Next-Generation Service Ecosystems: Integrating Digital Platforms and Generative AI

Nicos Komninos

URENIO Research, Aristotle University of Thessaloniki

International Conference "The Transformative Economy", 8-10 October 2024, Yerevan

Service ecosystems are the most common ecosystems in cities, encompassing activities in education, health, finance, culture, media, recreation, hospitality, security, governance, and many others.

Over the last 20 years, service ecosystems have evolved significantly, transitioning from

- **Supply chain models:** pre-2000s to early 2000s
  to
- **Digital platform-based models:** early 2000s to 2020
- **Models integrating digital platforms with generative AI:** 2020 to present and beyond.

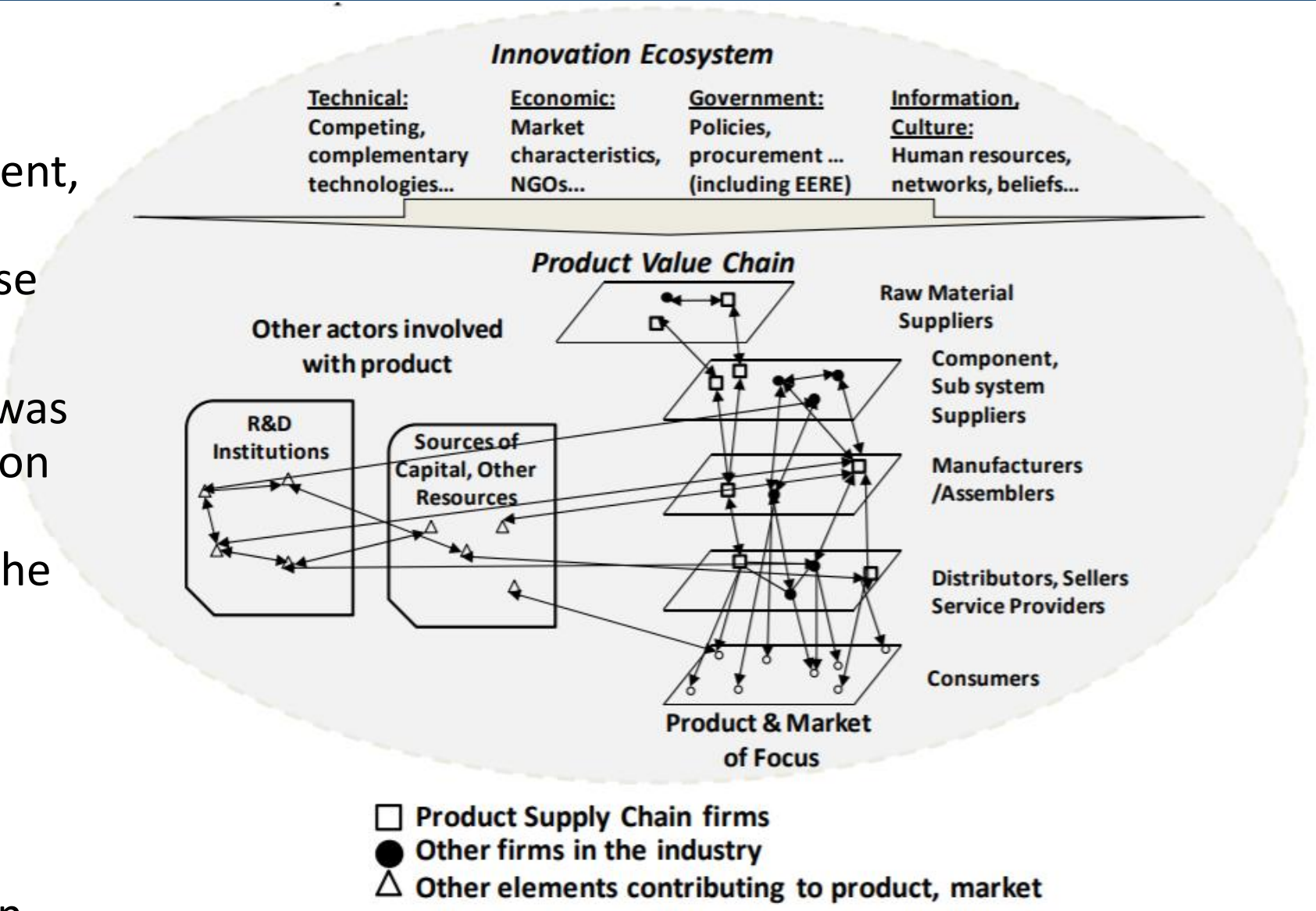
The talk outlines key features of these three **evolving service ecosystem models** and highlights innovations from converging digital platform ecosystems with generative AI. This model is under formation. Understanding its features, innovation mechanisms, and differences from previous service ecosystem models is important.

I. Supply chain-driven ecosystems (pre-2000s to early 2000s)

Both manufacturing and services **adopted the supply chain framework** (procurement, operations, marketing, and customer support) to organise production.

The **focus** in manufacturing was on the efficient transformation of materials into physical products, while in services, the **focus** was on the real-time delivery of expertise, interactions, or intangible offerings.

Both created **ecosystems** of organisations in collaboration



Source: Jordan, G., Mote, J., & Washington, G. (2014). A Framework for Evaluating R&D Impacts and Supply Chain Dynamics Early in a Product Life Cycle.

	Manufacturing supply chains	Service supply chains
	*Concerned with the **flow of physical goods**, inventory management, and supplier relationships*	*Focus on **managing human resources, customer interactions, real-time** delivery of services*
Tangibility of output	Output is **a tangible product**	The output is often **intangible**, like consulting, healthcare, IT services
Inventory management	**Store inventory** (raw materials, work-in-progress, finished goods)	Services are produced and consumed **simultaneously**
Demand and capacity management	Manage demand by **adjusting production schedules**, inventory levels, and supplier lead times	**Real-time** demand management
Lead time and delivery	Clear lead time between the order and the delivery of the product	Real-time or with much shorter lead times
Technology and automation	Often **highly automated**, with advanced **robotics**, machinery, and software	Leverage **digital technology,** cloud computing, customer relationship management (CRM)
Supplier relationships	Rely on a **wide network** of suppliers for raw materials and components	More **personalized** and customizable based on individual customer needs

Supply-chain ecosystems	Manufacturing ecosystems	Services ecosystems
Flexible specialisation SCs (Piore & Sabel, 1984)	Companies quickly **adjust supply chain nodes** and product offerings in response to changing market demand	**Customize and tailor services** to meet specific client needs; service industries in consulting, IT, marketing, healthcare adopted this model
Industrial districts (Becattini, 1991) **New industrial districts** (Scott, 1988; Storper, 1997)	**Geographically concentrated groups** of small and medium-sized enterprises (SMEs) that specialise in related manufacturing activities. The proximity allows for shared knowledge, collaboration, innovation.	Service industries also benefit from geographic concentration in **financial services districts** where banks, consulting firms, and investment companies cluster together, benefiting from shared infrastructure, talent pools, and networking opportunities.
System-areas (Garofoli, 1993)	Areas or regions where companies within a specific sector form **integrated networks** that allow them to share resources and collaborate across the value chain	Similarly, **creative industries system-areas,** with firms from design, media, advertising, and production in proximity collaborate and create a system that allows for sharing ideas, talent, and clients.
Clusters (Porter, 2000) (Cooke, 2002)	Geographically concentrated **groups of interconnected companies** and institutions in a specific industry	**Technology clusters in services,** San Francisco and Bangalore, are home to dense networks of technology service firms that provide software development, IT consulting, and cybersecurity

Supply chain service ecosystems combine:

Individual capabilities of service providers, relying on knowledge and continuous learning

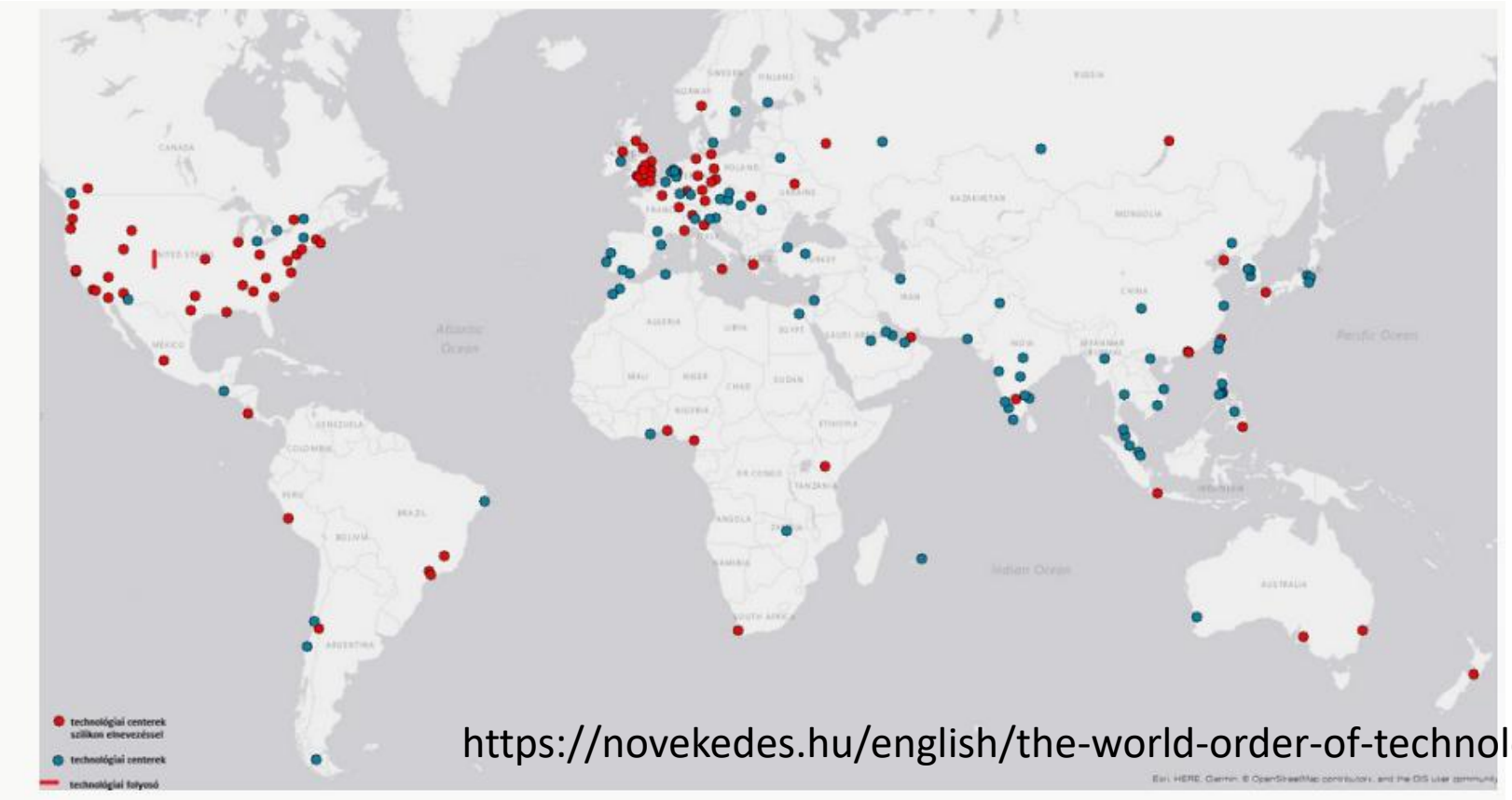
and

A **favourable external environment** encourages agglomeration due to externalities such as a shared labour market, knowledge diffusion through spillovers, research infrastructure, and collaboration institutions.

Key features of this organisational model include:

- Service providers' **physical presence** in the territory,
- Strong knowledge and **technology capabilities** of providers
- **Collaboration** through contracts, alliances, regulations, and formal agreements,
- Efficiency, reliability, and optimisation through **flexible supply chains**
- Rich **knowledge spillovers**

A spiked geography of supply chain service ecosystems



https://novekedes.hu/english/the-world-order-of-technology-in-10-maps

- San Francisco: Software development services, financial services, social media, cloud computing services,
- New York: Financial services, media, health services, and e-commerce
- Beijing: e-commerce, telecom services
- Bangalore: IT services and software development services
- Berlin: Fintech, e-commerce, and digital media
- London: Fintech, AI, cybersecurity, and health services; and Stockholm, with fintech and gaming.

II. Digital platform-based service ecosystems (early 2000s to 2020)

As digitalisation progressed and digital networking extended over broader spatial scales and territories, a new model for service ecosystems appeared

In the first decade of the 21st century, **a platform-based model** for providing services disrupted traditional service supply chains.

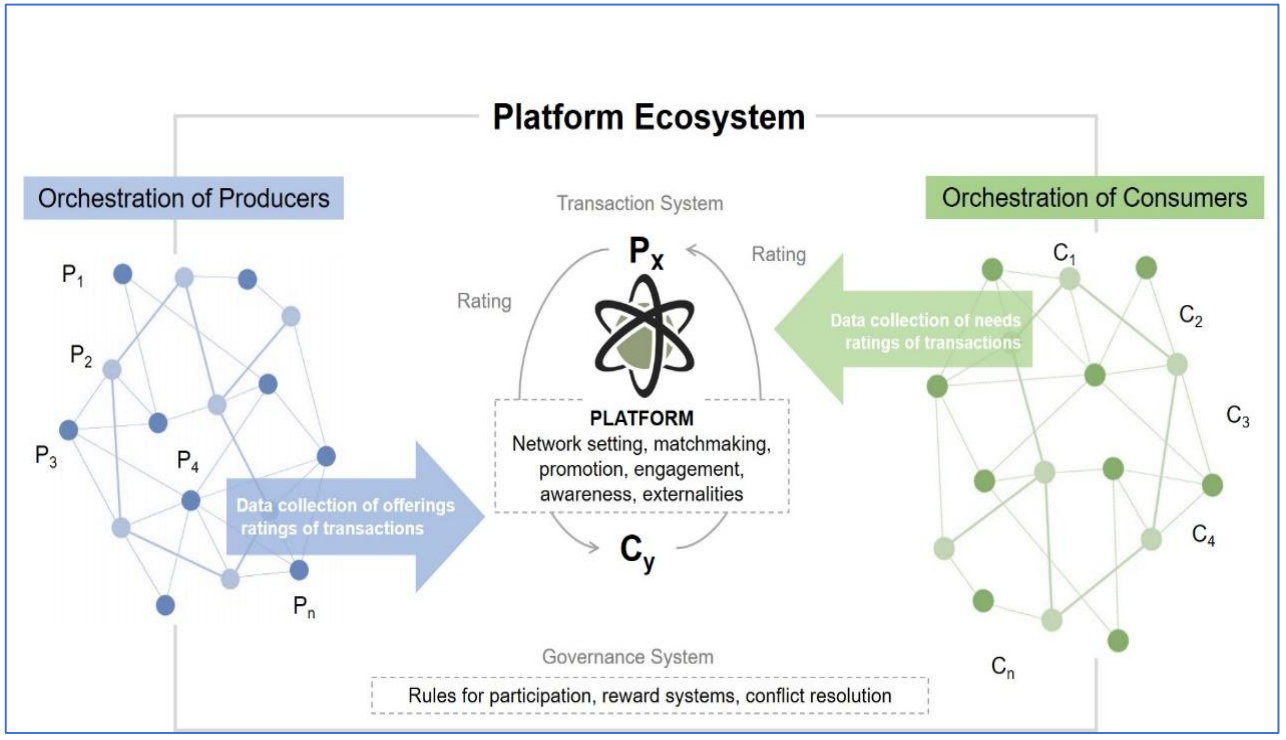
Platforms combine

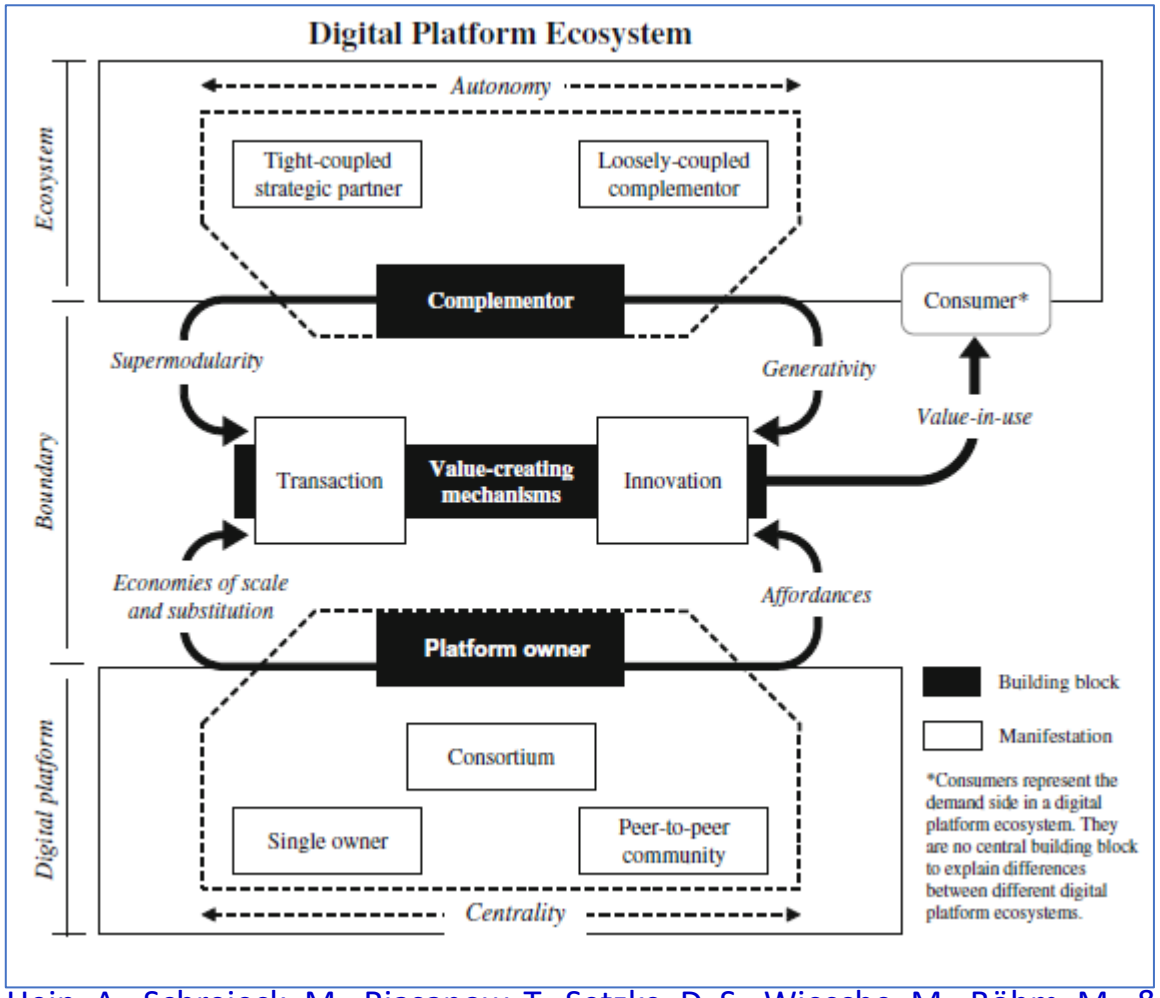
- A **digital technology** component managed by the platform provider (cloud, CMS, analytics, real-time operations)
- Resources provided by the platform **complementors**
- Institutional framework regulating relations among providers and transactions with the users
- A **new business model** of the gig economy, logged work organisation, free-lance workers, decentralised work

The platform economy defined by Acquier et al. (2017): "*a set of initiatives that intermediate decentralized exchanges among peers through digital platforms*."

Key **breakthroughs in digital technologies** provided the ground for this evolution:

- In the early 2000s, **Content Management Systems** (CMS) like WordPress (2003), Drupal (2001), and Joomla (2005) were released, offering platforms that made building applications and managing content easier, allowing greater user interaction, comments, forums, and user profiles.
- By 2004, the rise of **Web 2.0 emphasised user-generated content** and social interaction, leading to a boom in platforms designed for user engagement.
- **Airbnb was founded in 2008** by Brian Chesky, Joe Gebbia, and Nathan Blecharczyk. It started as a website called "AirBed & Breakfast," which offered short-term living quarters, breakfast, and a networking opportunity for individuals attending local conferences. The idea was to offer an affordable alternative to hotels.
- **Uber was founded in 2009** by Garrett Camp and Travis Kalanick as "UberCab", a service that allowed users to book black luxury cars via a mobile app. It quickly expanded and rebranded as "Uber," offering a range of transportation services by allowing private car owners to offer rides to passengers.
- Apart from mobility and hospitality, almost all service sectors embraced the platform model, including **financial services** (PayPal, Square), **freelance professions** (Upwork, Fiverr), **insurance** (Lemonade), **health services** (Teladoc, Zocdoc), **education** (Coursera, Udemy), and **trade** (Alibaba, Etsy).





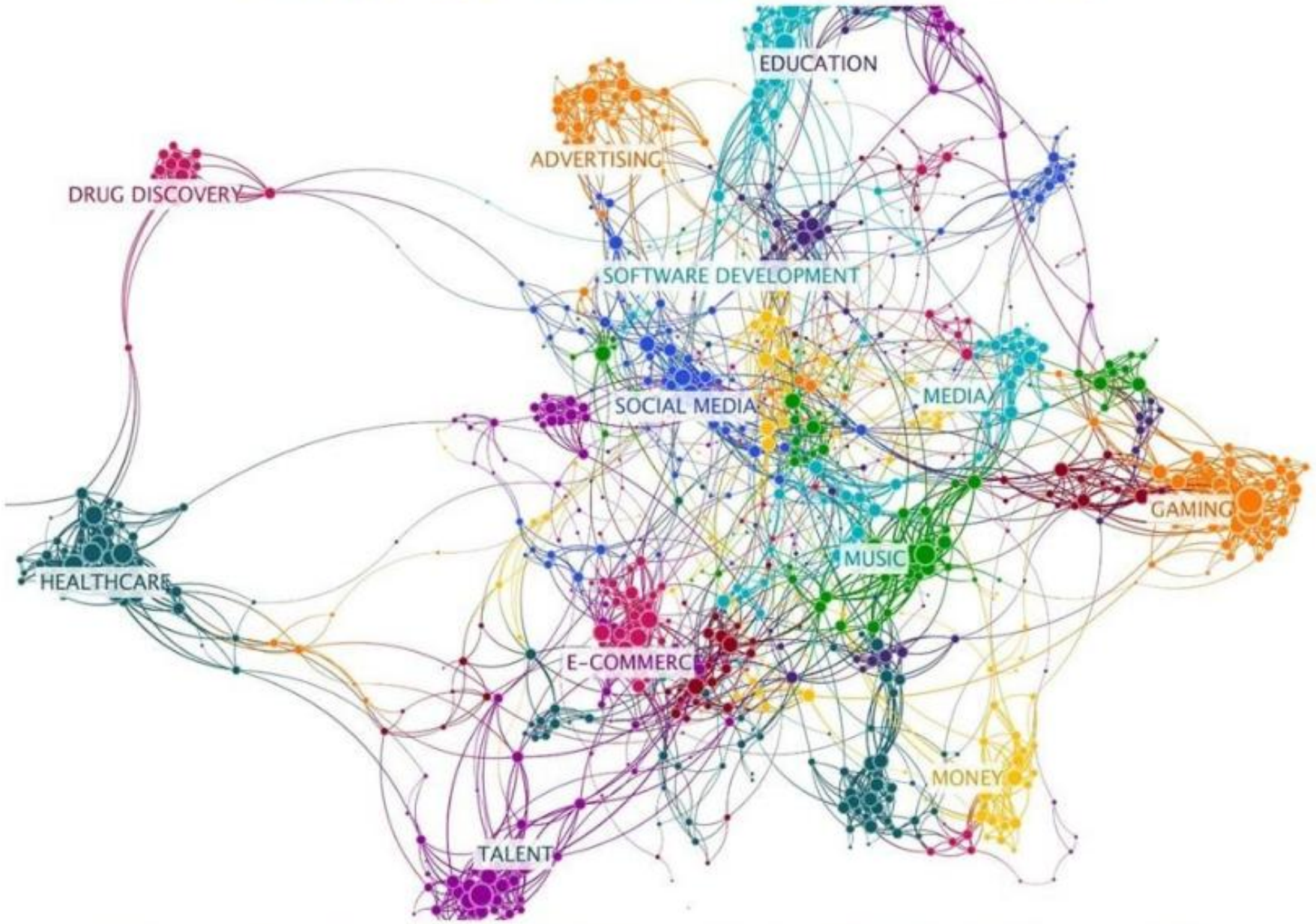
Hein, A., Schreieck, M., Riasanow, T., Setzke, D. S., Wiesche, M., Böhm, M., & Krcmar, H. (2020). Digital platform ecosystems. *Electronic markets*, *30*, 87-98.

Key features of platform ecosystems

- **Digital platforms** as central hubs that connect service providers with customers
- Use of **technology** to streamline processes, reduce costs, and enhance customer experience
- **Creation of ecosystems** where platform owners, service providers (complementors), and consumers interact
- Increased use of **data anal**ytics to understand customer preferences and optimise service delivery

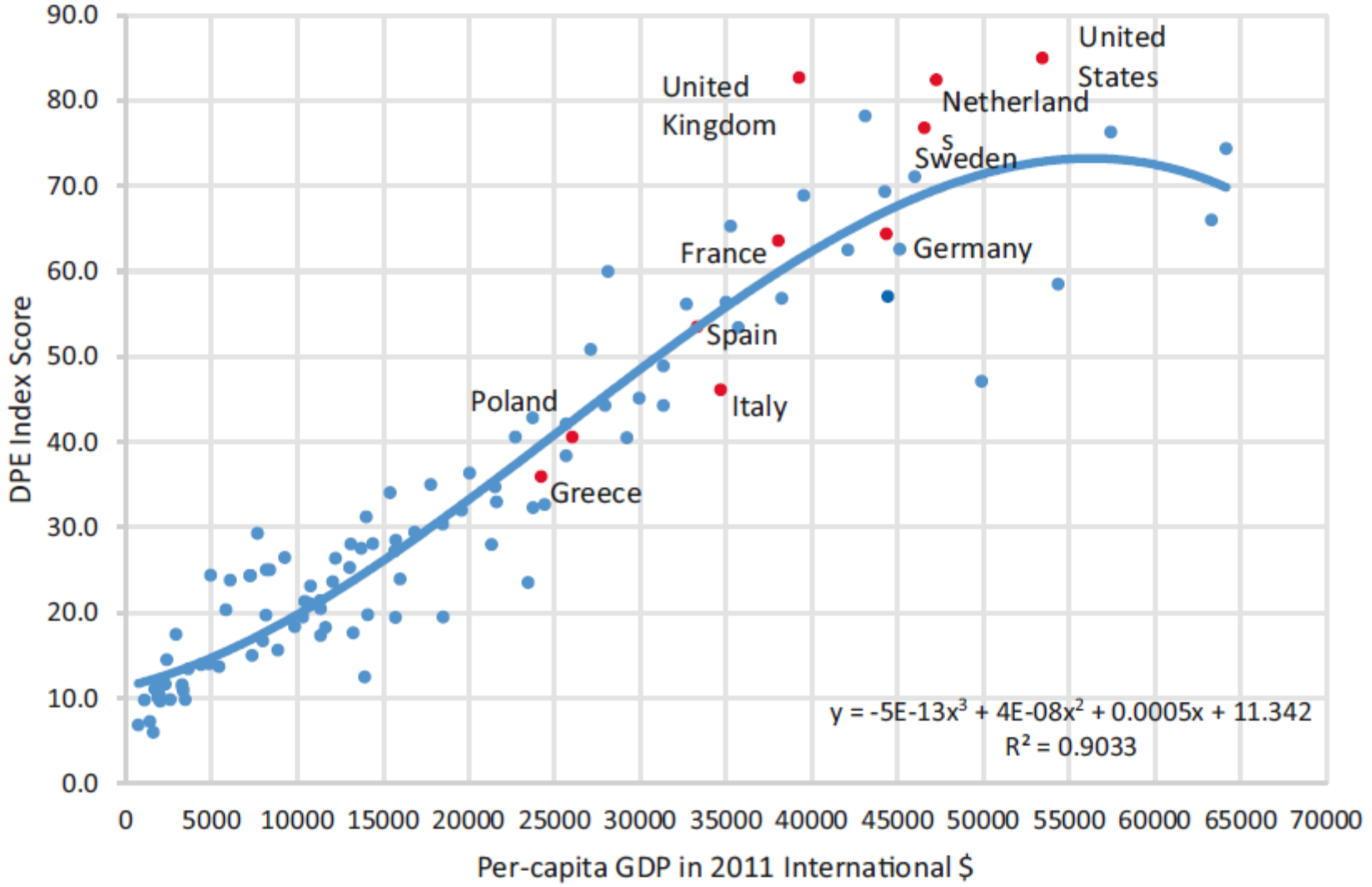
DIFFERENCES	Traditional Supply Chain Ecosystems	Platform Ecosystems
Control	More **centralised control** with one or a few dominant entities overseeing and coordinating the ecosystem	More decentralised, with a central platform setting rules but **participants acting independently**
Value Creation	**Linear** with each participant contributing to the final product or service, but the primary value captured by the end product or service provider	**Network-driven** with each participant contributing to the overall value of the ecosystem
Interconnections	Participants collaborate, but the **connections** between them are often more **direct**, and the relationships are usually bilateral	Participants are **interconnected** through the platform, forming a network where interactions can be multi-sided
Scalability	Growth is often **limited by the capacity** and resources of individual businesses within the ecosystem	**Rapid scalability and global reach** due to the digital nature of platforms, allowing for seamless connections and transactions
Innovation	Primarily taking place **within individual** businesses	Innovation **across the entire network**, with third-party developers building complementary products or services
Technology	The primary focus is often on the **operations of individual businesses**	Technology is **central to the functioning of the platform**, enabling interactions, transactions, and data exchange

From spiked to network geography of platform ecosystems

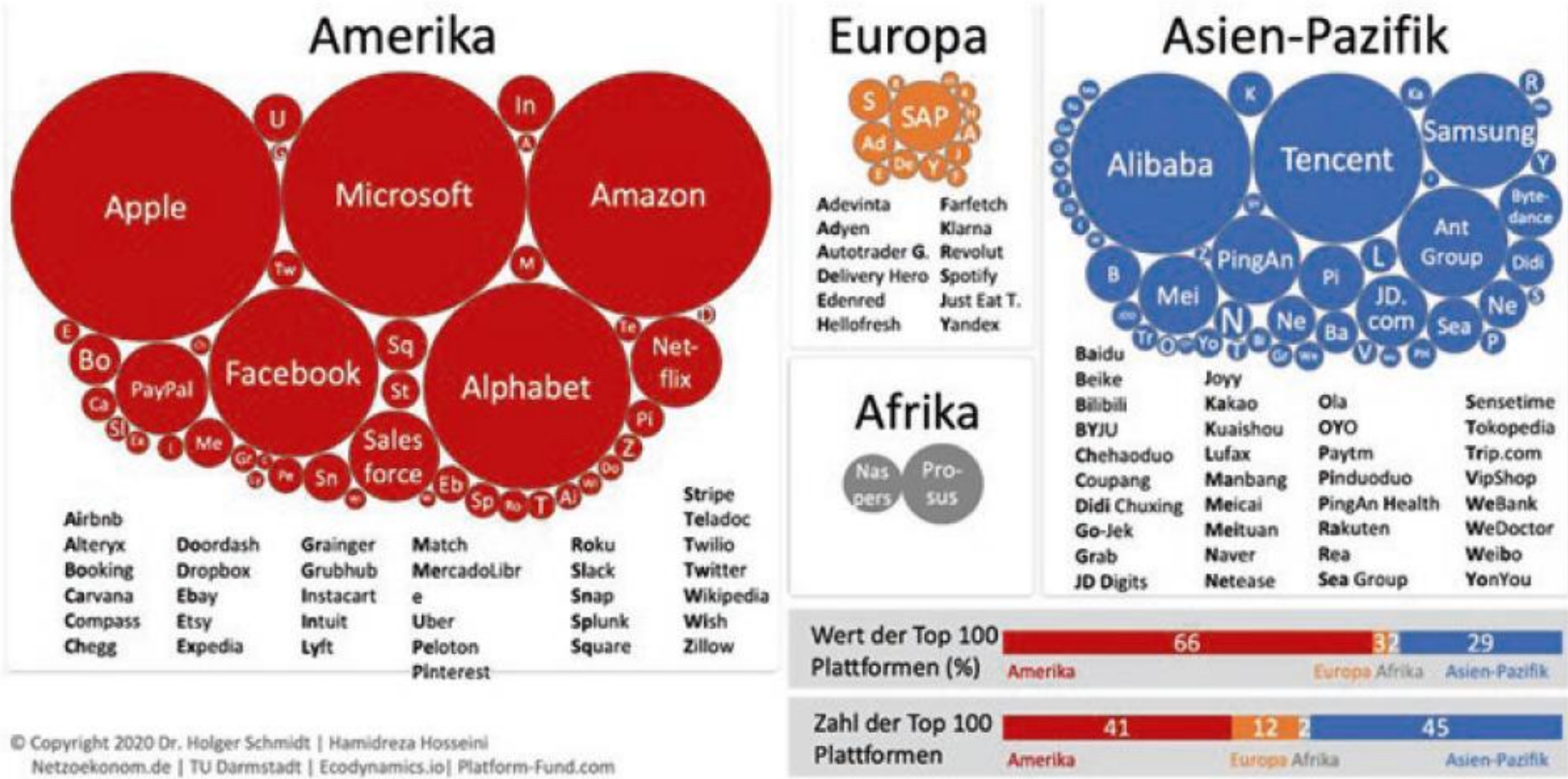


Source: P. Evans, Center for Global Enterprise with data and visualization from Quid, 2015

Digital Platform Index and Per-capita GDP



Note: The trend line is calculated without countries over 65 000 international $ per-capita GDP and without the oil-based economies of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates.



Source: https://www.netzoekonom.de/plattform-oekonomie/

Fig. 5.1 The top 100 platform companies around the world (October 2020)

III. Next-gen service ecosystems (2020 and beyond)
Digital platforms integrate generative AI

Attention Is All You Need

Ashish Vaswani* Google Brain avaswani@google.com

Noam Shazeer* Google Brain noam@google.com

Niki Parmar* Google Research nikip@google.com

Jakob Uszkoreit* Google Research usz@google.com

Llion Jones* Google Research llion@google.com

Aidan N. Gomez* † University of Toronto aidan@cs.toronto.edu

Łukasz Kaiser* Google Brain lukaszkaiser@google.com

Illia Polosukhin* ‡ illia.polosukhin@gmail.com

31st Conference on Neural Information Processing Systems (NIPS 2017), Long Beach, CA, USA

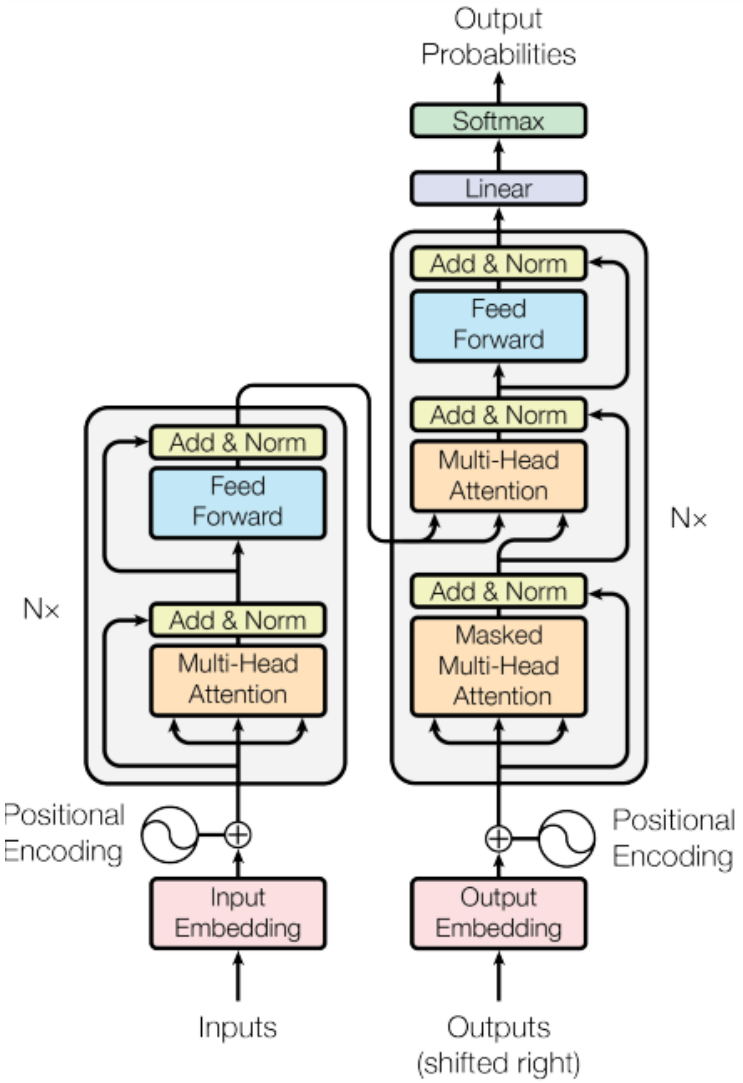
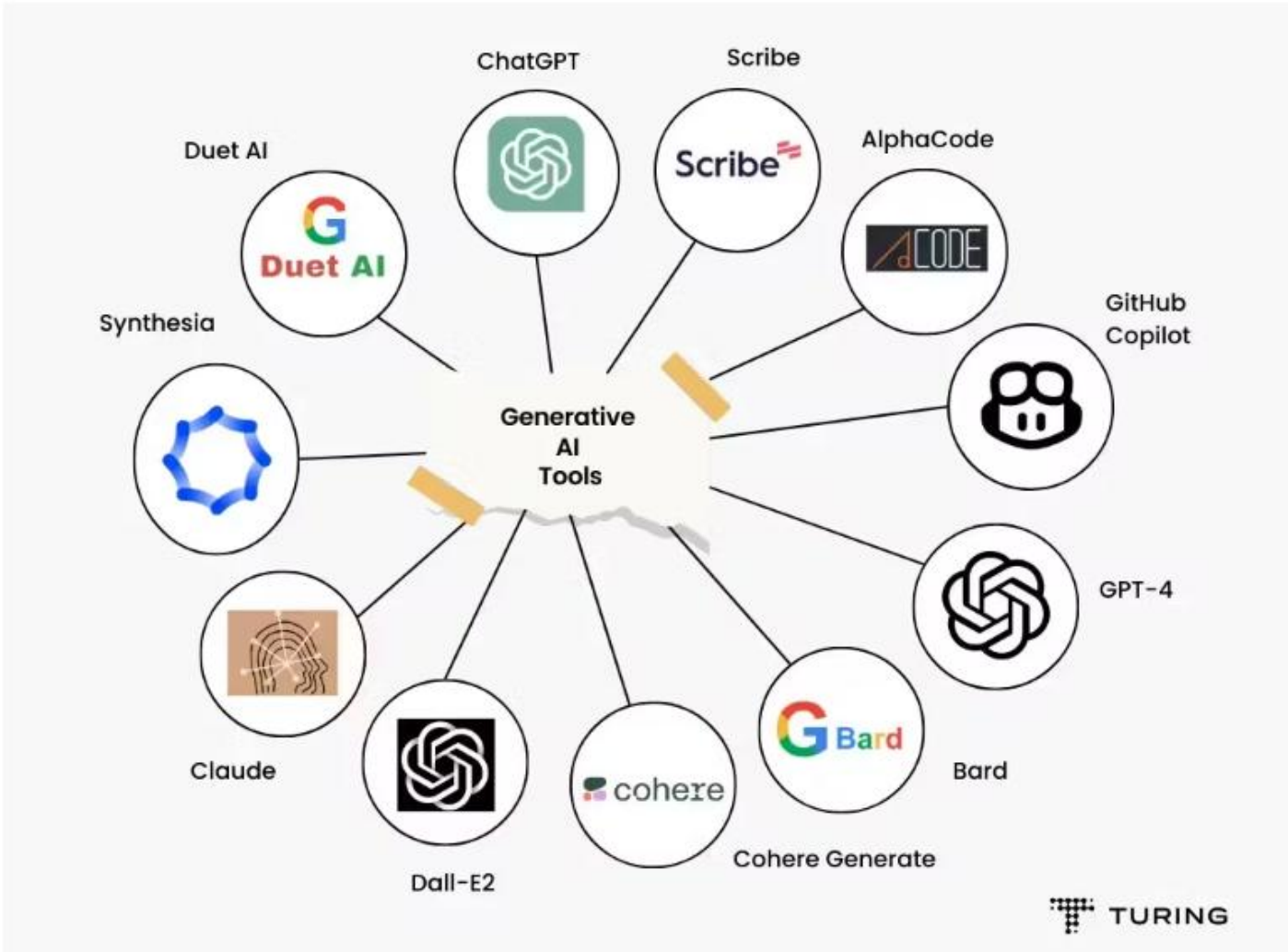


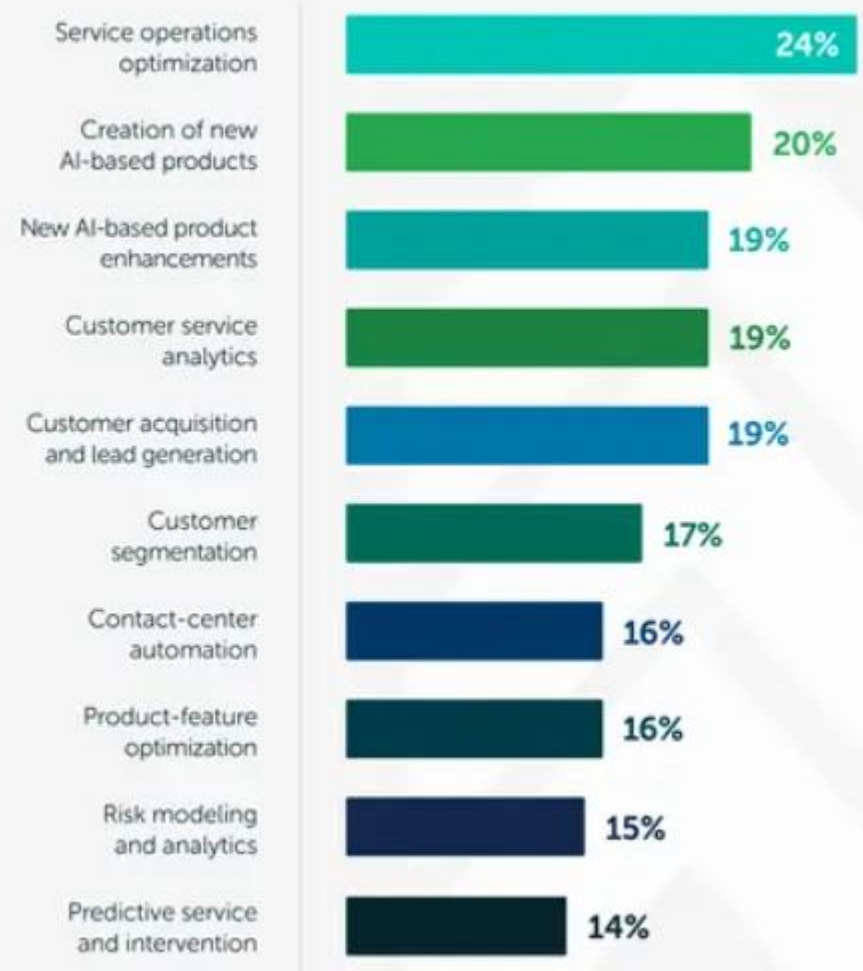
Figure 1: The Transformer - model architecture.

Top 11 generative AI tools and platforms

Let's explore the top 11 generative AI tools and platforms that are shaping the present and future of technology. We'll examine how each tool brings a unique set of advantages and numerical advancements to the table.



The most common AI use cases are **services and product development.**



Source: The State of AI in 2022, McKinsey (Dec. 6, 2022)

ANACONDA.

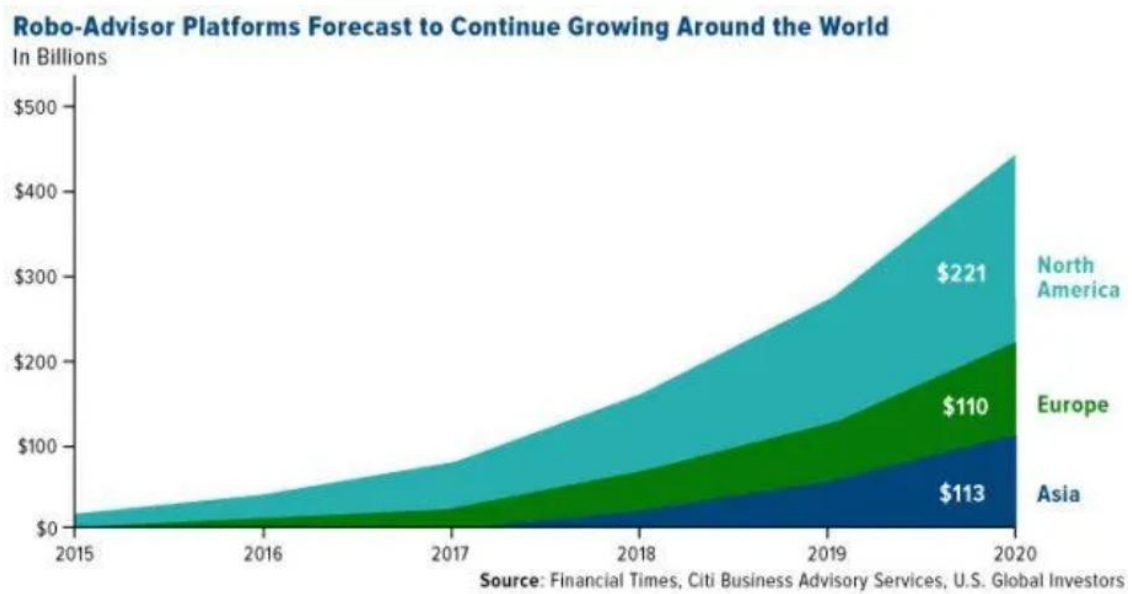
Digital platforms integrating AI

Source: Karthick Purushothaman, Technical Director @ Concentrix

GEN-AI	DIGITAL PLATFORMS		GEN-AI	DIGITAL PLATFORMS
Applications *Text Generation*: OpenAI, Anthropic, Cohere *Image Generation*: Midjourney, Stability AI, Adobe *Code Generation*: GitHub Copilot, Replit, Tabnine *Music Composition*: Amper Music, Aiva, Soundraw *Video Creation*: RunwayML, Synthesia, Pictory	Medium, WordPress, HubSpot, Mailchimp, Zendesk, Intercom, Canva, Adobe Creative Cloud, Instagram, Pinterest, Google Ads, Facebook Ads, GitHub, GitLab, Visual Studio Code, IntelliJ IDEA, JIRA, Confluence, Spotify, Apple Music, Adobe Premiere Pro, Final Cut Pro, Unity, Unreal Engine, YouTube, Vimeo, TikTok, Instagram, Udemy, Coursera.		**User Interfaces** *Web Applications*: Wix, Squarespace, Webflow *Mobile Apps*: AppSheet, Flutter, Kobiton *Voice Assistants*: Amazon Alexa, Google Assistant, Apple Siri *Desktop Applications*: Microsoft Office, Adobe Creative Cloud, Evernote *VR/AR Interfaces*: Oculus (Meta), HTC Vive, Magic Leap	Wix, WordPress, Drupal, Shopify, AppSheet, Flutter, Kobiton, React Native, Amazon Echo, Google Nest, Android Auto, Apple CarPlay, Microsoft Office, Notion, Adobe Creative Cloud, Evernote, Oculus, HTC Vive, STRIVR, Magic Leap.
Plugins & Integrations *Productivity Tools*: Notion AI, Zapier, Miro *Creative Software*: Adobe, Figma, Canva *Enterprise Solutions*: Salesforce, Microsoft Azure, Oracle *API Integrations*: Twilio, Stripe, Slack *Chatbot Extensions*: Dialogflow, ChatGPT Plugins, Rasa	Slack, Microsoft Teams, Asana, Trello, Zapier, Integromat, Canva, Figma, Adobe Photoshop, GIMP, Adobe Premiere, Final Cut Pro, Salesforce, HubSpot, SAP, Oracle ERP, Monday.com, Smartsheet, Shopify, WooCommerce, PayPal, Stripe, Twilio, SendGrid, Zendesk, Freshdesk, WhatsApp, Facebook Messenger, Alexa Skills, Google Assistant.		**Data Management & Security** *Data Integration:* Talend, Informatica, Alteryx *Data Security:* Palo Alto Networks, McAfee, Symantec *Data Governance:* Collibra, Alation, Informatica *Database Management:* MongoDB, Snowflake, Oracle Database *Data Backup & Recovery:* Veeam, Acronis, Carbonite	Snowflake, Tableau, Power BI, Palo Alto Networks, McAfee, Collibra, Oracle Database, Amazon RDS, MongoDB, Veeam, Carbonite.
Development Tools *Model Training*: Google Cloud AI, AWS SageMaker, NVIDIA AI *Data Annotation*: Scale AI, Labelbox, Snorkel AI *Simulation Environments*: Unity, SimScale, MATLAB *AutoML*: DataRobot, H2O.ai, Google AutoML *Frameworks*: TensorFlow, PyTorch, Keras	TensorFlow Hub, Hugging Face, Google Cloud, AWS, DataRobot, H2O.ai, Labelbox, Scale AI, Amazon Mechanical Turk, Clickworker, Unity, Unreal Engine, SimScale, ANSYS, Gazebo, ROS, Tableau, Power BI, Google AutoML, AWS, PyTorch, Keras.		**Ethics & Compliance** *Bias Mitigation*: IBM AI Fairness 360, Fairlearn, Pymetrics *Privacy Controls*: BigID, OneTrust, TrustArc *Regulatory Compliance*: RegTech AI, ComplyAdvantage, LogicGate *Transparency Tools*: Explainable AI by Google, Alibi, H2O.ai *Model Auditing*: Audit AI, Parrot Analytics, Accenture	Workday, Greenhouse, BigID, OneTrust, TrustArc, ComplyAdvantage, LogicGate, LegalZoom, Google Explainable AI, Alteryx, Qlik, Audit AI, Accenture, Parrot Analytics.

Digital platforms integrating AI

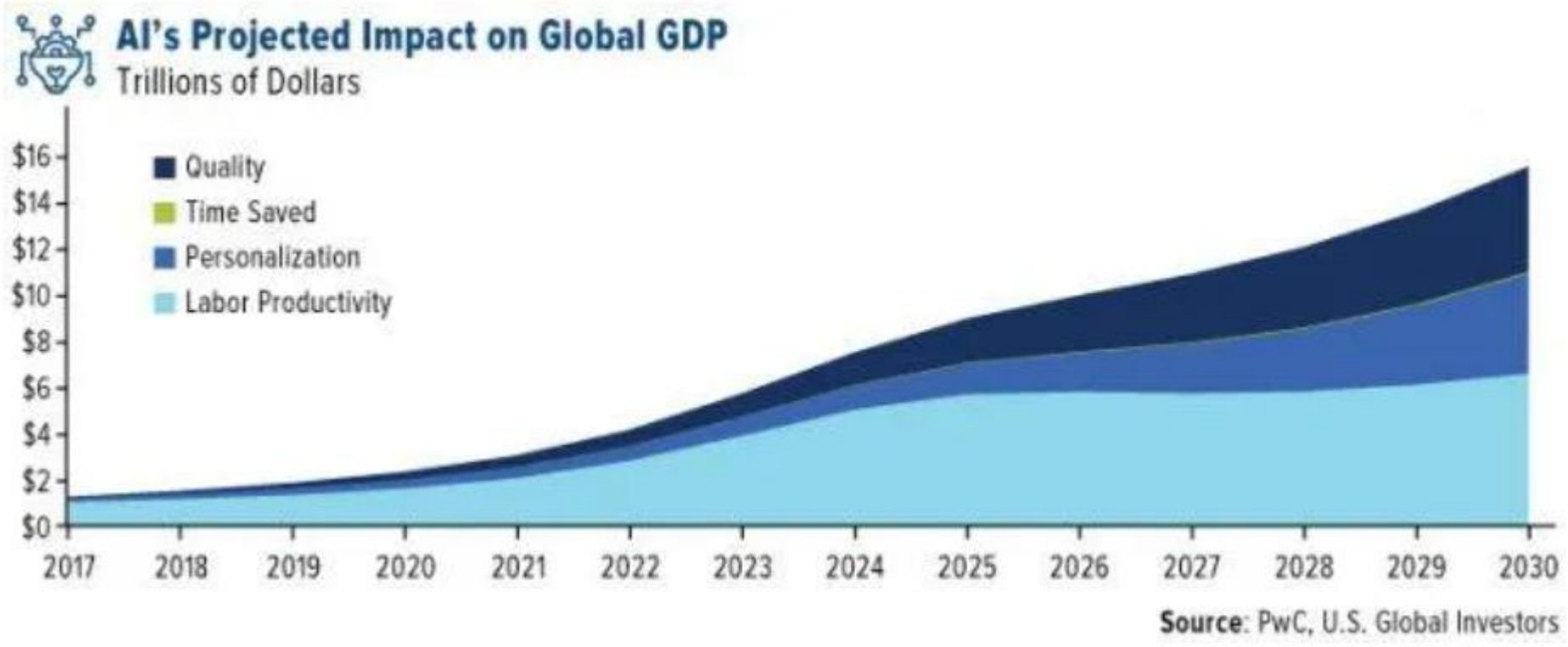
Source: ChatGTP



Robo-Advisor Platforms Forecast to Continue Growing Around the World U.S. GLOBAL INVESTORS

Digital platforms integrating AI

https://www.ai-ecosystem.org/mindmaps



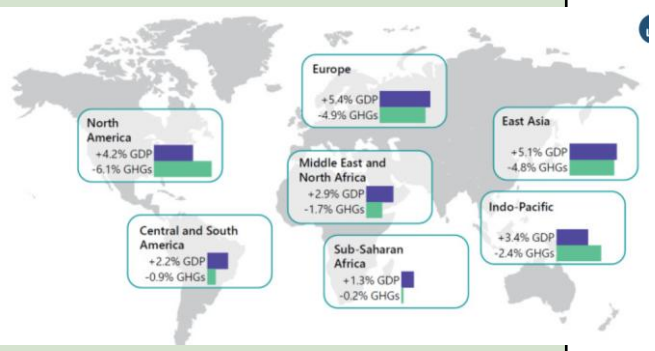
How: Gen-AI transforming platform ecosystems

Innovation system components	Digital platform types and functionalities	AI-powered knowledge functions
R&D and knowledge development: Intelligence, learning, technology acquisition, discovery	• Data sharing, learning, benchmarking platforms • Collaborative research platforms	• **Intelligence**: data analysis, prediction, discussion bots, value generation insights • **Learning**: provide guidance, facilitate complementors and users • **New knowledge creation**: data insights, identify user and complementor needs, improve platform services • **Knowledge dissemination**: platform marketing, promotion, personalized services, ecosystem growth
Funding: mainstream, equity, risk capital, co-funding, open innovation funding	• Funding platforms • Crowdfunding platforms	
Transforming: Process engineering, production capability, product / service launch	• Product development platforms • Production platforms • Procurement platforms • Joint services provision • Common infra, resources	
Market making: Market creation, marketing, product promotion	• Market creation platforms • Commerce platforms • 2-sided platforms	

Generative AI's capabilities are versatile and broadly applicable, cutting across different areas and system components rather than being limited to specific tasks or specialised domains. This contrasts with digital platforms, which are typically designed to optimize or support particular innovation system components.

Areas: Gen-AI transforming platform ecosystems

Enhancement of complementors services and capabilities	Improvement of data analytics and sustainability
• Generate AI-driven insights • **Generate new ideas**, support innovation processes, and redesign • Enhance brainstorming sessions by applying prompt engineering • Understand and learn from complex and non-linear relationships • **Enhance capabilities in automation** and **personalisation**: automating routine tasks and enhancing algorithmic management • Platform continuous improvement and innovation. Gen-AI integrated into the platform's evolution. • Improve customer and employee effectiveness • Enhance the **overall organisational effectiveness**	• AI solutions promoting environmental sustainability. **More efficient resource management** in electricity, water, and waste contributes to lowering the carbon footprints in French cities. • **AI-powered smart grids** that improve efficiency of renewable energy by predicting and regulating supply and demand • **AI solutions to monitor air**, water, and pollution in real-time and provide information for better decision-making • **Waste management systems** can utilize AI to find the best collection routes and recycling, helping organisations to achieve their sustainability objectives.

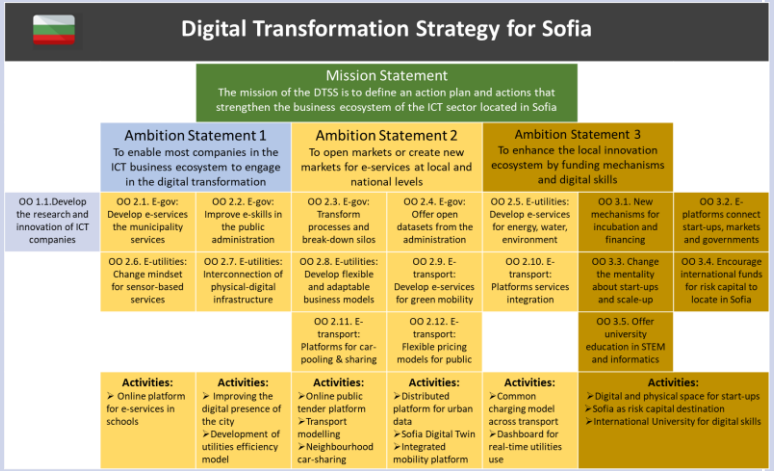


Areas: Gen-AI transforming platform ecosystems

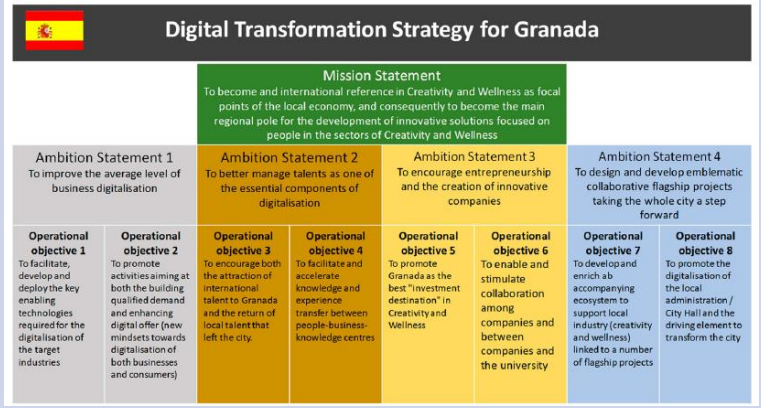
Changing roles for complementors	Platform ecosystem re-design
• Gen-AI autonomous content generation, optimisation, and adaptation—**reshape the landscape** traditionally dominated by human complementors and organisations • **Possible tensions** between platform complementors, Gen AI, and platform providers • Reconfiguration of the **relationship between** platform providers and complementors. • Changes in "**boundary work» between platform groups** and the **governance** employed by platforms to accommodate and integrate AI-driven capabilities • **Delineating the roles of AI and human complementors**: successful boundary work is crucial to balance the benefits of AI-driven efficiencies with the need to support and sustain human complementors.	**Gen-AI reshapes** the platform ecosystems. **Key dilemma:** • (a) **Opening the platform components** to a diverse range of complementors and third-party add-ons can stimulate innovation, enhance data collection, and improve AI training. **Risks of cloning of platform components by competitors**, leading to forks that could fragment their ecosystem. • (b) **Imposing restrictive access** through APIs might protect against such risks but could limit the platform's integrative potential. Gen-AI can **accelerate innovation and maintain a cohesive platform ecosystem**. Using Gen-AI, platform owners can secure adaptability and strategic foresight in the rapidly evolving landscape

Widening the Platform-AI model:
The city as a platform for collaboration, simulation, capabilities

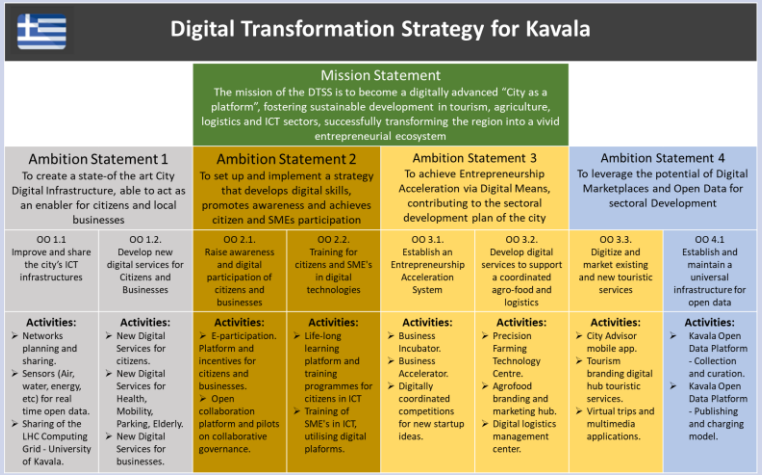
SOFIA - BL



GRANADA - SP



KAVALA - GR



ICT: Platform-based digital transformation

- Online platform for schools
- Contract and tender platform
- Distributed platform of urban data
- Sofia's Digital twin
- Dashboard for real-time utilities consumption
- Transport modelling
- Integrated mobility platform

HEALTH: Platform-based digital transformation

- Raising awareness on digitalisation
- Open Data across 3pl helix
- FiwareZone and Fiware technology
- Granada branding
- Spin-offs and start-ups in the HLS
- Knowledge transfer
- Collaborative R&D
- Digital Innovation Hubs

TOURISM: Platform-based digital transformation

- Digital City Infrastructure
- Support digital skills
- Train SMEs in digital technologies
- Accelerate entrepreneurship via digital means in logistics, digital tourism, hospitality
- Digital marketplaces
- Open Data initiatives

Komninos, N., Kakderi, C., Collado, A., Papadaki, I., and Panori, A. (2020).
”Digital Transformation of City Ecosystems: Platforms Shaping Engagement and Externalities across Vertical Markets”. *Journal of Urban Technology,* Vol 28 (1-2), pp. 93-114.
DOI: https://www.tandfonline.com/doi/full/10.1080/10630732.2020.1805712

Widening the use of the platform-AI model:

From transactions within an industry ecosystem to re-organise the entire infrastructure, skills, technology and resources offered in a city