

INFO4444 Computing 4 Innovation

**Week 4: Open Innovation &
Distributed Innovation I**

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School of Computer Science**



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Open Innovation

Section 1

Evolution of Innovation

Sub-section 1.1

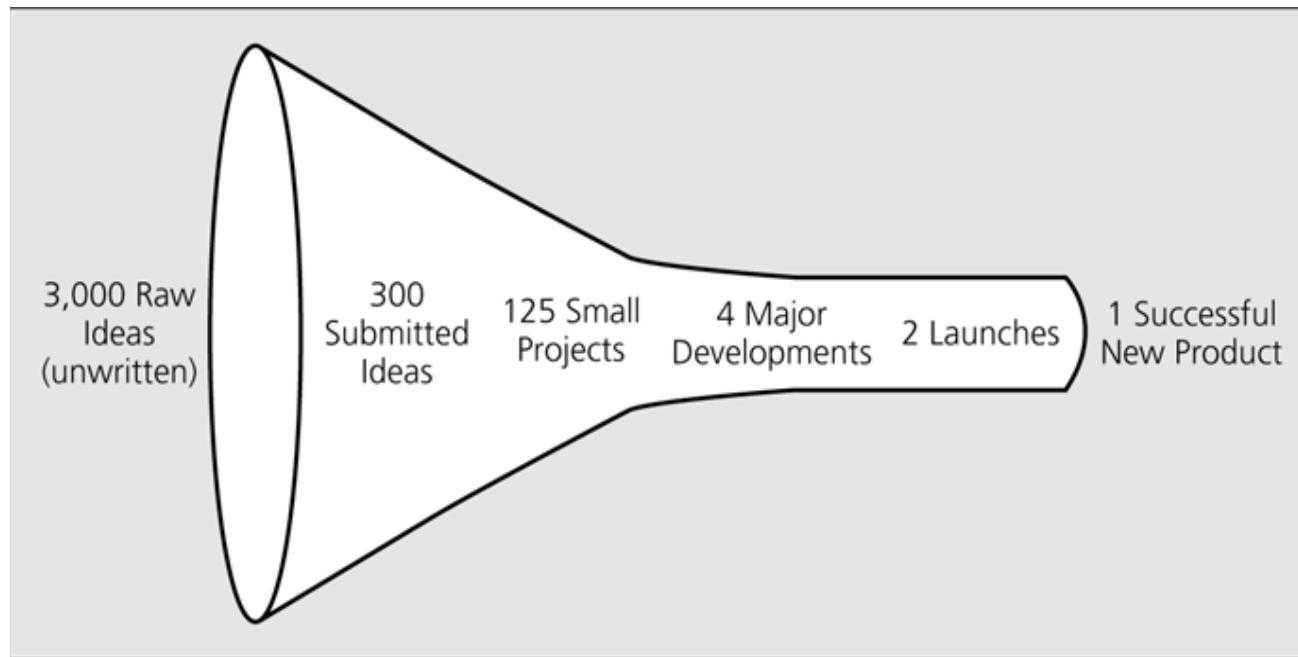
Evolution of innovation by companies: Traditional model

- In-house innovation: R&D / other
 - Different forms
- Innovation through “spillovers”



Evolution of Innovation by Companies

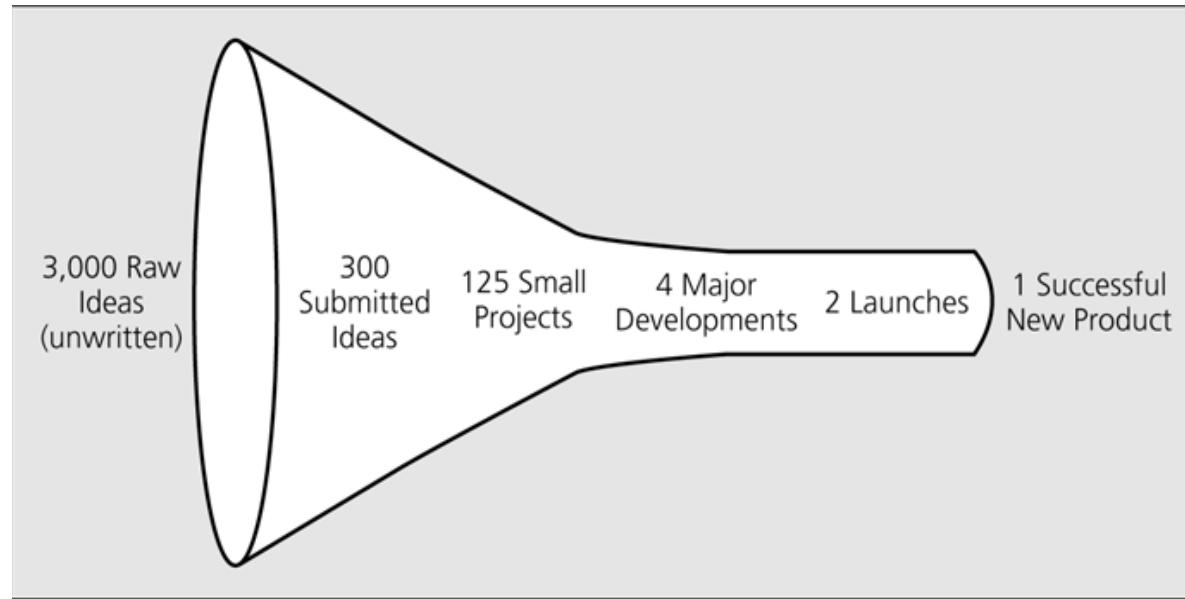
- The Innovation Funnel



Source – Schilling, 2013

Evolution Of Innovation By Companies

- Traditional model
 - Simple one-way flow
 - All activities in-house

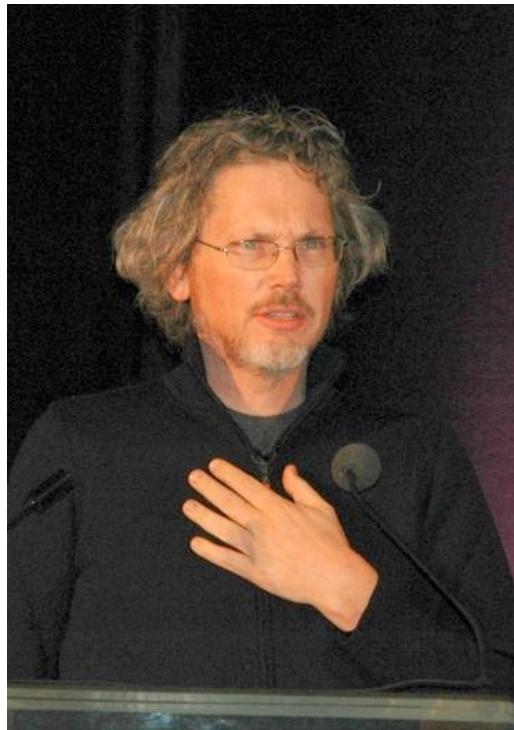


Source – Schilling, 2013

Evolution Of Innovation By Companies

- Trends in the late 20th century:
 - Worker's mobility between companies
 - Outsourcing of business activities
 - Globalisation
 - Advanced ICT infrastructure
 - **Venture capital funding** for small companies
 - Easier to build new technology companies
- So more opportunities for collaborative innovation

“Joy’s Law”



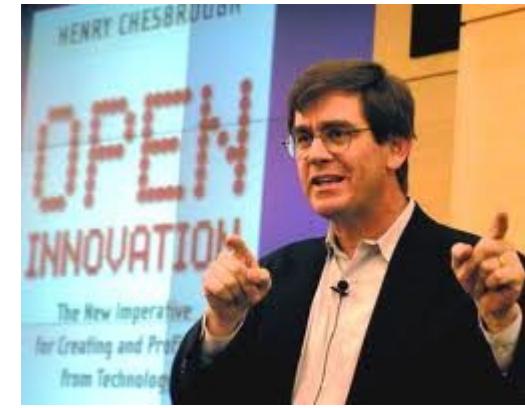
- “Most of the bright people don’t work for you -- no matter who you are. [So] you need a strategy that allows for innovation occurring elsewhere.”
- In 1990 speech - quoted by Surowiecki (1997)

Photo: Martin LaMonica/CNET Networks

Bill Joy
Co-founder of Sun Microsystems
Computer Scientist

“Open Innovation”

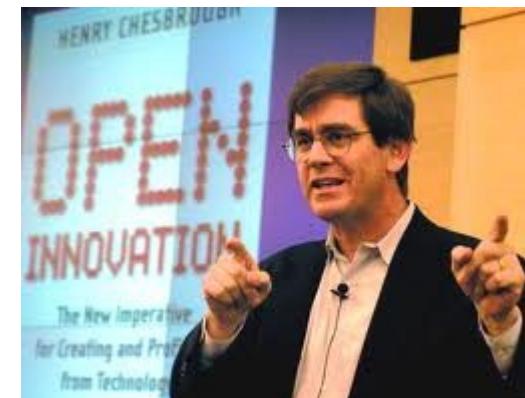
- Many companies open to outside ideas and innovations
- Cooperation and collaboration with external parties to increase innovation and reduce time to market



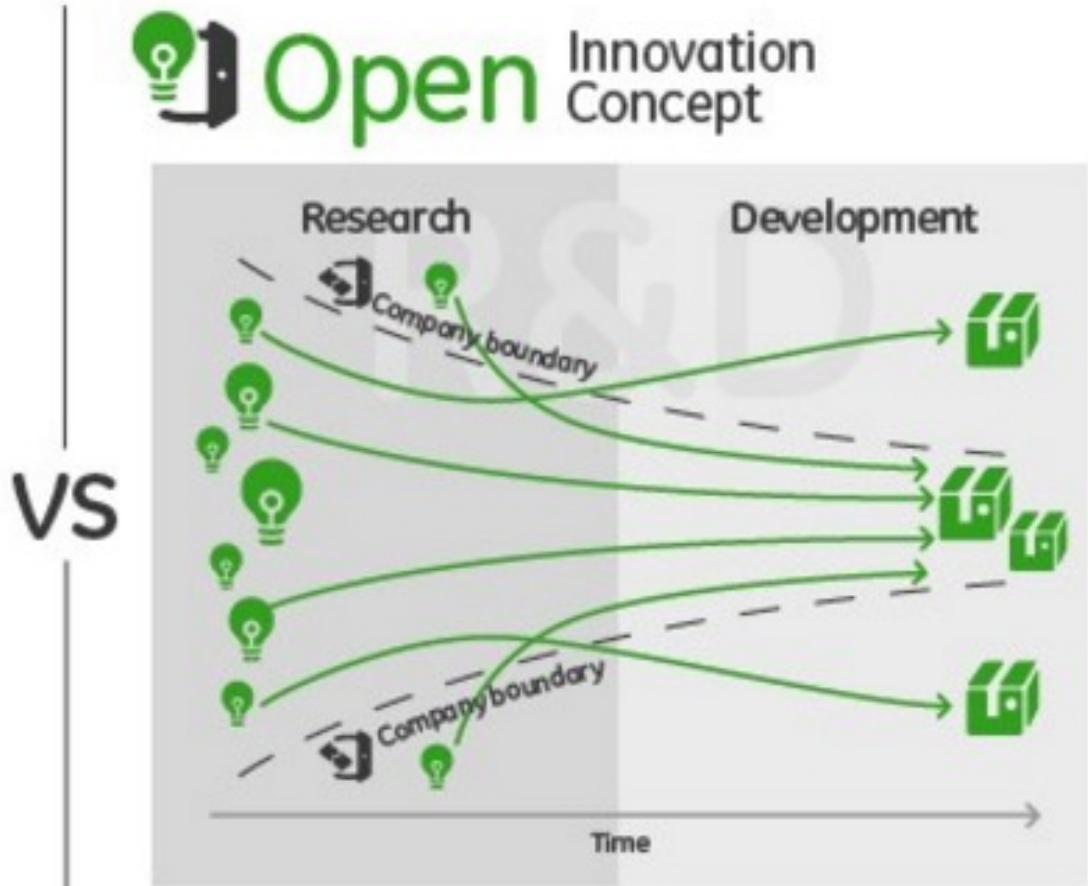
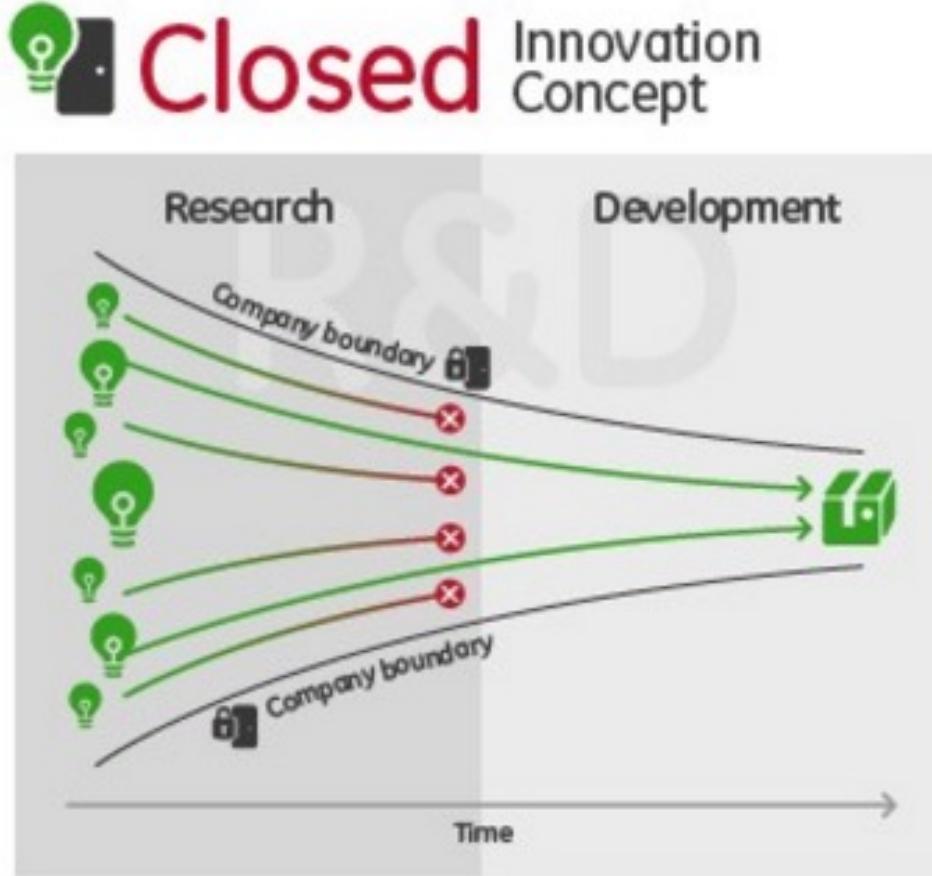
Henry Chesbrough,
Economist, Business
Administration
University of California,
Berkeley.
Started and promotes term
“open innovation”

Definition of “Open Innovation”

- “*the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation*”
(Chesbrough, 2006)
- Revised definition: “*a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization’s business model*”
(Chesbrough and Bogers, 2014)



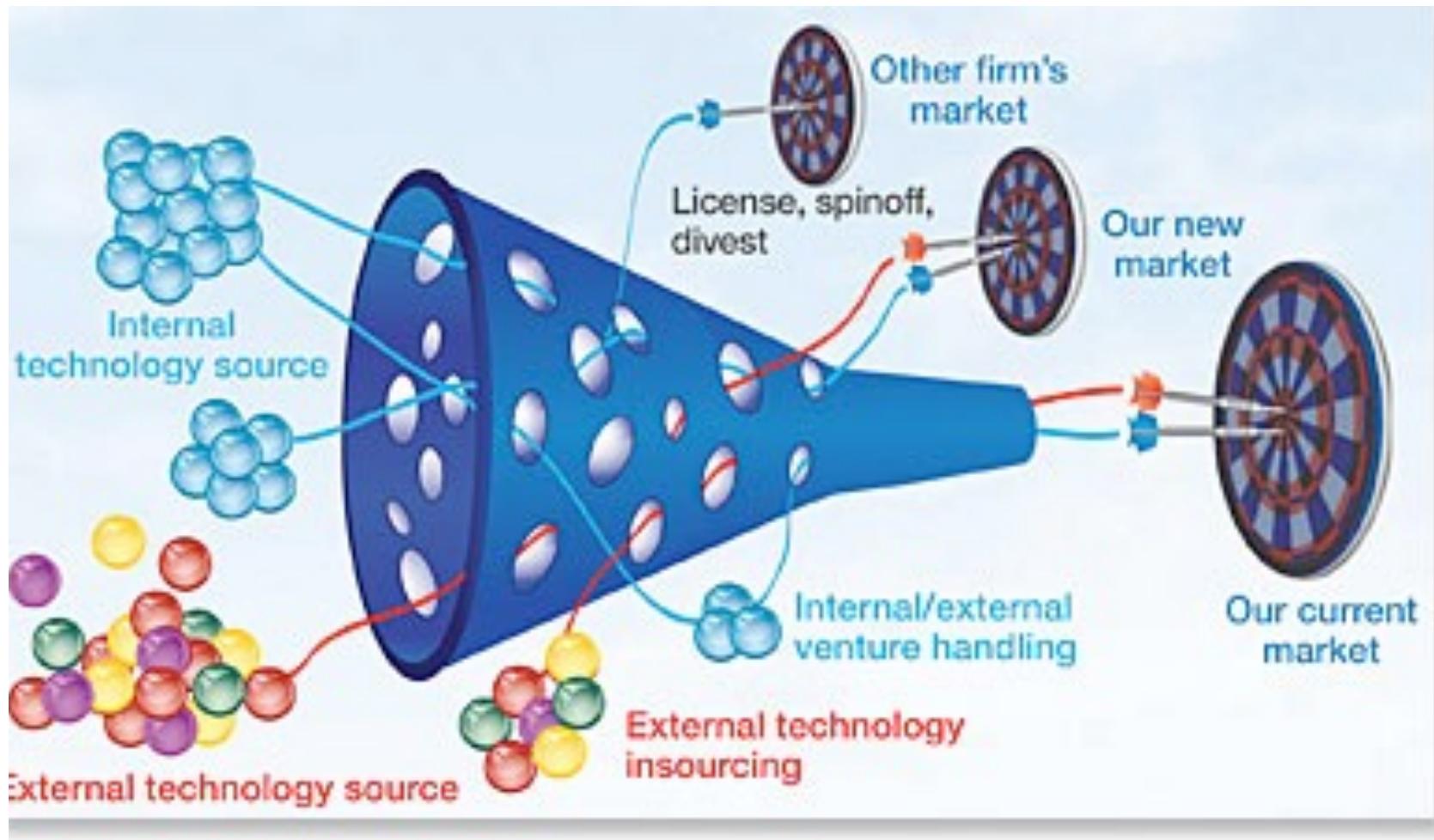
The classic innovation funnel: “Closed innovation”



Source: Charts adapted from QuickMBA.com

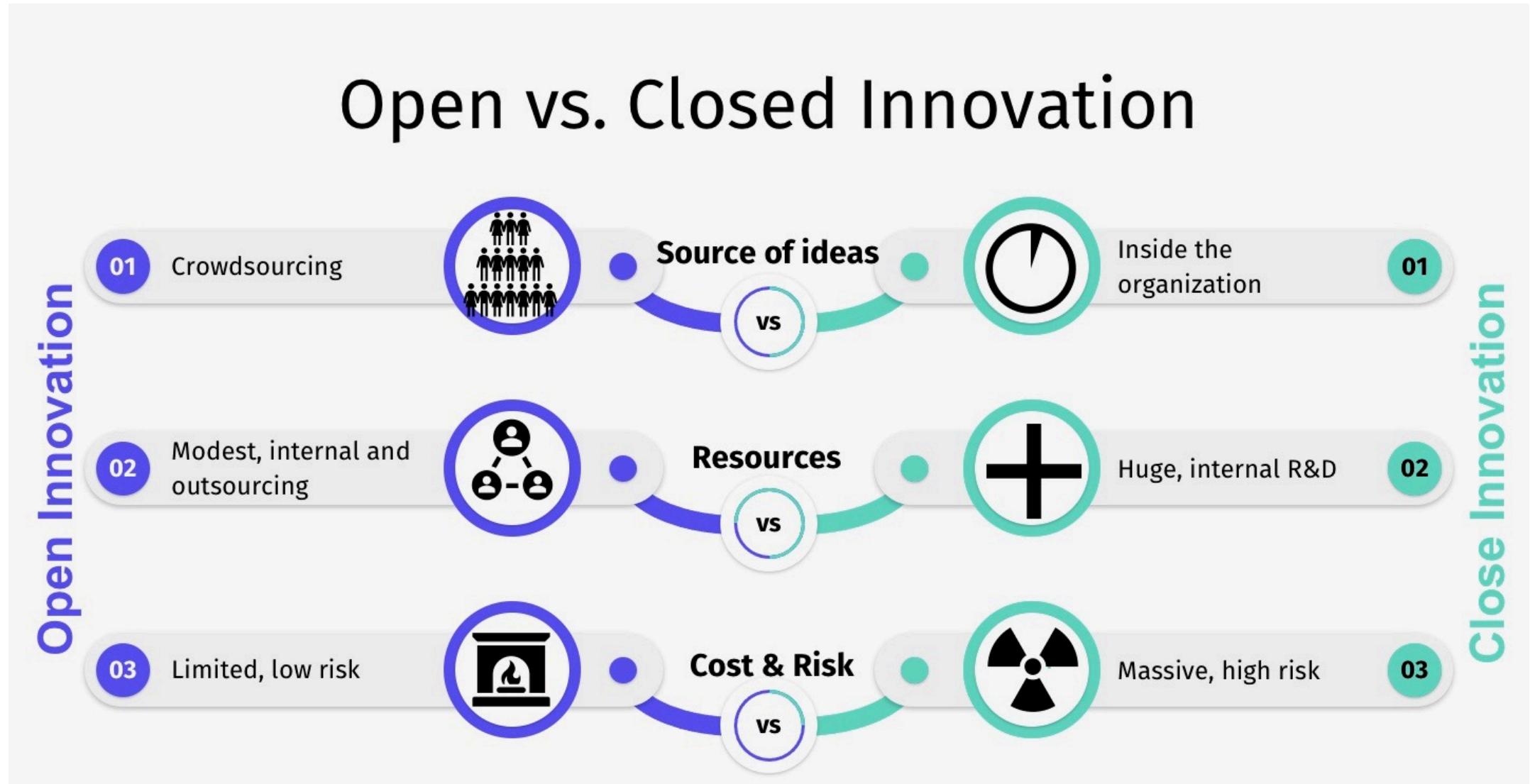
<http://www.geglobalresearch.com/blog/growing-middle>

Open Innovation



Source: Chesbrough (2013) - <http://spie.org/x91420.xml>

Open vs. Closed Innovation



<https://growenterprise.co.uk/2022/11/1 /how-do-open-innovations-change-the-business-game/>

From Closed Innovation to Open Innovation

Great technology and ideas can be found in companies of all sizes

- According to Chesbrough...
- In 1981:
 - Approx. 70% of total R&D spending was by companies with >25,000 staff
 - Approx. 5% of total R&D spending was by companies with <1,000 staff
- In 2012:
 - Approx. 35% of total R&D spending is by companies with >25,000 staff
 - Approx. 24% of total R&D spending is by companies with <1,000 staff

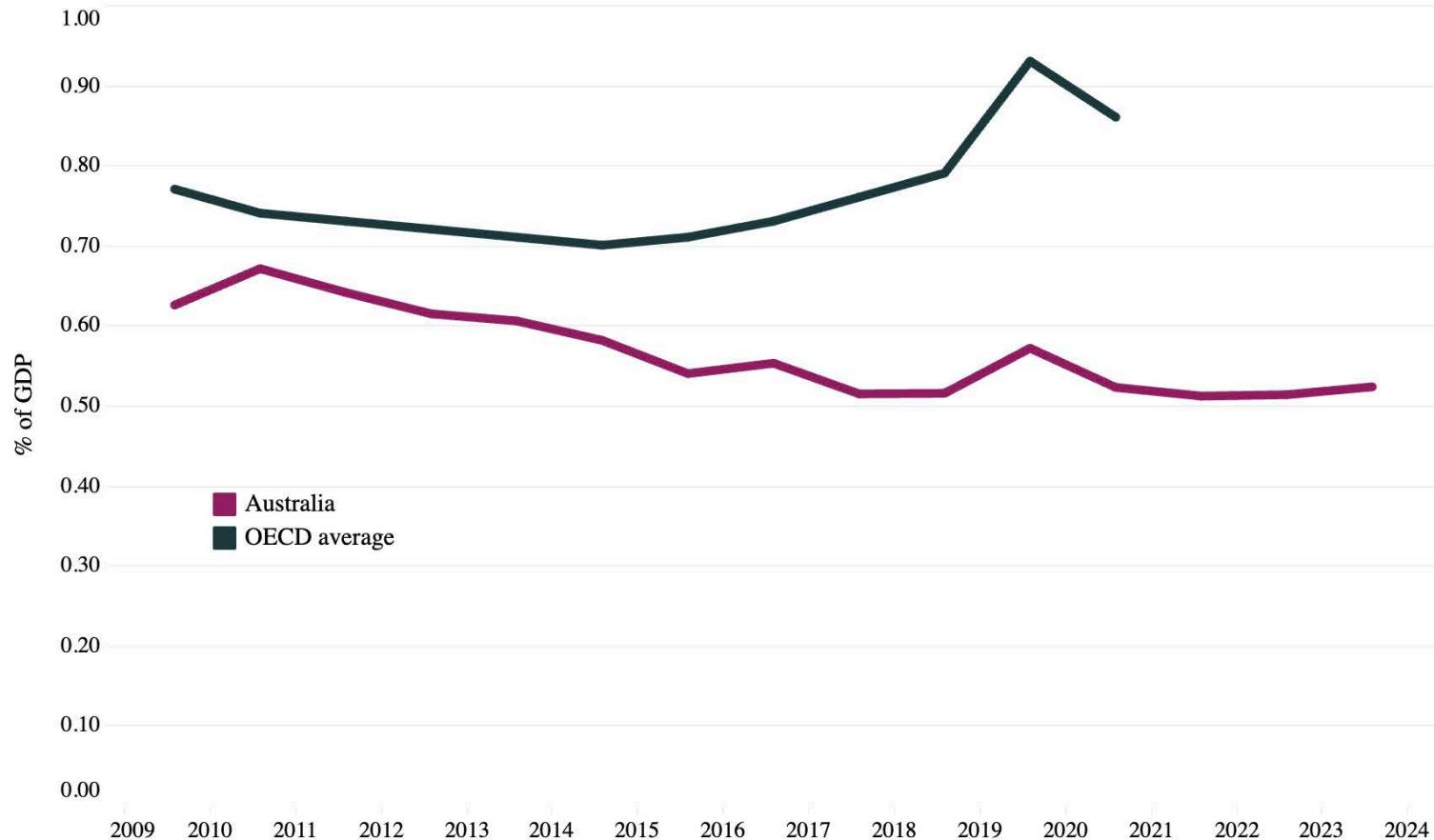
Source: <http://www.businessinsider.com.au/professor-henry-chesbrough-says-that-the-fortress-corporate-office-is-dead-2012-6>

R&D and innovation in Australia: 2024 update

In 2024, the Global Innovation Index ranked Australia the 23rd out of 133 countries listed.

- In 2024–25, total government R&D support (GBARD plus tax incentives) is forecast to be \$14.4 billion and 0.52% of GDP.

Figure 3 Total government R&D support as a percentage of GDP



[View on Tableau Public](#)



Notes: Total government R&D support refers to the sum of GBARD and R&D tax credits. OECD data is the average across OECD nations. Australian data for 2023 and 2024 are forecasts. The year listed reflects the first year in a financial year, for example, 2023 refers to the 2023–24 financial year.

Types of Open Innovation

1. Outside-in process:

- Enriching the company's own knowledge base. (integrating OpenAI's Whisper into a voice assistant)

2. Inside-out process:

- Ideas to market, selling IP, and transferring ideas to the outside. (ARM licensing its chip architectures to companies like Apple and Qualcomm)

3. Coupled process:

- “co-creation with (mainly) complementary partners through alliances, cooperation, and joint ventures, during which give and take are crucial for success.” (Microsoft & Darktrace collaboration to integrate AI-powered threat detection with Azure Sentinel)

Some Benefits of Open Innovation

- Larger base of ideas to draw from for innovation
- Reducing risk and cost of development
- New business opportunities with collaborators
- Share risks and pool resources with other companies
- Can be lower cost than large R&D departments

Risks of Open Innovation

- Lack of Control.
- External Resources.
- Higher Coordination Costs.
- Possible Loss of Own Capability Over Time.
- Possible Loss of Competitive Advantage.

Open Innovation or Closed Innovation?

Balancing Open and Closed Innovation

- Both traditional (“closed”) innovation and open innovation have benefits.
- Many companies do both and balance them:
 - Companies leverage both closed innovation for core competencies and open innovation for external collaboration and rapid development.
- Industry Examples:
 - Apple (closed for hardware, open for app ecosystem).
 - Google (open-source projects like Android but proprietary AI algorithms).
 - Tesla (open patents but internal battery and software innovation).

Open Innovation Adoption Amongst Companies

Sub-section 1.2

Open Innovation Adoption

Imagine Cup



Dream it. Build it. Live it.

Unlock your startup's potential with the Imagine Cup – the premier global technology startup competition for student founders using the Microsoft Cloud. Gain access to networking opportunities, global recognition and expert coaching during the competition to accelerate your startup.

[Register for Next Season](#)

<https://imaginecup.microsoft.com/en-us>

IT'S YOUR TIME TO SHINE!

Now it's your chance to unleash your creativity and show that you are a true master builder. Can you come up with an idea that wows your fellow LEGO® fans and persuades our review board to give it the green light?

[SUBMIT IDEA](#)



<https://ideas.lego.com/projects/create>

Samsung Mobile Advances

Join Samsung's partnership ecosystem to bring unique business value to the mobile market.
Applications are now open for SMA 2025.



2025 Start-up Innovation Challenge

The University of Sydney

<https://developer.samsung.com/open-innovation>

Companies can use....

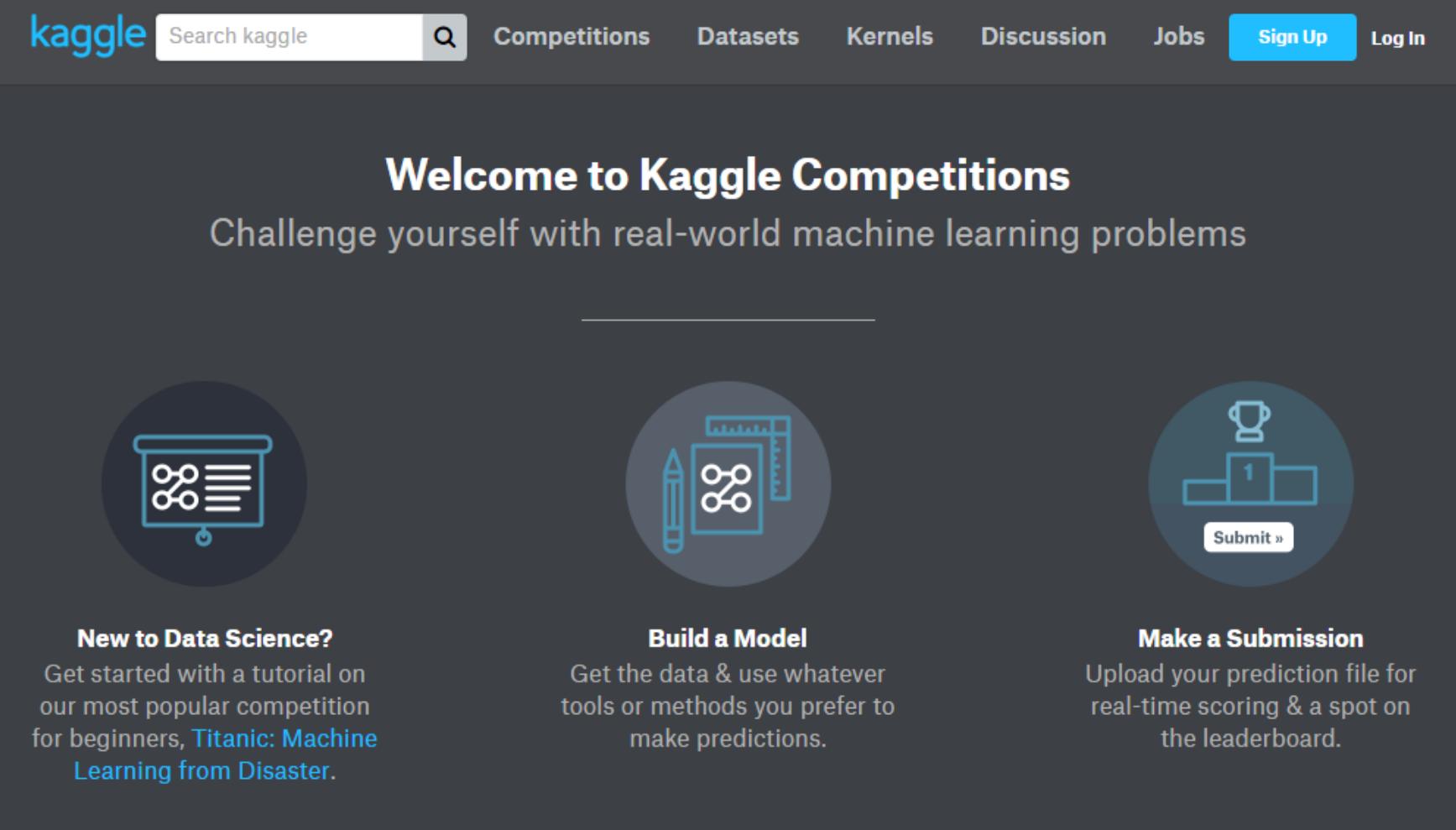
- Top coder by Nasa, ebay
- <https://www.topcoder.com/>
- <https://www.startus-insights.com/innovators-guide/corporate-open-innovation/>
- Kaggle
- <https://www.kaggle.com/>
- <https://www.kaggle.com/competitions/l1m-detect-ai-generated-text>



The Home of Data Science
& Machine Learning

Kaggle helps you learn, work, and play

Case Study: Kaggle – Big data competitions



The screenshot shows the main landing page for Kaggle Competitions. At the top, there's a navigation bar with links for 'Competitions', 'Datasets', 'Kernels', 'Discussion', 'Jobs', 'Sign Up' (in blue), and 'Log In'. Below the header, the text 'Welcome to Kaggle Competitions' is displayed in large, bold, white font, followed by the subtitle 'Challenge yourself with real-world machine learning problems' in a smaller, lighter font. The page features three circular icons: one showing a neural network icon, another showing a code editor icon, and a third showing a trophy icon with a 'Submit' button below it. Below each icon is a section with a title and a brief description.

New to Data Science?
Get started with a tutorial on our most popular competition for beginners, [Titanic: Machine Learning from Disaster](#).

Build a Model
Get the data & use whatever tools or methods you prefer to make predictions.

Make a Submission
Upload your prediction file for real-time scoring & a spot on the leaderboard.

<https://www.kaggle.com/competitions>

Case Study: Kaggle – Big data competitions

The Learning Agency Lab - PII Data Detection

Develop automated techniques to detect and remove PII from educational data.

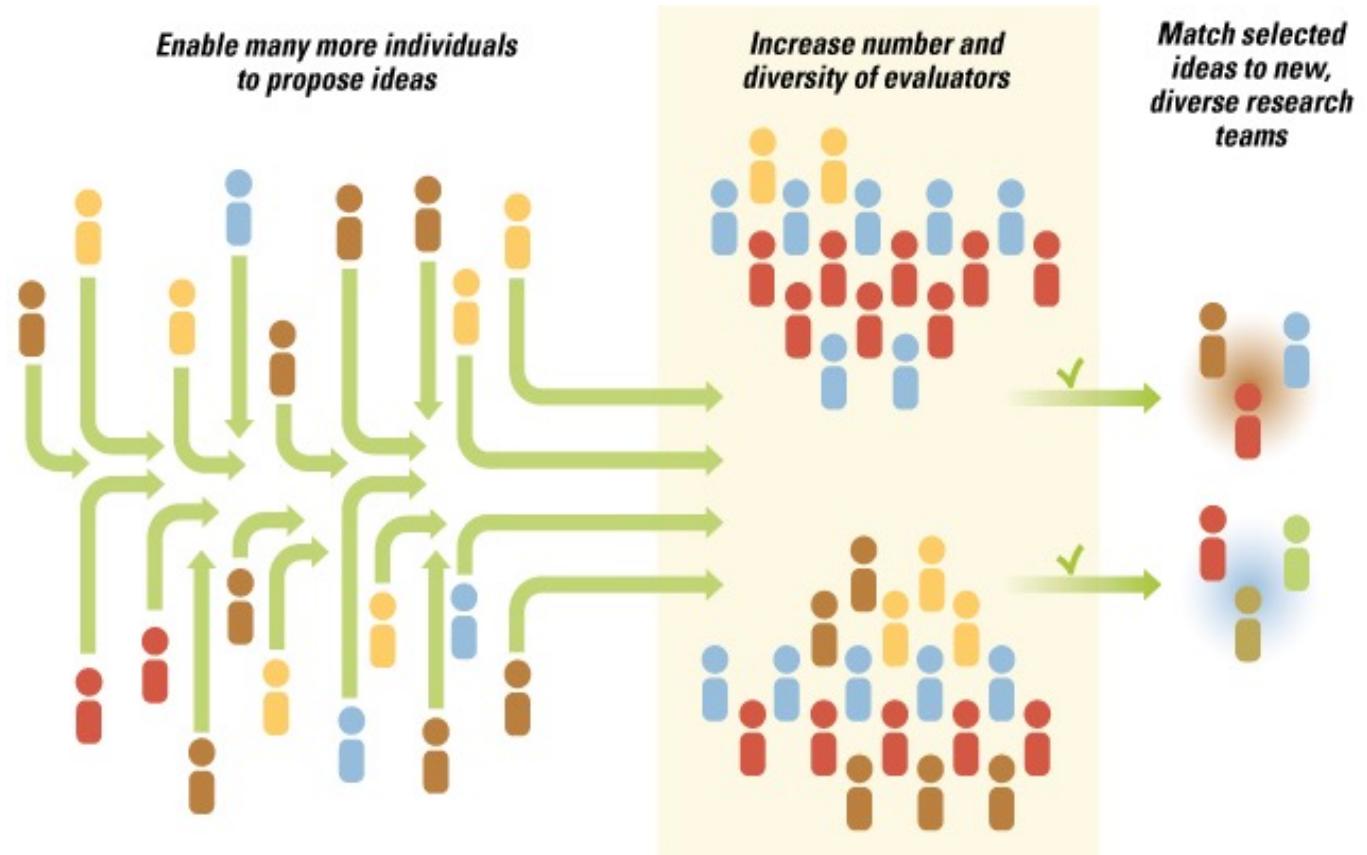
Distributed Innovation:

Modularity

Sub-section 1.3

Distributed innovation

- “a system in which innovation emanates not only from the manufacturer of a product but from many sources including users and rivals”
 - Eric von Hippel (1988) paraphrased by Carliss Baldwin (2012)



<http://sloanreview.mit.edu/article/experiments-in-open-innovation-at-harvard-medical-school/>

Distributed Innovation: Modularity

- An approach in which complex systems or **products** are broken down into **smaller, independent modules** that can be **developed separately** and **integrated later**.
- This allows multiple teams, organizations, or even **external contributors** to work on different components simultaneously, fostering collaboration, flexibility, and efficiency in innovation.
- The extent to which a software/ Web application may be **divided into smaller modules** (software engineering) <https://www.techopedia.com/definition/24772/modularity>

Enabling Distributed Innovation: Modularity

- A standard interface enables components to be combined easily (e.g. by user, within company, between companies)
- Modularity can enable many different configurations to be achieved from a given set of components.



<https://developer.android.com/guide/platform/index.html>

Enabling Distributed Innovation: Modularity

- Modularity at:
 - **User level**
 - e.g. Microsoft Office plug-ins
 - **Producer (company) level**
 - e.g. Software products based on a company's platforms
 - **Industry level**
 - e.g. PC components made by different companies

Approaches to distributed innovation

Sub-section 1.4

Some Approaches To Distributed Innovation

- A. Product platforms
- B. Web APIs
- C. Crowdsourcing innovation / Crowdfunding Innovation
- D. Releasing data sets “Open data”
- E. Free and Open-Source Software
- F. User innovation
- G. Platform ecosystems
- H. Accelerators, investment and others

Some Approaches To Distributed Innovation

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Product Platforms & Web APIs

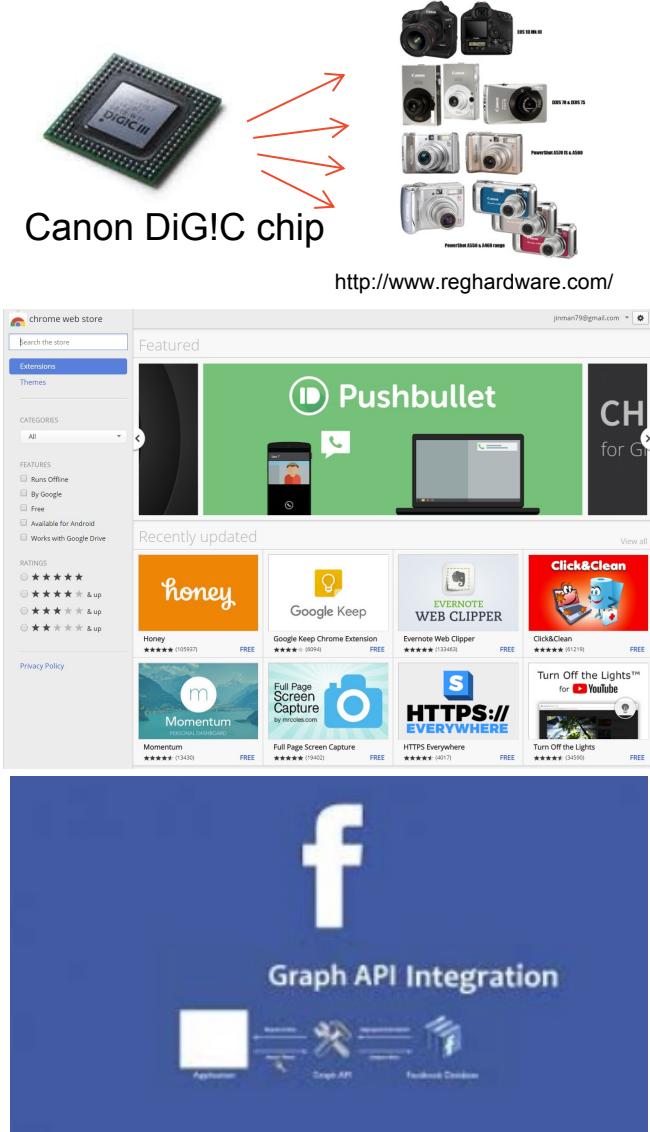
Section 2

Product Platforms: In Detail

Sub-section 2.1

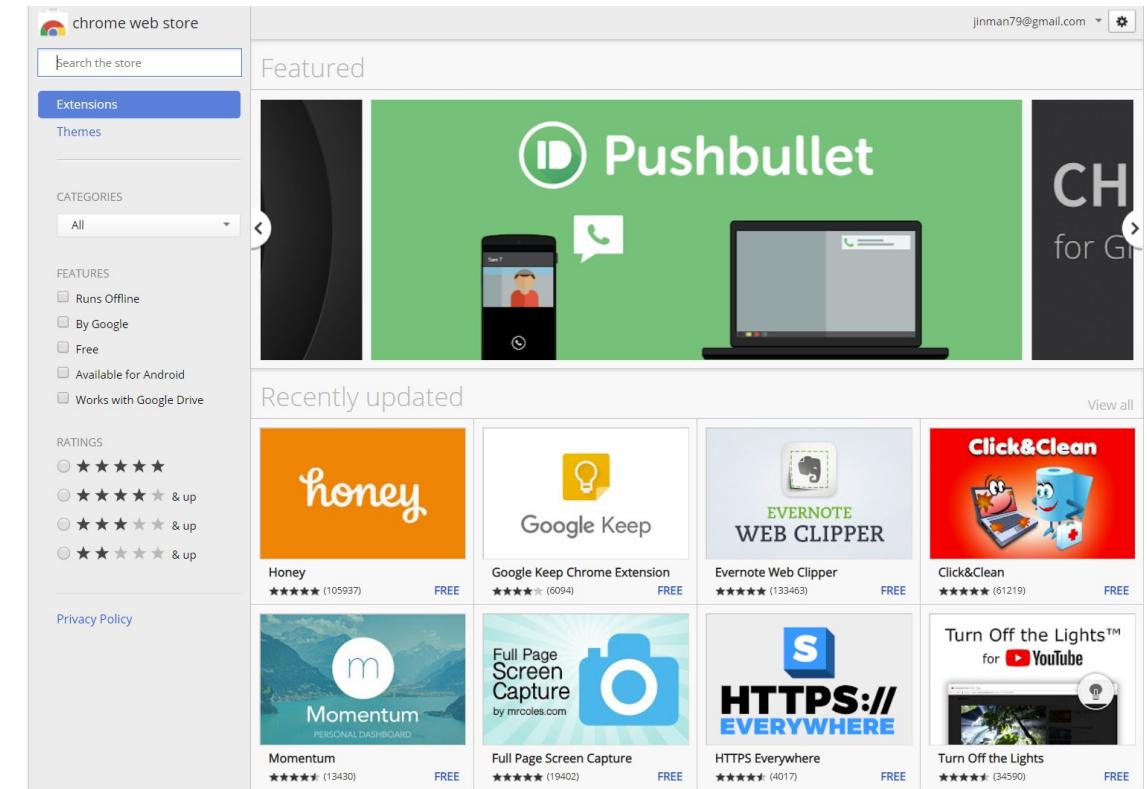
Product Platforms

- Reusable components/design frameworks (1990s)
- Foundation of components around which a company builds related products
- Also known as “product family engineering”
- Allow creating rich line-up of different products with the same core functions
- Efficient re-use of a common platform



Product Platforms – Example: Google Chrome Extensions

- Customize the browsing experience
- Tailor Chrome functionality and behavior to own needs
- Based on web technologies such as HTML, JavaScript, and CSS.



Product Platforms - Benefits

- External product platform:
 - Lead to new businesses, and new business models
- Internal product platform:
 - Reuse technology components in multiple products:
 - Faster development
 - Lower effective cost
 - Higher adaptability and 'evolve-ability'
 - Can benefit a range of products
 - Can focus on innovative value-add

How Can Product Platforms Enable Innovation?

Product Platforms Enable Innovation

- Make source code available
 - To customize the software (e.g., Core Java platform)
- Toolkit (software and documentation):
 - To write own software based on the toolkit (e.g., SAP XML Toolkit for Java)
- Plug-in/add-on support in software
 - To customise software without access to source code (e.g., Google Chrome Extensions)
- Full product platform for external innovation
 - To write applications on the platform (e.g.,: Android and app architectures)
- Live data/functionality via (APIs)
 - To build new services using the data (e.g.,: Facebook API)

Web APIs

Sub-section 2.2

Web APIs

- Interfaces for web-based services to interact (usually RESTful APIs)
- Modularity on the web
- Used for e.g:
 - Maps
 - Payment
 - Messaging
 - Automation

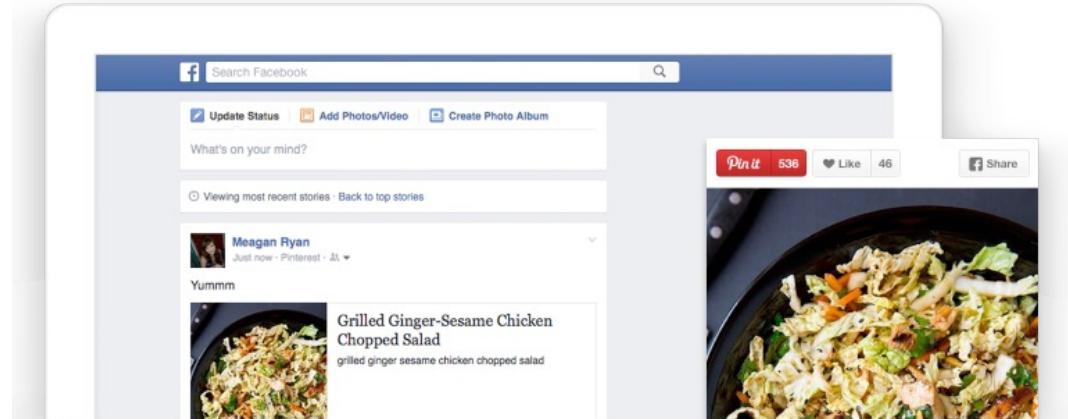


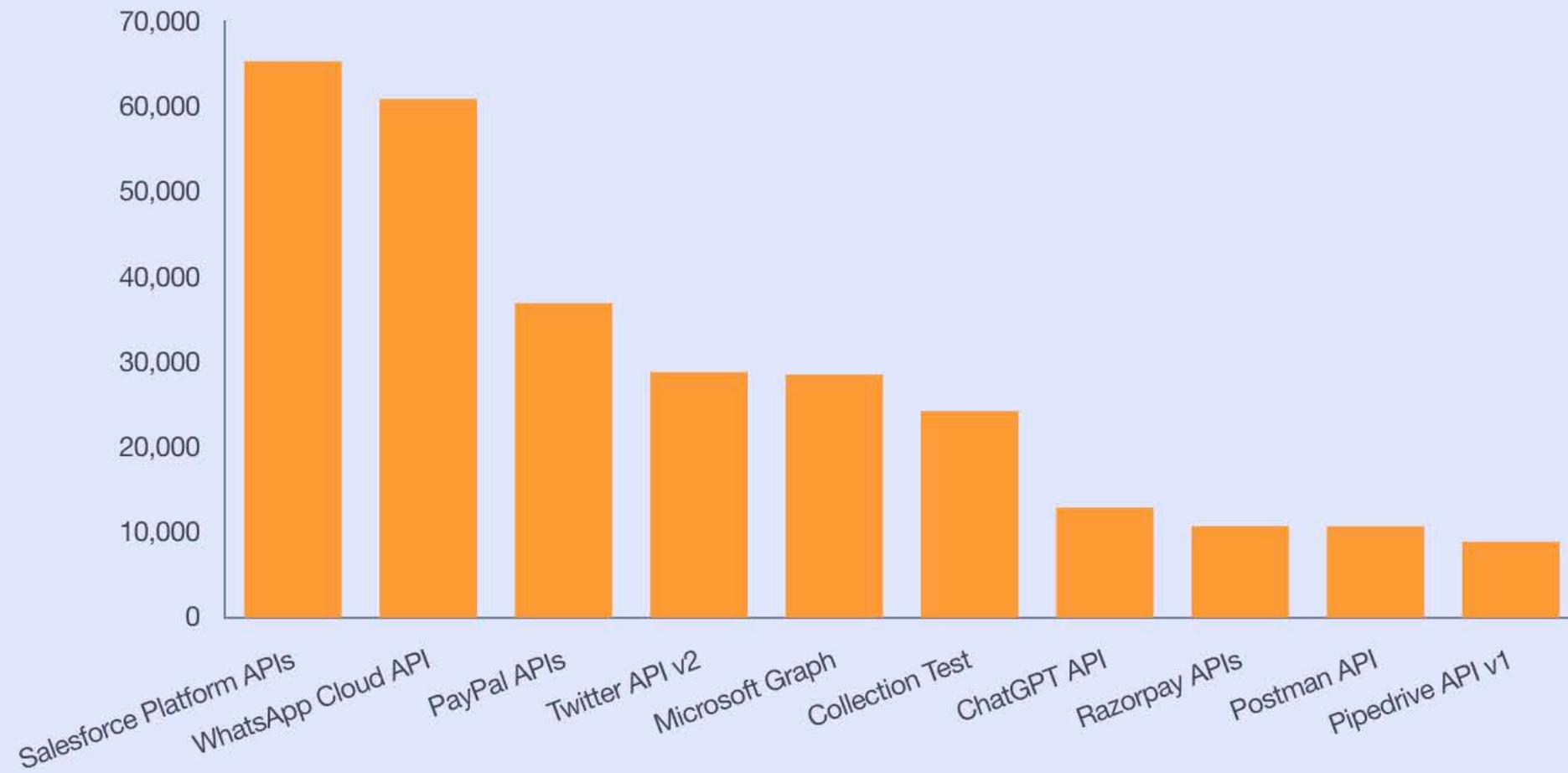
Image: facebook.com/developer



Image: developer.google.com

Web APIs

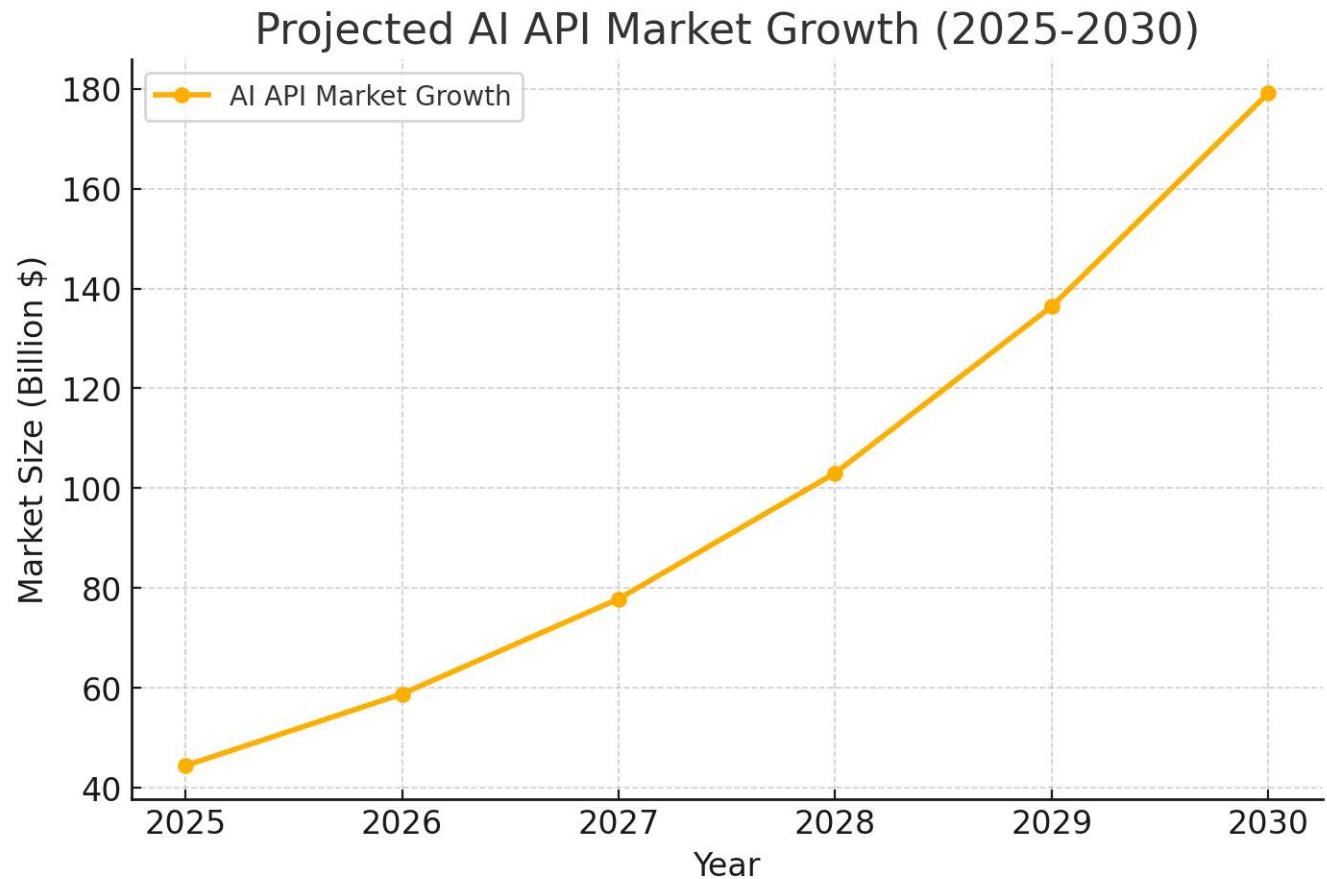
Most popular APIs



Web APIs - AI API

The AI API market has experienced substantial growth over the past decade. According to a report by MarketsandMarkets, the global AI API market is projected to grow from \$44.41 billion in 2025 to \$179.14 billion by 2030, at a Compound Annual Growth Rate (CAGR) of **32.2%** during the forecast period.

https://www.marketsandmarkets.com/Press_releases/ai-api.asp



FORBES > INNOVATION

In 2023, APIs Have Become Business Critical



Gleb Polyakov Forbes Councils Member

Forbes Technology Council

COUNCIL POST | Membership (Fee-Based)



May 30, 2023, 10:15am EDT

APIs and Business

“In the past, the biggest companies were those closest to the data (e.g. a system of record), able to impose a tax, or lock-in to their platform. In the API economy, the biggest companies may be the ones that aggregate the most data smartly and open it up to others.”

<https://techcrunch.com/2016/05/21/the-rise-of-apis/>

How Web API Help Distrubted Innovation?

API Business Models

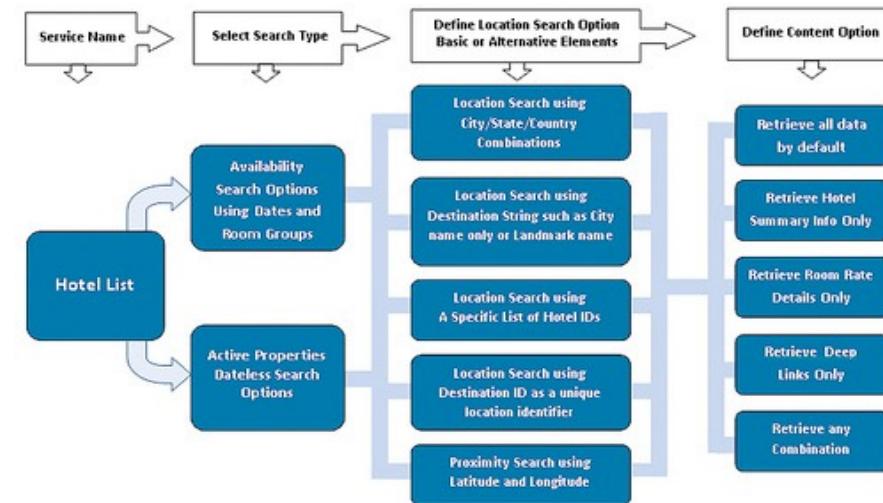
- API business models define how companies monetise and provide access to their APIs
- Models can be: Free / Developer Pay / Developer Gets Paid / Indirect
- ***API as a product***
 - Significant or single source of income for the company. APIs must provide easy to monetize value, is highly competitive or unique
- ***API enhancing existing product***
 - Most of monetized APIs. API providers have a greater options, ranging from direct pay-to-play to indirect, commission-based compensation
- ***API promoting existing product***
 - Offered for free, to attract interest and traffic to the API provider

<https://www.epam.com/insights/blogs/a-guide-to-picking-the-right-business-model-for-your-api-strategy>

Using APIs for business

- Salesforce.com generates 50% of its revenue through APIs
- Expedia generates 90%
- eBay generates 60%

The screenshot shows the Expedia.com.au website interface for hotel search. The search parameters are set for Sydney (and vicinity), New South Wales, Australia, dates from Friday, 8 April to Saturday, 9 April, and 1 room. The results page displays 572 hotels. A promotional message indicates 55% of rooms are booked. Below this, average prices are listed: Hotel avg AU\$224, 3 star avg AU\$174, 4 star avg AU\$189, and 5 star avg AU\$302. A daily deal for Larmont Sydney by Lancemore is highlighted, showing a 25% discount off the total rate from AU\$187.

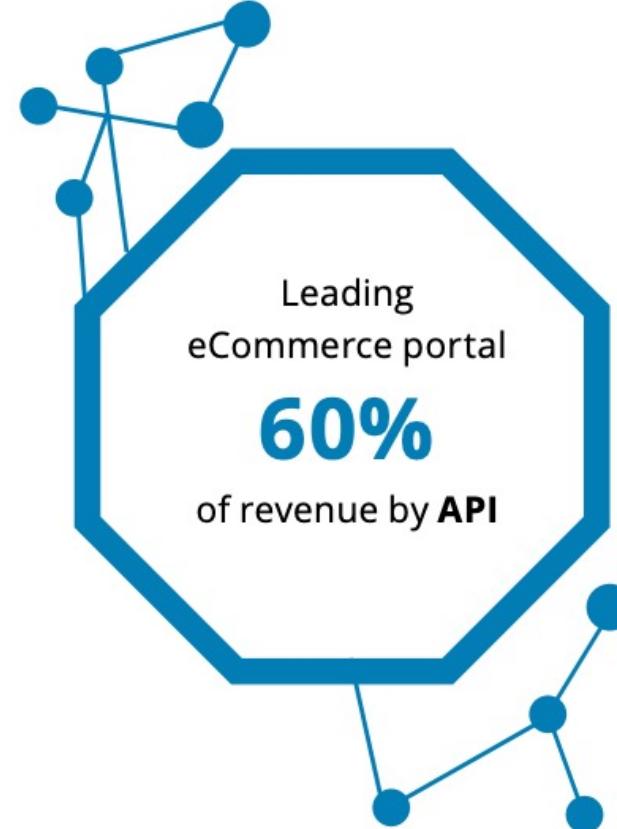
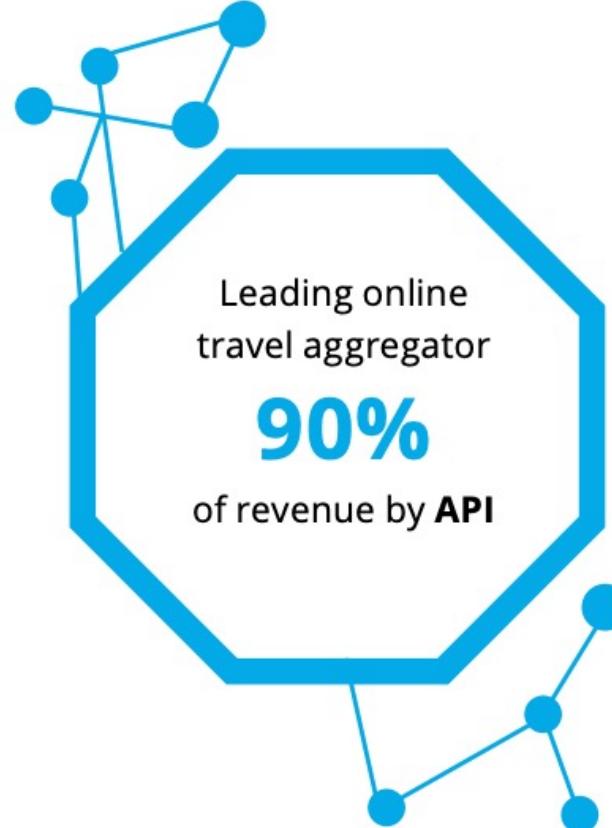
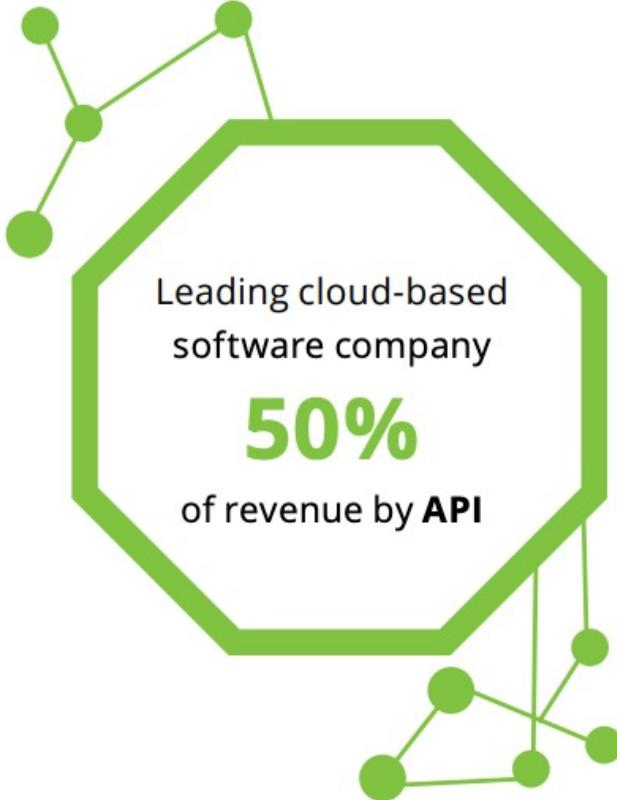


Expedia Affiliation Network – typical pathways <http://developer.ean.com/docs/getting-started>

Source: <https://hbr.org/2015/01/the-strategic-value-of-apis>

Using APIs for business

Figure 3: APIs share of revenue



Source: Harvard Business Review

Using API - My Health Record

<https://myhealthrecorddeveloper.digitalhealth.gov.au/>

- Offered by the Government to increase the acceptance of personal health records.
- The Australian Digital Health Agency's Developer Portal: offers guides to assist software developers connecting digital health solutions to each other and to the national infrastructure. (<https://developer.digitalhealth.gov.au/resources/guides?page=%2C%2C1>)



<https://developer.digitalhealth.gov.au/resources/services/my-health-record/my-health-record-fhir-gateway>

Crowdsourcing and Crowdfunding

Crowdsourcing: What is it?

- Crowd + Outsourcing
- **Taking a function once performed by employees and outsourcing it to an undefined (large) network of people in the form of an open call**

The use of the **open call format and the wide network** of potential laborers

Jeff Howe, Wired Magazine, 2006

Crowdsourcing: Newer definition

- A type of **participative online activity** where a party proposes to individuals, via a flexible open call, the **voluntary undertaking of a task**
- The undertaking of the task, and in which the crowd should participate bringing their work, money, knowledge and/or experience, **always entails mutual benefit**
- The user receives the satisfaction of a given type of need, while the crowd- sourcer obtains and utilize to their advantage what the user has brought to the venture

Estellés-Arolas, E., & González-Ladrón-de-Guevara, F. (2012). Towards an integrated crowdsourcing definition. *Journal of Information science*, 38(2), 189-200.



https://en.wikipedia.org/wiki/Main_Page

The image shows the Waze website. At the top, there is a navigation bar with icons for user profile, "Waze", "Carpool", and "Partners". On the right side of the bar are links for "Live map", "Download", and "Log In". The main headline reads "Get the best route in real time with help from fellow drivers". Below the headline are two buttons: "Download" and "Learn more". A downward arrow icon is positioned below the "Learn more" button. To the right of the headline is a photograph of a city street with a purple route line and two callout bubbles: one yellow with an exclamation mark and one white with a lightning bolt inside a cloud. At the bottom of the page, there is a link "https://www.waze.com/en-GB/".

<https://www.waze.com/en-GB/>

Crowdsourcing: The typical crowdsourcing process

The Crowdsourcing Process *In Eight Steps*

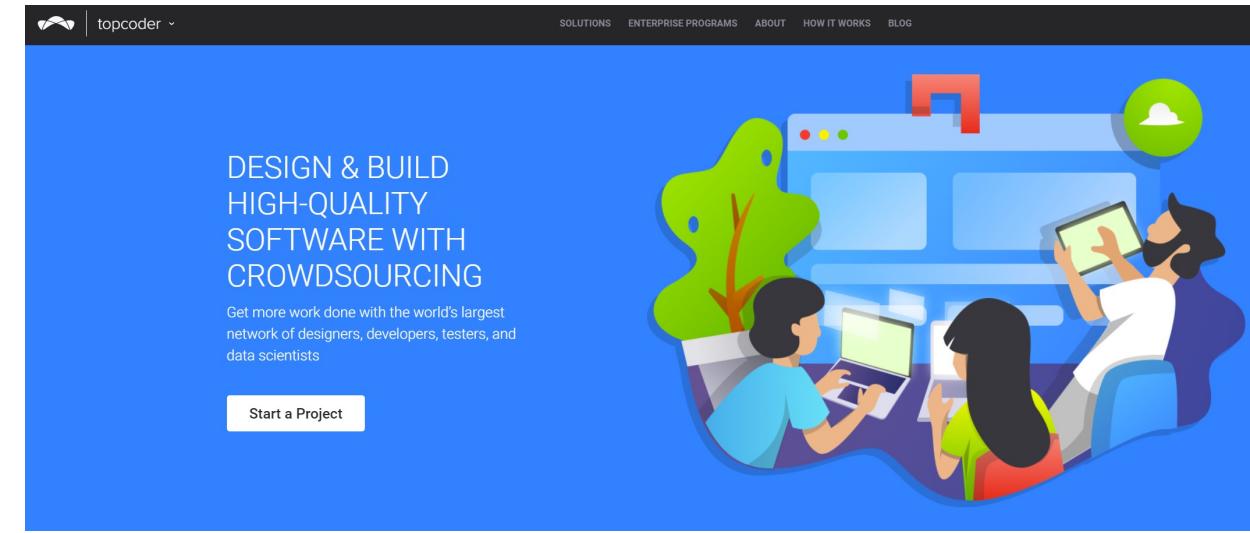


Image by Daren C. Brabham | www.darenbrabham.com

Other Examples – crowdsourcing for developments



The screenshot shows the 'Welcome to Kaggle Competitions' page. At the top, there's a navigation bar with links for 'Competitions', 'Datasets', 'Kernels', 'Discussion', 'Jobs', 'Sign Up', and 'Log In'. Below the navigation is a search bar with the placeholder 'Search kaggle' and a magnifying glass icon. The main heading 'Welcome to Kaggle Competitions' is followed by the subtext 'Challenge yourself with real-world machine learning problems'. There are three main sections: 'New to Data Science?' (with a link to 'Titanic: Machine Learning from Disaster'), 'Build a Model' (with a link to 'Get the data & use whatever tools or methods you prefer to make predictions.'), and 'Make a Submission' (with a link to 'Upload your prediction file for real-time scoring & a spot on the leaderboard.'). Each section has a circular icon with a blue and white design.



The screenshot shows the 'topcoder' homepage. At the top, there's a navigation bar with links for 'SOLUTIONS', 'ENTERPRISE PROGRAMS', 'ABOUT', 'HOW IT WORKS', and 'BLOG'. The main heading is 'DESIGN & BUILD HIGH-QUALITY SOFTWARE WITH CROWDSOURCING'. Below it is a subtext: 'Get more work done with the world's largest network of designers, developers, testers, and data scientists.' A 'Start a Project' button is located below the subtext. To the right, there's a colorful illustration of three people working on laptops and tablets, surrounded by a green tree and a red cube.

<https://www.topcoder.com/>

<https://www.kaggle.com/competitions>

Crowdfunding

- The sourcing of funds from a crowd
 - A specific type of crowdsourcing

Platform	Total Raised	Supporters	Platform Fee	Payment Fee	Important to Know
 GoFundMe	\$25B	50M	0%	2.9% + \$0.30	<ul style="list-style-type: none"> ✓ Can quickly set up withdrawals and deposits take an average of 2-5 business days ✓ Coaching and account support throughout the fundraising and donation process ✓ Easy to use fundraising tools make setup fast (e.g., mobile app and superior add beneficiary feature) ✓ The GoFundMe Giving Guarantee – in the very rare case that something isn't right with a fundraiser, donors may be eligible for a 100% refund of their donation
 Indiegogo	\$1.5B	10M	5%	3.0% + \$0.30	<ul style="list-style-type: none"> ✓ Offers "flexible funding" ✓ Specializes in technology and hardware product launches ✓ Regular email support hours; marketing and campaign strategy support
 Kickstarter	\$3B	15M	5%	3.0% + \$0.20	<ul style="list-style-type: none"> ✓ Specializes in creative projects with robust reward level feature ✗ 14-day wait to withdraw and deposits take 5-7 business days ✗ Limited email support hours ✗ Requires Kickstarter approval to launch a fundraiser
 Fundly	\$330M	NA	4.9%	2.9% + \$0.30	<ul style="list-style-type: none"> ✓ Can withdraw immediately and deposits take 2-5 business days ✗ No donor guarantee policy for fraud protection ✗ Limited email support hours
 JustGiving	NA	22M	Nonprofits: 0-5% Personal: 0%	Nonprofits: 2.9% Personal: 2.9% + \$0.30	<ul style="list-style-type: none"> ✓ Supports UK gift aid ✗ 14-day wait to withdraw and deposits take 6-10 business days ✗ No fraud protection offered ✗ Limited email support hours
 Facebook	NA	NA	Nonprofit: 0%	Nonprofit: 0%	<ul style="list-style-type: none"> ✓ Can withdraw immediately and deposits take 7+ days ✓ Zero fees for charities registered with Facebook ✗ Nonprofits must undergo a 24-hour charity verification process, slowing down setup ✗ No donor guarantee policy

Why do people engage with crowdsourcing?

- the desire to earn money;
- to develop one's creative skills;
- to network with other creative professionals;
- to build a portfolio for future employment;
- to challenge oneself to solve a tough problem;
- to socialize and make friends;
- to pass the time when bored;
- to contribute to a large project of common interest;
- to share with others; and
- to have fun.

Types of Crowdsourcing

Type	How it Works	Kinds of Problems	Examples
Knowledge Discovery and Management	Organization tasks crowd with finding and collecting information into a common location and format	Ideal for information gathering, organization, and reporting problems, such as the creation of collective resources	Peer-to-Patent <i>peertopatent.org</i> SeeClickFix <i>seeclickfix.com</i>
Broadcast Search	Organization tasks crowd with solving empirical problems	Ideal for ideation problems with empirically provable solutions, such as scientific problems	InnoCentive <i>innocentive.com</i> Goldcorp Challenge <i>Defunct</i>
Peer-Vetted Creative Production	Organization tasks crowd with creating and selecting creative ideas	Ideal for ideation problems where solutions are matters of taste or market support, such as design or aesthetic problems	Threadless <i>threadless.com</i> Doritos Crash the Super Bowl Contest <i>crashthesuperbowl.com</i> Next Stop Design <i>nextstopdesign.com</i>
Distributed Human Intelligence Tasking	Organization tasks crowd with analyzing large amounts of information	Ideal for large-scale data analysis where human intelligence is more efficient or effective than computer analysis	Amazon Mechanical Turk <i>mturk.com</i> Subvert and Profit <i>subvertandprofit.com</i>

Brabham (2011)

Crowdsourcing for innovation: Another typology

- Intermediary platforms
 - Research & Development platforms (eg NineSigma)
 - Marketing, Design & Idea platforms (eg 99designs)
 - Collective intelligence & Prediction platforms (eg Kaggle)
 - HR and Freelancers platforms (eg TopCoder, Amazon Mechanical Turk)
 - Open innovation software (eg Imaginatik)

Crowdsourcing for innovation: Another typology (Cont.)

- Creative co-creation
 - Eg Threadless
- Corporate initiatives
 - Product ideas crowdsourcing (eg IBM InnovationJam)
 - Branding and Design crowdsourcing (eg Fluevog)
- Peer production
 - Wikipedia
- Public crowdsourcing
 - Eg Creativecommons.org

Is open-source crowdsourcing?

Distributed Innovation Summary

- Product platform: A core product or technology serves as a foundation, allowing third parties to develop additional features, extensions, or entirely new innovations.
 - Example: Android OS allows developers to create apps that run on a shared mobile platform.
- Web APIs: Interfaces that enable third-party developers to integrate functionalities into their own applications, fostering ecosystem growth.
 - Example: Google Maps API is used by ride-sharing apps like Uber to provide navigation services.
- Crowdsourcing Innovation: Leveraging a large, distributed group of contributors to solve problems, generate ideas, or fund innovations.
 - Example: Tesla's "Bug Bounty" program that invites security researchers and ethical hackers to identify vulnerabilities in its software, including its Autopilot system and in-car applications.

Case Study:

Tesla's Open Patent Strategy