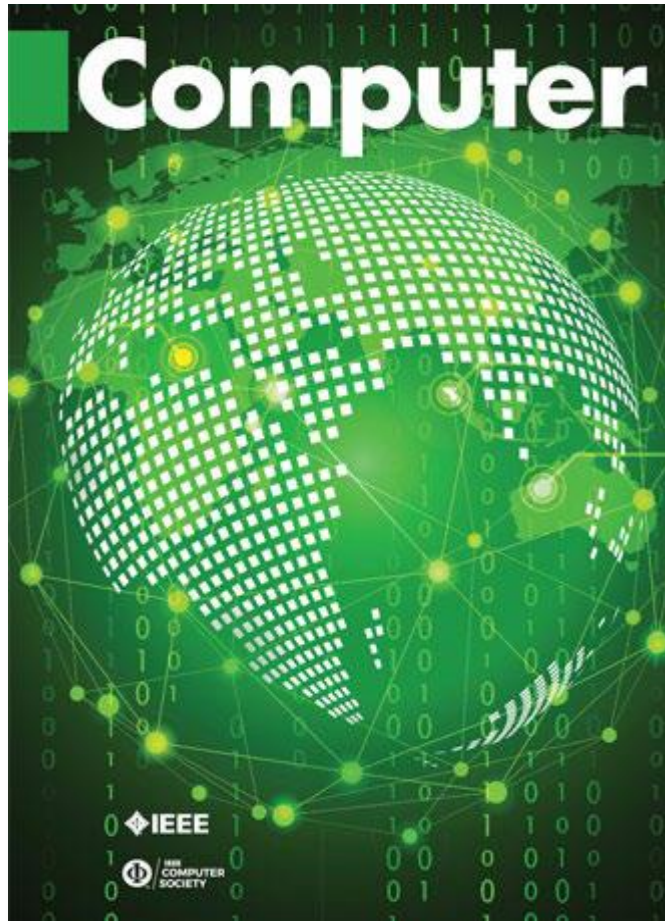




TRILLIONS SPENT, STILL FAILING: WHY IT NEEDS HUMAN CENTRIC THINKING

Robert N. Charette
IEEE Life Senior Member
IEEE Life Senior Member Computer Society
4 February 2026

What's Human-Centric Computing?



“HCC is a set of methodologies that apply to any field that uses computers in applications in which people directly interact with devices or systems that use computer technologies. The field is emerging from the convergence of multiple disciplines that are concerned both with understanding human beings and with the design of computational artifacts.”

Alejandro Jaimes et al. “Human-Centered Computing--Toward a Human Revolution,”
IEEE Computer, May 2007

Create IT systems that are intuitive, accessible, and improve the way people interact with technology

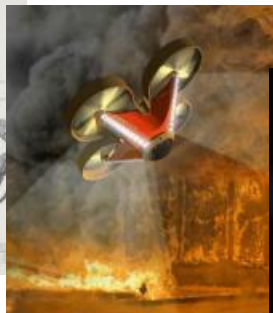
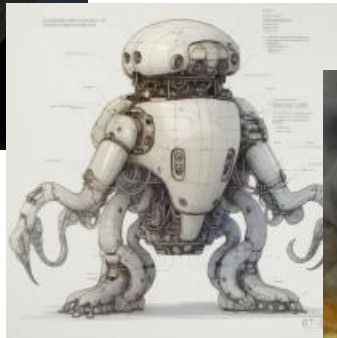
Interactions With Technology



Paradox of Persistent Failure in the Face of Success

What's Our Stake in IT Success?

Every major social policy now depends on correct, reliable and affordable IT at its core



What's Our Stake in IT Success?

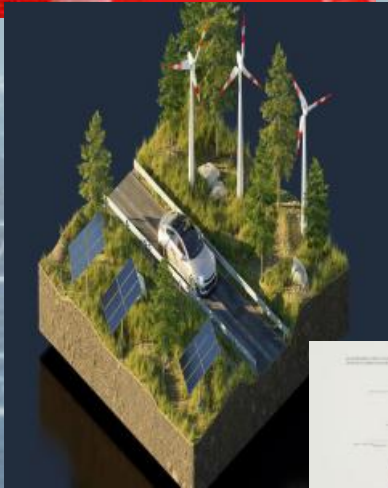
DPI

Digital Public Infrastructure



What's Our Stake in IT Success?

Next to electrical infrastructure which IT is merging into an obligatory-dependence relationship, a failure of its computing system infrastructure is a dystopian-like threat to modern society



Paradoxical IT Tensions & Dilemmas

Triumphs vs. Pathologies

- Ubiquity vs. Fragility
- Exponential Capability vs. Linear Learning
- Automation at Scale vs. Error at Scale
- Rapid Innovation vs. Institutional Amnesia
 - Data Abundance vs. Insight Scarcity
 - Automated Control vs. Human Backup
- Global Dependence vs. Local Understanding





Risks? What Risks?

- IT Projects are 20 Times More Likely to Fail in Comparison to Other Types of Projects
- Are the Riskiest of All Projects Types in Terms of Cost
- Annual U.S. Cost of Failure
 - *Operational: \$1.81 Trillion*
 - *Software Development: \$260 Billion*
 - *Opportunity Costs: \$2 Trillion+*

**Risk is not a technical
property alone**

PHOENIX PAY SYSTEM DISASTER

~~EIGHT~~ YEARS AND COUNTING...

TEN[↑] UN[↑] Happy Anniversary

February 24, 2026



PSAC · BC

Public Service Alliance of Canada



Crunch Numbers, Not People!



- Replace four decade-old regional pay system with customized PeopleSoft payroll package beginning in 2009, rollout in 2016
- Requirements:
 - 80,000 pay rules spanning 105 collective agreements with federal public-service unions
 - Create 34 human-resource system interfaces across 101 government agencies
- Estimated cost CA\$310m/**Current CA\$5.1b**
 - Over 70% of 460,000 government employees have experienced being underpaid, overpaid or not paid at all at one time or another

“Incomprehensible failure of project management and oversight.”

Canadian Auditor General Michael Ferguson

Crunch Numbers, Not People!



A Case Study in Manufactured Risk

- Politics overrode engineering sense
- Laughably underestimated the project's complexity and cost
- Sacrificed functionality, testing, support and training to stay within budget and attain promised cost benefits
- Scrapped pilot rollouts/parallel ops
- Ignored warnings, risk signals & past payroll attempt failure lessons

Where are the human-centric concerns?

Crunch Numbers, Not People!



A Case Study in Manufactured Risk

- Politics overrode engineering sense
- Laughably underestimated the project's complexity and cost
- Sacrificed functionality, testing, support and training to stay within budget and attain promised cost benefits
- Scrapped pilot rollouts/parallel ops
- Ignored warnings, risk signals & past payroll attempt failure lessons

Consider the ethical dilemmas of the software engineers!

Crunch Numbers, Not People!



A Case Study in Manufactured Risk

- Politics overrode engineering sense
- Laughably underestimated the project's complexity and cost
- Sacrificed functionality, testing, support and training to stay within budget and attain promised cost benefits
- Scrapped pilot rollouts/parallel ops
- Ignored warnings, risk signals & past payroll attempt failure lessons

As of 31 Dec 2025:

- 45,000 pay issues (less than a year old)
- 111,000 pay issues (more than a year old)
- Over 75% of checks manually processed

Crunch Numbers, Not People!



- U.K. Post Office's electronic point-of-sale (EPOS) Horizon system
- Rolled out in 1999 riddled with 100's of errors deliberately hidden
- Complaints quickly followed
- Numerous UK Post Office Officials Horizon claim from 1999 – 2019

“Fundamentally Sound” & “Robust.”

UK Legal Presumption

“In the absence of evidence to the contrary, the courts will presume that mechanical instruments (including computer systems) were in order at the material time.”

Crunch Numbers, Not People!



- Post Office dishonestly accused 3,500 local post branch managers of false accounting, fraud, and theft
- Approximately 900 of these managers were convicted, with 236 jailed between 1999 and 2015
- Deception finally broke open in 2019 and the Post Office forced to confess and apologize during independent public statutory Inquiry 2020-2021

The Horizon System cover-up has led to the "greatest miscarriage of justice in British history."

***Rishi Sunak, the UK Prime Minister
2024***

Crunch Numbers, Not People!



- Post Office dishonestly accused 3,500 local post branch managers of false accounting, fraud, and theft
- Approximately 900 of these managers were convicted, with 236 jailed between 1999 and 2015
- Deception finally broke open in 2019 and the Post Office forced to confess and apologize during independent public statutory Inquiry 2020-2021

***Where are the
human-centric concerns?***

Crunch Numbers, Not People!

USCG Electronic
Health Record
System



\$67+ million



\$186+ million



\$50 million+/\$1.8+ billion

SSA Disability Case
Processing System



\$300+ million

Canberra
HRIMS Program



\$77+ million



CROWDSTRIKE

\$5.4+ billion



\$1+ billion

Jaguar Land Rover



\$2.5+ billion

Project Future



\$1.31+ billion

Crunch Numbers, Not People!



- **Michigan's Midas System**
(~40,000 *Falsely Accused*)
- **Australia's Centrelink System**
(~400,000 *Falsely Accused*)
- **Dutch Child Benefit System**
(~26,000 *Falsely Accused*)

***No Human Oversight of
Algorithmic Decisions***



Crunch Numbers, Not People!



- Michigan's Midas System
(~40,000 *Falsely Accused*)
- Australia's Centrelink System
(~400,000 *Falsely Accused*)
- Dutch Child Benefit System
(~26,000 *Falsely Accused*)

***Where are the
human-centric concerns?***



Crunch Numbers, Not People!

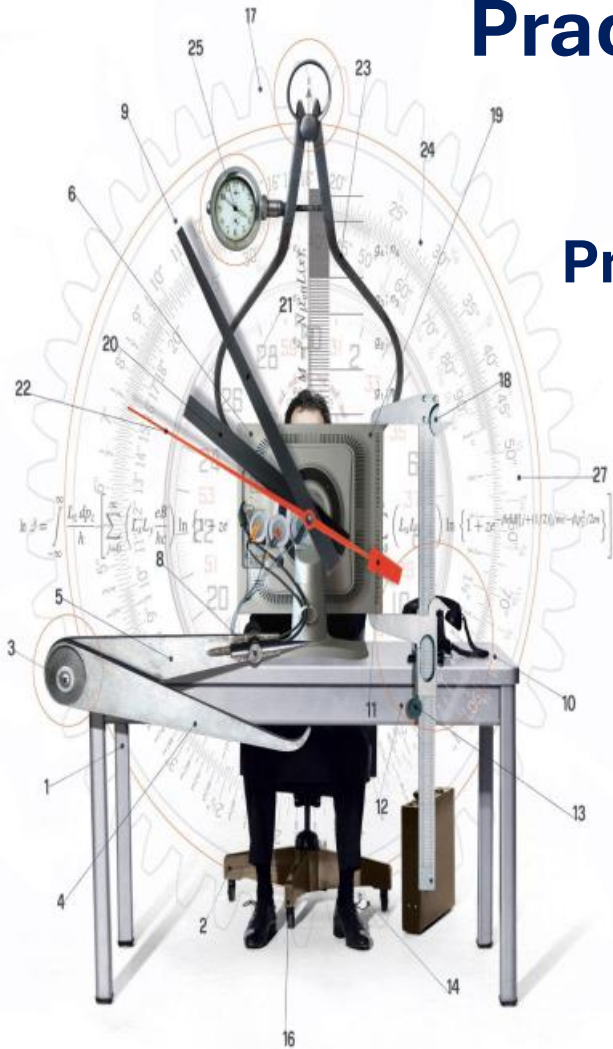
Ironies and Paradoxes of Automation

The Irony: The more advanced the automated system, the more crucial the [flawless] contribution of the human operator becomes to operational success

The Paradox: The more reliable the automation, the less the human operator may be able to contribute to success



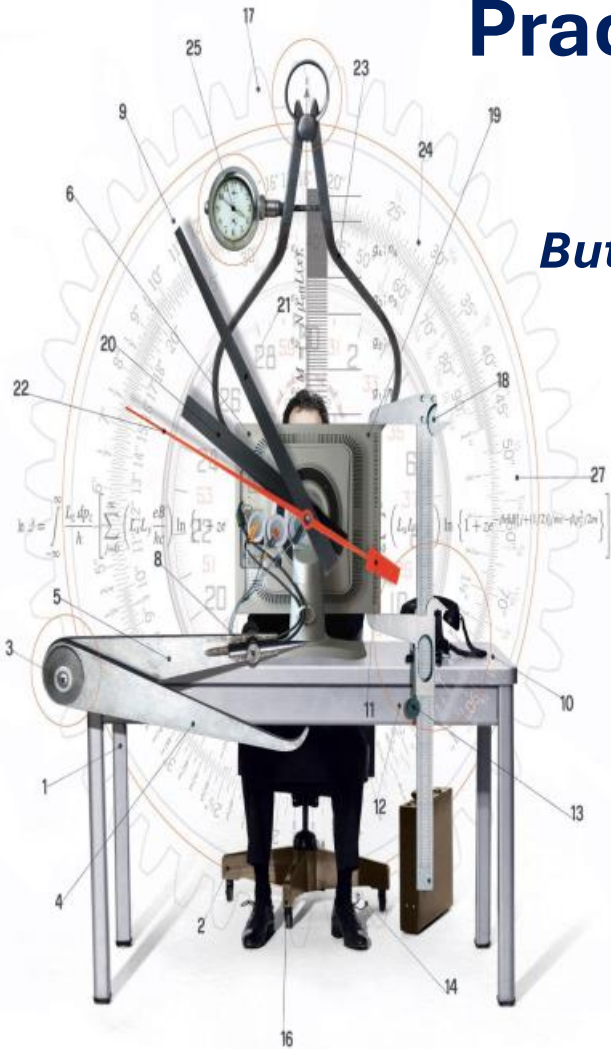
Can Better Software Engineering Practices Save Us?



Progress has been made...

- **Reduction local defect density**
- **Lower operational errors**
- **Improved recoverability**
- **Better deployment frequency/feedback**
- **Improved scalability, integration & interoperability**
- **Overall better code quality**
- **AI probably will greatly improve upon many of these areas**

Can Better Software Engineering Practices Save Us?

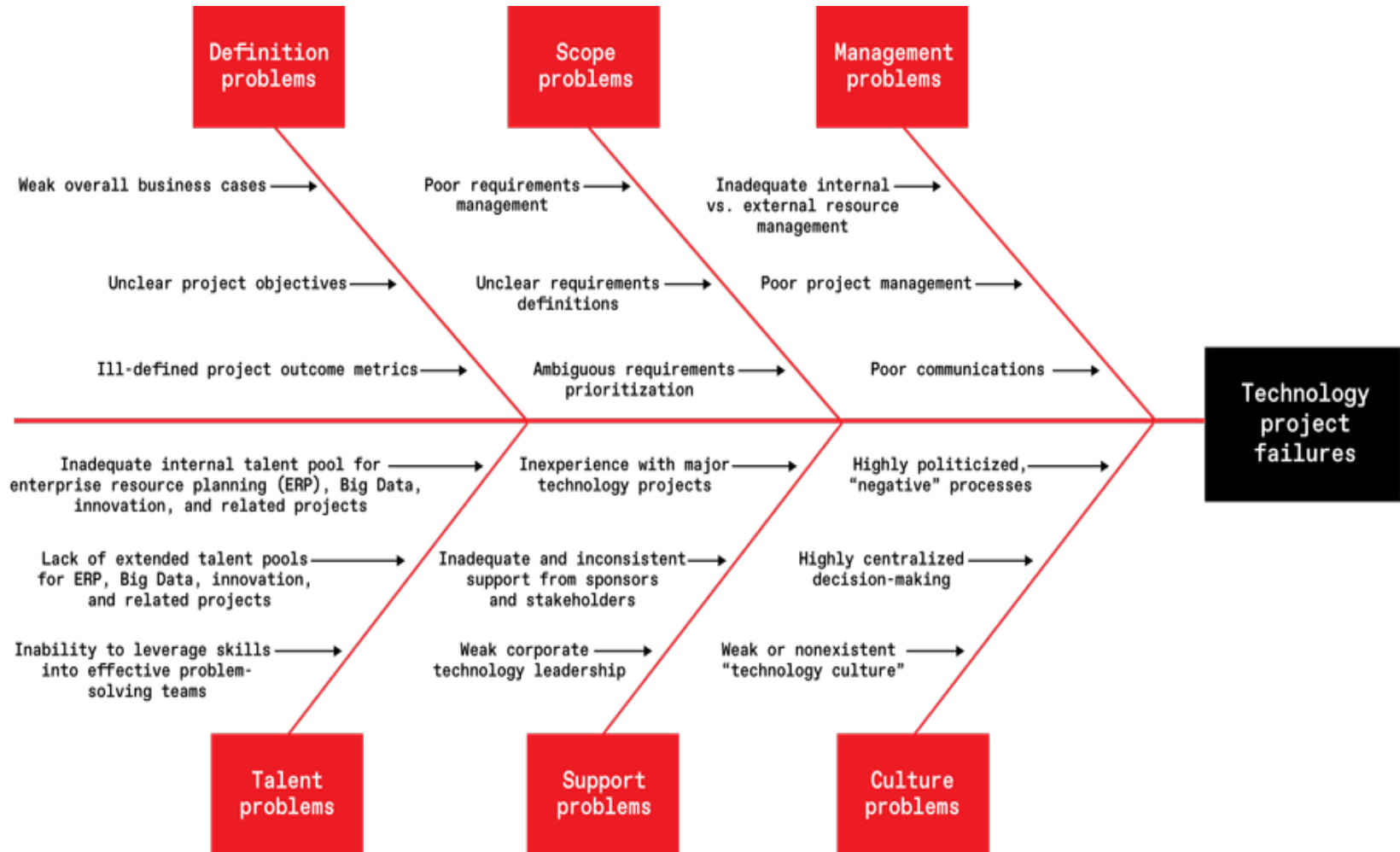


But progress constantly challenged by...

- Traditional vs. modern development
- Naïve assumptions & constraints
- Persistent technical optimism and biases
- Escalating incentive misalignments
- Surging system-of-systems interactions
- Obstinate IT failure amnesia
- Unwavering belief of IT as universal hammer

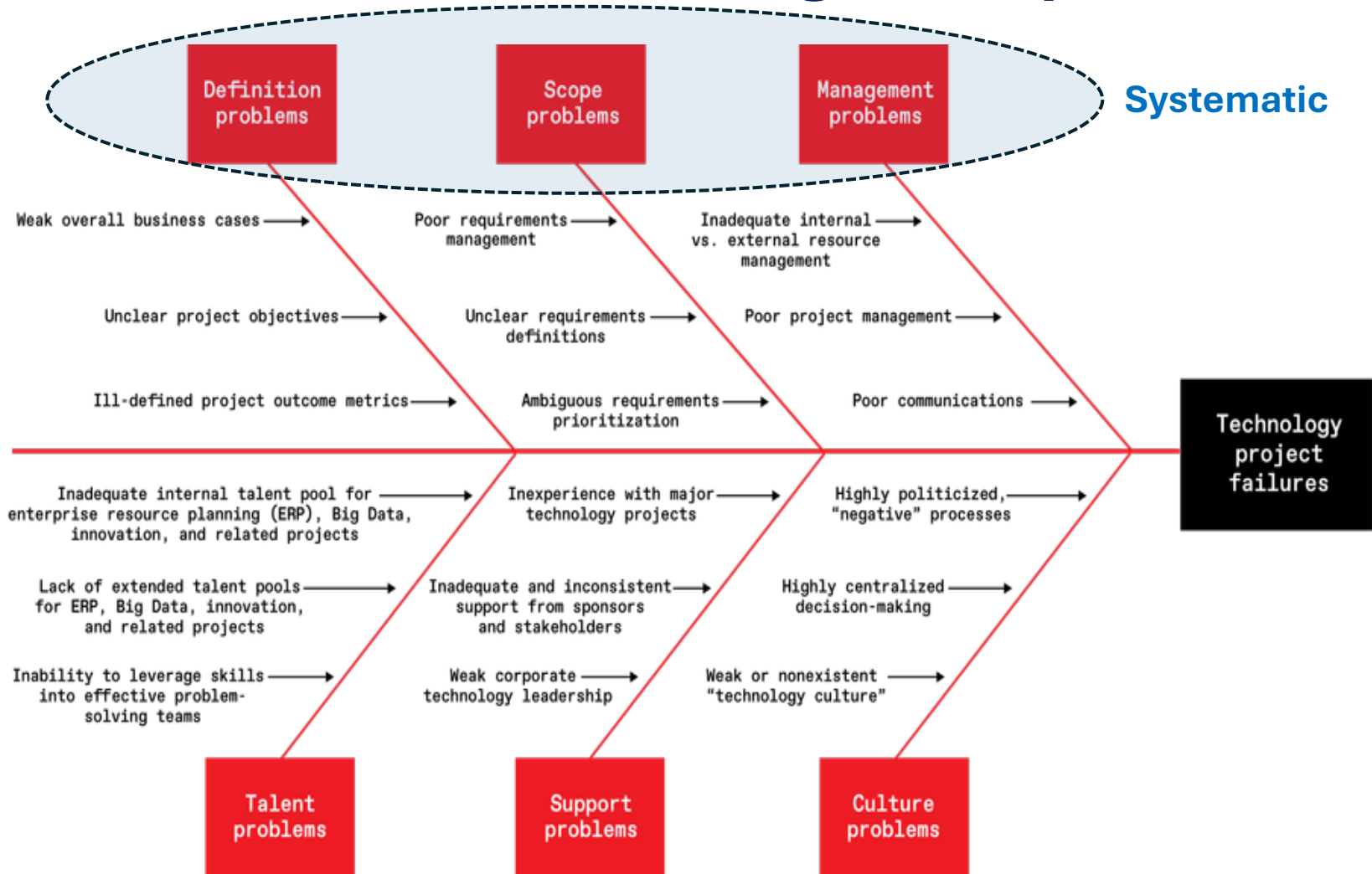
**Software Engineering
Alone is Not Enough!**

Factors Crunching IT People!



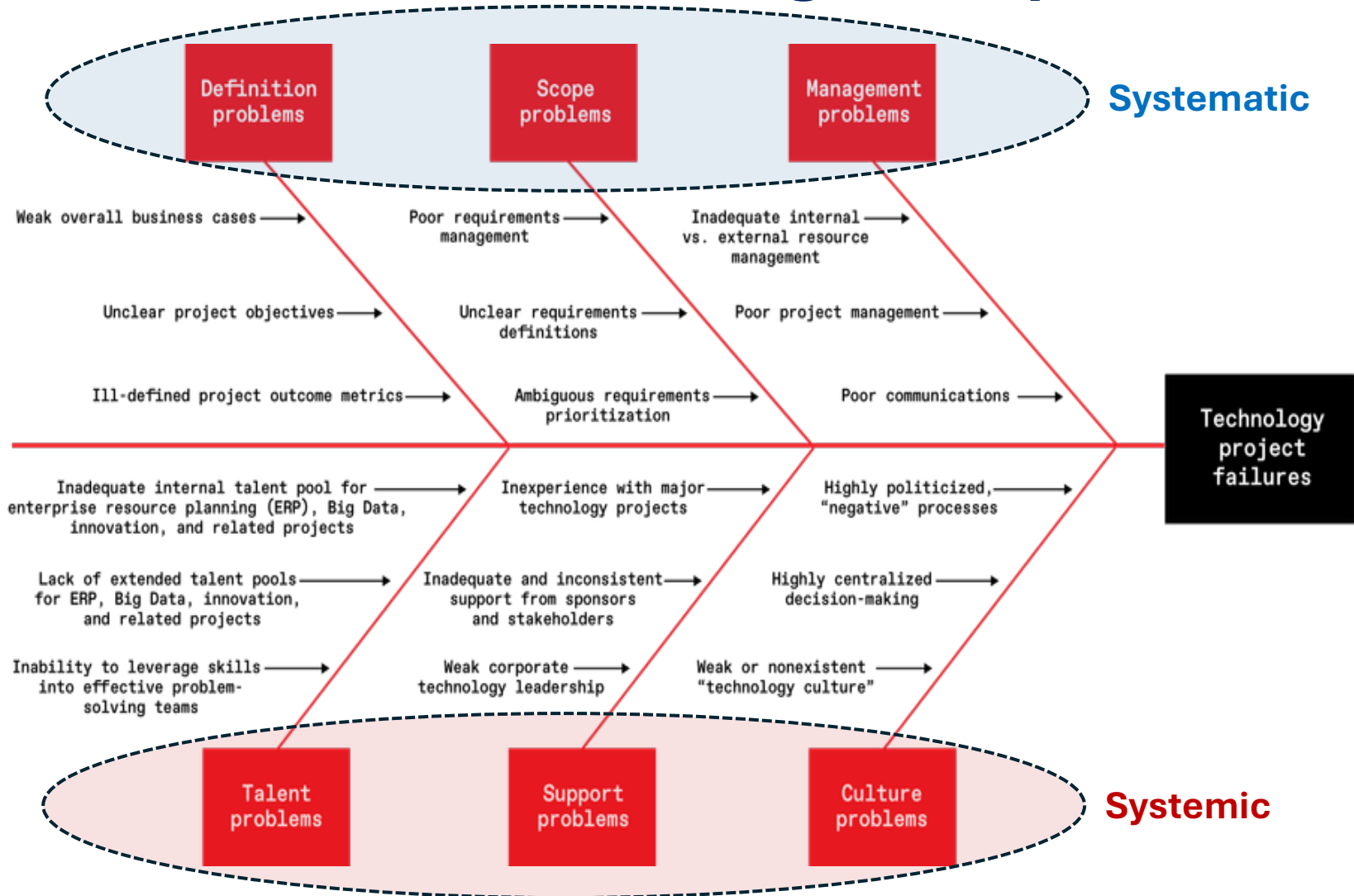
Stephen Andriole, 3 Main Reasons Why Big Technology Projects Fail – & Why Many Companies Should Just Never Do Them, Forbes, 2021.

Factors Crunching IT People!



Stephen Andriole, 3 Main Reasons Why Big Technology Projects Fail – & Why Many Companies Should Just Never Do Them, Forbes, 2021.

Factors Crunching IT People!



Stephen Andriole, 3 Main Reasons Why Big Technology Projects Fail – & Why Many Companies Should Just Never Do Them, Forbes, 2021.

Human-Systems Mismatches Abound

Political Intent and Narrative

"We will fix it with IT"

Policy & Program Design

Laws, Mandates, Budgets, Schedules

System Architecture

Platforms, Interfaces, Data, Integration

Development & Operations

Specs, Design, Code, Test, Updates

Positive Human Consequences

Patients, Citizens, Services, Infrastructure

To achieve human-centric computing, we need to address both systematic and systemic issues across the organization*



HCC GOAL

*(and among them!)

Human-Systems Mismatches Abound

Risk Root Causes

Information Gaps Control Loss Time Compression
Incomplete Data Decision Ambiguity Delayed Reaction

Political Intent and Narrative

"We will fix it with IT"

Policy & Program Design

Laws, Mandates, Budgets, Schedules

System Architecture

Platforms, Interfaces, Data, Integration

Development & Operations

Specs, Design, Code, Test, Updates

Positive Human Consequences

Patients, Citizens, Services, Infrastructure

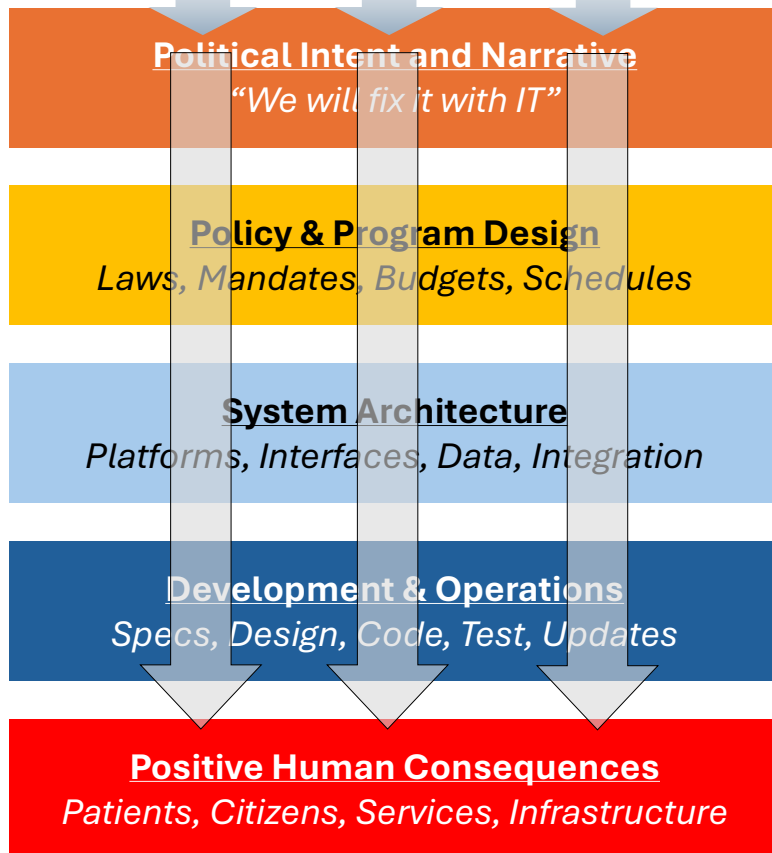
To achieve human-centric computing, we need to address *both* systematic and systemic issues across the organization

HCC GOAL

Human-Systems Mismatches Abound

Risk Root Causes

Information Gaps Control Loss Time Compression
Incomplete Data Decision Ambiguity Delayed Reaction



Risk Amplification

***Small errors at the top become
large harms at the bottom***

To achieve human-centric computing, we need to address both systematic and systemic issues across the organization



Human-Systems Mismatches Abound

Risk Root Causes



Risk Amplification

*Small errors at the top become
large harms at the bottom*

To achieve human-centric computing, we need to address both systematic and systemic issues across the organization*

... and wildcard externalities and internal spillovers.

HCC GOAL

*(and among them!)

Human-Systems Mismatches Abound

Risk Root Causes

Information Gaps Control Loss Time Compression
Incomplete Data Decision Ambiguity Delayed Reaction



Risk Amplification

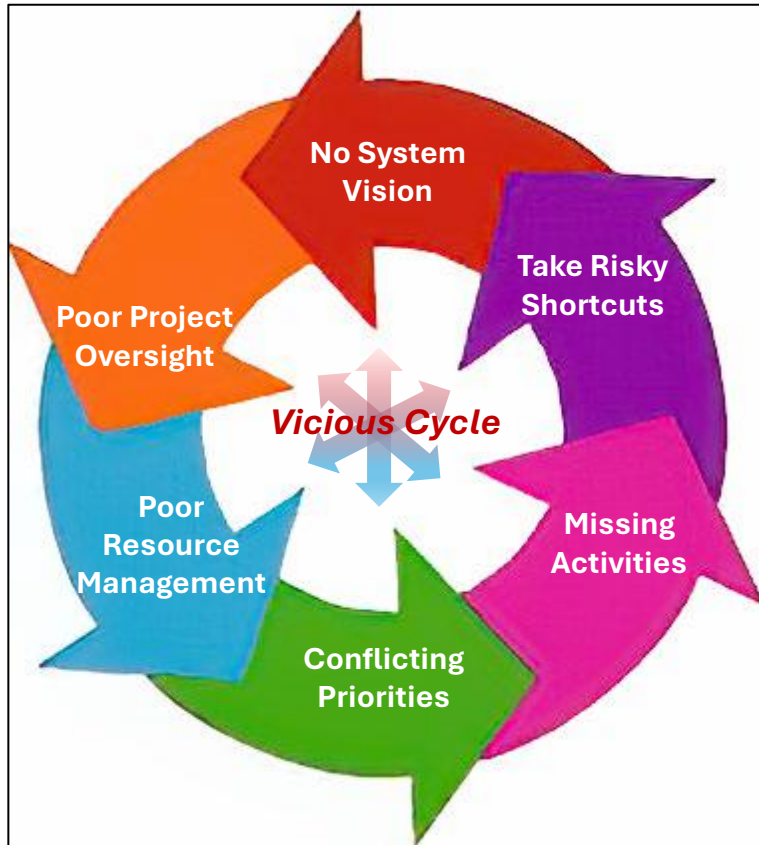
*Small errors at the top become
large harms at the bottom*

*** Cost to fix downstream?**

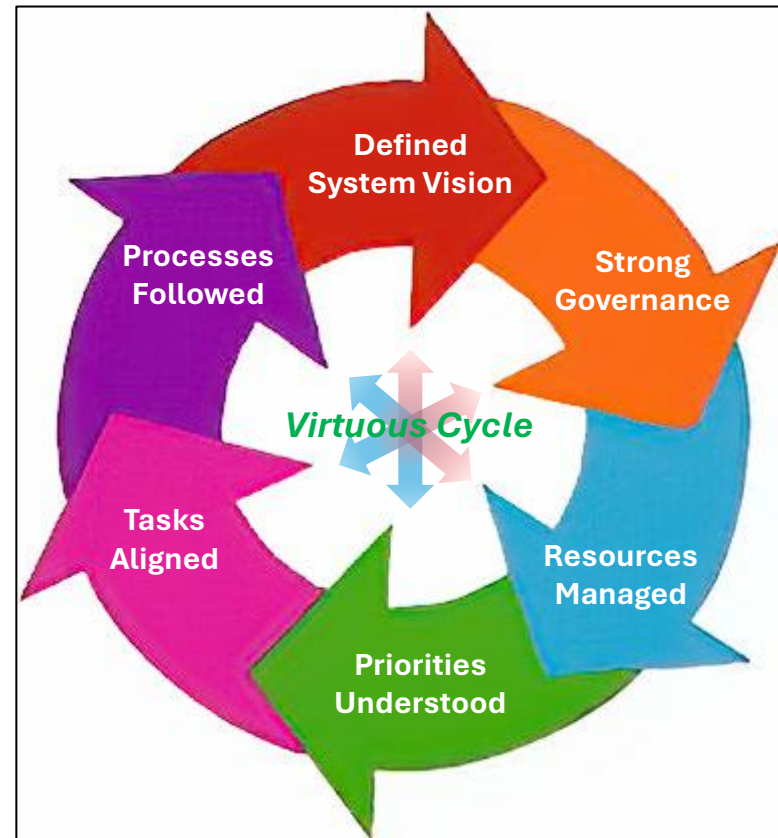


***Where are the
human-centric concerns?***

Reducing Mismatches

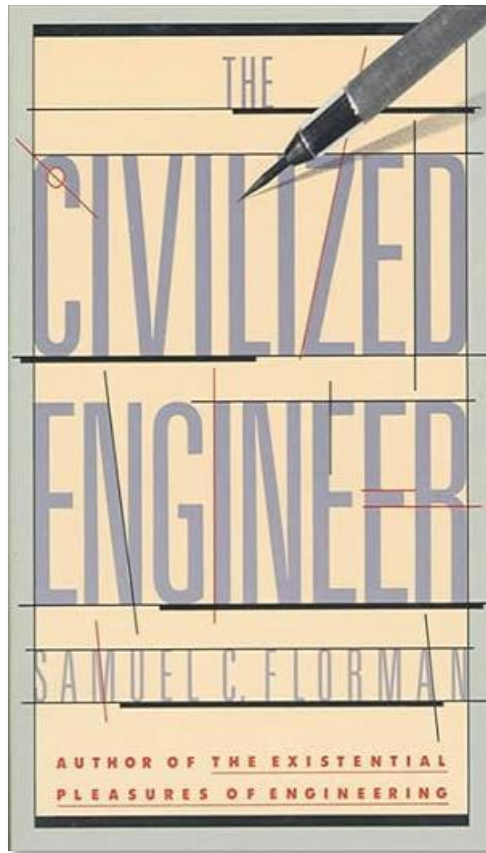


Human-centric concerns are a low-priority decision criteria



To achieve this, human-centric concerns must be at the forefront of decisions across the enterprise

Human-System Mismatches Show Maturity & Discipline Gaps, *Not* a Moral Failure



Every mature engineering field eventually learns three things:

- *Early decisions dominate outcome*
- *Uncertainty must be surfaced, not suppressed*
- *Systems fail in ways their designers did not imagine*

“For a successful technology, reality must take precedence over public relations, for Nature cannot be fooled.”

Richard Feynman

Remembering the Human Cost of Automation Without Human-Centric Design

C-SUITE

Hidden Costs Ignored

- ROI calculations exclude legal liability, reputational damage, and human harm
- Externalize costs so borne by society
- Tragedy of the commons undermines trust

Must account for risks beyond traditional metrics

DEVELOPERS

Inadequate Tools, Methods and Resources

- Tools don't support human-centric design considerations
- Methods fail to account for edge cases, human factors and human biases
- Lack of resources places unreasonable trade-off decisions on developers

Need frameworks embedding human considerations

END USERS

Bearing the Consequences

- Needs excluded from automation risk/reward calculations
- Poor software imposes cognitive burden, frustration and unaccounted for costs
- Automation paradox and information asymmetry creates unfair outcomes

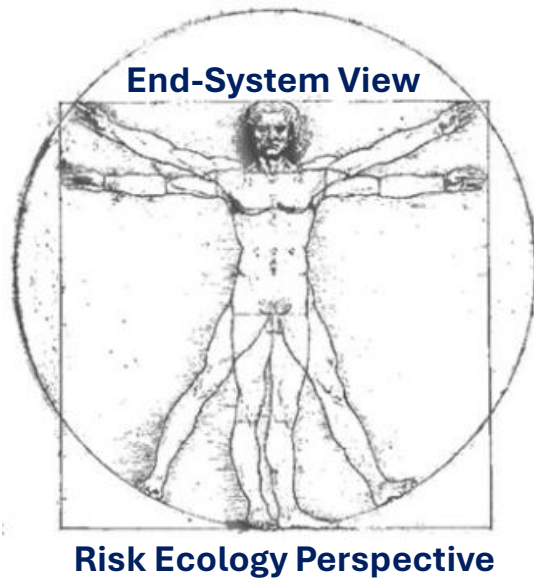
Must be central to decisions, not afterthoughts

What must be done here?

To reduce impacts here?

Engineering IT Systems For **ALL** People

Design Heuristics for Human-Centered Computing



- **Redefine System Boundaries**
- **Keep Humans Meaningfully Engaged**
- **Design for the “Risk Ecology”**
- **Match Complexity to Human Capacity**
- **Ask Where Does the Error Go?**
- **Make AI Errors Discoverable/Visible**
- **Accept Professional & Ethical Accountability**

Ask What Do I Know? What Do I Need to Know?



Changing Current Normative Decision Behaviors ... Realistic?

We do *KNOW* how to build HCC systems, but fighting...

- 75 Years of Know-How beating Know-What
- Massive financial incentives for building rapidly deployed & flawed software
- IT Industry's addiction to failure porn & pompous puffery
- Lack of accountability for decisions leading to poor consequences
- Persistence institutional learning amnesia
- Collective societal shrug of shoulders

So, Who Is Going To Change Today's Behaviors?

You!!!



Reading List

R. Charette, [Trillions Spent and Big Software Projects Are Still Failing](#), *IEEE Spectrum*, 2025

R. Charette, [Doctor's Screen Time Hobbles Health Care](#), *IEEE Spectrum*, 2025

L. Ulrich, [Inside Hyundai's Massive Metaplant](#), *IEEE Spectrum*, 2025

J.L. King et al., [Healthy Skepticism](#), *IEEE Computer*, 2024

R. Charette, [The EV Transition Is Harder Than Anyone Thinks](#), *IEEE Spectrum*, 2023

B.Flyvbjerg and D. Gardner. [How Big Things Get Done](#), Penguin Random House, 2023

HRIMS Project, [Positioning for Success in Complex Implementations](#), Audit Report, 2023

Australian Royal Commission, [Robodebt Scheme](#), 2022-2023

CISQ, [The Cost of Poor Software Quality in the US: A 2022 Report](#)

Amnesty International, [Xenophobic machines: Discrimination through unregulated use of algorithms in the Dutch childcare benefits scandal](#), 2021

S. Andriole, [3 Main Reasons Why Big Technology Projects Fail – & Why Many Companies Should Just Never Do Them](#), *Forbes*, 2021.

R. Charette, [How Software Is Eating the Car](#), *IEEE Spectrum*, 2021

R. Charette, [Demanding Fair and Ethically Aligned IT for the Future](#), *IEEE IT Professional*, 2021

R. Charette and J.L. King, [Winning and Losing in IT](#), *IEEE Computer*, 2021

R. Charette, [Dragging Government Legacy Systems Out of the Shadows](#), *IEEE Computer*, 2021

R. Charette, [Inside the Hidden World of Legacy IT Systems](#), *IEEE Spectrum*, 2020

[UK Post Office Horizon IT Inquiry and Reports](#), 2020 - 2024

Reading List

R. Charette, [Evolving From Know-How to Know-What](#), *IEEE Computer*, 2019

R. Charette, [Five Enduring Government IT Failures](#), *IEEE Spectrum*, 2019

R. Charette, [U.S. Coast Guard's \\$67 Million EHR Fiasco](#), *IEEE Spectrum*, 2018

R. Charette, [Puncturing Pernicious Project Pufferies](#), *IEEE Computer*, 2018

R. Charette, [Michigan's MiDAS Unemployment System: Algorithm Alchemy Created Lead, Not Gold](#), *IEEE Spectrum*, 2018

R. Charette, [Canadian Government's Phoenix Pay System an 'Incomprehensible Failure,'](#) *IEEE Spectrum*, 2018

R. Charette, [Low Clearance Ahead: Can Predictable IT Crashes Be Avoided?](#), *IEEE Computer*, 2017

R. Charette, [IT's Fatal Amnesia](#), *IEEE Computer*, 2017

G. Lewis, [Failure porn: There's too much celebration of failure and too little fear](#), Medium, 2015

US Congress, [Social Security's \\$300 Million IT Project Investigation: Bad News for Taxpayers](#), 2014

A. Jaimes et al. [Human-Centered Computing--Toward a Human Revolution](#), *IEEE Computer*, 2007

R. Charette, [Automated to Death](#), *IEEE Spectrum*, 2009

R. Charette, [Why Software Fails](#), *IEEE Spectrum*, 2005

S. Floman, [The Civilized Engineer](#), Macmillan Publishers, 1987

[AI Incident Database](#)

[Community Reporting of Algorithmic System Harms \(CRASH\) Project](#)

[MIT AI Tracker](#)