



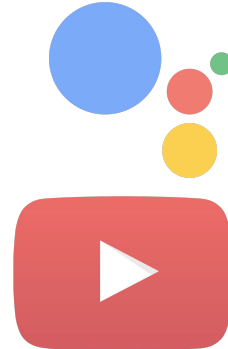
# Impact Journey

Lessons learned through an engineer's lens

[irwin@google.com](mailto:irwin@google.com)

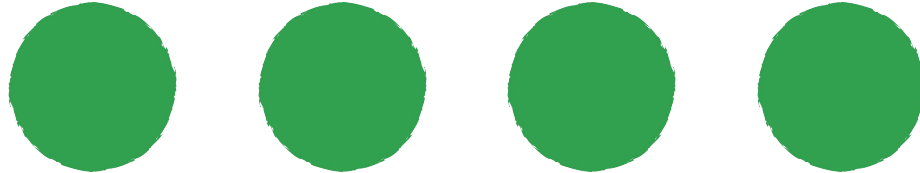


# Irwin Boutboul



Google  
Startups for  
Sustainable  
Development

# What's impact?



# Impact definition



CSR

Corporate social  
responsibility



ESG

Environmental Social  
Corporate Governance



SDG

Sustainable Development  
Goals



ETC

?

# Unfulfilled promise



**Engineering**  
**1% positive impact**





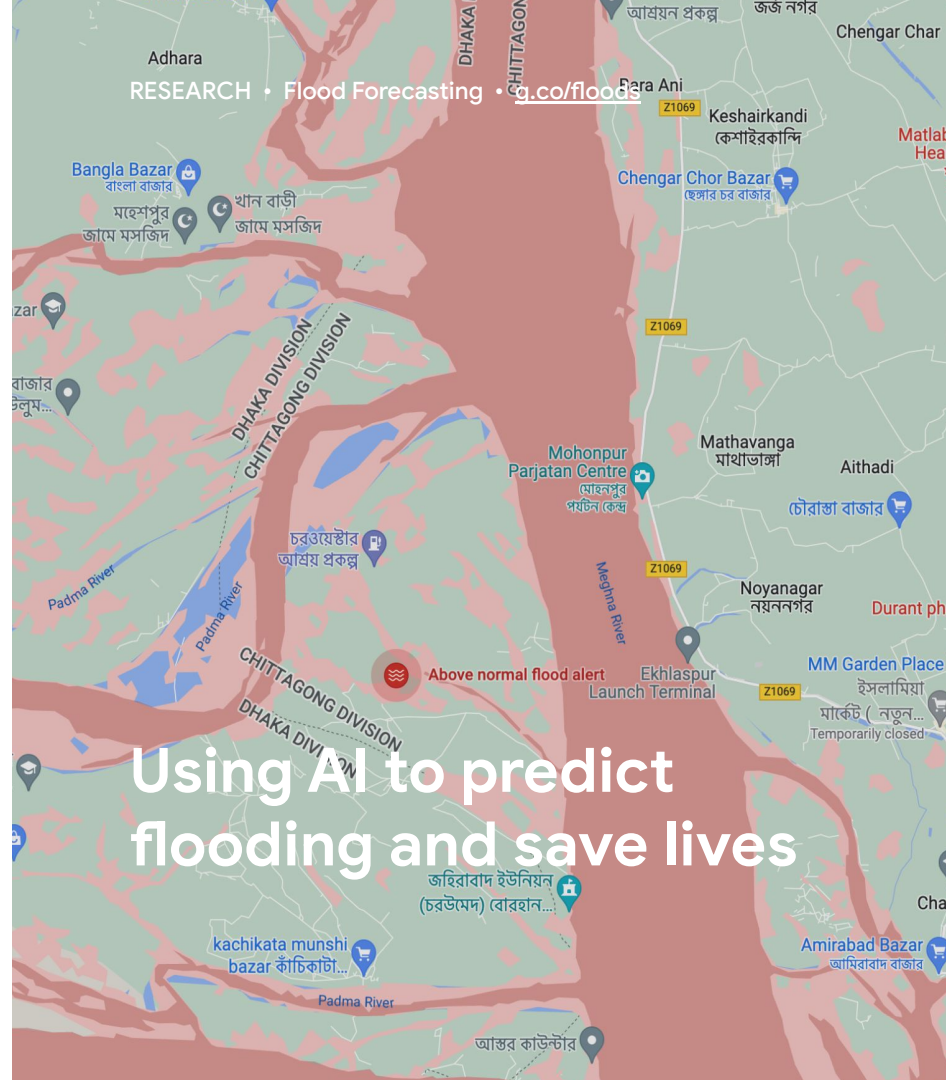
RESEARCH • ARDA •

<https://about.google/stories/seeingpotential/>

## Increasing access to diabetic eye screening with AI



RESEARCH • Flood Forecasting • [g.co/floods](https://www.google.com/maps/@23.81034,90.31469,15z)



## Using AI to predict flooding and save lives



RESEARCH • [Read Along](#) • [readalong.google.com](#)

# Learning to read with AI

RESEARCH • Green Light

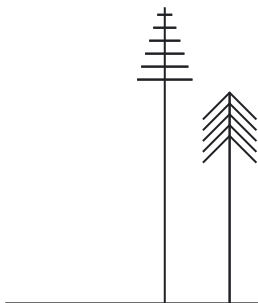
# Using AI to optimize traffic lights and reduce emissions







## The impact startup ecosystem



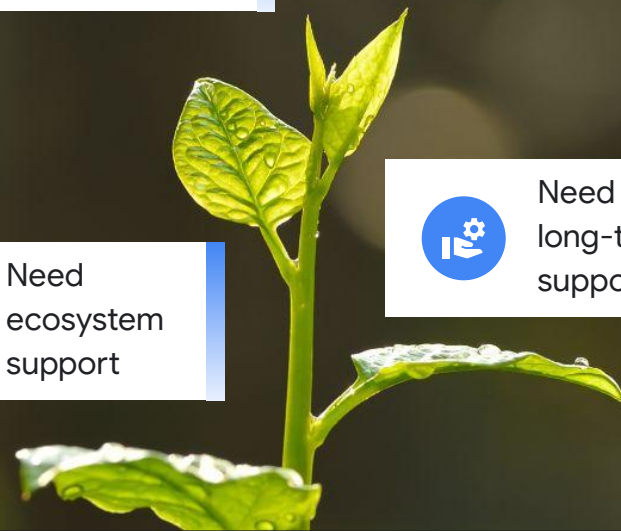
Often  
underfunded /  
resourced



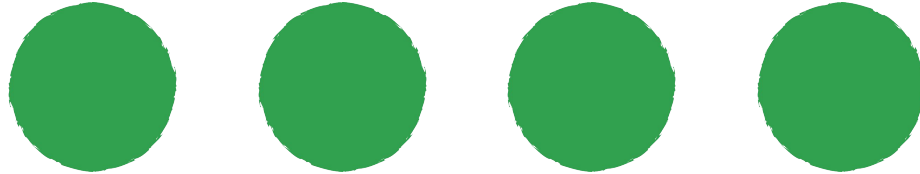
Need  
ecosystem  
support



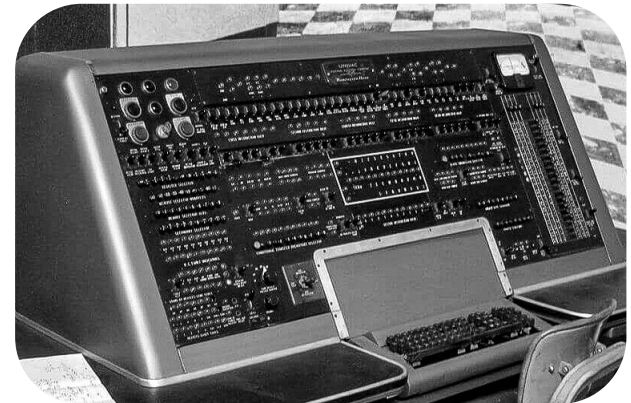
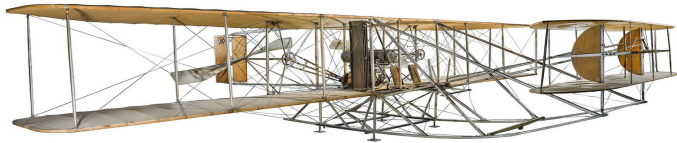
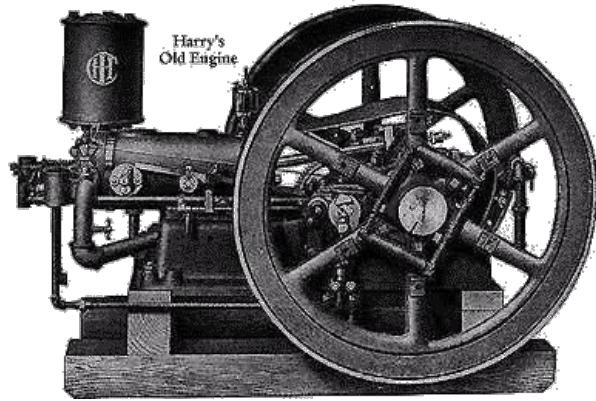
Need  
long-term  
support



The impact of the other  
**99%** engineering



# Unprecedented innovation



# Unprecedented speed of penetration



**75 years**

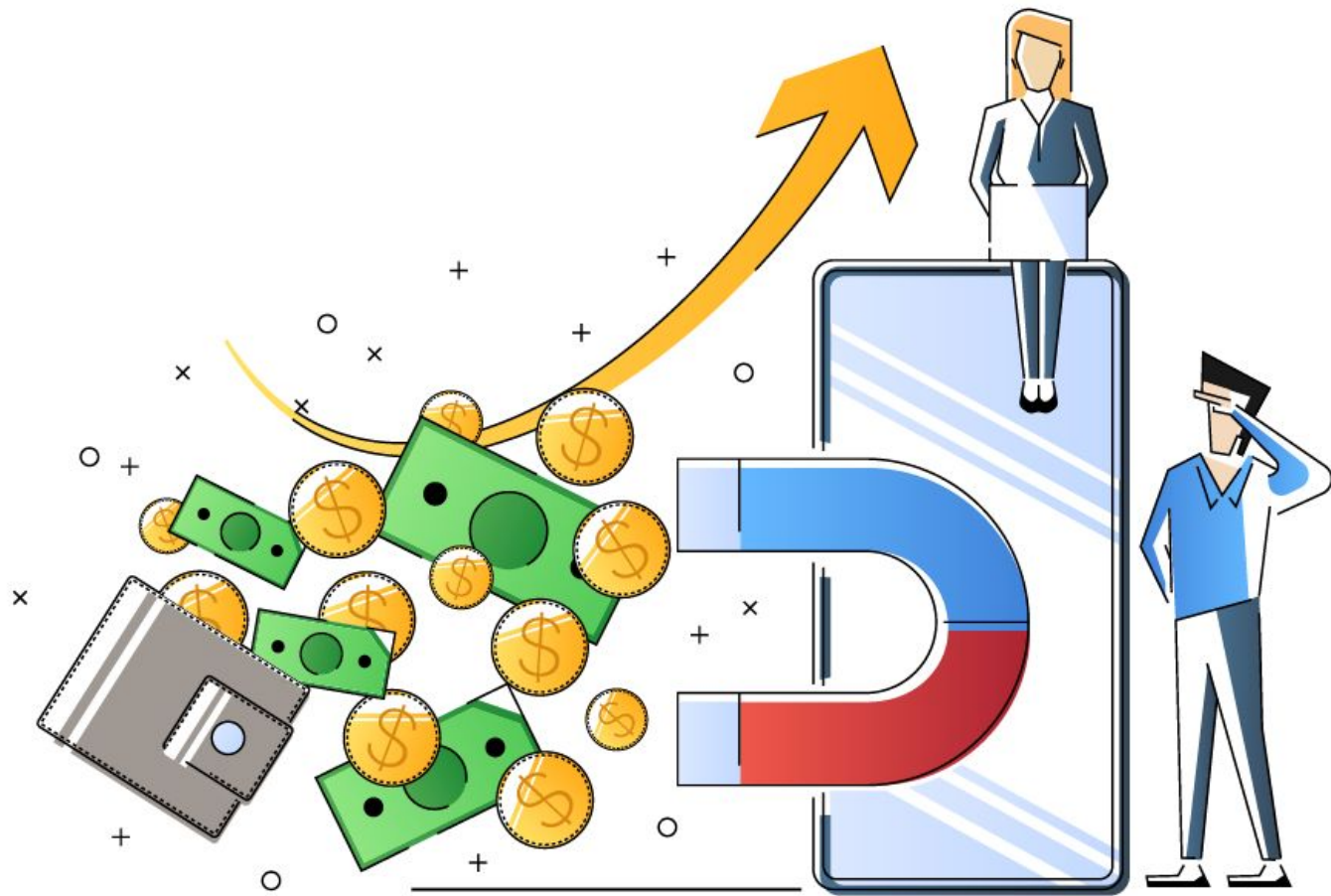


**12 years**



**12 years**

**50% penetration**

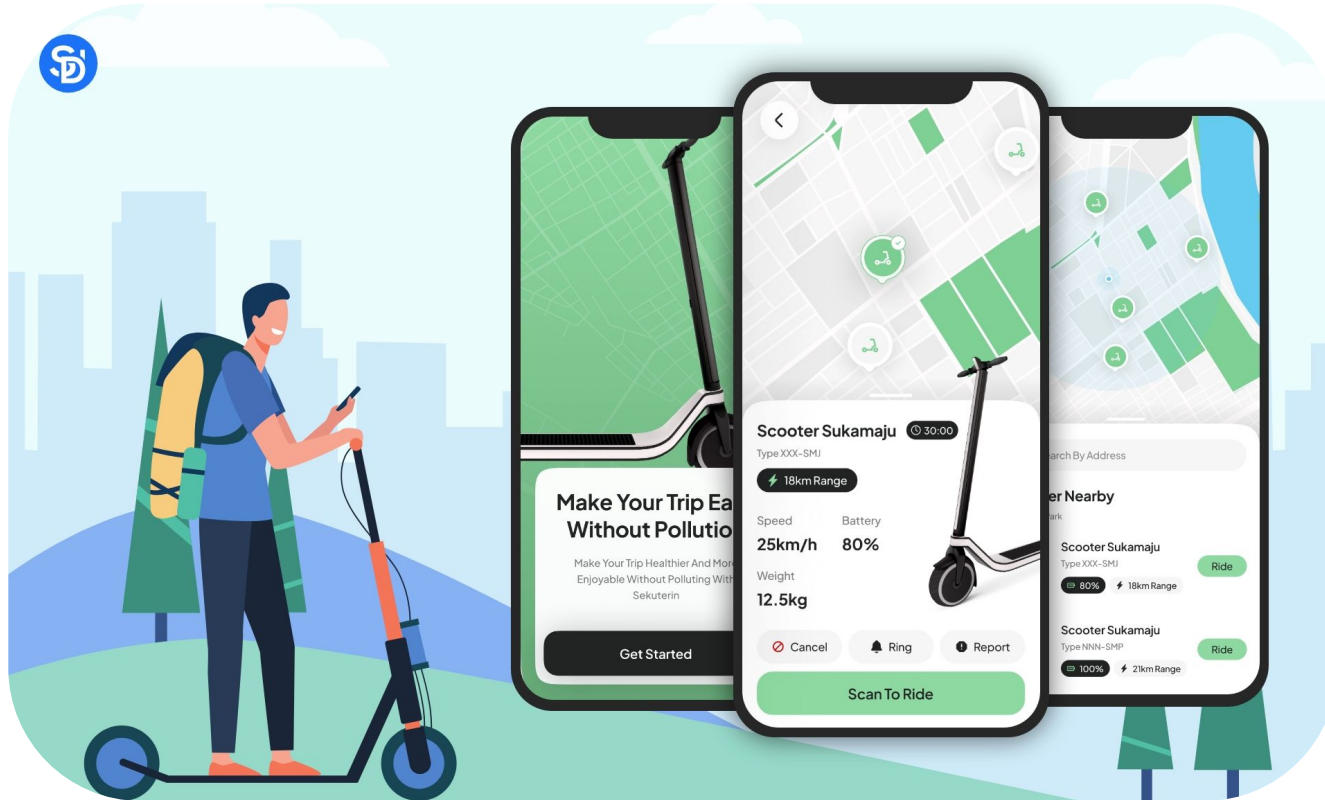




# Uber wework



# Impact tech case study



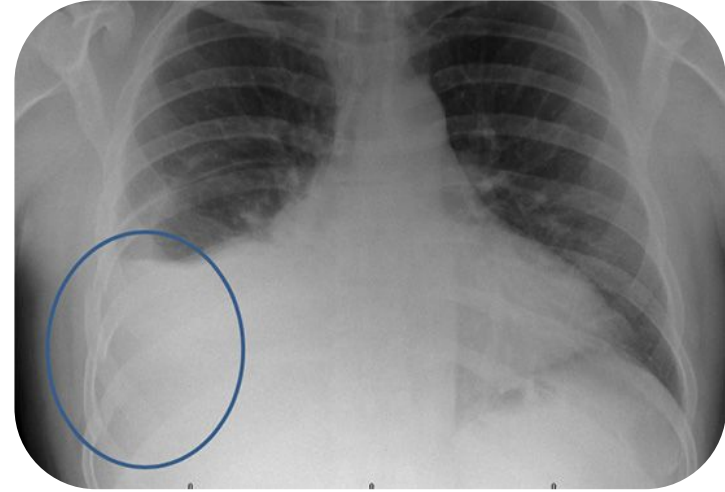
## #1 environmental impact



# #1 environmental impact



## #2 societal impact



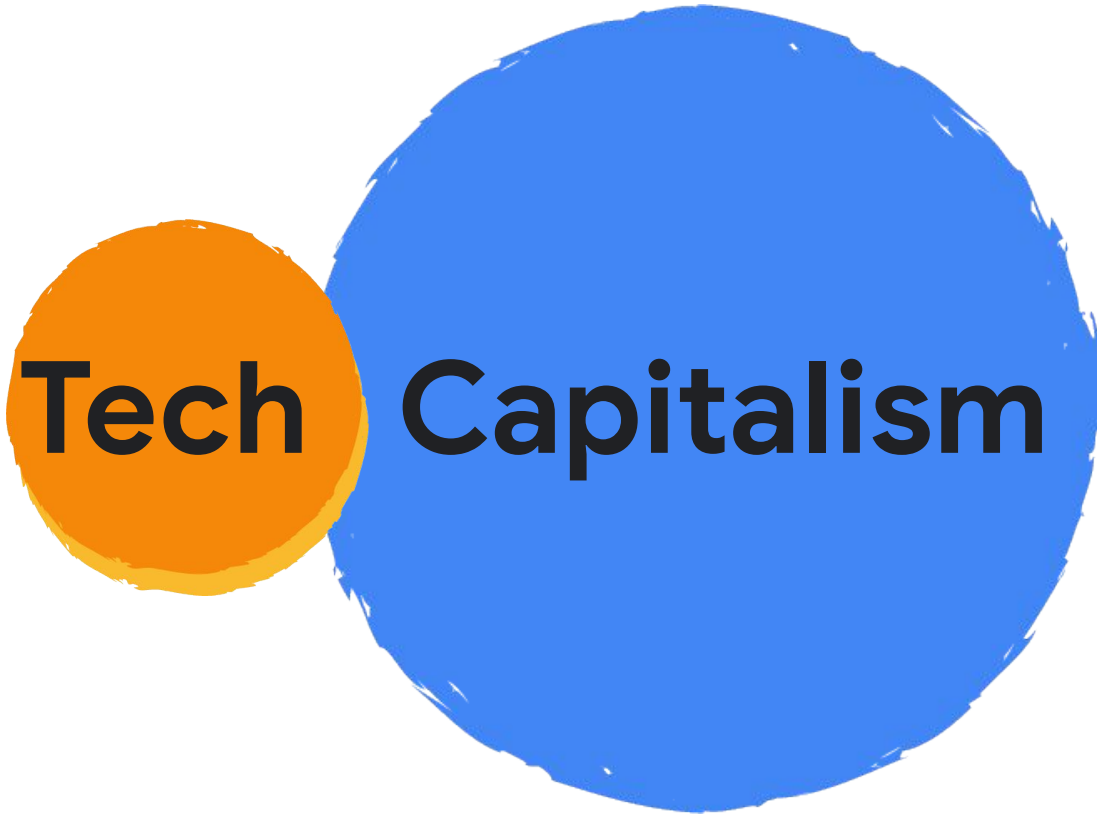


## #3 Long term impact

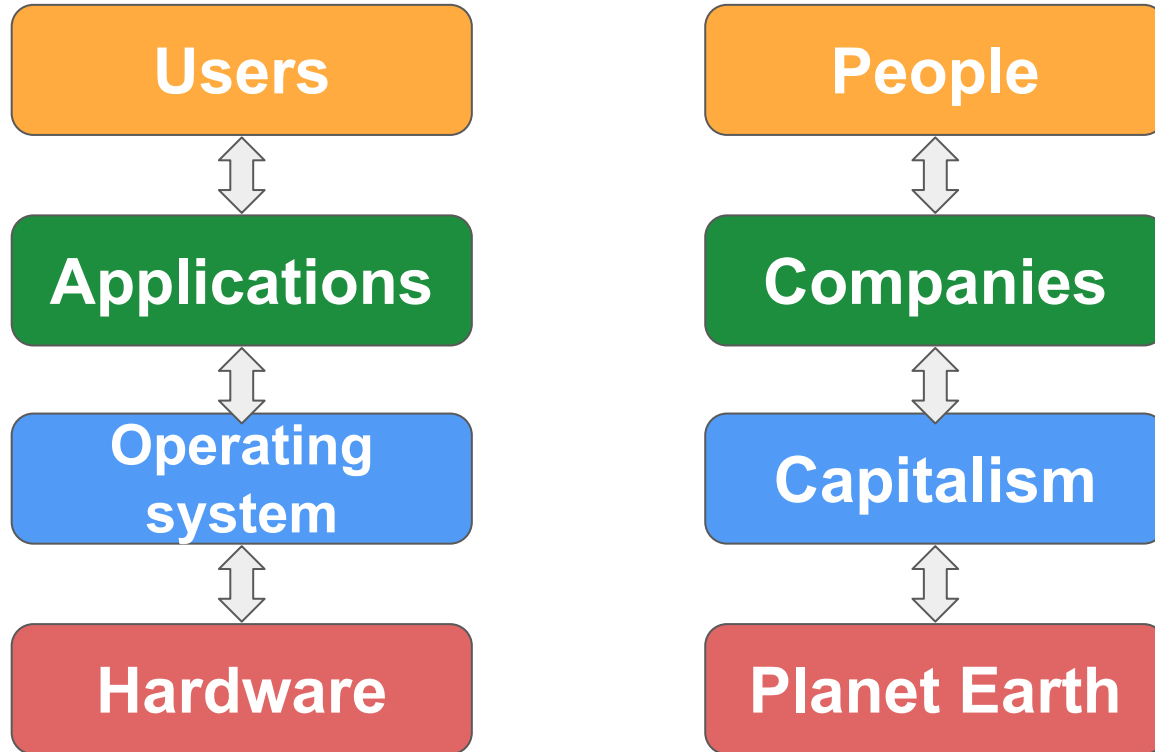


Bottom line?





# Complex systems

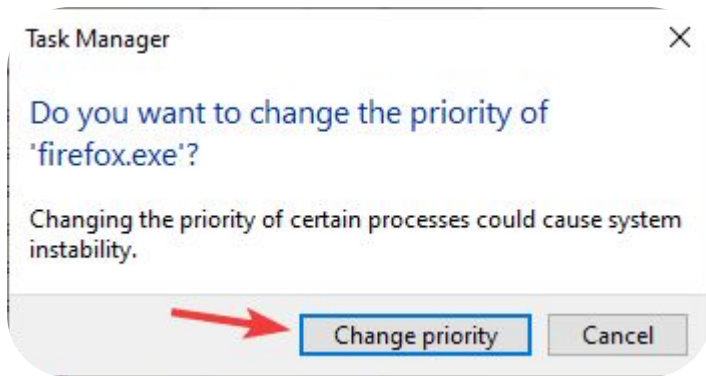
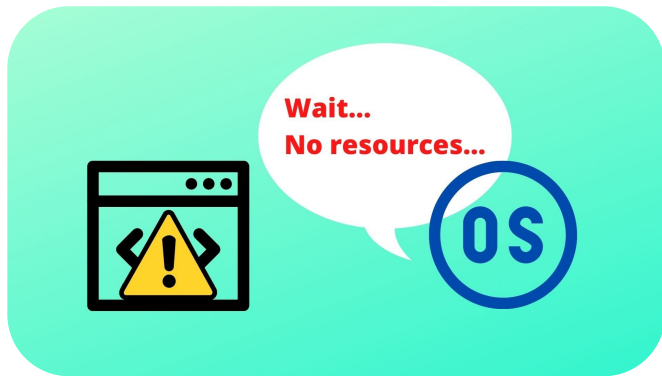


# Capitalism issues





## Issue #1 - Some apps are impacted more than others

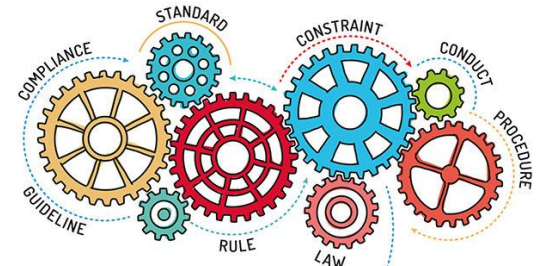
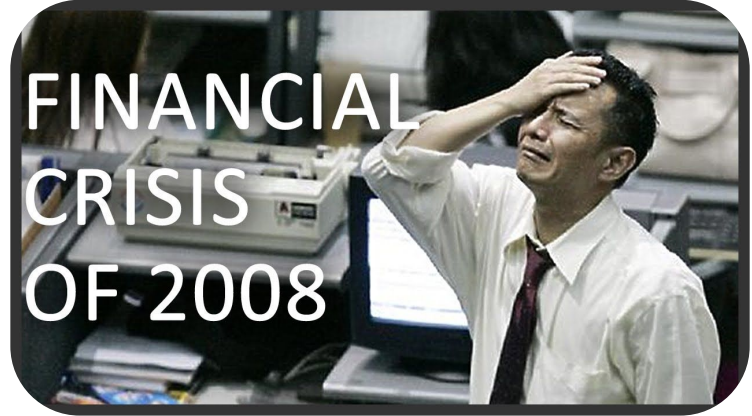


## Issue #2 - System crashes!

```
...ules has been detected and windows has been shut down to prevent damage to  
your computer.  
...RIVER_IRQL_NOT_LESS_OR_EQUAL  
If this is the first time you've seen this Stop error screen,  
restart your computer. If this screen appears again, follow  
these steps:  
  
Check to make sure any new hardware or software is properly installed.  
If this is a new installation, ask your hardware or software manufacturer  
for any windows updates you might need.  
  
If problems continue, disable or remove any newly installed hardware  
or software. Disable BIOS memory options such as caching or shadowing.  
If you need to use Safe Mode to remove or disable components, restart  
your computer, press F8 to select Advanced startup options, and then  
select Safe Mode.  
  
Technical information:  
*** STOP: 0x000000D1 (0x0000000C,0x00000002,0x00000000,0xF865A89)  
  
*** g3.sys - Address F865A89 base at F8655008, DateStamp 3d9991eb  
  
Beginning dump of physical memory  
Physical memory dump complete.  
Contact your system administrator or technical support group for further  
assistance.
```

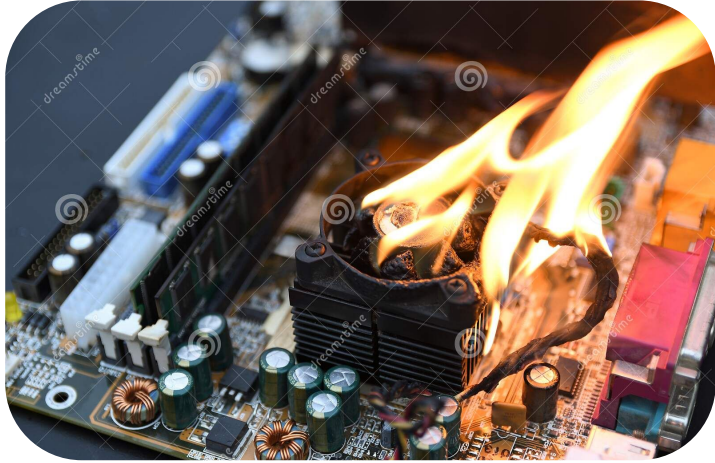


## FINANCIAL CRISIS OF 2008



Regulation

### Issue #3 - Sometimes the hardware is destroyed



The background of the slide is white, featuring a decorative pattern of overlapping circles in various shades of green. These circles are scattered across the frame, with some appearing more prominent than others, creating a modern, organic feel.

# **Learnings for Engineers**

## Observation #1

Engineers are building for a  
a deprecated C



## Observation #2

Everything is connected,  
but we engineer  
without understanding  
relationships

## Observation #3

We are engineering  
solutions without taking  
impact into account

## Observation #4

Our society  
is not paying attention to  
the first 3 observations

A multi-disciplinary approach

Engineering

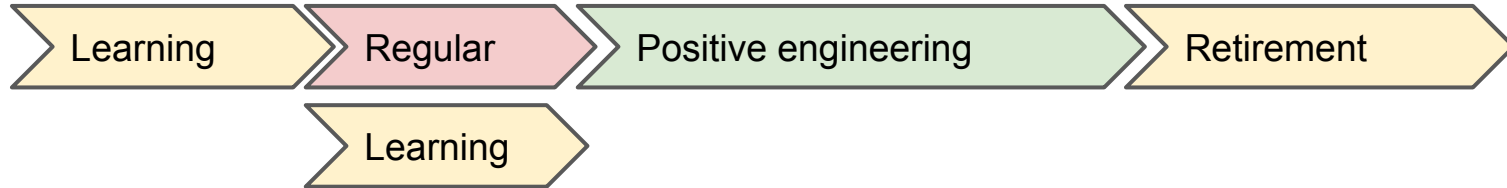
Law & Economics

User behavior

Natural resources

Philosophy

# Learning journey



**Ask questions**

**Highlight problems**

**Challenge status quo**

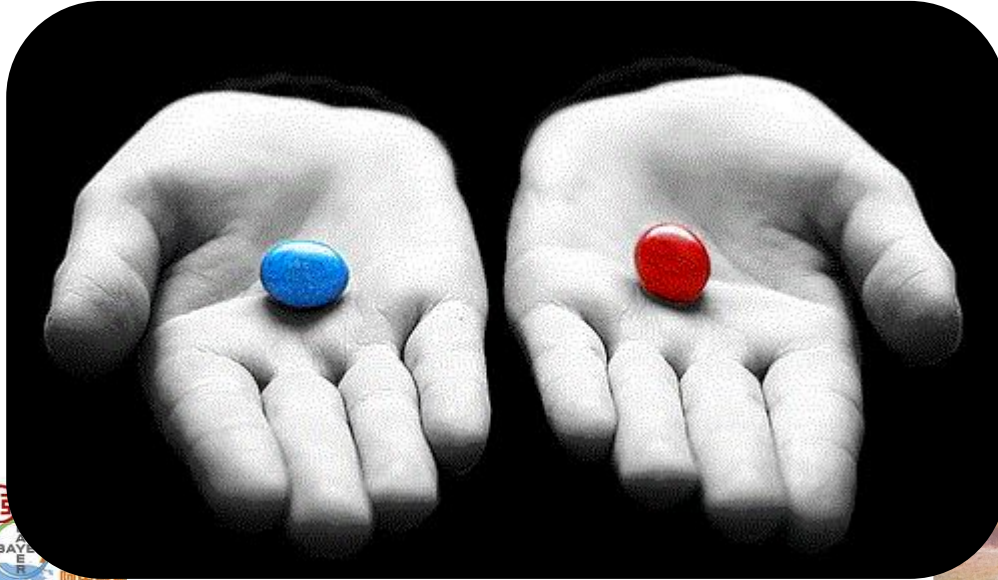
**Focus on impact**



# Equations that changed our world

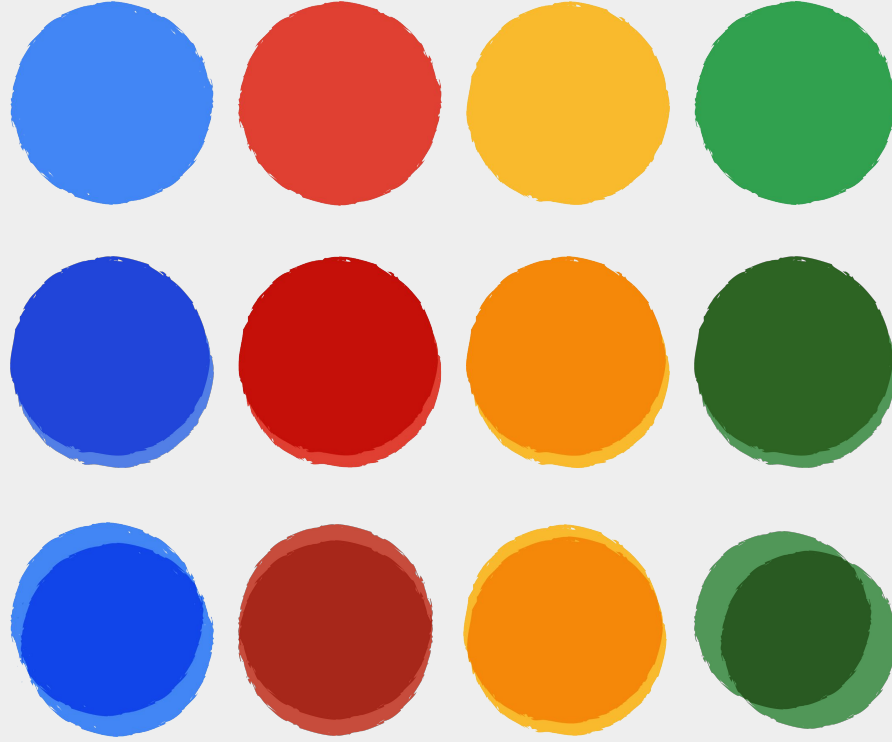
1. Pythagorean's Theorem —  $a^2 + b^2 = c^2$
2. Logarithms —  $\log_a b = c \Leftrightarrow a^c = b$
3. Derivatives —  $\frac{df}{dt} = \lim_{h \rightarrow 0} \frac{f(t+h) - f(t)}{h}$
4. Law of Gravity —  $F = G \frac{m_1 m_2}{r^2}$
5. Imaginary Numbers —  $i = \sqrt{-1}$
6. Euler's Formula —  $V - E + F = 2$
7. Normal Distribution —  $f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$
8. Wave Equation —  $\frac{\partial^2 y}{\partial t^2} = \frac{1}{v_c^2} \frac{\partial^2 y}{\partial z^2}$
9. Fourier Transformation —  $F(k) = \int_{-\infty}^{\infty} f(x) e^{-2\pi i k x} dx$
10. Navier-Stokes Equation —  $\rho \frac{D\vec{v}}{Dt} = -\nabla p + \rho \vec{g} + \mu \nabla^2 \vec{v}$
11. Maxwell's Equation —  $\begin{matrix} 1. \nabla \cdot \vec{E} = \rho \\ 2. \nabla \cdot \vec{B} = 0 \\ 3. \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} \\ 4. \nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \epsilon_0 \frac{\partial \vec{E}}{\partial t} \end{matrix}$
12. 2<sup>nd</sup> Law of Thermodynamics —  $dS \geq 0$
13. Relativity —  $E = mc^2$
14. Schrodinger's Equation —  $\hat{H}\Psi = i\hbar \frac{\partial \Psi}{\partial t}$
15. Information Theory —  $H = -\sum p_i \cdot \log_2 p_i$
16. Chaos Theory —  $x_{t+1} = kx_t(1 - x_t)$
17. Black Scholes Equation —  $\frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS \frac{\partial V}{\partial S} + \frac{\partial V}{\partial t} - rV = 0$

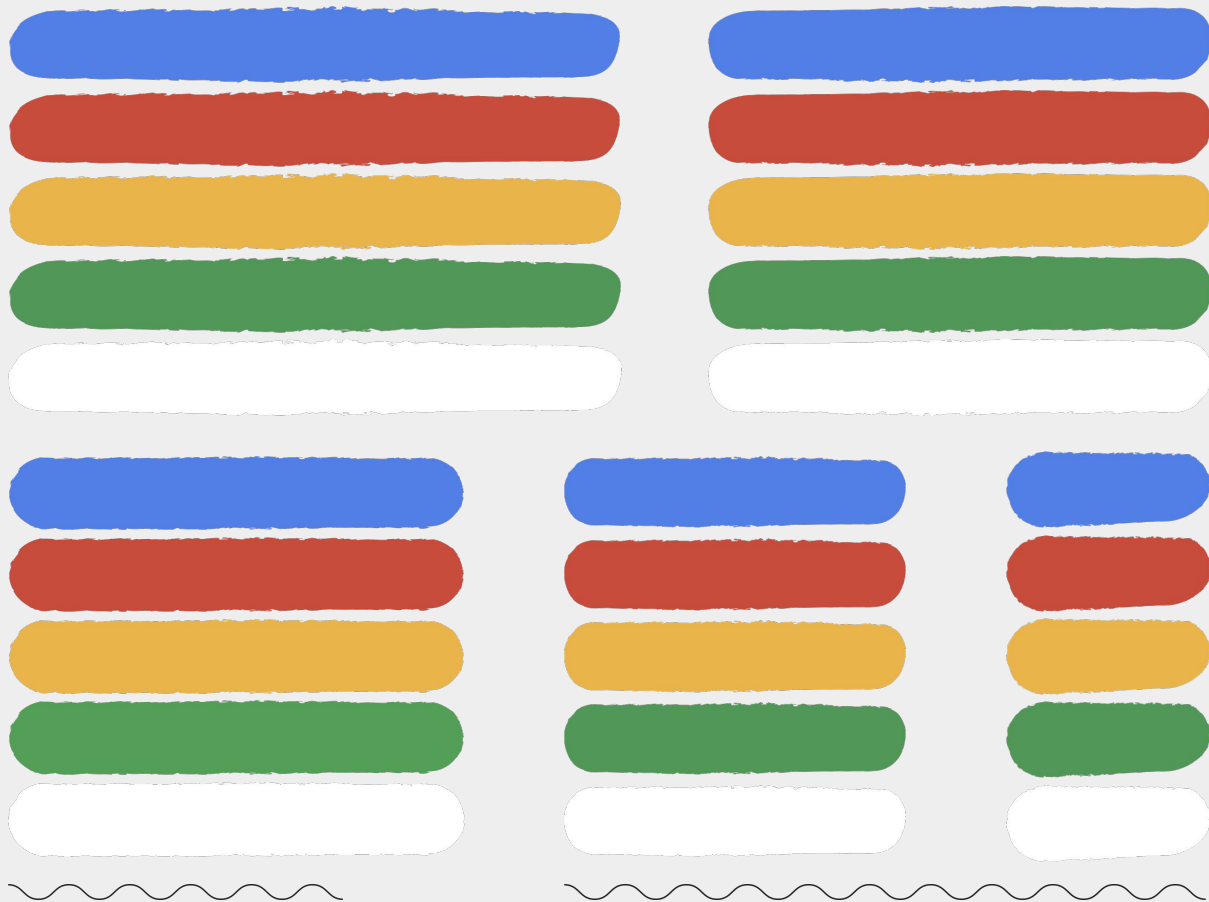
# Conclusion





**Thank you**

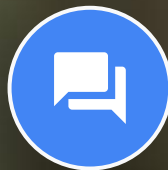






# Startups for Sustainable Development

Support a global ecosystem of impact-focused startups. Leverage the Sustainable Development Goals as a guiding framework to measure positive impact.



**Advisors**



**Business  
dev**



**Tech**







# Startups for Sustainable Development

400



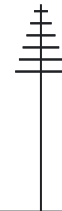
Startups

70



Countries

140



Partners



300+

Advisors



10000+

Mentoring  
sessions



17

SDGs