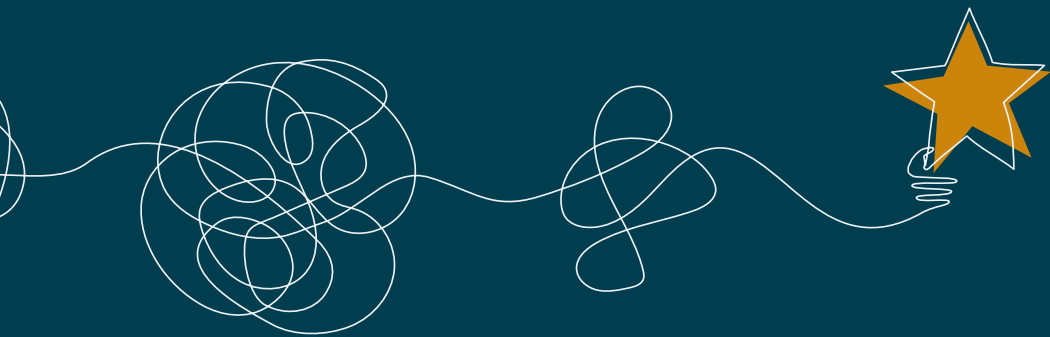


Don't waste a tech debt crisis

Take a value-driven approach to
technical debt to minimize risk and
meet rapidly changing customer needs

/thoughtworks

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Executive summary

Rapid changes in markets and society have increased uncertainty, making it more challenging for C-suite executives, technology leaders, and board members to manage risks effectively while prioritizing the right initiatives — to deliver the right business outcomes.

This challenge is compounded by the technical debt organizations have accumulated over many years. Recent high-profile failures arising from technical debt underscore the need for more efficient approaches to keep IT systems and infrastructure up-to-date. These failures, which have had significant consequences for both customers and the organizations themselves, are a warning to other businesses: They may experience the same problems if they don't address their technical debt.

Technical debt builds up over time and can cause significant issues, creating operational, financial and legal risks. Business leaders face pressure to manage these risks while still delivering on their plans and demonstrating return on investments. To achieve this balance, companies must implement an integrated operating model across business and IT that enables them to make decisions that reduce technical debt — and deliver new value.

At Thoughtworks, we have a proven operating model, EDGE, that holistically addresses business priorities, including technical debt, applying iterative practices around value-driven portfolio management, customer-centricity, product-focused teams and engineering effectiveness. In this model, strategy is brought much closer to execution and ongoing, real-time measurement enables dynamic steering.

In this white paper, we explore how to apply the EDGE operating model and other techniques to:

- Govern your investment in technical debt remediation
- Orient your organization toward customer needs in a sustainably profitable way
- Shift to a more proactive stance that improves your ability to handle external events and market shifts

Introduction

Technical debt — the accumulation of small technical inefficiencies over time — can create significant issues in the long run. Recent high-profile failures of legacy systems have highlighted the importance of keeping systems and infrastructure up to date and functioning efficiently. These failures, which had major consequences for customers and the companies themselves, alert other organizations of what's at stake if they don't address their own technical debt.

Business leaders and board members must provide governance at both a strategic and operational level to prevent such failures. But following a linear, project-based approach of investing in new systems and infrastructure can be expensive, time-consuming. At the same time, companies must deliver on their strategic plans, focusing on product and customer-centricity to generate new value. Making all this work well requires a more fluid balance between planning and execution. Simply put, more dynamic and adaptive approaches are required.

Without an integrated operating model that connects business and IT, it's virtually impossible to bring these concerns together. This operating model must also adapt to help the organization respond quickly to unforeseen shifts in customer, business and market demands.

Through an iterative approach that integrates the business and technical aspects of technology decision-making, organizations can deliver customer value while proactively managing technical debt. And that's what Thoughtworks' EDGE operating model is all about.

EDGE treats the reduction of technical debt as a strategic business enabler rather than a separate, technology-focused issue. By approaching technical debt as an element of strategic business investment and customer-centric value generation, organizations can make more effective decisions, build a coherent strategy and adapt quickly as market shifts emerge.

In the next few sections we'll examine the true business impact of technical debt to show why all types of businesses should proactively address their own debt. We'll also show how organizations can use the EDGE model and other techniques to establish adaptive portfolios for new value creation and technical debt remediation.

The real-world impact of technical debt

Over the last couple of years, we've seen several high-profile examples of the impact of technical debt.

For example, COVID-19 pandemic shone a light on the technical debt that had built up in US state and federal government systems. As millions of US citizens tried to file unemployment claims online, the skyrocketing volumes caused systems to crash. These systems were running on mainframes using COBOL code that was 40 years old or more, and one of the biggest challenges was finding enough programmers capable of working with this older language.

Technical debt hit the headlines again when Southwest Airlines was forced to cancel nearly 16,000 flights over the holiday period in December 2022. When severe snowstorms disrupted air travel, Southwest's 20-year-old scheduling systems couldn't keep up to match available crew members with aircraft that were ready to take off. This failure cost Southwest around \$800 million in compensation and lost revenues — and only time will tell the future impact of the loss of customer goodwill.

Less than two weeks after the Southwest incident, the US Federal Aviation Administration (FAA) added to the technical debt discussion when a 30-year-old pilot notification system, NOTAM, failed for several hours.

The FAA issued a relatively brief "ground stop" that affected most forms of aviation in and around US airspace. The cost of this incident is harder to measure, as it impacted airlines, private flights and business aviation — and inconvenienced tens of thousands of passengers and crew members. However, the

costs will likely involve lost revenue, compensation for affected passengers, increased operational expense and any additional expenses incurred in resolving the issue.

According to one [National Public Radio report](#), the outage caused airlines to cancel more than 1,300 flights, and delay nearly 10,000 more. Crew and maintenance disruptions alone likely cost the US airline industry millions of dollars.

While the impact of leaving tech debt unchecked can be dramatic, organizations can mitigate the risks of failure — and generate new customer value — by adopting an adaptive operating model that brings agile principles to technology and business decision-making.

An adaptive operating model for value creation

In their 2019 book, EDGE: Value-Driven Digital Transformation, Thoughtworkers Jim Highsmith, Linda Luu, and David Robinson explored how the extraordinary pace of change has exposed a huge gap between business strategy and its execution.

According to EDGE, business leaders want to respond to the latest opportunities and risks, such as technical debt, by adapting their strategies. But many organizations' processes, practices and capabilities aren't comprehensive or flexible enough to help.

However, by applying agile principles such as business and technical stakeholders working together to manage their strategy and execution processes, organizations can generate more customer value and close this gap. And by incorporating technical debt as a standard component of investment considerations, stakeholders can make more proactive and informed decisions about it.

In the past, organizations approached strategy — and by extension, portfolio management — as a linear process. Decision-makers chose what they wanted to achieve, allocated resources and took action to make it happen. In this approach, the link between strategy and execution is static rather than adaptive. But as more businesses are discovering, the linear approach isn't fit for purpose in today's rapidly-evolving enterprise landscape.

The EDGE operating model, however, applies agile principles to the business processes of strategic planning and execution. An iterative cycle of plan-execute-measure ensures that the strategy stays on course — or can be updated as needs require. Further, EDGE includes risk elements such as technical debt in the planning and execution lifecycle as a standard approach to optimizing customer value.

Next, we'll look at the core of the model, value-driven portfolio management, and explore three dimensions required to make EDGE work in your organization.

Value-driven portfolio management

One of the fundamental questions raised by EDGE is, “How should we invest?” That’s why the central component of the operating model is value-driven portfolio management.

The “value” in “value-driven” refers to customer value. Many companies see value primarily from an internal perspective, such as revenue and margin. Under EDGE, however, the value sought involves what is important for the customer, which further enables the company’s internal value. By creating products that customers use and love, companies are rewarded with repeat business (revenue) and premium pricing for services that are perceived to be higher in value (margin).

Every enterprise, from the smallest to the largest, must sift through its opportunities to come up with focused goals — which opportunities to pursue, which to consider further in the future and which to abandon. It’s not an easy process and requires skillful analytical ability along with keen judgment.

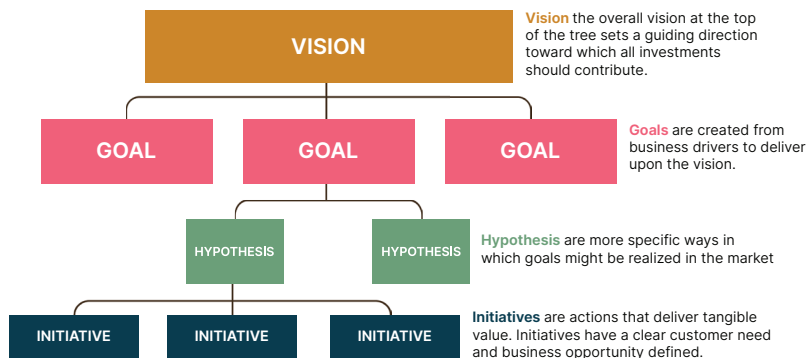
Crucially, EDGE and its tools are not a replacement for these analytical skills, but rather enhance the decision-maker's abilities to think clearly and choose better alternatives

Value-driven portfolio management prioritization under the EDGE operating model has three stages:

- Determine what to invest in by articulating the business vision and strategy as a set of goals, hypotheses to test and initiatives that test the hypotheses.
- Develop actionable, outcome-oriented measures of success (MoS) that indicate leading and lagging measures, so portfolios can be adapted flexibly as new situations emerge.
- Use the relative value of the MoS to prioritize investments.

Under EDGE, organizations can easily visualize a strategy and its potential execution options as a “Lean Value Tree.”

By including key elements of technical debt in this tree, along with the hypotheses and MoS that describe the value-driven portfolio, organizations can routinely include decisions about technical debt alongside standard allocations of investment



Example: Lean Value Tree is a visual tool to facilitate capturing and sharing an organization of vision and strategy.

Figure 1 - Lean Value Tree

A foundational agile principle is the importance of responding to change rather than simply following a plan. This means applying fast-feedback loops to a process, which is precisely what happens in the EDGE operating model.

EDGE feedback loop

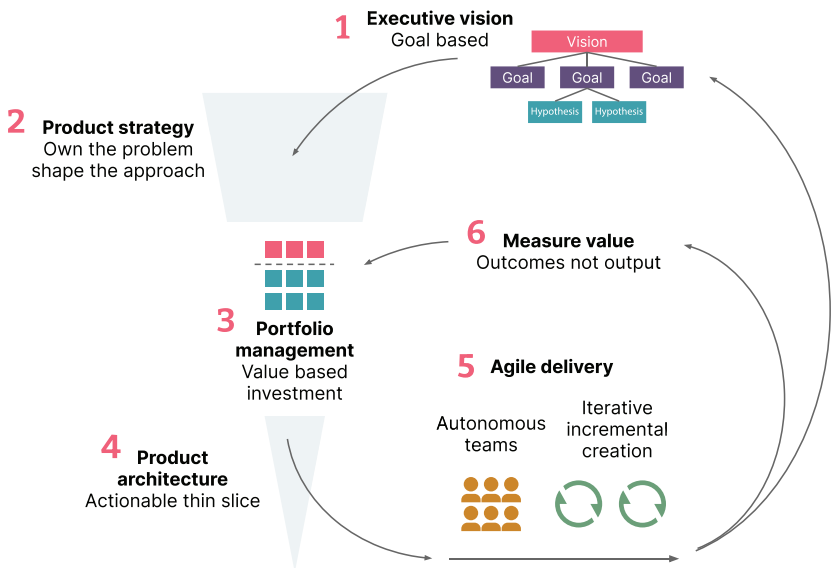


Figure 2 - EDGE feedback loop

1. Executive vision: leaders guide empowered teams through a shared strategic vision. Organization level strategy is communicated through outcome based goals.

2. Business/product strategy: problem space analysis to shape a high level approach and identify hypotheses towards achieving goals.

3. Portfolio management: investments are allocated based on value. Work in progress is limited. Stop starting, start finishing!

4. Product architecture: value is turned into actionable thin slices ready for delivery. Large programs of work are broken into small 'learning driven' chunks.

5. Agile delivery: an adaptive and incremental approach to delivery with fast feedback loops early and often.

6. Measure value: work is measured on value delivered, not work output.

Another advantage of value-driven portfolios in the EDGE operating model is that they can easily be cascaded across the enterprise. This enables executives, managers and frontline workers to be involved in the strategy and execution process, making it easier to form an aligned top-down and bottom-up strategy.

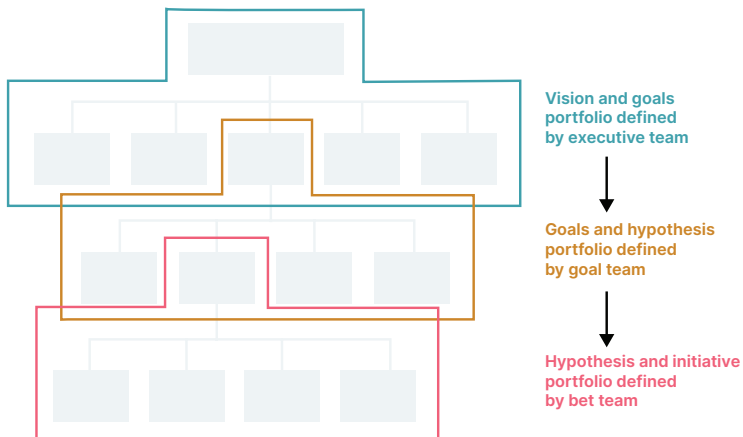


Figure 3 - Cascading a Lean Value Tree across an organization

Next, we'll explore three organizational features that enable effective value-driven portfolio management: customer-centricity, product teams, and engineering effectiveness.

Customer-centricity

In organizations with substantial technical debt, it can be difficult to identify where to begin remediation. However, the best approach is to start by thinking about customer needs. When you're caught up in the daily challenges of aging technology, operational troubles and difficult market conditions, it can be very tempting to fall into organizational practices that are easier to manage. But these practices can be disconnected from how the organization creates value for its customers and shareholders, which leads to these common errors:

1. Defining goals and desired outcomes with an internal focus, rather than focusing on the wants and needs of customers.
2. Choosing success criteria after defining organizational initiatives, rather than identifying success criteria that measure progress toward customer-focused outcomes.
3. Planning organizational initiatives based on existing capabilities, rather than designing initiatives to improve customer-focused performance indicators.

When planning the remediation of technical debt, these practices often translate into activities like:

1. Deciding that the organization's technical debt has become unmanageable, and defining an internal outcome of "modernizing our technology".

2. Choosing key performance indicators based on that “modernization” initiative, such as “number of applications modernized”.
3. Looking at the organization's current capabilities to define what it means to modernize an application, and choosing a technology stack that's no longer actively maintained, simply because the organization's developers have skills in that stack.

Instead, it's best to start from customer needs, based on the EDGE operating model, as shown here:



Figure 4 - Customer centricity drives the organization

At their core, commercial organizations exist to create value for customers and society, and in the process, capture some of that value back for themselves and their shareholders. The better they are at providing that value, the greater the value they can capture for themselves.

Without customer needs serving as a north star, it's incredibly challenging to prioritize modernization efforts. But when the core goals of all organizational efforts are aligned with specific customer needs, the value of each investment and its prioritization become much clearer.

Organizationally, one way to enable this focus which EDGE prescribes is to put so-called "product teams" into place. We describe this in the next section.

Product teams

Another common challenge is an inability to translate customer-focused goals into effective programs of aligned work in IT departments. EDGE solves this problem by eliminating it entirely through a different form of organization — product teams.

In modern organizations, technology has become so enmeshed within the operations and functions of organizations that without that technology, there is no business. That also means many of the opportunities for organizational improvement — revenue increases, cost reductions, efficiency gains — are realized through technology.

EDGE responds to this by incorporating technology and technologists directly into the business. Developers, product managers, designers and technologists aren't organized around specific IT projects or applications, but in teams that support specific organizational value streams. These product teams have all the capabilities, team members and tools they need to operate autonomously and deliver customer value.

Instead of giving product teams features to develop or projects to complete, they're given business problems to solve and the latitude to solve them in the most efficient and effective manner they can come up with. This approach is why organizations like Google are willing and able to pay so highly for their technologists — those technologists create dramatic improvements to Google's top and bottom lines on a very regular basis.

The autonomy of product teams massively decreases the time between them receiving goals and delivering results. This acceleration of time-to-value is one of the key reasons why this approach is effective. Many technology initiatives take a long time to begin creating returns on investment, but a product team's approach leads to much faster results, which improves the net present value of the overall return on investment in each team.

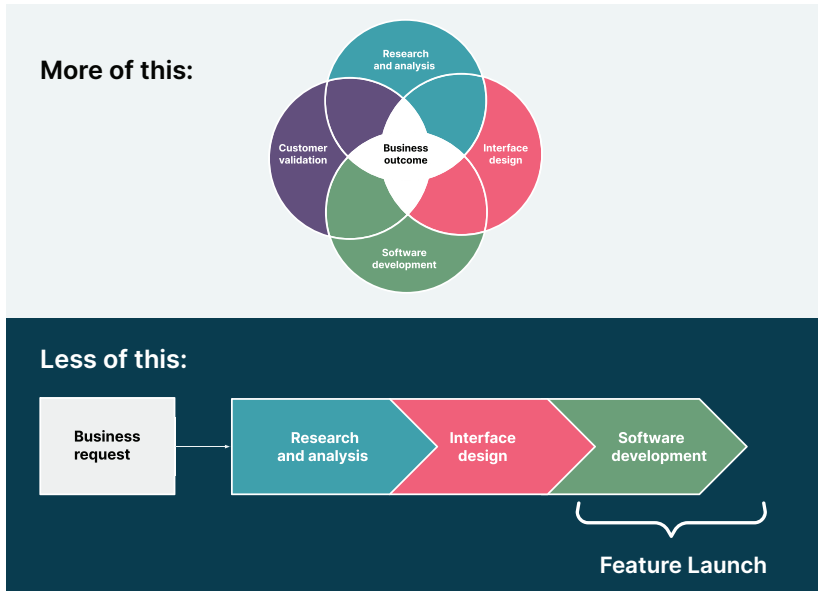


Figure 5 - An interdisciplinary approach to software development drives faster time to market and greater value

Engineering effectiveness

With development costs rising, top talent becoming harder to attract and retain, and competitive landscapes evolving faster than ever, organizations everywhere want to do more with less and create greater value through their engineering teams.

Engineering effectiveness is a vital component of a coherent approach to maximize value creation and reduce technical debt. It can go by many names: Developer experience (DX). Engineering excellence. Developer productivity. But ultimately, they're all focused on improving one thing — engineering effectiveness. Increasing engineering effectiveness reduces the friction in organizations and enables them to deliver continuous, outsized value.

A proven, holistic framework

Our Engineering Effectiveness framework is a modular, scalable approach that continuously engages and drives outcomes for engineering organizations. As shown below, the framework covers six focus areas in the product and engineering value stream and three organizational enablers for a holistic engineering transformation.

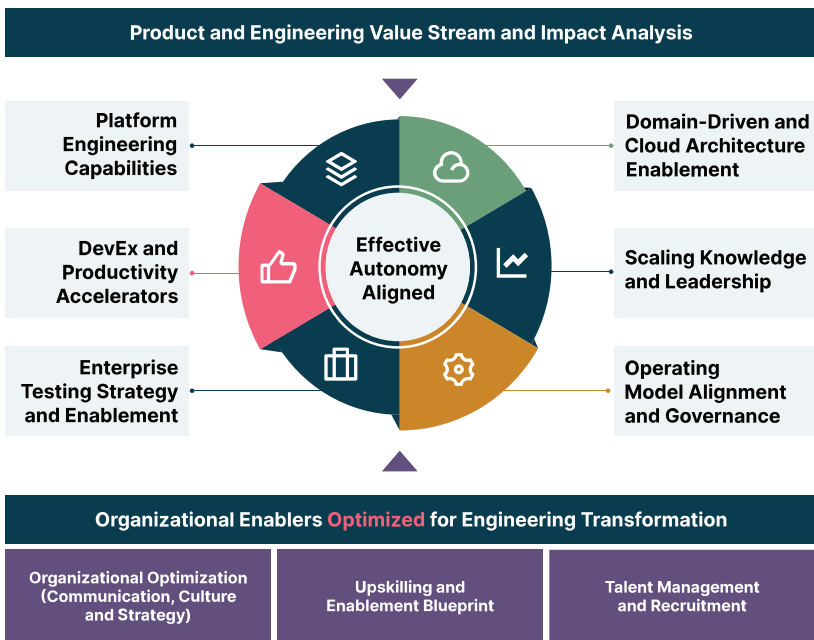


Figure 6 - Thoughtworks' Engineering Effectiveness framework

Built on proven practices, it enables organizations to deliver transformational results at an accelerated pace, and we've used it to help our clients:

- Reduce time-to-market by up to 50%
- Improve deployment frequency from bi-weekly to over 100 deployments a day
- Increase resiliency and reduce downtime for critical, mass-market product launches
- Build a strong, tech-forward reputation to improve hiring
- Create internal platforms that increase engineer satisfaction and retention

Conclusion

High-profile failures have highlighted the need for companies to proactively address technical debt to prevent significant issues in the future. It's a challenge that affects every organization, in every industry. And it's a challenge Thoughtworks has been helping businesses overcome for over 30 years.

Since 1993, Thoughtworks has applied agile principles to help our clients respond to change. By implementing value-driven portfolio management in the EDGE operating model, we enable organizations to deal with their technical debt by making it visible, measuring it, and including it in strategic and portfolio planning. This integrated operating model connects business and IT to bring together the twin concerns of risk mitigation and value creation, and enable companies to swiftly respond to unforeseen shifts.

With a pragmatic approach that treats technical debt as a strategic business concern, our clients can make more effective decisions and build a coherent strategy while proactively managing technical debt. When organizations support this approach with other continuous improvement practices, including customer-centricity, product teams and engineering effectiveness, they can thrive amid disruption.

When organizations expand this approach beyond the technology team and across the enterprise (including the board of directors), all stakeholders have visibility of technical debt and can make informed decisions about how to minimize risk, increase customer satisfaction, and improve business results.

Adopting an adaptive operating model like EDGE can also create additional business opportunities, including greater differentiation and higher organizational resilience. As the world becomes increasingly complex, we have the experience and expertise to help you transition from fragmentation to coordination, from ambiguity to clarity, and from decline to growth. Our commitment to excellence ensures you'll have a reliable partner in navigating the challenges ahead — and seizing the opportunities that come with them.



Barton Friedland
Principal Advisory Consultant

As a digital pioneer at both Apple and NeXT Computer, Barton has worked with and implemented leading-edge technologies for over 30 years for large-scale global organizations. His primary areas of focus are strategy, decision-making and execution.

His academic background brings together computer science and anthropology as a powerful toolset to drive technical and organizational change – and the alignment required to drive it.

Over the last 15 years he has focused exclusively on strategy & digital transformation, with an emphasis on the development of distinctive competencies within organizations. This includes the development and management of intellectual property, acquisitions, as well as integration and evolution of business units within an organization.

Barton brings a refreshing and empowering perspective to his clients that enables them to foster sustainable innovation, evolve organizational practices, and outperform through an evidence-based, value-driven approach to strategy, decision-making and execution.



Marcelo De Santis

Chief Digital Officer

Marcelo is a digital leader, entrepreneur and angel investor with 20+ years of global experience in creating growth with new business models, innovative technology and disruptive go-to-market approaches.

He is currently Chief Digital Officer at Thoughtworks and works with C-suite executives to invent, launch and scale digital business models that leverage their organization's core capabilities and create new revenue streams. Previously he held the positions of Chief Digital and Information Officer at Kraft Foods, Mondelez and Pirelli.

Marcelo is co-founder of Angeles Investors and currently serves on the Board of Directors of UNICEF and Hispanic IT Executive Council. HITEC featured him as one of the top 100 most influential Hispanic professionals in 2019 and 2020. In 2019 Crain's nominated him as one of top 50 CEOs, entrepreneurs and technologists.

Marcelo holds a Master in Business Administration from Northwestern Kellogg and a Bachelor in Computer Science from Universidad Argentina de la Empresa.

About Thoughtworks

Thoughtworks is a global technology consultancy and community of passionate purpose-led individuals, 12,500+ people strong across 50 offices in 18 countries. Over 25+ years, we have helped our clients solve complex business problems by integrating strategy, design and engineering to drive digital innovation. For more information visit: [thoughtworks.com](https://www.thoughtworks.com)

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