



SW Engineering Careers in AI times



Prof. Dr. Ricardo Colomo-Palacios



Agenda

1. About me
2. Maturity: Is there a Career for SW Engineers?
3. What to do after your Ph.D (in SW Engineering)
 - a) Academia
 - b) Industry
 - c) Entrepreneurship
 - d) What about a break?
4. Tech Employment in Europe & Outlook
5. Conclusions



1. About me



- ✓ Bachelor (1994), Master (1997) and Ph.D (2006) in Computer Science (SE).
- ✓ Executive MBA (2003).
- ✓ Since 2022, Full Professor at Technical University of Madrid (@upm), previous positions in Norway (Full profesor @hiof, 2014-2022) and Spain (Assoc. Professor @uc3m).
- ✓ Served as a CIO, CTO, Project Manager, Software Engineer and Consultant for several organizations in Spain.
- ✓ Serial Tech Entrepreneur.
- ✓ Since 2024 EiC Computer Standards & Interfaces (@Elsevier).
- ✓ 15 graduated PhD students, 2 ongoing, 4 left during studies.

More information at: www.rcolomo.com



2. Maturity: Is there a Career for SW Engineers?

- ✓ A career is the job or profession that someone does for a long period of their life (Collins).
- ✓ Oxford & Cambridge Dictionaries treat a career not just as a single position, but as a sequence of connected roles over time.
- ✓ Etymology: French *carrière* evolved from Latin *Carraria* (Path for Chariots), formed from *Carrus* (Chariot) which origin is Celtic.

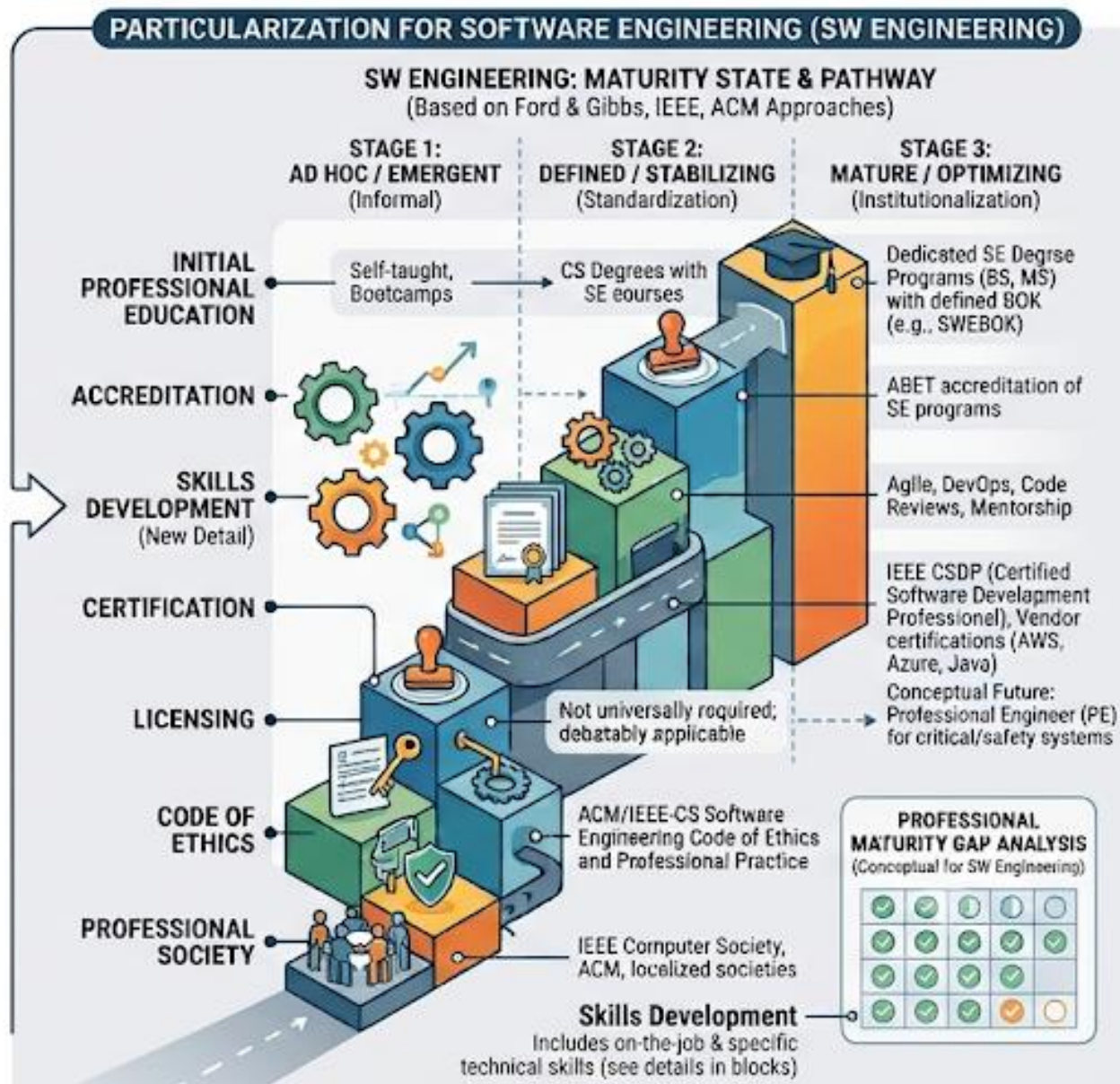


1. Initial professional education
2. Accreditation
3. Skills development
4. Certification,
5. Licensing
6. Code of ethics,
7. Professional development
8. Professional society.

Ford & Gibbs (1996). A Mature Profession of Software Engineering. SEI.

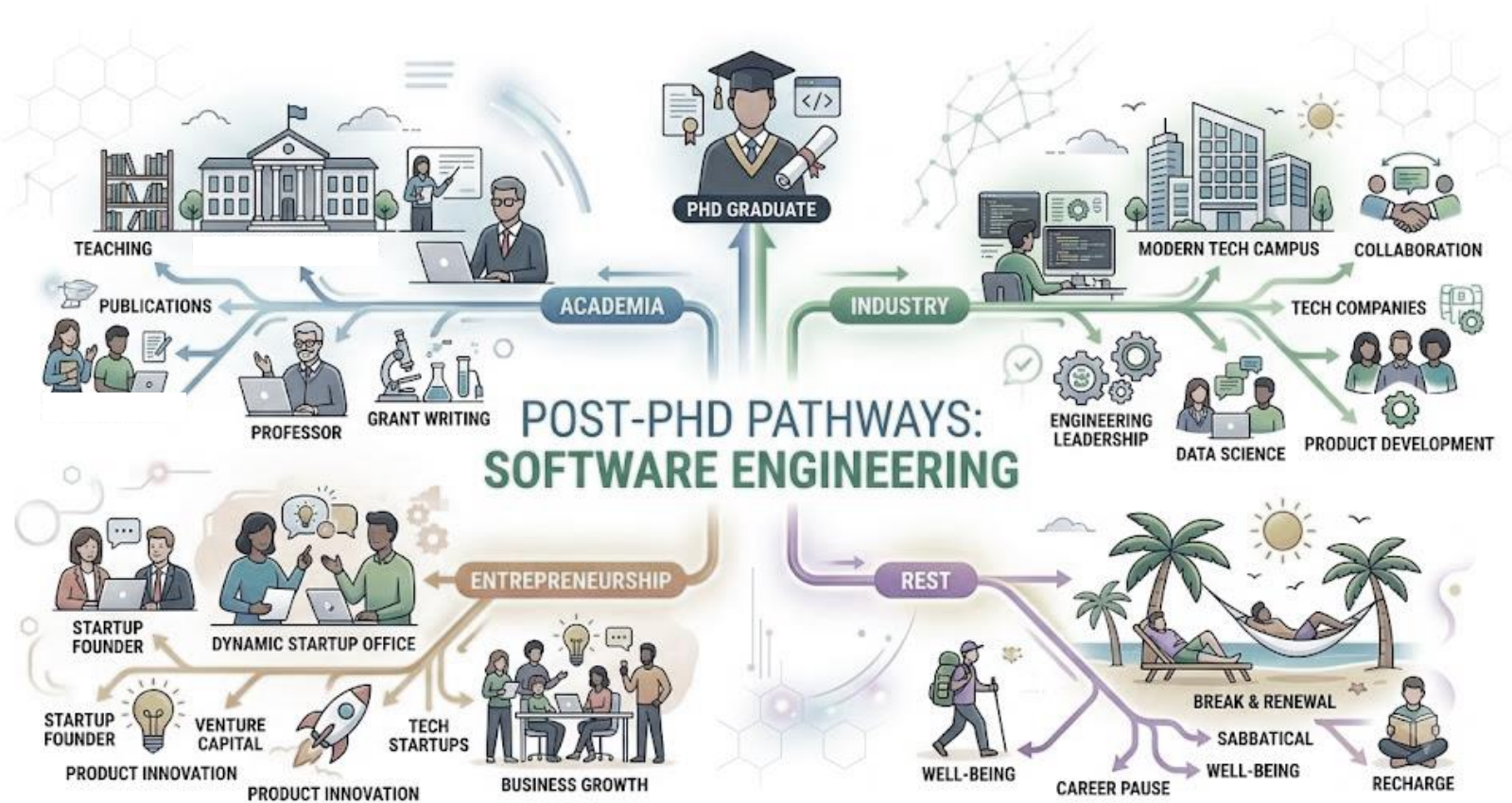


2. Maturity: Is there a Career for SW Engineers?





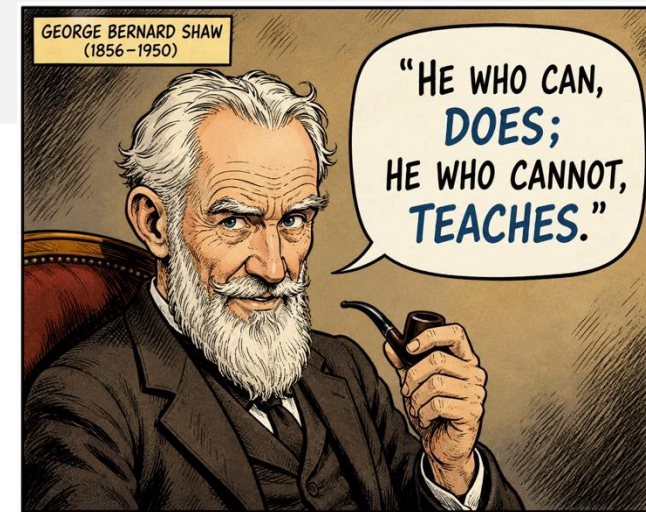
3. What to do after your Ph.D (in SW Engineering)



Do your own Mix

3.1. To do: Academia

- ✓ A touch of cynicism (is always needed):
George Bernard Shaw, 1903, Man and Superman:
Section Maxims for Revolutionists, Maxim 36.
- ✓ Academics in Europe:
 - Spain: 50M→140k (Public+Private) by 2024.
 - Finland: 5.5M→2100 FP, 624 AP, 352 Assit Prof., around 11k in total including all
 - <https://www.professoriliitto.fi/en/whats-new/salary-survey-of-the-finnish-union-of-university-professors-for-2025/>
- ✓ Around 4-5% of these are Computing related (Not all SW Engineering).
- ✓ Currently there is a crisis in attracting and retaining computing university professors across Europe. Factors:
 - **Salary Gap:** In all levels from assistant professors to full professors.
 - Loss of the Ph.D Pipeline: doctoral candidates leave academia immediately upon graduation.
 - **Accreditation Systems:** In several European countries (ANECA in Spain).
 - Complex International Relocation & Visas.
 - Slow Hiring Cycles.





3.1. To do: Academia. A flavour of ANECA

ANECA ACADEMIA 2024 FRAMEWORK: COMPUTING PROFESSOR ACCREDITATION IN SPAIN

PROFESOR/A TITULAR DE UNIVERSIDAD (PTU) - ASSOCIATE PROFESSOR

PTU: JUNIOR/EARLY CAREER TRACK



RESEARCH & TRANSFER



TEACHING



LEADERSHIP & MANAGEMENT



PREREQUISITES

PhD Degree
≥ 4 years full-time teaching
≥ 9 months mobility



RESEARCH & TRANSFER

Up to 8 contributions
Shortcut:
2 Sexenios OR
1 Research + 1 Transfer Sexenio

Computing:
JCR (Q1/Q2),
CORE A/A* proceedings



TEACHING

DOCENTIA evaluation
Open-access learning resources
Course design



LEADERSHIP & MANAGEMENT

Co-direction of PhD / TFM
Active team member or PI in grants
Degree coordination

ACADEMIC PROGRESSION PATH



Requires k
Tenure &
Experience

CATEDRÁTICO/A DE UNIVERSIDAD (CU) - FULL PROFESSOR

CU: SENIOR/ESTABLISHED TRACK



RESEARCH & TRANSFER



TEACHING



LEADERSHIP & MANAGEMENT



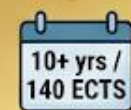
PREREQUISITES

PTU status (or PhD ≥ 8 Exc.)
≥ 10 years full-time teaching
≥ 140 ECTS (1400 h)



RESEARCH & TRANSFER

Up to 20 contributions
Continuous activity across last 10 years
Computing:
Leadership in top JCR/CORE, Patents, Tech Transfer



TEACHING

DOCENTIA evaluation
2 Quinquenios
Advanced course creation
Pedagogical training leadership



LEADERSHIP & MANAGEMENT

PhD thesis direction
Principal Investigator (PI) in national/EU grants
Unipersonal roles (Dean, Dept Chair)

Computing Specialization: Top Conference Proceedings (CORE A/A) recognized along JCR Journals. Transfer: Software, Patents, Article 60 contracts prioritized. Open Science deposit mandatory.

3.2. To do: Industry

- ✓ According to national surveys (Aarresaari Network Career & Employment Survey of Finnish university doctoral graduates), around 37% of STEM PhD holders in Finland remain in university.
- ✓ Compensation Gap: Starting industry salaries for CS PhDs routinely outpace entry-level academic postdoctoral research contracts by 25% to 40%.
- ✓ Viewpoints:
 - Institutes Vs. “Real” Industry.
 - Product-First (SAP, Amazon) Vs. Research-First (MS, Google) → People Assessment
 - Marie Skłodowska-Curie Actions (MSCA) & European Research Council (ERC):
 - MSCA: primarily creates postdoctoral positions and promotes researcher mobility.
 - ERC: primarily creates top research groups, within which postdocs are recruited.
 - Channels:
 - Job Portals
 - Academic Positions,
 - Nature Careers,
 - ResearchGate Jobs,
 - LinkedIn
 - EURAXESS
 - Lists (SIGSOFT, DbWorld...)
 - Hidden Market (networking!!!)



3.3. To do: Entrepreneurship

- ✓ Not extensive-consolidated data available, but...
 - European Molecular Biology Laboratory (EMBL) tracked PhD students and 0.7% of graduates immediately transitioned to entrepreneurs and 1.5% long term.
 - Nature PhD & Postdoc Career Surveys, While 10–15% of postdocs express interest in entrepreneurship, just 2%-4% actively launch a company as their 1st job post-contract.
 - OECD / Eurostat - Careers of Doctorate Holders. Entrepreneurship rates among doctoral graduates in Europe is 2% - 5% depending on the specific country.
 - State of European Tech Report (Atomico / Slush). Over 15% of founders in deep-tech software sectors hold a PhD or completed a postdoc.

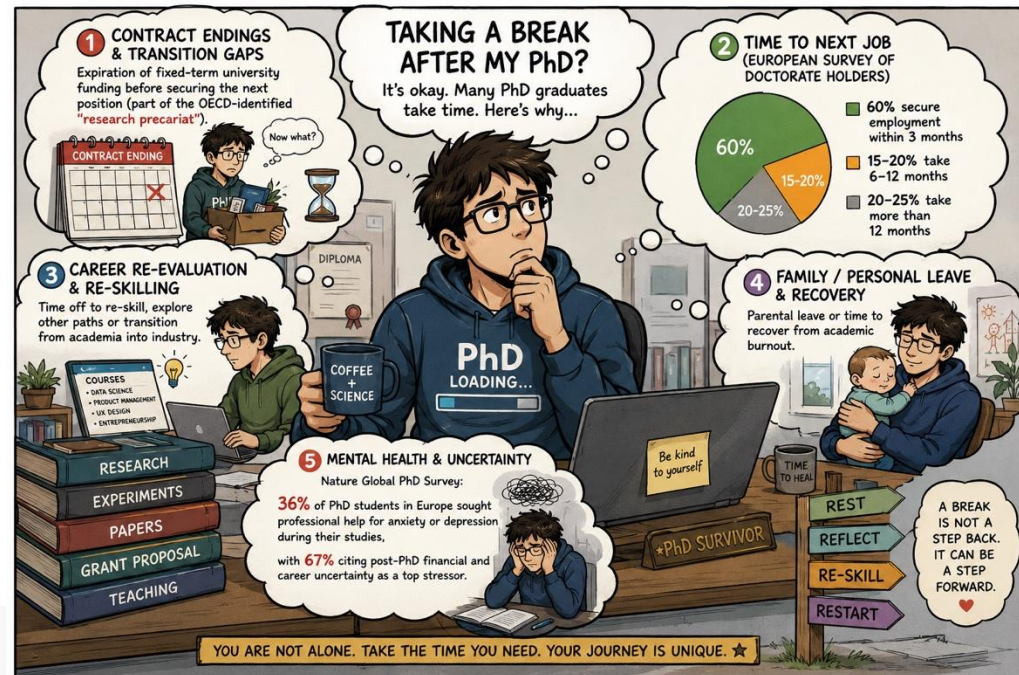
- ✓ The European Commission's EU Startup and Scaleup Strategy (2025) focuses on tech-driven startups, recognising software, AI, cloud computing, cybersecurity and digital technologies as the main engines of EU innovation.





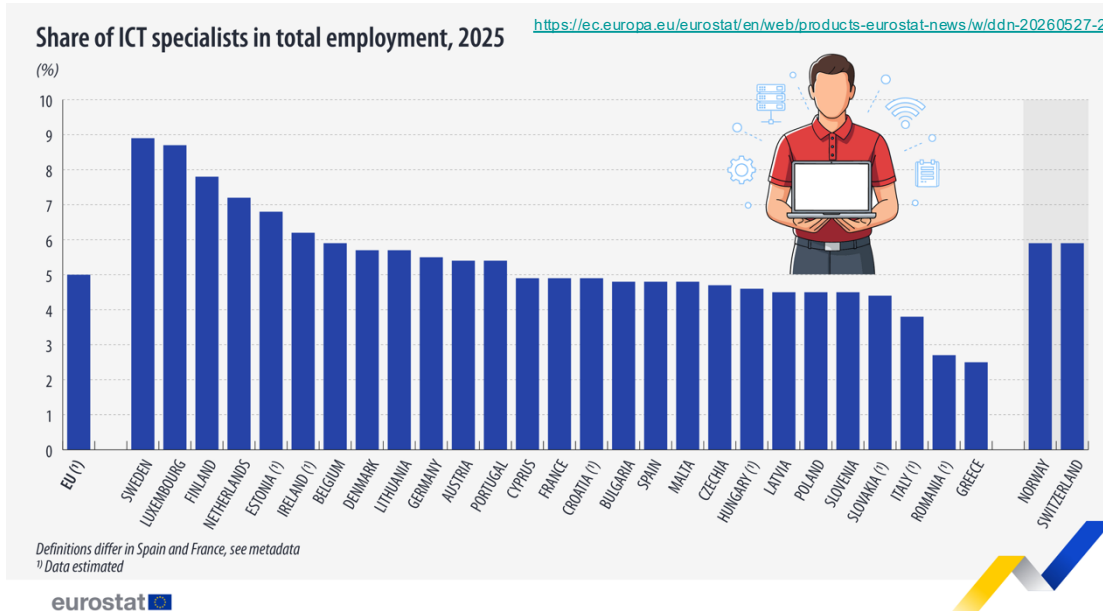
3.4. What about a break?

- ✓ Primary Reasons for Breaks:
- **Contract Endings & Transition Gaps:** Expiration of fixed-term university funding before **securing** the next position (reported by the OECD as part of the "research precariat"). DocEnhance European Survey of Doctorate Holders:
 - 60% of European PhD graduates secure employment within 3 months.
 - 15-20% take 6-12 months.
 - **Career Re-evaluation:** Months off to **re-skill** or **transition** from academia into industry.
 - **Family / Personal Leave:** Parental leave or recovery from **academic burnout**.
 - Nature Global PhD Survey: 36% of PhD students in Europe sought professional help for **anxiety** or **depression** during their studies, with 67% citing post-PhD financial and **career uncertainty** as a top stressor.



4. Tech Employment in Europe & Outlook

- ✓ According to Eurostat 2026 Digitalisation Report (2026, data from 2025):
 - Around 10.5 M ICT specialists in the EU.
 - 5% of the total employment.
 - Around 60% of growth since 2015 (Total employment growth is 10%).



- ✓ Target established by the EU Digital Decade: 20 M ICT specialists by 2030.
- ✓ According to Europe's Tech Job Market (<https://www.index.dev>):
 - Europe has roughly 3.5 million active software developers.
 - Major developer hubs include Berlin (~178,000) and Stockholm (~46,000).



4. Tech Employment in Europe & Outlook

- ✓ (Looks like) AI is **changing the nature of software engineering** jobs much faster than it is reducing the total number of jobs.
- ✓ According the AI-Enabled ICT Workforce Consortium (Cisco, Microsoft, Google, IBM, SAP, Accenture... under the EU-US Trade and Tech. Council), **91.5% of ICT specialist jobs in Europe will be significantly transformed by AI.**
<https://www.cisco.com/c/dam/m/ai-enabled-ict-workforce-consortium/executive-summary.pdf>
- ✓ The European Central Bank (Data from 5000 EU firms) → AI is not yet causing widespread layoffs.
- ✓ No consolidated data from Eurostat, CEDEFOP, OECD, or European Commission, but (<https://www.ecb.europa.eu/press/blog/date/2026/html/ecb.blog20260304~d9e34fc95f.en.html>):
 - “**Current European evidence does not indicate widespread reductions** in SEN employment attributable solely to AI. Instead, AI is associated with **slower recruitment of junior developers**, automation of routine programming tasks, and a restructuring of software engineering roles toward higher-value activities such as architecture, integration, security, and AI supervision”



4. Tech Employment in Europe & Outlook

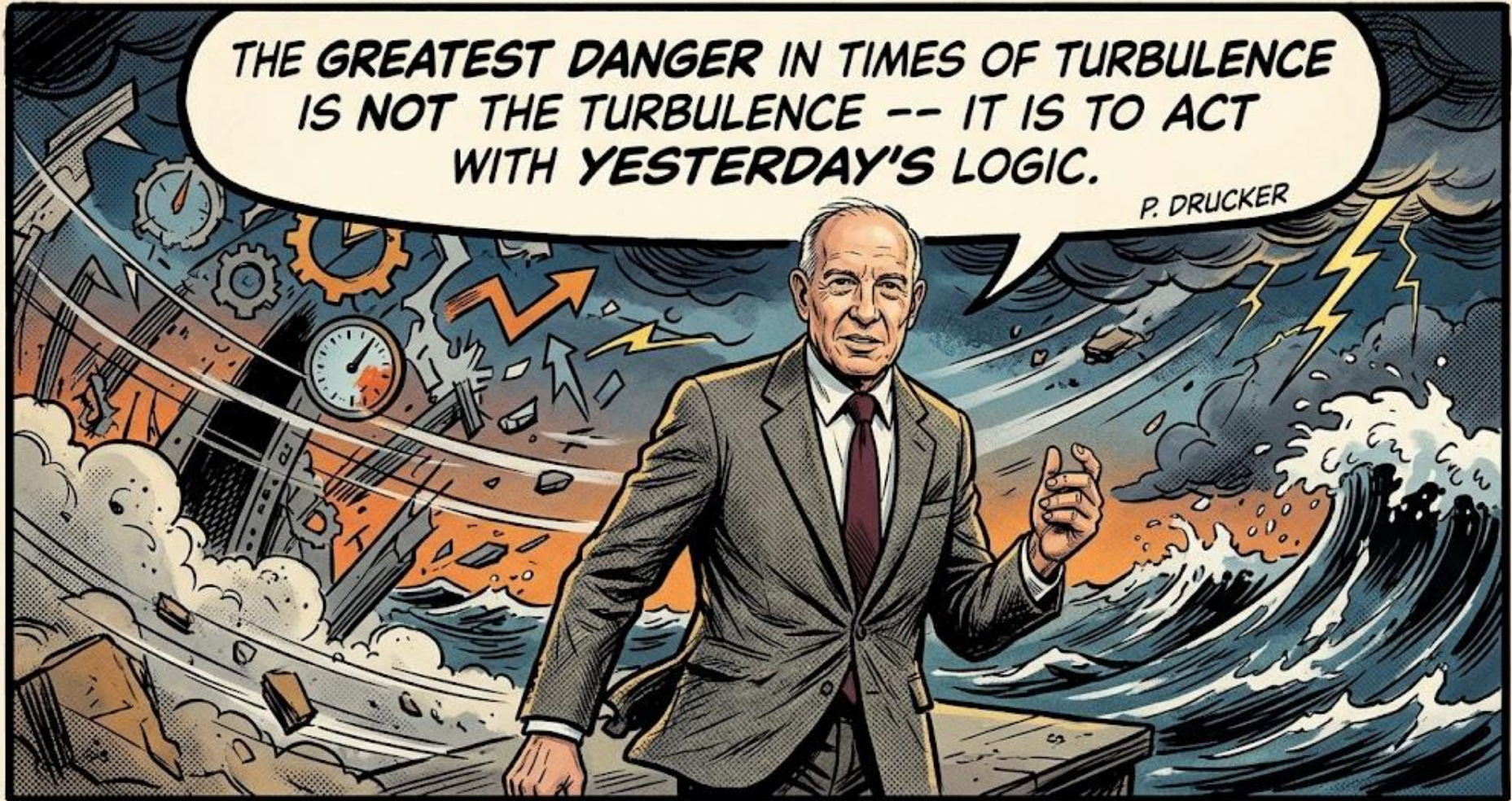
- ✓ US tech job postings on Indeed also dropped 36% from 2020 to 2025.
 - <https://www.theguardian.com/technology/ng-interactive/2026/jul/12/software-developers-engineers-ai>
- ✓ The role of Software Engineer is not disappearing. It's evolving. Key Skills:
 - Use AI tools to improve productivity.
 - Validate AI-generated code before it reaches production.
 - Solve complex technical problems.
 - Communicate effectively with technical and business teams.
 - Adapt as technologies continue to evolve.
 - <https://soltech.net/the-ai-impact-on-software-engineering-jobs/>
- ✓ While 84% of developers are already using, or plan to use, AI tools, only 29% trust AI-generated output to be accurate.
 - <https://stackoverflow.blog/2026/04/02/what-the-ai-trust-gap-means-for-enterprise-saas/>
- ✓ Vibe Coding (user tells the agent what to do, do not supervise when it is running, do not review code or the output) Vs. Agentic Engineering (human in control and accountable for the output). Skills erosion...But this is not boolean.
 - <https://www.normaltech.ai/i/201537309/vibe-coding-is-not-agentic-engineering>
- ✓ Just 44% of agent-produced code survives to user commits.
- ✓ Vibe-coded commits introduce vulnerabilities nine times the human-only rate.
 - <https://arxiv.org/pdf/2604.20779>



5. Conclusions

**THE GREATEST DANGER IN TIMES OF TURBULENCE
IS NOT THE TURBULENCE -- IT IS TO ACT
WITH *YESTERDAY'S* LOGIC.**

P. DRUCKER



Drucker, P. (1980). "Managing in Turbulent Times".



SW Engineering Careers in AI times



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