility	Improved employee experience	Increased security	Increased security	Cost-reduction benefits
Increased security	Cost-reduction benefits	Increased business agility	More architecture flexibility	Improved employee experience

Figure A5. Top 3 business objectives of modernization (by industry)

[1] Kaplan, Juliana; Towey, Hannah; and Rains, Taylor. "*Airline collision close calls are on the rise partly because there's not enough people working the high-paid, high-stress job that prevents them.*" Insider, August 2023: https://www.businessinsider.com/air-traffic-controller-shortage-salary-requirements-plane-collisions-close-calls-2023-8

[2] Auerbach, David; Buerhaus, Peter; Donelan, Karen; Staiger, Douglas. "A Worrisome Drop In The Number Of Young Nurses." Health Affairs, April 2022: https://www.healthaffairs.org/content/forefront/worrisome-drop-number-young-nurses

[3] O'Connell, Jon. "Third of utility workforce reaching retirement age soon." Energy Central, January 2017: https://energycentral.com/news/third-utility-workforce-reaching-retirement-age-soon

Section 6: Industries and digital transformation

In one question, we asked: "Which of these statements most and least reflect your approach and thinking on digital transformation? Please choose top 3 in order of priority (out of 9)." The top 3 options selected were:

1. "Market challenges and disruptions are placing pressure on our IT infrastructure and applications."
2. "Digital transformation is central to our organization's overall business strategy."
3. "Our digital transformation journey is tied to our desire to keep pace with or exceed customer expectations."

In all 10 industries, two options vied for first place: "market challenges and disruptions" and "central to business strategy" (**Figure A6**).

This presents the central tension around tech debt, digital transformation and the speed and impact within which external forces are moving. Tech debt doesn't show up when systems — even older systems — are functioning to meet the needs of modern businesses. It's when businesses and market conditions change that the needs of the business change.

Executive thinking around digital transformation was dominated by market challenges and disruptions. In many places, this overrode concerns for strategic considerations and customer expectations.

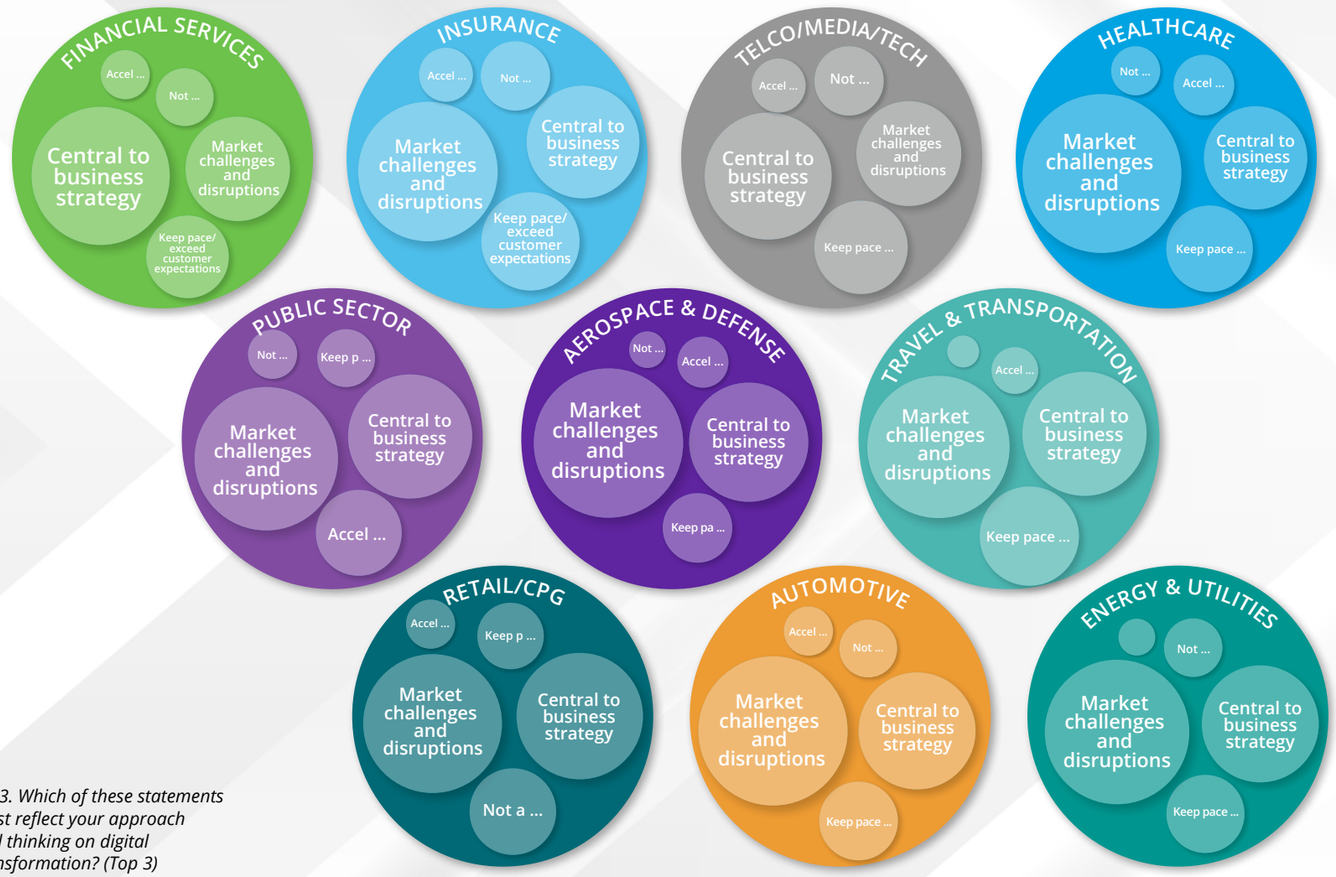


Figure A6. Top statements that reflect thinking on digital transformation (by industry)

Section 7: Modernization projects by industry

The current state of the global economy is uneven at best. Inflation, political uncertainty and technology change are mixing with global demography changes, civil unrest and challenges to trade or trade policy. As companies look to do business in this economy, system modernization is an imperative, not just a nice-to-have. Since not many companies are sitting on piles of cash (or have a desire to funnel them all to modernization), the question is what projects are winning the greatest wallet share. Again, most of the industries charted their own path, with the exception of insurance and financial services.

If one is looking for a set of industry priorities for the post-pandemic world, **Figure A7** paints a reasonable picture. In the industry drill-down slides available from DXC Consulting, an additional drill-down is available on the particular modernization priorities within each functional project area.

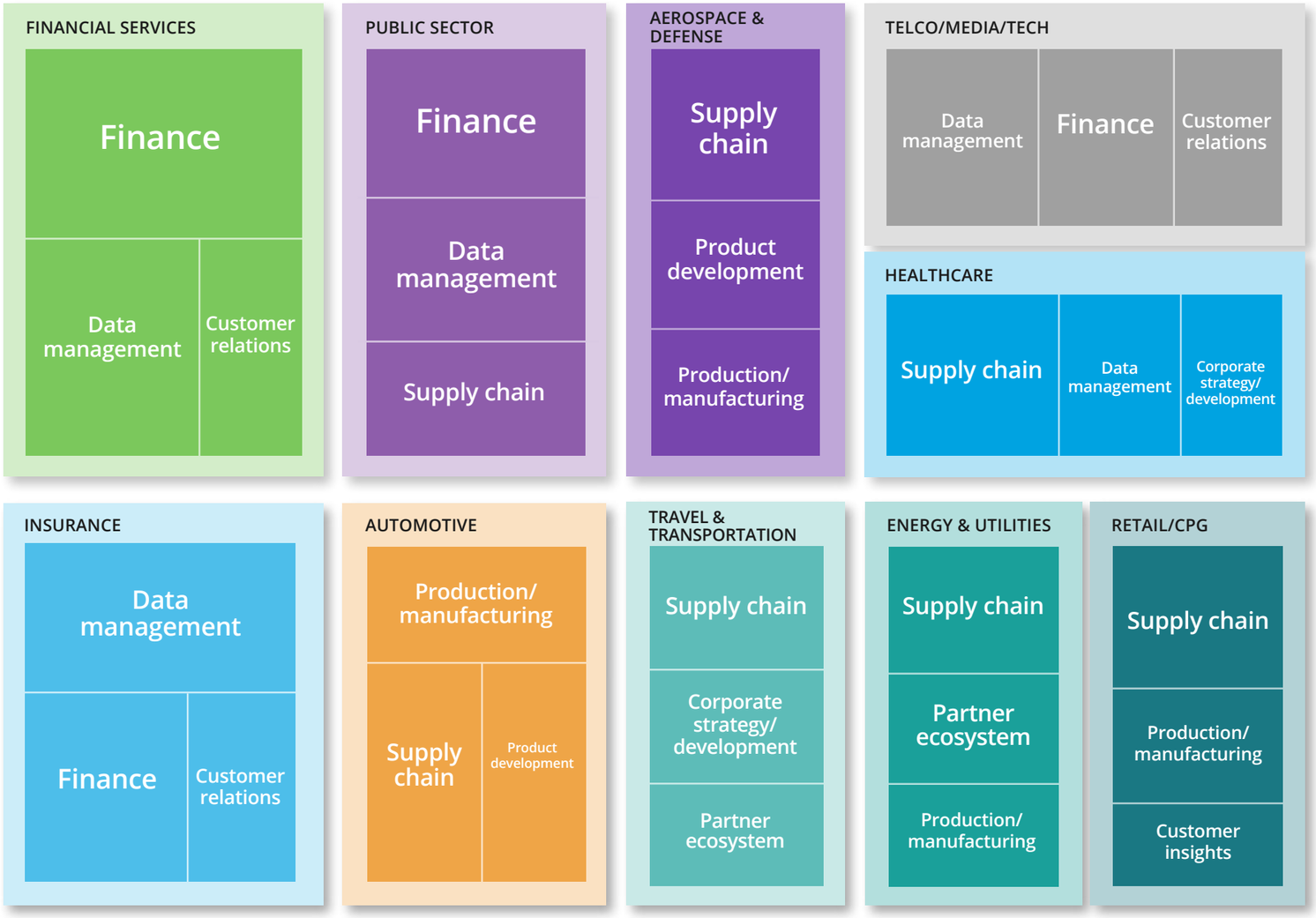


Figure A7. Priorities by industry. *Survey question: "In which of the following business areas/functions is your organization currently actively working on a modernization project? List Top 3 in order of priority."*

Section 8: Obstacles to modernization

If there was an expectation for commonality in modernization obstacles across industries, that just isn't so, as shown in **Figure A8**. It's worth addressing some of the core components. Technical barriers included end-state technology standards and architecture. Also, note that the IT executives we spoke with never ranked technical obstacles as more prominent than fourth on their list.

Legal barriers — including compliance and regulatory changes — topped the list for five out of 10 industries. Financial barriers were most often in the top 3; they included investment, business case and ROI challenges. Cultural barriers addressed sponsorship, buy-in and support; these were considered a lower-level barrier in most industries.

Knowledge also figured highly — in the top 3 for seven industries. Knowledge barriers reflected loss of specification of systems, software, processes, machines and dependencies. Understanding the industry and how to work across it is still relevant; importing talent across industries is a good way to shake things up, but knowledge of the imperatives, operations and commercial models has value to organizations. (It might not be well understood exactly how much value it has, but that's a different topic.) Expertise — including experience, talent, tools and skills — was one of the most variably ranked barriers across industries.

Financial Services	Insurance	Aerospace & Defense	Telco/Media/Tech	Travel/Transportation
Legal 59%	Legal 57%	Financial 39%	Legal 57%	Legal 57%
Expertise 53%	Financial 53%	Knowledge 37%	Financial 49%	Knowledge 41%
Financial 52%	Knowledge 45%	Cultural 35%	Expertise 48%	Financial 39%
Knowledge 47%	Technical 37%	Expertise 32%	Knowledge 45%	Cultural 39%
Cultural 44%	Expertise 35%	Legal 31%	Technical 40%	Expertise 35%
Technical 41%	Cultural 32%	Technical 24%	Cultural 29%	Technical 29%

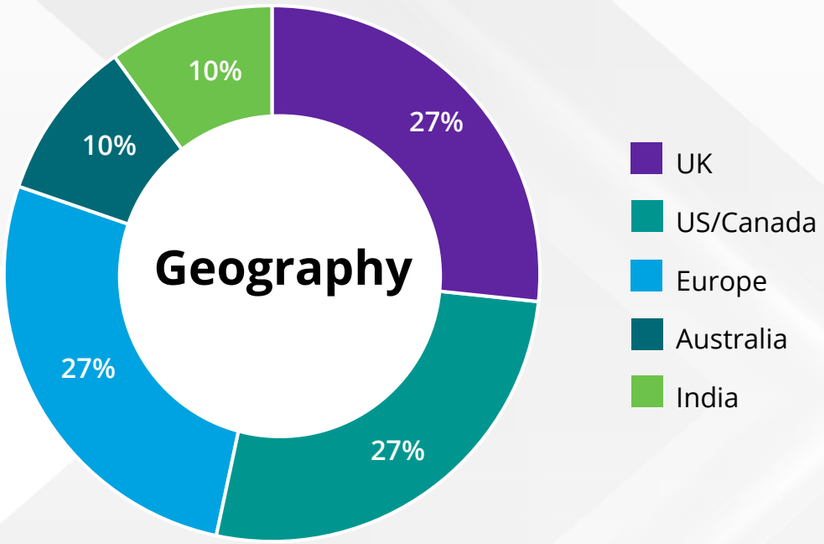
Energy & Utilities	Healthcare	Automotive	Retail/CPG	Public Sector
Expertise 56%	Knowledge 43%	Knowledge 59%	Legal 56%	Financial 59%
Knowledge 52%	Financial 43%	Legal 52%	Expertise 52%	Knowledge 51%
Legal 48%	Cultural 36%	Financial 51%	Financial 52%	Legal 49%
Financial 48%	Expertise 33%	Expertise 44%	Knowledge 49%	Technical 36%
Cultural 45%	Legal 33%	Cultural 39%	Cultural 44%	Expertise 36%
Technical 32%	Technical 25%	Technical 36%	Technical 43%	Cultural 33%

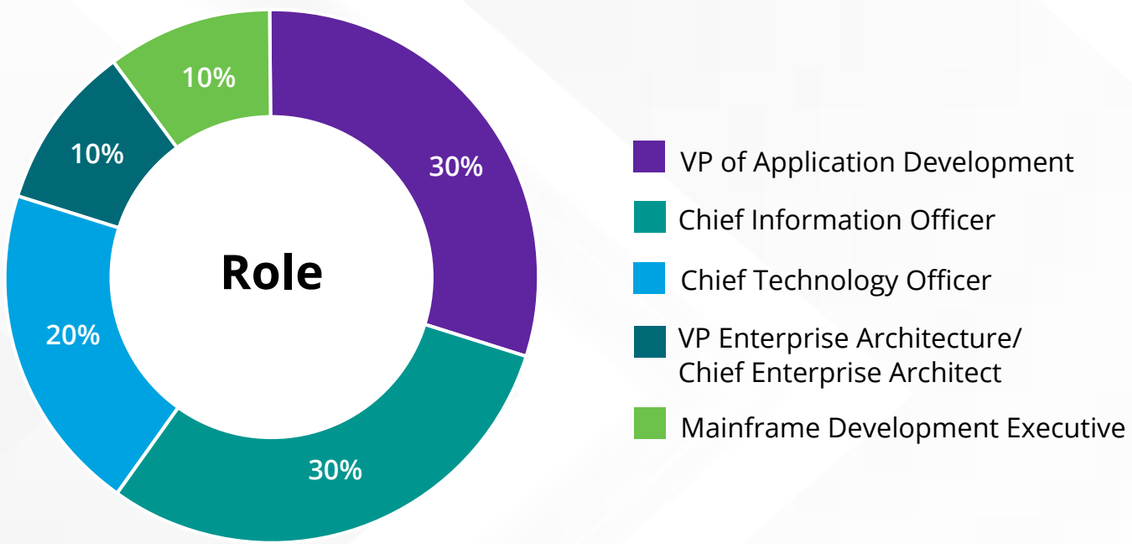
Figure A8. Top modernization obstacles by industry

Q.P10. How significant are the following challenges in advancing modernization projects in your organization?

- Legal, regulation, compliance
- Knowledge, loss of specification of systems, software, process, machines, dependencies
- Expertise, talent, tools, skills
- Cultural, sponsorship, buy-in, support
- Financial, investment, business case
- Technical, end-state technology standards and architecture

Respondent profiles: Modernization and technical debt survey, February 2023 (n=750)





Qualifying questions:

Q.S1. Is your organization working with and/or investing in any IT modernization or technical debt elimination activities to specifically transform the application portfolio? (Qualifying response: Yes)

Q.S2. How familiar are you with your organization's tech debt and modernization projects/investments? (Qualifying responses: Working On Modernization Projects And Influencing Investments Is Part Of My Primary Role [5] or Aware And Consistently Involved [4])

Revenues (USD)

$1 billion – $4.99 billion	20%
$5 billion – $9.99 billion	20%
$10 billion or more	60%

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Acknowledgments

DXC Leading Edge extends its gratitude to each of the following for their exceptional contributions to the success of this research report. Your dedication, expertise and collaborative spirit have been the driving force behind this publication. We look forward to the journey of innovation and discovery ahead. Thank you:

- iResearch Services (iresearchservices.com) for survey execution and results
- Andy Scrivner, Dimensions Design (dimensions-design.com), for graphics and design support
- DXC Marketing, Creative Services and Social teams for creating fabulous content to share

We would also like to thank the following for their contributions in our journey of exploring tech debt:

Michael Corcoran, Kevin Cunningham, Alex Kokkonen, Lori Lewis, Susan Mann, Simon Wardley

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