DIGITAL TRANSFORMATION OF INDUSTRIES

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A RECAP: AI AS A GENERAL PURPOSE TECHOLOGY

Remember, GPTs:

- are pervasive, i.e. they spread to most sectors
- are technologically dynamic, i.e. they get better over time, hence, their cost reduces over time
- show innovational complementarities

Some consider AI the most important GPT of our era. This means that the economic impact of AI will be reflected by its ability to transform all sectors of the economy; consequently, to trigger the wave of AI-driven transformation, comprehensive support and funding of AI development and adoption across the economy is needed.

A RECAP: AI AS A GENERAL PURPOSE TECHOLOGY

But GPTs take their time before producing their effects on the economy.

It took more than ½ century to the steam engine to supersede horsepower during the 1st industrial revolution and 40 years to finalise the electrification process during the 2nd industrial revolution and the microprocessor was invented almost 50 years ago…

GPTs need time:

- Because they require some form of restructuring of industries (you can't simply renew your capital);
- Because they need trained and skilled workers (and for them it is a paradigm shift).

AI & ML AS A PREDICTION TECHNOLOGY

AI is valuable because it enhances the industrial process with prediction, which has to be intended in a statistical way, as the ability to use available information (data) to derive information that it is not available). AI industrialises statistics!

Prediction is becoming cheaper and as it gets even more cheap, many problems will be reframed as prediction problems (from loan defaults & financial risk to medical diagnosis).

Prediction is useful because it is an essential input to the decisional process (if there is no decision, prediction is useless)

As the price of a commodity falls, people buy more of its complements. Identifying the complements to prediction is a key challenge with respect to recent advances in AI. Prediction is not the sole input to a decision. The other aspects of a decision are complements to AI: data, action and judgment.

THE DIGITALISATION PROCESS

Digitisation is the conversion of analogue data and processes into a machine readable format, 1s and 0s that can be read and manipulated by computers; it can be used in multiple ways that makes data vastly more productive than its analogue equivalent. This is thanks to algorithms that can interpret, process, and transform digital data into executable instructions.

Digitalisation is the use of data and digital technologies as well as interconnection that results in new, or changes to existing, activities, while digital transformation refers to the economic and societal effects of digitisation and digitalisation.

Data is at the heart of the digital transformation. It is not new, but gathering, storing and managing data was labour-intensive before it became digital. The capacity for acquiring and managing data is expanding through the proliferation of devices, services, and sensors. This phenomenon has been described by “big data” and “Internet of Everything”. In this environment, algorithms not only create value from data, but the data in turn improves algorithms.

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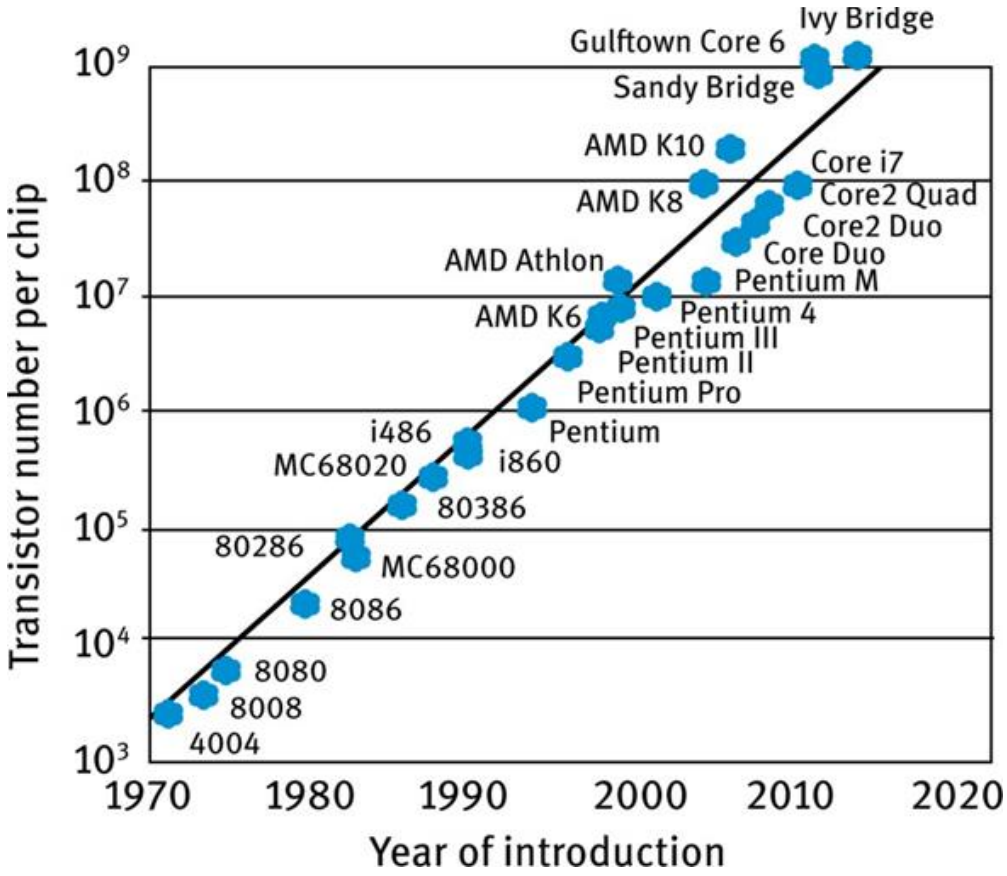
SCALE SCOPE AND SPEED

Digital technology has been a driving force along three dimensions: scale, scope and speed. Rapid progress along these dimensions has propelled digital innovation. A fundamental driver is the Moore's "law": exponential increase (for 50 years) in the number of transistors per square inch doubling every 18-24 months.

These factors work to create complex economic and social effects that reflect a fundamental change in the nature of production This includes the growing role of S, S and S in operations.



SCALE WITHOUT MASS

Unlike physical products, which tend to have high fixed costs and substantial marginal costs that decline with scale, digital products and services, notably software and data, have marginal costs close to zero. Combined with the global reach of the Internet, this allows these products and the firms and platforms that use them to scale very quickly, often with few employees, tangible assets and/or no geographic footprint.

Policy implication

The scale effect of being digital may allow the rapid acquisition of market share thanks to lower costs of production, easier penetration of multiple markets and a higher intensity of knowledge assets suggesting that policies ensure that barriers to entry and innovation are low, and adjust size-based approaches such as de minimis thresholds and categorisation based on number of employees.

SCOPE

"Economies of scope" are benefits realised by conglomerates that could support many product lines by sharing common costs such as legal, finance, accounting, and marketing, or through vertical integration, which obviated the need and costs of complex contracting between firms. Digitisation facilitates the creation of complex products that combine many functions and features (e.g. the smartphone) and enable extensive versioning, recombination and tailoring of services. Interoperability standards enable the realisation of economies of scope across products, firms, and industries.

Policy implication

Policies may need to span multiple policy domains, requiring co-ordination across historically separate issue areas and a more multidisciplinary perspective. This may argue for high-level principles as opposed to narrow rules, a shift from strict harmonisation to interoperability, and the convergence of policy oversight authority.

SPEED: DYNAMICS OF TIME

Digitalisation accelerates economic and social activity: markets clear faster, ideas spread more quickly, the time buffer associated with distance shrinks, as does the time it takes to identify, engage and develop a community. Advantage increasingly goes to first movers and fast followers.

Digitally accelerated activities may outpace deliberative institutional processes, set procedures and behaviours, and limited human attention. Technology also allows the present to be easily recorded and the past to be probed, indexed, repurposed, resold and remembered.

Policy implication

Guiding policy principles may be preferred to specific rules that may be quickly rendered obsolete. New approaches such as the use of regulatory sandboxes and the exploitation of data flows and big data analytics may both accelerate and enable more iterative and agile policy making.

INTANGIBLE CAPITAL AND THE NEW SOURCES OF VALUE CREATION

Intangible forms of capital like software and data are receiving greater investment. Sensors that generate data allow machinery and equipment (e.g. jet engines, tractors) to be incorporated into new services. Platforms enable firms and individuals to monetise or share their physical capital easily, changing the nature of ownership (e.g. from a good to a service).

Policy implication

Policymakers may want incentives to investment more aligned with the economics of digital innovation and production (e.g. R&D, data, IP). The ability to efficiently market services derived from capital equipment (as opposed to direct investments) may have implications for incentives to invest as well as measures of investment and productivity.

TRANSFORMATION OF SPACE

Thanks to their intangible, machine-encoded nature, software, data, and computing resources can be stored or exploited anywhere, decoupling value from borders, and challenging traditional principles of territoriality, geographically-based communities and sovereignty. This separation creates opportunities for jurisdictional arbitrage.

Policy implication

Policies relying on geographical specifications like rules of origin or defined markets may need to be revised, to consider other points along the process of value creation and distribution (e.g. location of value creations vs. value delivery). This separation of value creation from use increases the need for policy interoperability between countries and regions.

EMPOWERMENT OF THE EDGES

The "end-to-end" principle of the Internet has moved the intelligence of the network from the centre to the periphery. Armed with computers and smartphones, users can innovate, design and construct their own networks and communities through mailing lists, hyperlinks and social networks.

Policy implication

Public policies will need to consider reorientation away from centre (large institutions) and toward more granular units like individuals. This includes policies ranging from digital security and data stewardship to labour and social policies.

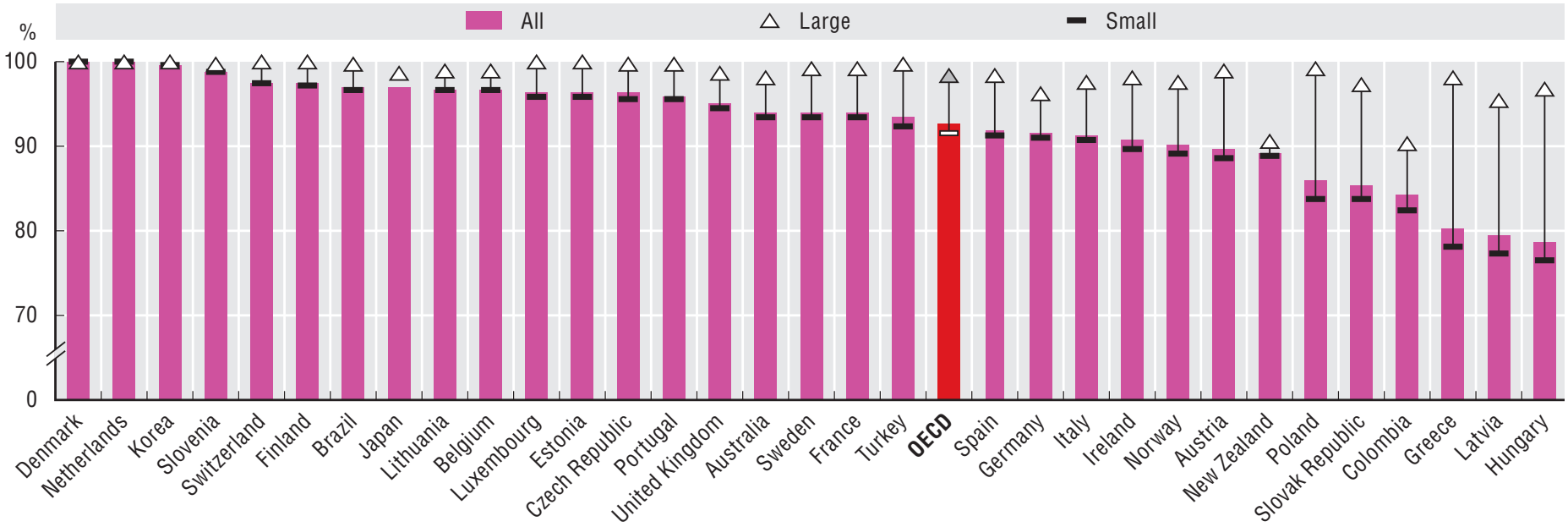
PLATFORMS AND ECOSYSTEMS

Lower transaction costs of digital interactions reflect the development not only of direct relationships but also digitally empowered multi-sided platforms, which in turn contribute to further reducing transaction costs in many markets. Several of the largest platforms essentially serve as proprietary ecosystems with varying degrees of integration, interoperability, data-sharing, and openness.

Policy implication

Public policies need to reflect on the shift of markets toward platforms which may increase efficiencies while re-intermediating and re-concentrating activity that may have implications for maintaining sufficient competition. Governments may need to rethink the provision of public services to take advantage of platforms.

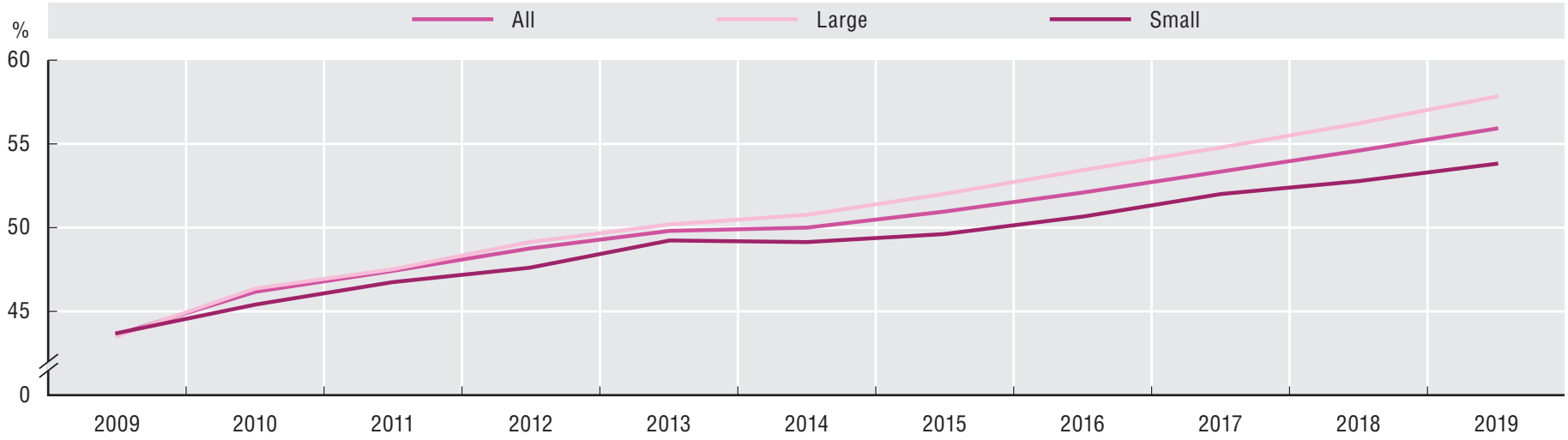
ICT USAGE BY BUSINESSES



Broadband uptake by firms is the most important indicator of the transformation of business models. While Bband uptake is approaching saturation, it is still uneven.

A different picture emerges when we consider high-speed Bband (only 20%).

EMPLOYED PERSONS WITH COMPUTERS



The share of employees using Internet-connected devices offers a better indicator of the extent to which ICTs have been embedded throughout the activities of a business. This indicator has significantly increased across the OECD during the last decade. It nevertheless remains slightly lower among small firms compared to large firms.

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DIFFUSION OF ICT TOOLS AND ACTIVITIES

Websites follow broadband as the most widely diffused tools. Despite being a hallmark of the online age, a much lower proportion of firms make e-commerce sales. Digitalisation allows greater business integration, beyond the information flows management within companies, for a variety of business functions.

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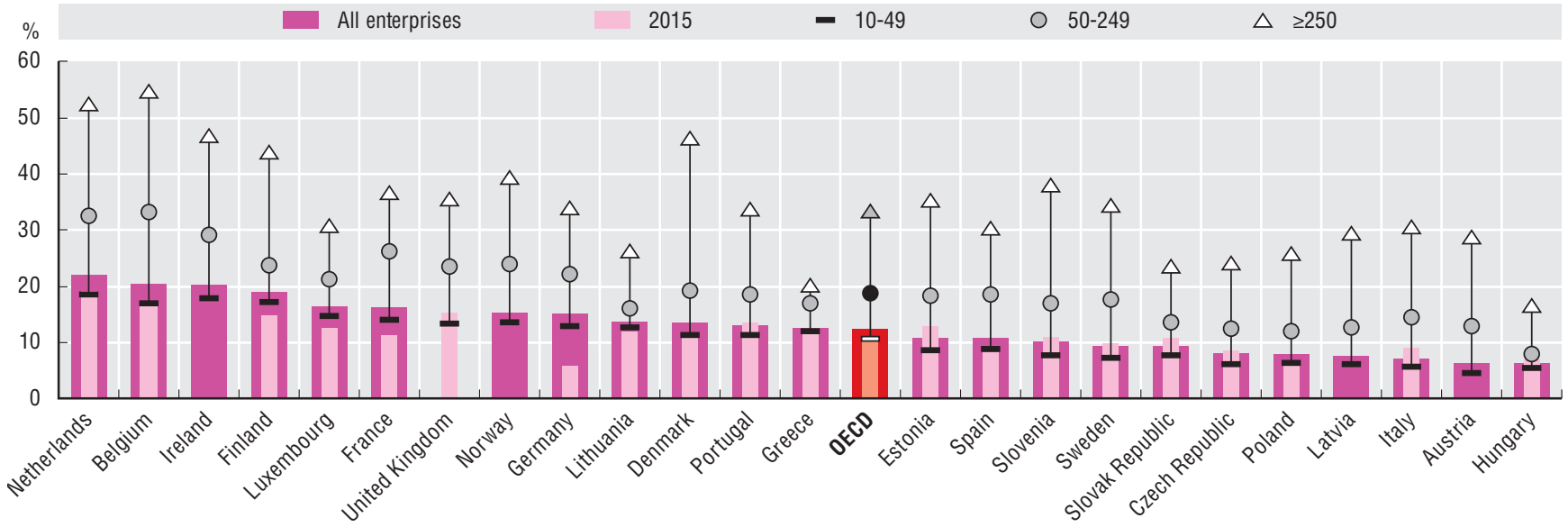
ENTERPRISES PERFORMING BIG DATA ANALYTICS



BDA refers to the use of technologies and software tools for analysing the huge amount of data generated from electronic activities and from M2M communications. Declining cost of data storage and processing have facilitated the collection of data and the adoption of BDA. The expansion of cloud computing combined with the advent of easier tools have made BDA more accessible to SMEs.

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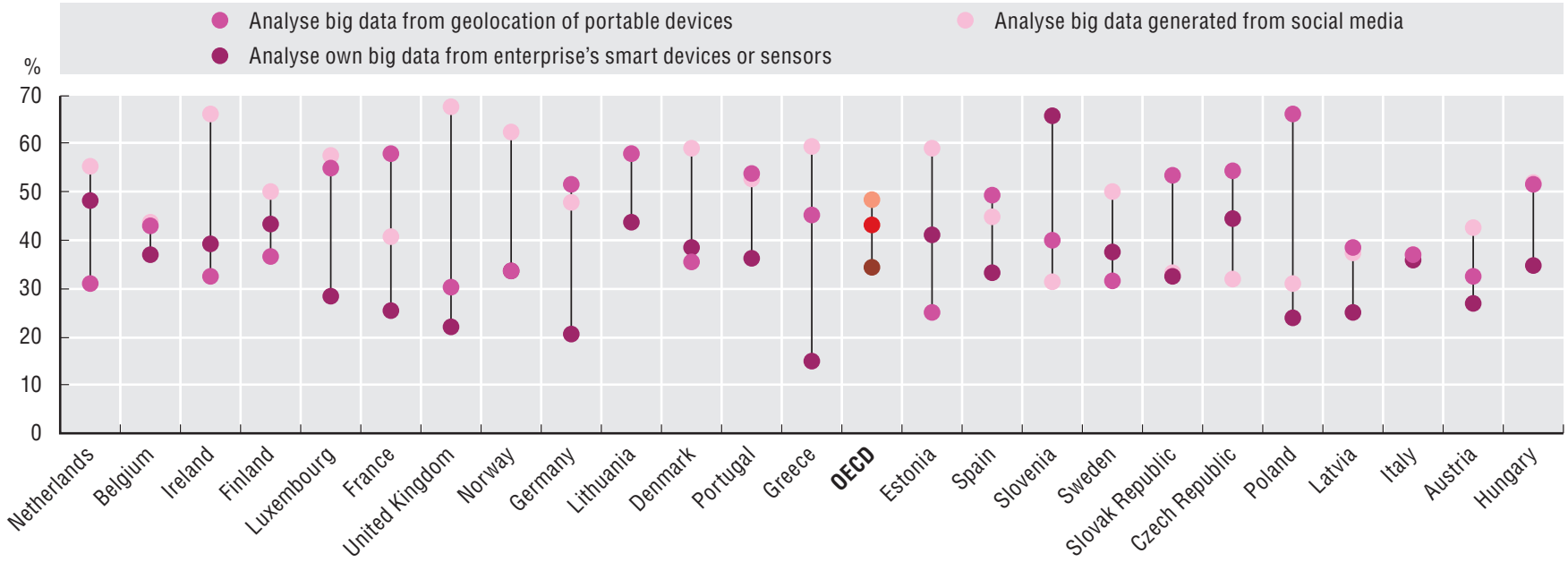

The most intensive users of data from geolocation of devices is in the transportation and storage industry. Industries such as electricity, gas, air conditioning and water supply are the most intensive users of data from smart devices or sensors. Social media data are mainly used in the accommodation and food industry.

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POLICIES TO PROMOTE ICT USAGE IN BUSINESSES

Policies aimed at promoting ICT usage by businesses vary greatly and are set out in broad terms. Often policies are directed - implicitly or explicitly - at enhancing firms' profitability (increasing sales, boosting competitiveness, lowering operating costs, reducing compliance costs and improving productivity). Policy objectives are also articulated at the more macro level in terms of driving growth and employment.

The uptake of digital technologies is a means for achieving these aims. E-commerce, business tools and software, social media and online marketing, and security and privacy tools are all frequently reported. As such, policies tend to articulate intermediate objectives or targets around two outcomes.

First, they want to ensure firms have access to the knowledge and skills needed to choose and use the tools that will most benefit them. Second, they want to help businesses adopt digital tools, which may include the need to fund investment expenditures.

POLICY INSTRUMENTS

Countries	Financial support		Non-financial support	Regulations and statutory guidance	Total
	Direct	Indirect			
Australia	2	2	2	1	7
Austria	1	1	1	1	4
Chile	..	..	1	1	2
Colombia	1	1	1	1	4
Czech Republic	..	..	1	2	3
Denmark	2	..	3	2	7
Estonia	2	..	2	..	4
Finland	1	..	..	..	1
Germany	2	..	3	3	8
Israel	1	1	..	..	2
Japan	1	2	..	..	3
Korea	3	..	..	..	3
Latvia	2	1	1	3	7
Lithuania	1	1	1	1	4
Mexico	..	..	..	1	1
Netherlands	..	1	..	..	1
Norway	1	..	1	1	3
Portugal	1	1	1	..	3
Slovenia	1	..	1	..	2
Spain	1	..	..	..	1
Sweden	2	0	2	1	5
Turkey	1	..	..	..	1
Brazil	..	2	..	..	2
Costa Rica	..	..	1	..	1
Russian Federation	3	1	1	1	6
Singapore	..	..	1	1	2
Total	**29**	**14**	**24**	**20**	**87**

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PRINCIPLES OF POLICY MAKING IN AI

AI should benefit people and the planet by driving inclusive growth, sustainable development and well-being.

AI systems should be designed in a way that respects the rule of law, human rights, democratic values and diversity, and they should include appropriate safeguards – for example, enabling human intervention where necessary – to ensure a fair and just society

There should be transparency and responsible disclosure around AI systems to ensure that people understand AI-based outcomes and can challenge them.

AI systems must function in a robust, secure and safe way throughout their life cycles and potential risks should be continually assessed and managed.

Organisations and individuals developing, deploying or operating AI systems should be held accountable for their proper functioning in line with the above principles.

OECD RECOMMENDATIONS

Facilitate public and private investment in research & development to spur innovation in trustworthy AI.

Foster accessible AI ecosystems with digital infrastructure and technologies and mechanisms to share data and knowledge.

Ensure a policy environment that will open the way to the deployment of trustworthy AI systems.

Empower people with the skills for AI and support workers for a fair transition.

Co-operate across borders and sectors to progress on responsible stewardship of trustworthy AI.

OECD RECOMMENDATIONS

Assigning oversight to an existing ministry or department	· The White House Office of Science and Technology Policy oversees the United States' national AI strategy. · Estonia's Ministry of Economic Affairs and Communications created the national AI strategy. · France coordinates AI policy implementation from within the Prime Minister's Office.
Creating a new governmental or independent body for AI	· AI policy in the United Kingdom is coordinated by the UK Government's Office for Artificial Intelligence. · The U.S. White House established the National AI Initiative Office. · Singapore created a National AI Office to co-ordinate the implementation of its national AI strategy.
AI expert advisory groups	· Austria's Council on Robotics and AI · Canada's Advisory Council on AI · Spain's Artificial Intelligence Advisory Council · The United States' Select Committee on AI under the National Science and Technology Council
Oversight and advisory bodies for AI and data ethics	· Germany's Data Ethics Commission · The Data Ethics Advisory Group in New Zealand · The United Kingdom's Centre for Data Ethics and Innovation (CDEI) · Singapore's Advisory Council on the Ethical Use of AI and Data.

THANKS

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