Coding in the Red

The State of Global Technical Debt | 2025

CAST

The bill comes due

Technical debt costs companies time, money, and customers. It is incurred each time a company prioritizes speed over quality in writing software. Sometimes the decision to do so is wise: time-to-market can make or break a business. But over years, even the costs of smart decisions add up, and four decades into the modern software age, it is clear the bill has come due.

While it began as a concept, tech debt evolved in recent years into a measurable problem that companies track. What is new is a global tally of the issue.

With the first-ever release of this data – tapping CAST's analysis of over 10 billion lines of code – our research finds that global tech debt levels have reached 61 billion days in repair time. Drawn from 17 countries that represent 51% of the world's GDP, this stark figure is also a conservative one.

First is last

Advanced economies are carrying the most debt. Led by the United States, the countries that pioneered software earliest now find themselves tied down, Gulliver-style, by the most lines of decrepit code.

Not the expected future

Developers from past decades never imagined that their code would be running in 2025. But billions of short-term decisions later, many seen as rational at the time, have together dug a deep hole. Indeed, if the world's ~25 million developers stopped what they're doing to work solely on tech debt, they would finish sometime around the year 2034.

Companies will not take a decade off from innovating. Nor is this a problem where AI alone can run to the rescue. LLMs can quickly create new applications, but their

The bill comes due

probabilistic nature struggles to fix the big, old, slow ones already installed. That's where more humans, armed with new insights, are needed.

New light in the dark

Not all tech debt is created equal. Often less than 10% of it is severe, inflicting outsized damage on their surrounding systems. IT's challenge is finding it in their labyrinth of 'black boxes'.

New technologies, from this company and others in the emerging field of software intelligence, are mapping applications from the source code level on up. In doing so, new contours and fault lines are being discovered, including the varieties of tech debt and fastest pathways to pay them off. Given the findings released in this report, it is important that companies begin these journeys now.

Collective reckoning for individual action

Applications don't exist in a vacuum. Their interconnectedness spans countries and sectors so completely that a problem in one line of code can – and regularly does – ripple across continents. Today's conditions are too fragile a foundation for business, and too brittle a bedrock for society. Anyone's technical debt has become everyone's technical debt, and that is why we share this data today. By publishing this research, we aim to size the collective issue, shine new light into its nature, and spur conversations on how to tackle this tech debt for the benefit of all.

Workdays forfeit to technical debt

61 billion

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The unequal geography of tech debt

Leaders to laggards

Measured by the time required to repair code – the most comparable metric across geographies – the most indebted country is the United States, followed by Italy and France.

Notably, emerging economies such as Malaysia, Ecuador, and Peru, have a much lighter tech debt burden. This opens the door for a potential development 'leapfrog' opportunity, driven by AI, last seen with deployment of mobile networks in the early 2000s.

WORKDAYS TO REPAIR 1,000 LINES OF CODE

	Country	Workdays
1	United States	2.07
2	Italy	1.99
3	France	1.98
4	India	1.84
5	Spain	1.82
6	Austria	1.77
7	Netherlands	1.72
8	Mexico	1.67
9	UK & N. Ireland	1.60

	Country	Workdays
10	Brazil	1.58
11	Germany	1.58
12	Malaysia	1.55
13	Denmark	1.50
14	Canada	1.49
15	Ecuador	1.45
16	Peru	1.40
17	Belgium	1.12

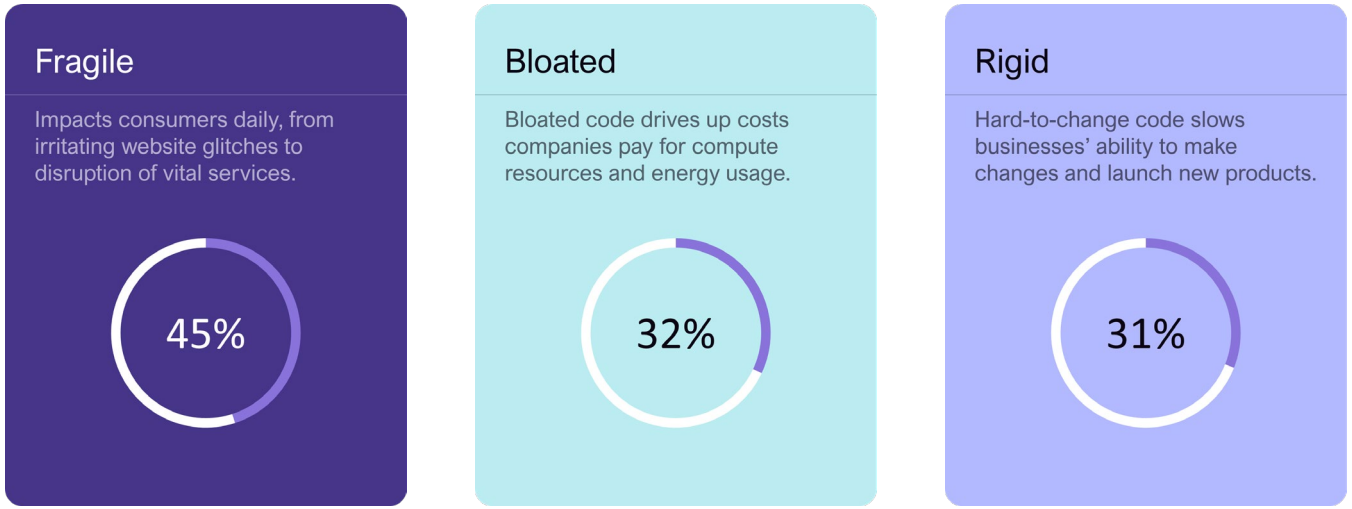
What’s weighing down the world’s code

Breaking down breakdowns

Nearly half of the world’s code – 45% – is fragile, susceptible to breaking down when facing unexpected conditions. A third of code, 32%, is bloated, written in an overly complex way which then consumes more compute and energy than is required. Finally, 31% of code is too rigid, making it harder for developers to make changes.

Applications can have multiple forms of tech debt at the same time, compounding costs for companies and consumers.

PREVALENCE OF TECHNICAL DEBT TYPES

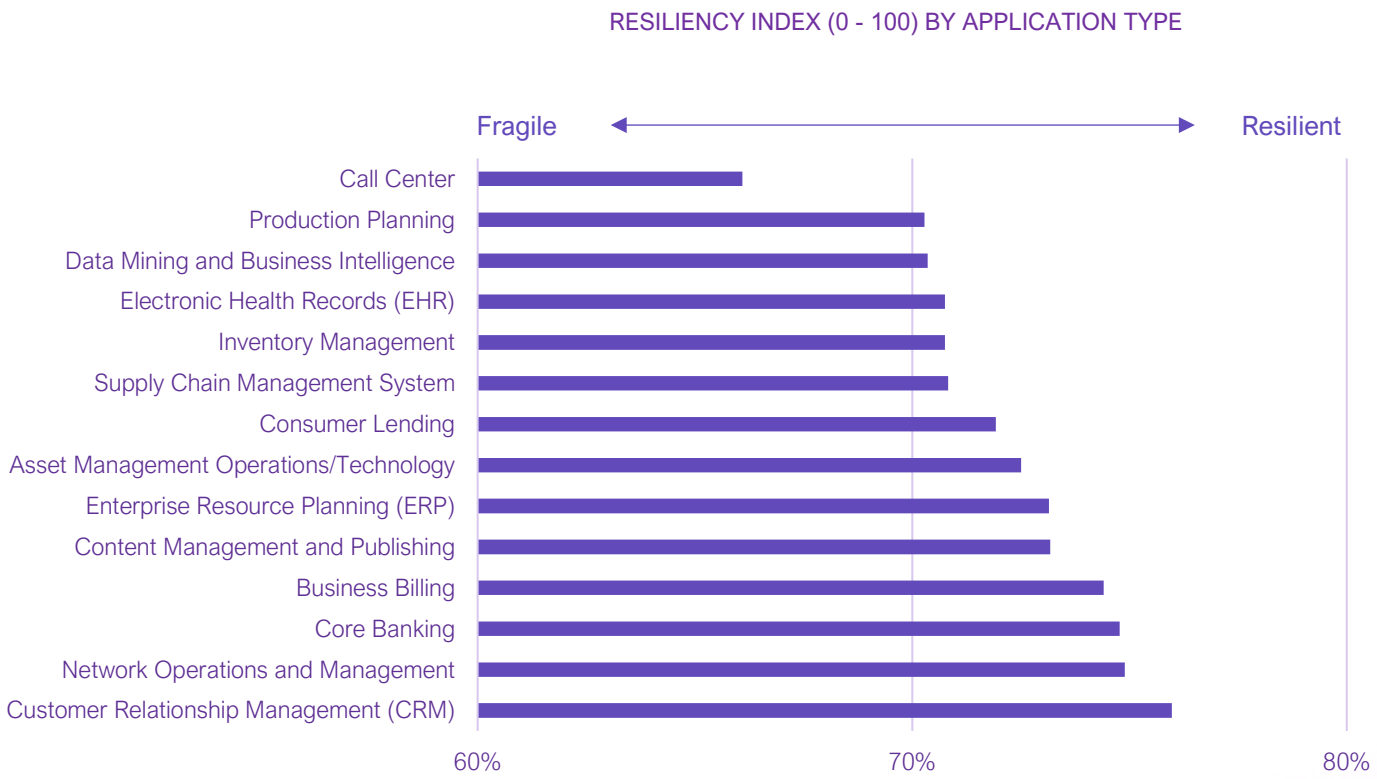


Which applications break first

Breaking down breakdowns

Worldwide, different types of tech debt are concentrated in certain applications. Call center software is particularly liable to break down under pressure, such as a surge in demand.

Systems managing some of society's most critical systems, such as those running global supply chains, electronic health records, and consumer lending, demonstrate only moderate resilience.



Some programming languages carry more debt

Practically speaking

Tech debt is unevenly distributed by programming language. For example, there is twice as much to pay off in Python than in Go.

Skills gaps delay the ‘paying off’ the world’s tech debt. Some languages, like COBOL, haven’t been widely taught in generations. And while senior IT pros want to prioritize tackling debt, junior developers rarely see it as a path to advancement. Top talent prefers building new applications in the latest languages.

WORKDAYS TO REPAIR 1,000 LINES OF CODE

	Language	Workdays
1	Python	4.50
2	JavaScript	3.66
3	JSP	3.53
4	C/C++	3.27
5	Objective C/C++	2.87

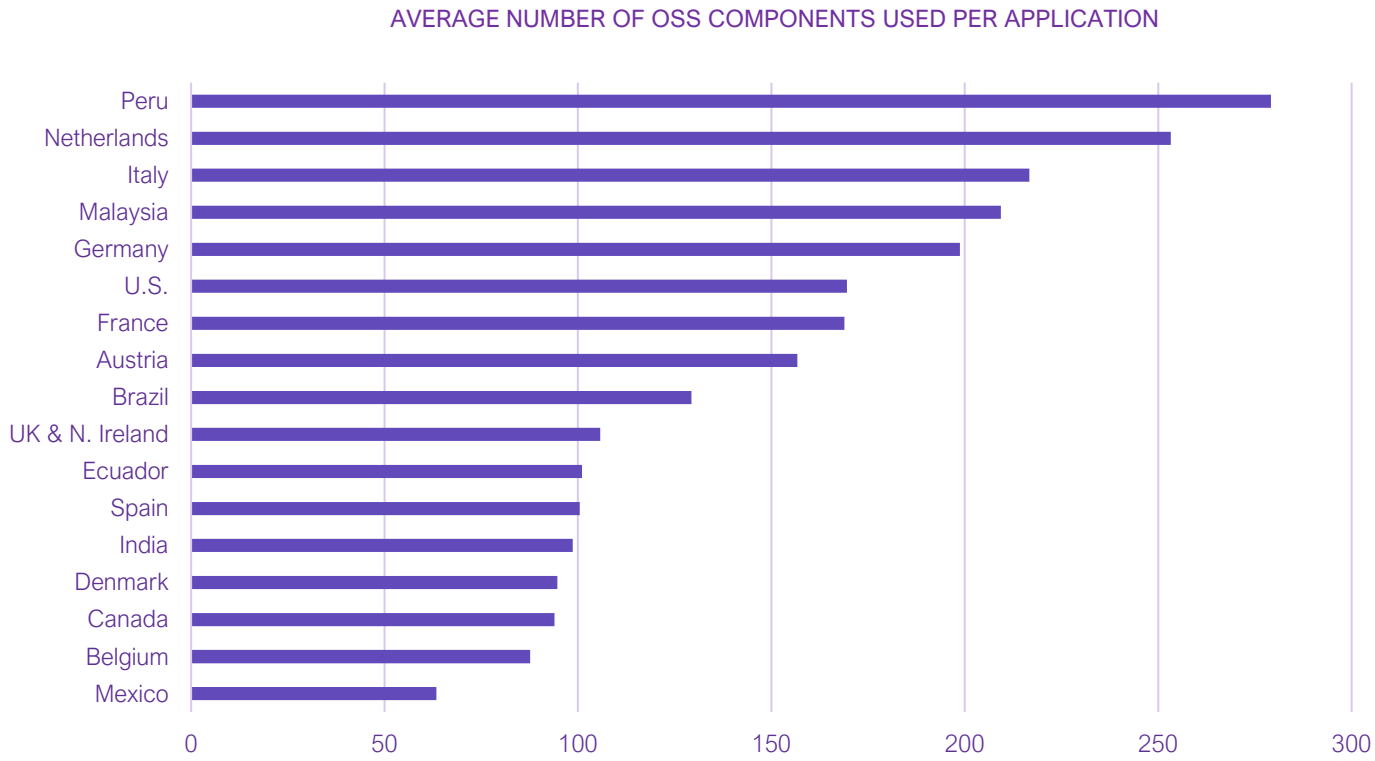
	Language	Workdays
6	PL/SQL	2.30
7	Swift	2.20
8	Groovy	2.18
9	COBOL	2.05
10	Go	2.01

The open-source dimension

Open to issues

Open-Source Software (OSS) inherently introduces tech debt from outdated components, security vulnerabilities, and intellectual property legal exposures. Company OSS usage differs significantly by country, as does its contribution to their tech debt.

Many emerging economies see AI-generated code as a potential “leapfrog” opportunity, similar to the mobile revolution of the early 2000s. However, given LLMs’ reliance on OSS, the risks warrant deeper exploration.

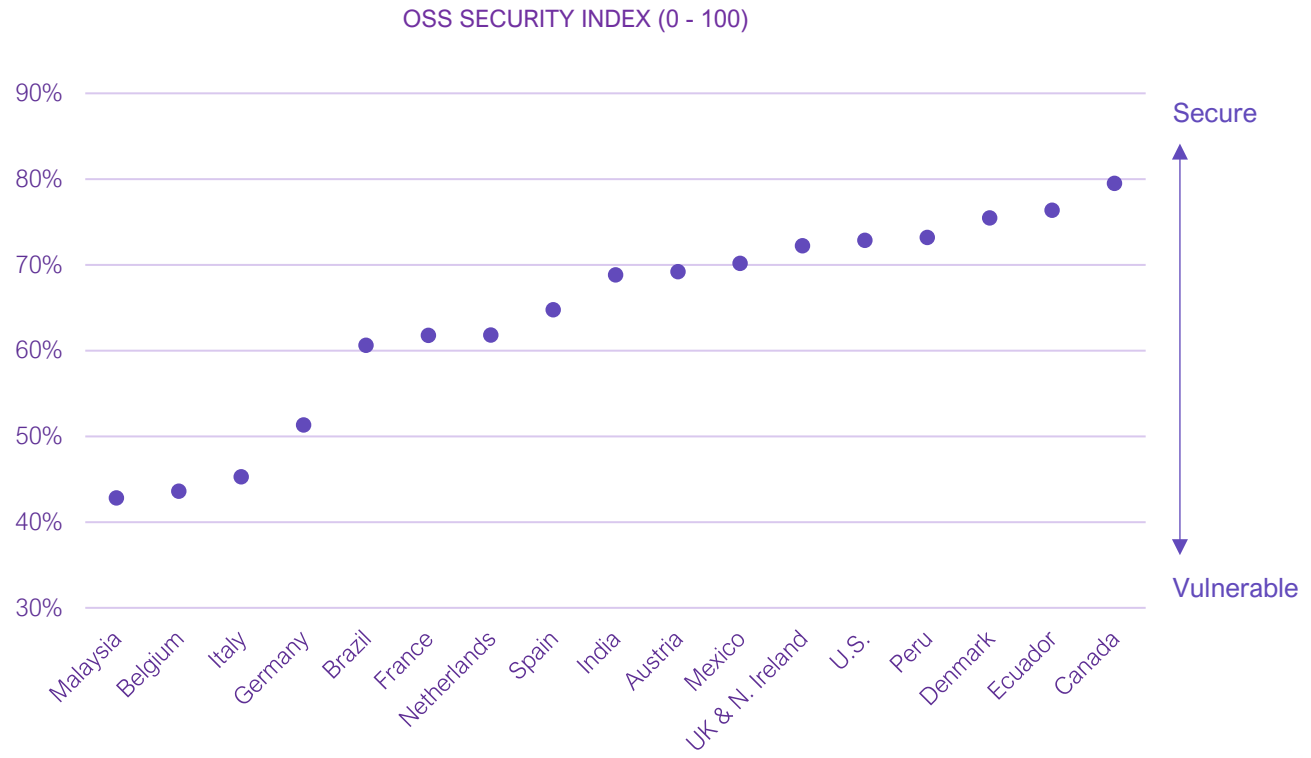


Open-source gap 1: Security

Too open

Implementing OSS can introduce security gaps and vulnerabilities. These issues then prolong the resolution of tech debt, as companies struggle to fix the systems they would rather replace.

Malaysia, Belgium, and Italy recorded the lowest security scores, due to the vulnerabilities within their OSS code. Canada, Ecuador, and Denmark have the least amount of debt to pay off in this area.

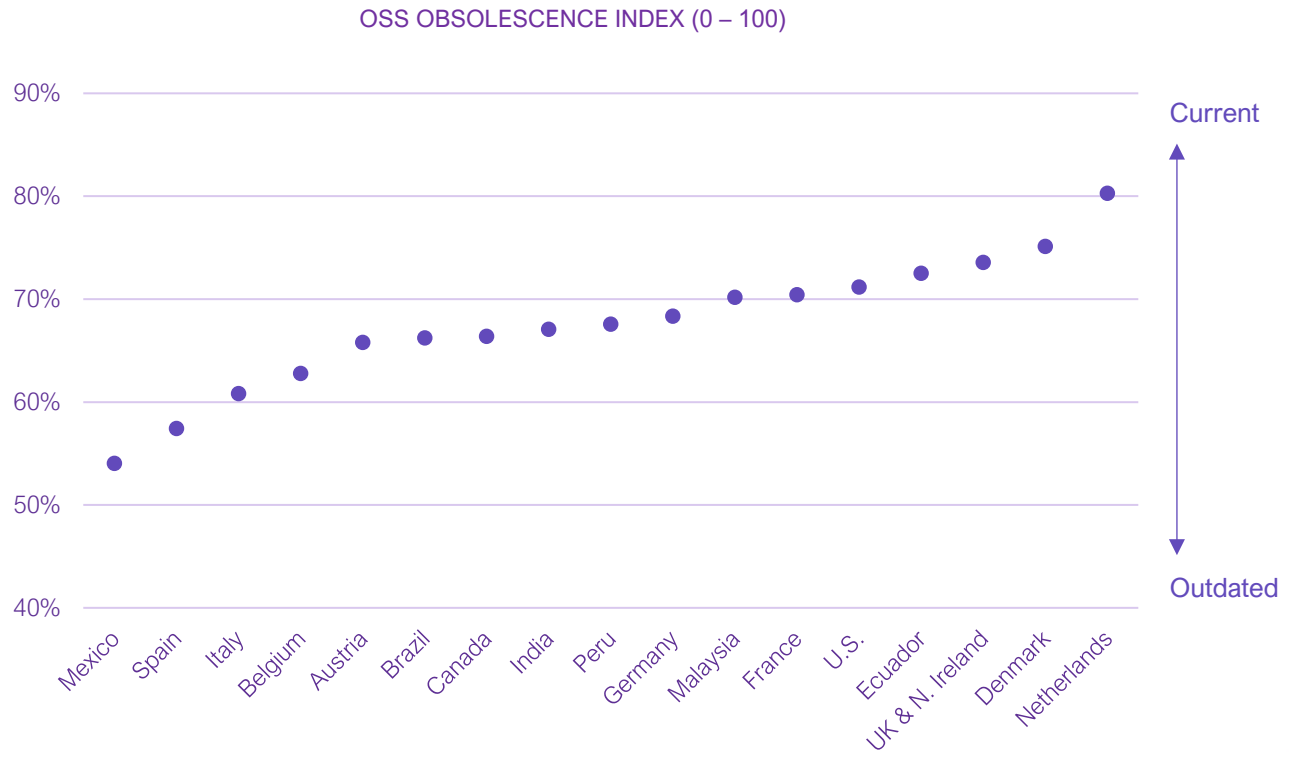


Open-source gap 2: Obsolete software

Too old

Keeping up with version releases is challenging, especially for companies managing hundreds or thousands of applications. Tracking updates from open-source contributors is difficult at-scale, and the problem is worsened by staff turnover and poor documentation.

With the lowest scores, Mexico, Spain, and Italy carry the most obsolete components. The Netherlands, Denmark, and UK & Northern Ireland are best positioned.

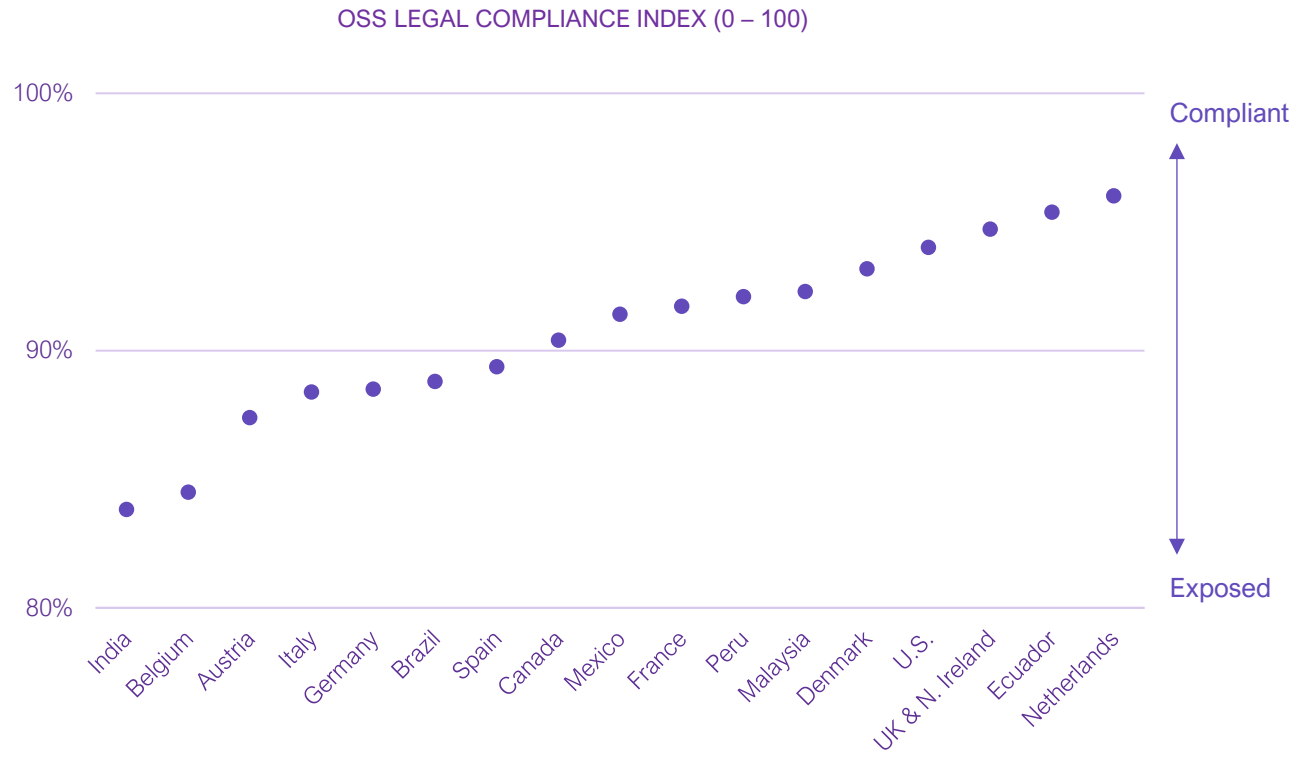


Open-source gap 3: Intellectual property liability

Too exposed

OSS license requirements vary widely, from simple author attribution to the mandatory disclosure of an entire application's source code when open-source components are used. Manual tracking of these obligations is often overlooked by developers and IT leaders, creating substantial legal risks.

India, Belgium, and Austria carry the most risk in this area, while the Netherlands, Ecuador, and UK & Northern Ireland hold the least.



Ranking the gaps

Too open

Over decades, OSS use has piled up the most technical debt in the area of security vulnerabilities.

Intellectual property legal compliance is comparatively stronger.

OSS INDEXES BY COUNTRY

Country	Legal Compliance	Obsolescence Index	Security Index
Austria	87%	66%	69%
Belgium	84%	63%	44%
Brazil	89%	66%	61%
Canada	90%	66%	80%
Denmark	93%	75%	75%
Ecuador	95%	73%	76%
France	92%	70%	62%
Germany	88%	68%	51%
India	84%	67%	69%
Italy	88%	61%	45%
Malaysia	92%	70%	43%
Mexico	91%	54%	70%
Netherlands	96%	80%	62%
Peru	92%	68%	73%
Spain	89%	57%	65%
UK & N. Ireland	95%	71%	73%
U.S.	94%	74%	72%

Methodology

The data set for this report is based on 10 billion lines of code, drawn from 47,000 applications across 3,000 companies operating in 17 countries.

It includes software originally written and installed as early as the 1980s and still in active use, providing a unique long-term view of technical debt.

The countries collectively represent 51% of global GDP, based on the most recent World Bank figures available as of July 2025.

To reflect meaningful and real-world conditions, only countries with a minimum of 100 scanned applications were included.

Technical debt is defined as the extra work developers must do to fix or improve software that was built quickly at the expense of quality. This definition aligns with industry standards and reflects the practical implications of suboptimal development practices.

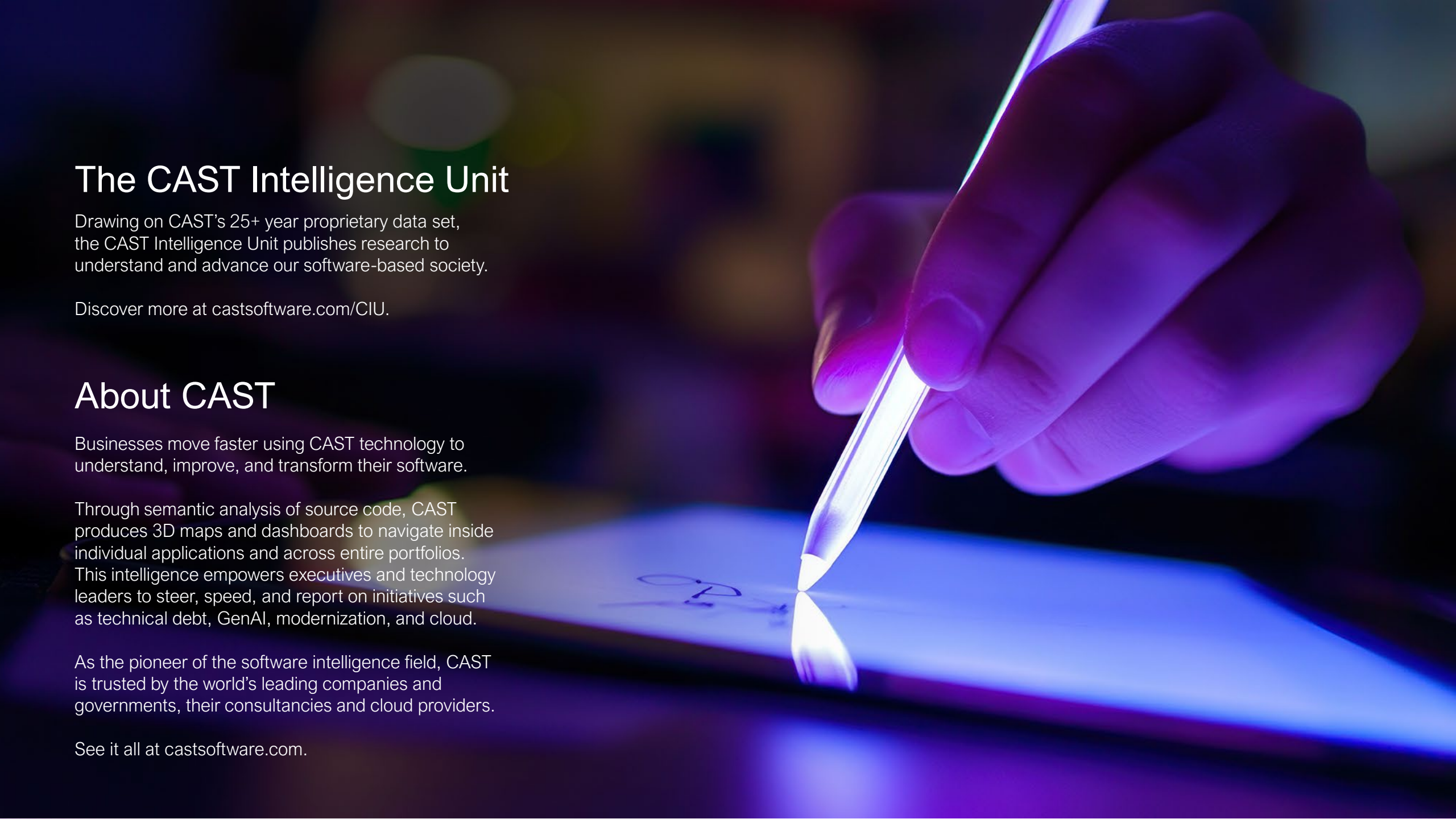
Methodology

At each stage of calculation, CAST has adopted a deliberately conservative approach, relying on the most credible and publicly available data sources for estimating the number of companies, applications, and software developers worldwide.

As a result, the totals presented in this report should be viewed as a prudent baseline for the global scale of technical debt.

Calculation of workdays

	Value	Source
Average number of applications used by large enterprises	367	Forrester, “The Crisis of Fractured Organizations,” 2022
Number of large enterprises worldwide	377,000	Statista, “Number of large companies worldwide 2000-2023”, 6/23/2025
Total applications used by large enterprises	138,359,000	Calculation
Total workdays of technical debt for 47,000 applications	21,140,216	CAST
Number of applications in CAST data set	47,824	CAST
Average repair time (workdays) per application	442	Calculation
Total workdays of technical debt	**61,160,486,466**	Calculation



The CAST Intelligence Unit

Drawing on CAST's 25+ year proprietary data set, the CAST Intelligence Unit publishes research to understand and advance our software-based society.

Discover more at castsoftware.com/CIU.

About CAST

Businesses move faster using CAST technology to understand, improve, and transform their software.

Through semantic analysis of source code, CAST produces 3D maps and dashboards to navigate inside individual applications and across entire portfolios. This intelligence empowers executives and technology leaders to steer, speed, and report on initiatives such as technical debt, GenAI, modernization, and cloud.

As the pioneer of the software intelligence field, CAST is trusted by the world's leading companies and governments, their consultancies and cloud providers.

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