OECD.AI Policy Observatory

International conference on AI in Work, Innovation, Productivity and Skills
1-5 February 2021

Session 5:

The OECD AI Systems Classification Framework: progress, challenges & way forward

Part 1: Overview of the OECD's work on AI

Part 2: Introducing the classification framework

Part 3: Using the framework on actual AI systems

Part 4: Applying the framework to jobs & skills

Part 5: Discussion

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The OECD AI Principles

10 PRINCIPLES FOR TRUSTWORTHY AI

Value-based principles

- Socio-economic & environmental impacts
- Human-centred values and fairness
- Transparency, explainability
- Robustness, security, safety
- Accountability

Recommendations for policy makers

- Investing in research
- Data, compute, technologies
- Enabling policy environment
- Jobs, skills, transitions
- International cooperation

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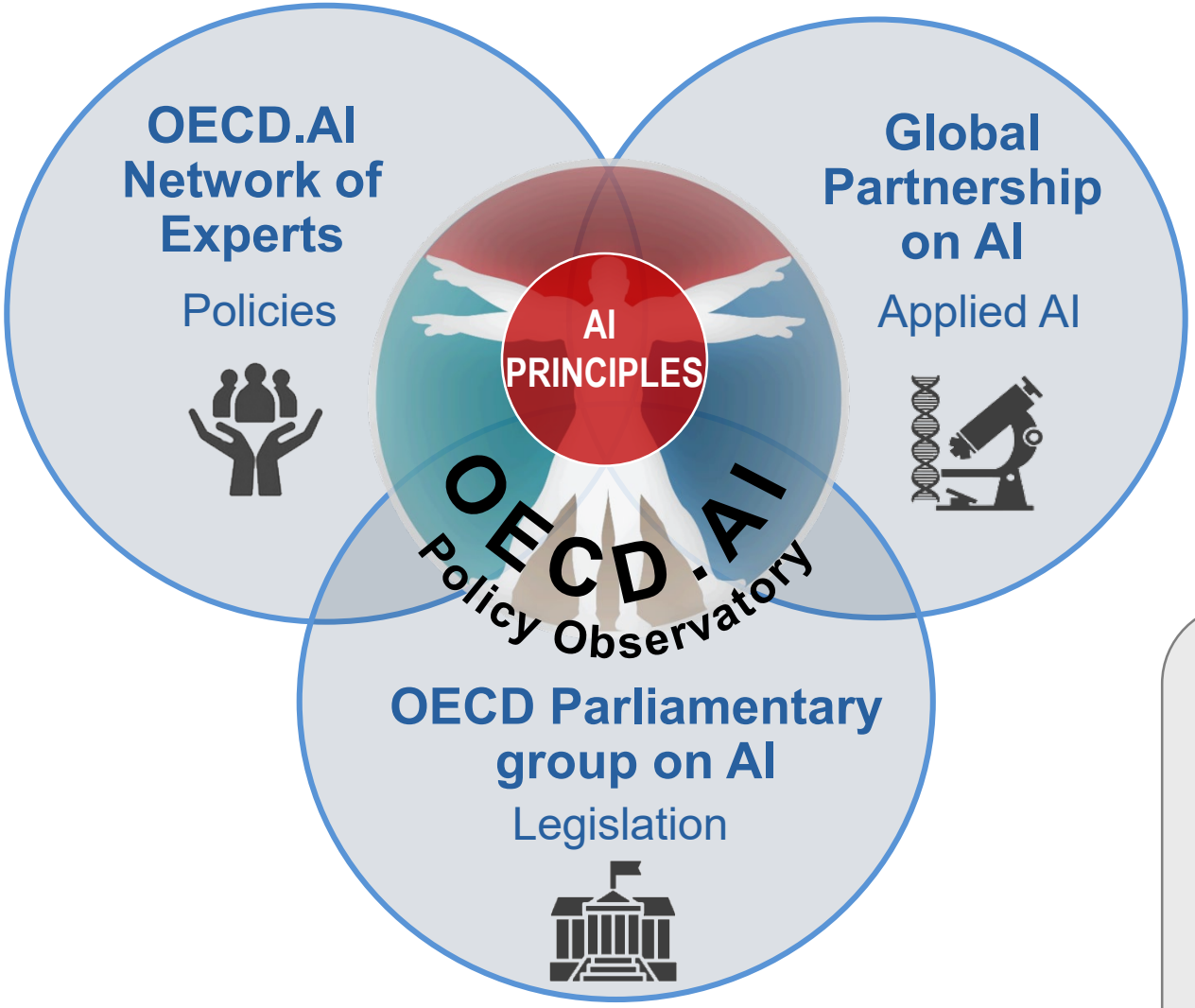
Complementary expert groups – different memberships & mandates



PARTICIPATION in complementary initiatives by partner institutions

- EC
- G20
- UNESCO, UN
- CoE
- IDB, CAF
- ISO, IEEE…

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The OECD network of experts on AI (ONE AI)

- multi-disciplinary and multi-stakeholder
- **200+ AI experts** from national governments, IGOs and the EC, business, civil society, academia, trade unions.
- advises the OECD & facilitates collaboration with other initiatives.

ONE AI is divided into several Working Groups

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What types of AI systems raise what types of policy issues?

WG CAI : Classifying AI systems

10 PRINCIPLES FOR TRUSTWORTHY AI

Values-based principles

- Socio-economic & environmental impacts
- Human-centred values and fairness
- Transparency, explainability
- Robustness, security, safety
- Accountability

National Policies

- Investing in research
- Data, compute, technologies
- Enabling policy environment
- Jobs, skills, transitions
- International cooperation

WG TAI: Tools for Trustworthy AI

WG PAI: National AI policies

AI Compute

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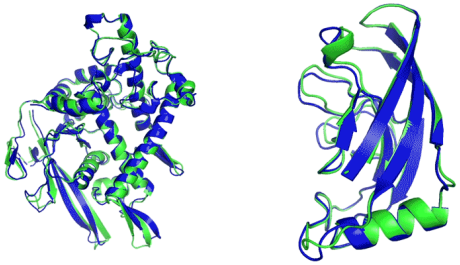
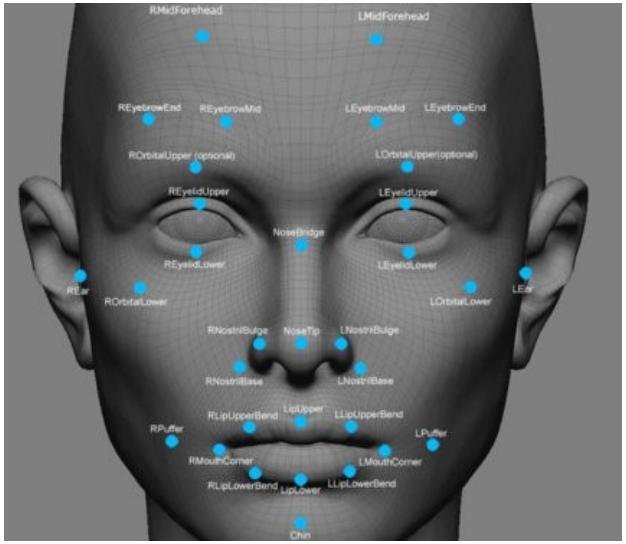
Why classify AI systems?

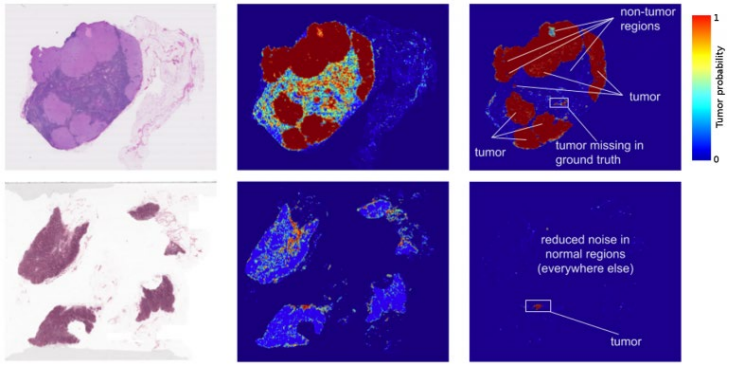


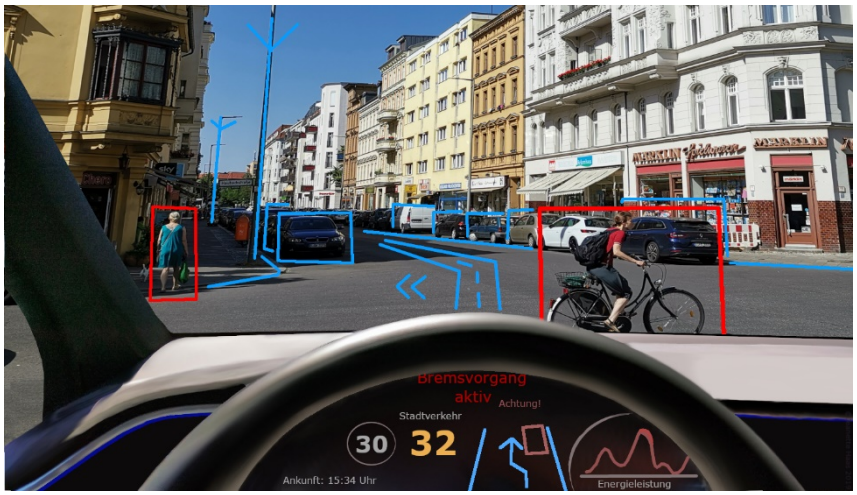
T1037 / 6vr4
90.7 GDT
(RNA polymerase domain)

T1049 / 6y4f
93.3 GDT
(adhesin tip)

Experimental result
Computational prediction







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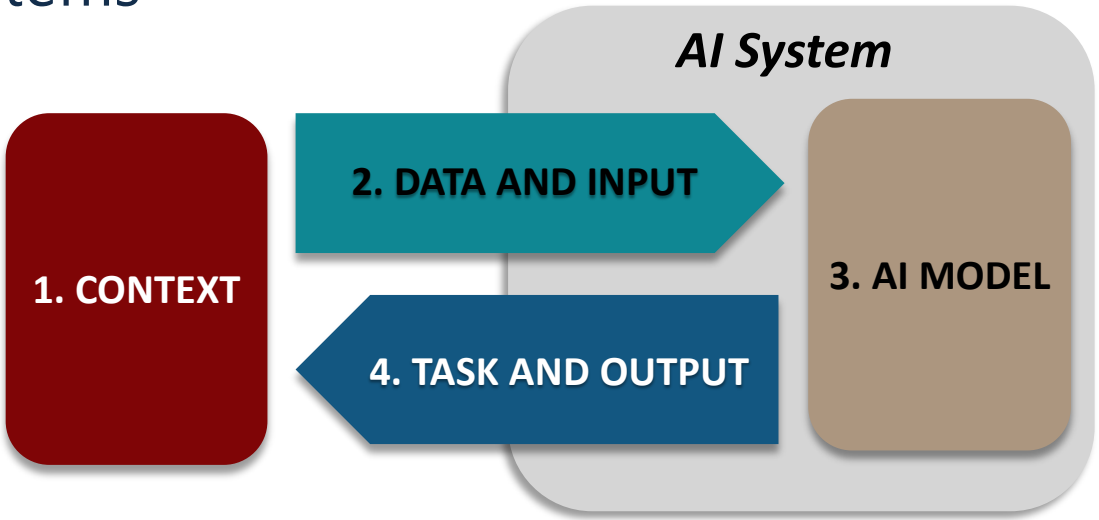
Overview of the classification framework

A user-friendly framework to navigate policy implications of different *types* of AI systems



4 key dimensions:

1. **Context**, including sector (healthcare, etc.), impact and scale
2. **Data and input**, including data collection, personal nature of data
3. **AI model (technologies)**, incl. model type and model building process
4. **Task and output**, incl. AI system's task (e.g., recognition, personalisation, etc.) and action autonomy

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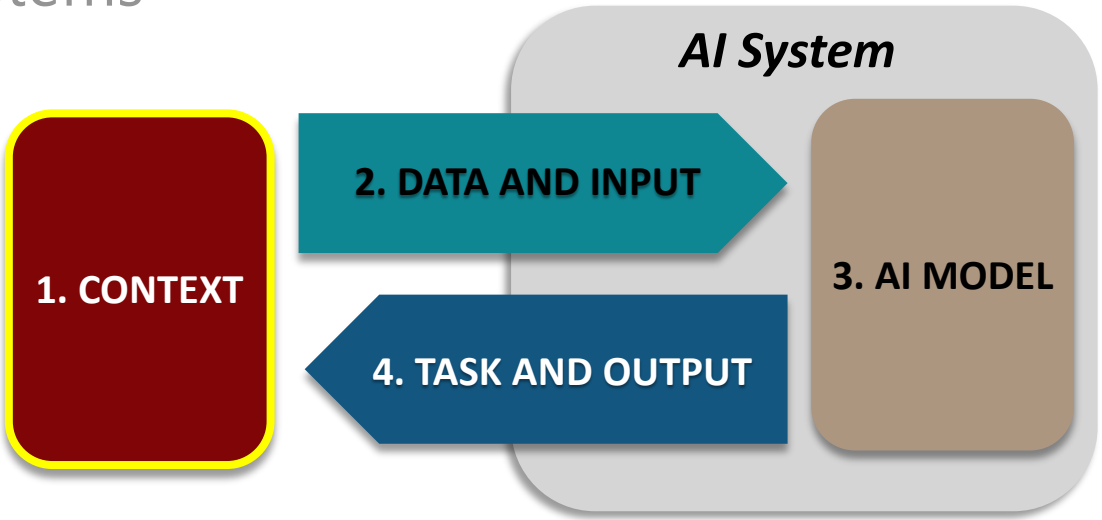
Dimension: 1) CONTEXT

A user-friendly framework to navigate policy implications of different *types* of AI systems



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Dimension: 1) CONTEXT

Properties / Attributes	Description
Industrial sector	• Using: International Standard Industrial Classification of All Economic Activities (ISIC REV 4) to identify sector and compare to cross-country data
Deployment impact / scale / impacted stakeholders	• Breadth of deployment (e.g. pilot, company level) • AI system maturity • Stakeholders impacted (e.g. workers, consumers) • For-profit or non-profit use
Benefits and risks to individual rights and well-being	• Impacts on human rights (e.g. criminal sentence) • Impact on well-being (e.g. job quality) • Low-risk contexts (e.g. restaurant recommendation)
Benefits and risks to critical functions / activities	• AI system serving in critical sector or infrastructure (e.g., energy, transport, water, health) • AI system serving critical functions in a sector
Related Consideration (To be developed)	• Users of AI system (e.g. expert vs. non-expert)

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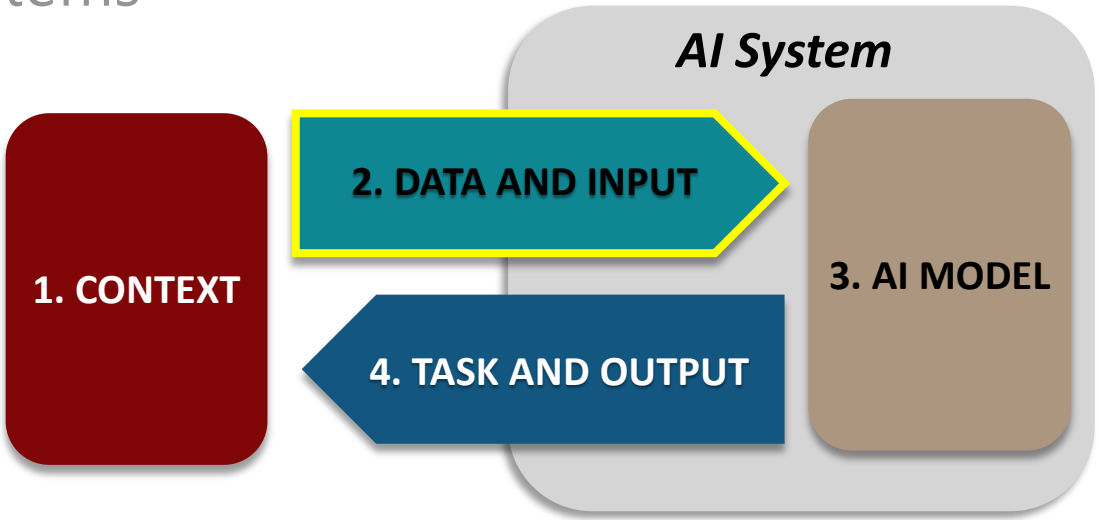
Dimension: 2) DATA AND INPUT

A user-friendly framework to navigate policy implications of different *types* of AI systems



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Dimension: 2) DATA AND INPUT

Properties / Attributes	Description
Data and input collection/origin	• Data collection (by sensing or perceiving) • Data provenance (level of awareness) • Dynamic nature of data (e.g. real-time), Scale of data set
Data and input structure	• Structure of data (e.g. structured vs. unstructured data), • Data encoding (standardised format vs. non-standardised format)
Data and input domains	• 3 domains: Proprietary data, Public data, Personal data • Taxonomy of personal data (for assessing the risk to privacy)
Data quality	• Representativeness • Adequate sample rate, Data noise, Missing values and outliers
Data qualification	• Guarantee the appropriate data as input to solve a specific problem (note: this is different from data quality)
Related Consideration (To be developed)	• Implication for privacy and fairness (e.g. sensitive data) • Implication for robustness (e.g. quantity of data vs. the number of variables in a model)

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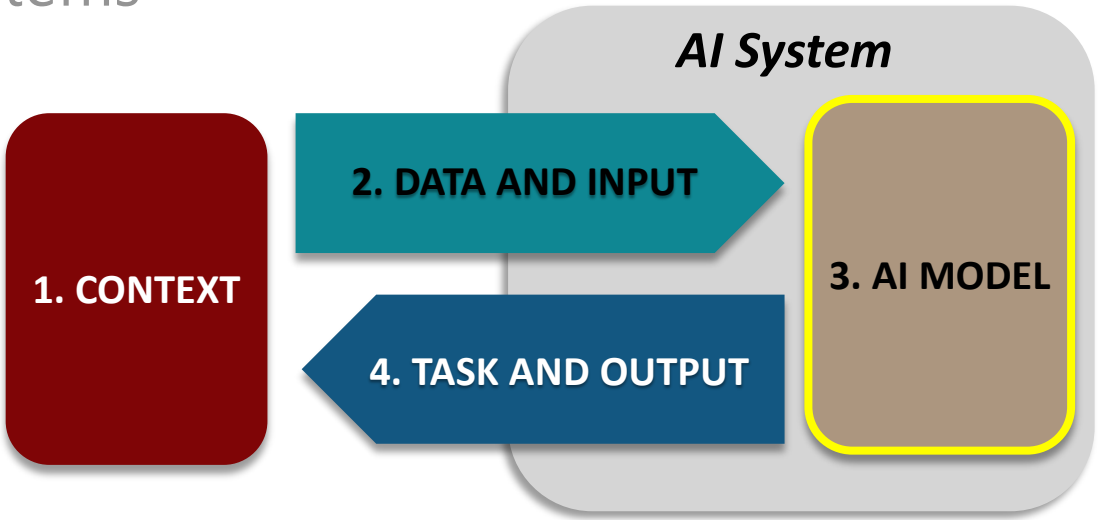
Dimension: 3) AI MODEL

A user-friendly framework to navigate policy implications of different *types* of AI systems



4 key dimensions:

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2. **Data and input**, including data collection, personal nature of data
3. **AI model (technologies)**, incl. model type and model building process
4. **Task and output**, incl. AI system's task (e.g., recognition, personalisation, etc.) and action autonomy

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Dimension: 3) AI MODEL

Properties / Attributes	Description
AI model type	• **Symbolic AI models** • **Statistical AI models** • **Hybrid AI models (majority of systems live here)**
Acquisition of capabilities / model building	• Acquisition from knowledge: symbolic AI • Acquisition from data: machine learning
Related Consideration	• **Fairness**: Choice of AI model, input datasets, and tasks all relate to downstream issues of (potential) bias. • **Accountability:** This is determined by how humans interact with the model (are they 'on the loop' or 'in the loop'). • **Robustness**: Need for mechanism to ensure the robustness of modern ML systems (e.g. adversarial defenses, fail-safe procedures, formal verification) • **Performance**: Different models have different performance characteristics

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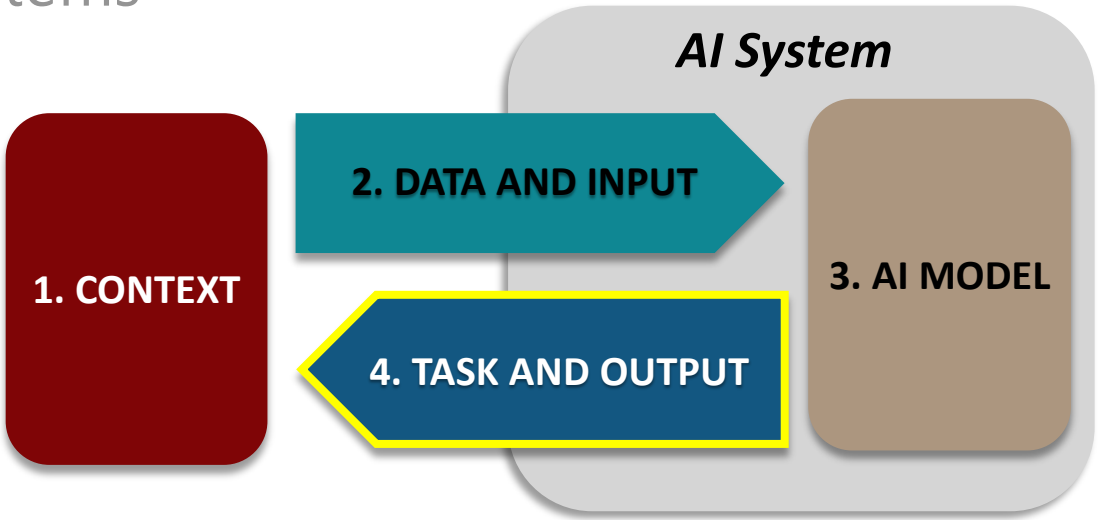
Dimension: 4) TASK AND OUTPUT

A user-friendly framework to navigate policy implications of different *types* of AI systems



4 key dimensions:

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3. **AI model (technologies)**, incl. model type and model building process
4. **Task and output**, incl. the AI system's task (e.g., recognition, personalisation, etc.) and action autonomy

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Dimension: 4) TASK AND OUTPUT

Properties / Attributes	Description
Task of the system	• Recognition, Event detection, Forecasting, Personalisation, Interaction support, Goal-driven optimization, Reasoning with knowledge structures
Action of the system (autonomy level)	• High autonomy (**human-out-of-the-loop**) • Medium autonomy (**human-on-the-loop**) • Low autonomy (**human-in-the-loop**)
Combining tasks and actions into composite systems	Specific policy consideration for: • Autonomous systems (e.g. driverless vehicle) • Control systems (e.g. robotics and factories) • Content generation (e.g. misinformation, deep fake)
Related Consideration (To be developed)	• Robustness and security (e.g. expected performance and reliability information) • System operator (e.g. role of evaluator) • Degree of automation (e.g. job displacement)

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***Disclaimer** : the following slides use existing commercial products for purely theoretical purposes. The OECD classification framework has not coordinated with these products' owners. As a result, there may be inaccuracies based on the authors' read of the publicly accessible materials.*

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Next: Putting the framework in practice

1

Sector of deployment
(e.g., Transportation and storage, human health and social work activities, Education)

Critical function
(e.g., health, safety, and security of citizens; essential economic and societal services)

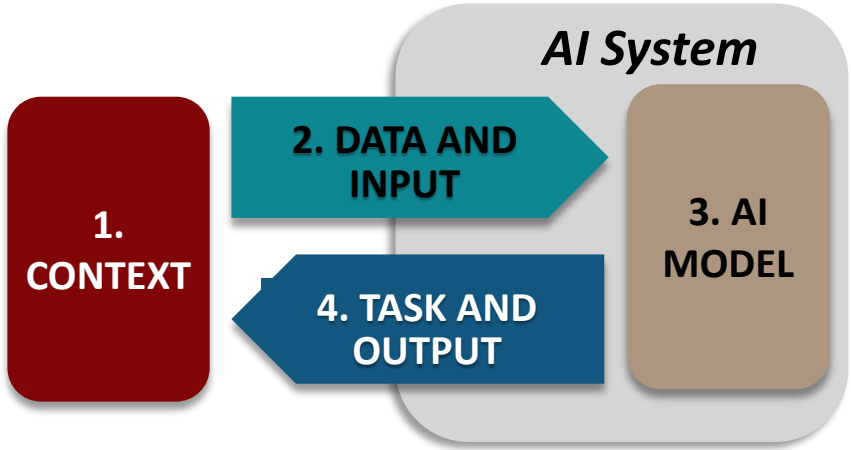
System users
(e.g., AI-expert vs. non-AI expert user)

2

Data collection
(e.g., humans, automated, system experience)

Data domain
(e.g., proprietary, public, personal)

Data structure
(e.g. structured, semi-structured, unstructured)



3

Acquisition of capabilities
(e.g., learn from people vs. provided data vs. system experience)

AI model type
(e.g. supervised, probabilistic, symbolic)

4

System task
(e.g., recognition, personalization, goal-driven optimization)

Level of action autonomy
(e.g., high (human out-of-the-loop), medium (human on-the-loop), low (human-in-the-loop)

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Applying the Framework to sustainable development

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Applying the Framework to sustainable development

Development practitioners need a decision-making framework to determine whether systems can effectively support development objectives in order to invest.

This framework, **when used responsibly**, can help in

- Mapping **value propositions of AI systems to development outputs**.
- Reflect on potential **challenges and risks** (in design, implementation, impacts)
- Improving regulation, tech policy and **impact**.

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AI in sustainable development

Sector of deployment
Education

1

Critical function
No

System users
Non AI expert amateur (students)

Data collection
Collected by humans and automated tools

2

Data domain
Personal

Data structure
Structured

Acquisition of capabilities
From data

3

AI model type
Generative, semi-supervised, non-probabilistic

4

System task
Personalization, interaction support

Level of action autonomy
Medium – provides recommendation for human decision execution

Example ID

Name: M-Shule

Link: here

Short description: Delivers personalized lessons via SMS based on curriculum standards and student skills and abilities. Tracks and analyses performance to provide recommendations.

Lessons & activities adapted from the local curriculum…

…tailored in an adaptive learning engine…

…engaged with through an SMS interface.

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AI in hiring processes

1

Sector of deployment
Administrative and support service activities

Critical function
No

System users
Amateur (job candidate and HR personnel)

2

Data collection
Collected by automated tools

Data domain
Proprietary, proprietary personal

Data structure
Unstructured

3

Acquisition of capabilities
From data

AI model type
Discriminative, semi-supervised, probabilistic

4

System task
Personalization, interaction support, recognition

Level of action autonomy
Medium – provides recommendation for human decision execution

Example ID

Name: myInterview

Link: here

Short description: conducts smart video interviews, picking questions based on company needs, and scans all interview videos to create curated interview “playlists" for companies to review.

AI in manufacturing

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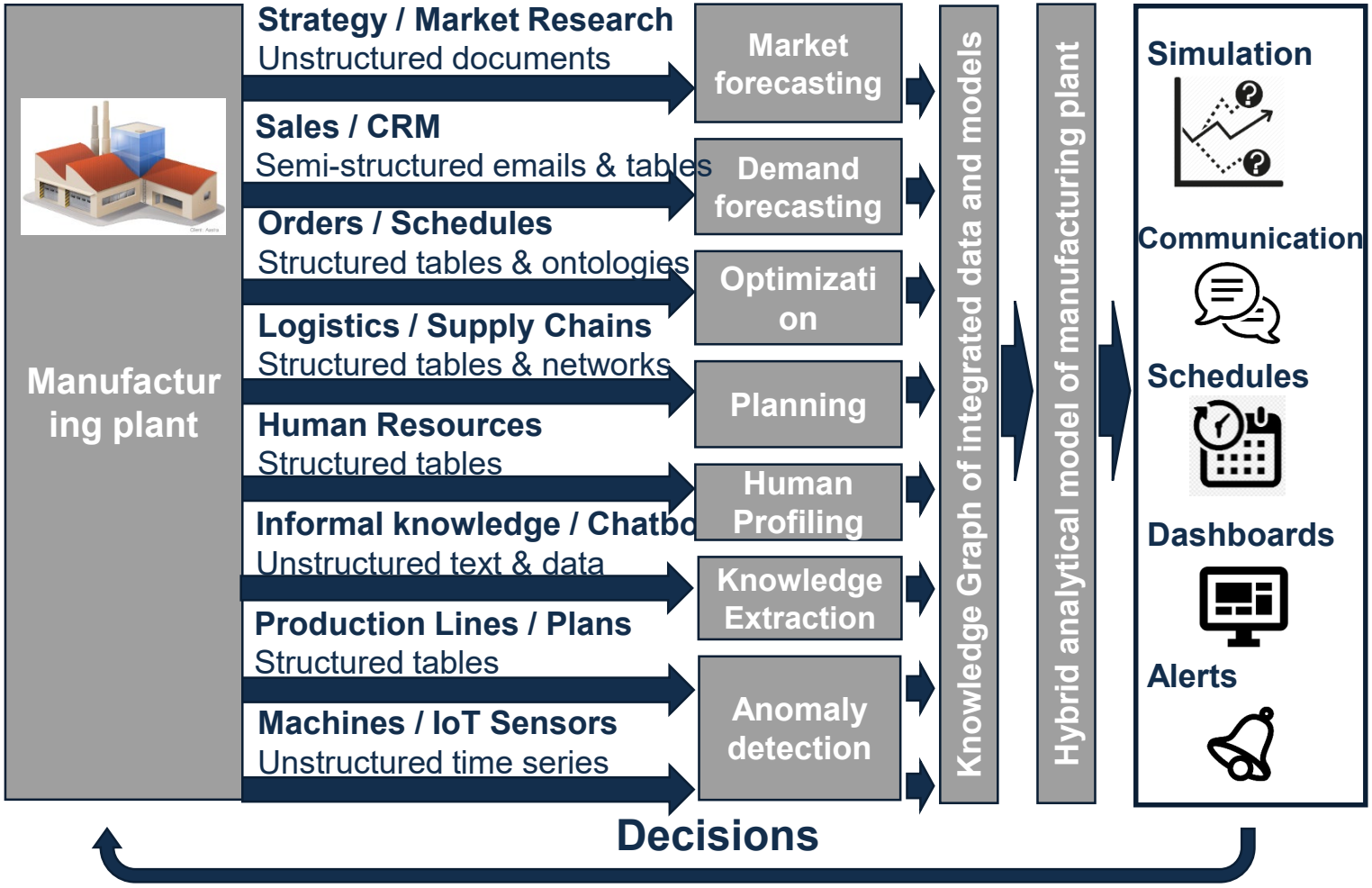
Framework Dimensions: 1. Context | 2. Data & Input | 3. AI Model | 4. Output

Manufacturing plant example structured using OECD AI Classification Framework



Example taken from Qlector.com LEAP system

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AI in critical sector applications

1

Sector of deployment
Public administration and defense

Critical function
Yes

System users
Practitioner who is not an AI expert (police)

2

Data collection
Collected by automated tools

Data domain
Public

Data structure
Semi-structured

3

Acquisition of capabilities
From data augmented by human-encoded knowledge

AI model type
Hybrid model

4

System task
Recognition

Level of action autonomy
Medium - provides a prediction for human decision execution.

Example ID

Name: ShotSpotter

Link: here

Short description: ShotSpotter is a technology deployed in 85 cities which uses a combination of acoustic microphones and software to automatically listen for gunfire and, if it thinks it has heard gunfire.

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AI applied to criminal justice

Sector of deployment
Public administration and defense

1

Critical function
Yes

System users
Practitioner who is not an AI expert (justice professionals)

Data collection
Collected from human inputs

2

Data domain
Personal

Data structure
Structured

Acquisition of capabilities
From data and human–encoded knowledge

3

AI model type
Generative, supervised learning, non-probabilistic

System task
Forecasting, recognition

4

Level of action autonomy
Medium - provides a prediction for human decision execution.

Example ID

Name: ML algorithms for predicting juvenile recidivism

Link: here

Short description: Tool that generates risk assessments based on information on defendant demographics and criminal history.

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Applying the framework to assess labour market impacts

- **Using the framework as a single reference point for all stakeholders**, policymakers: policy considerations, businesses: AI-related business decisions.

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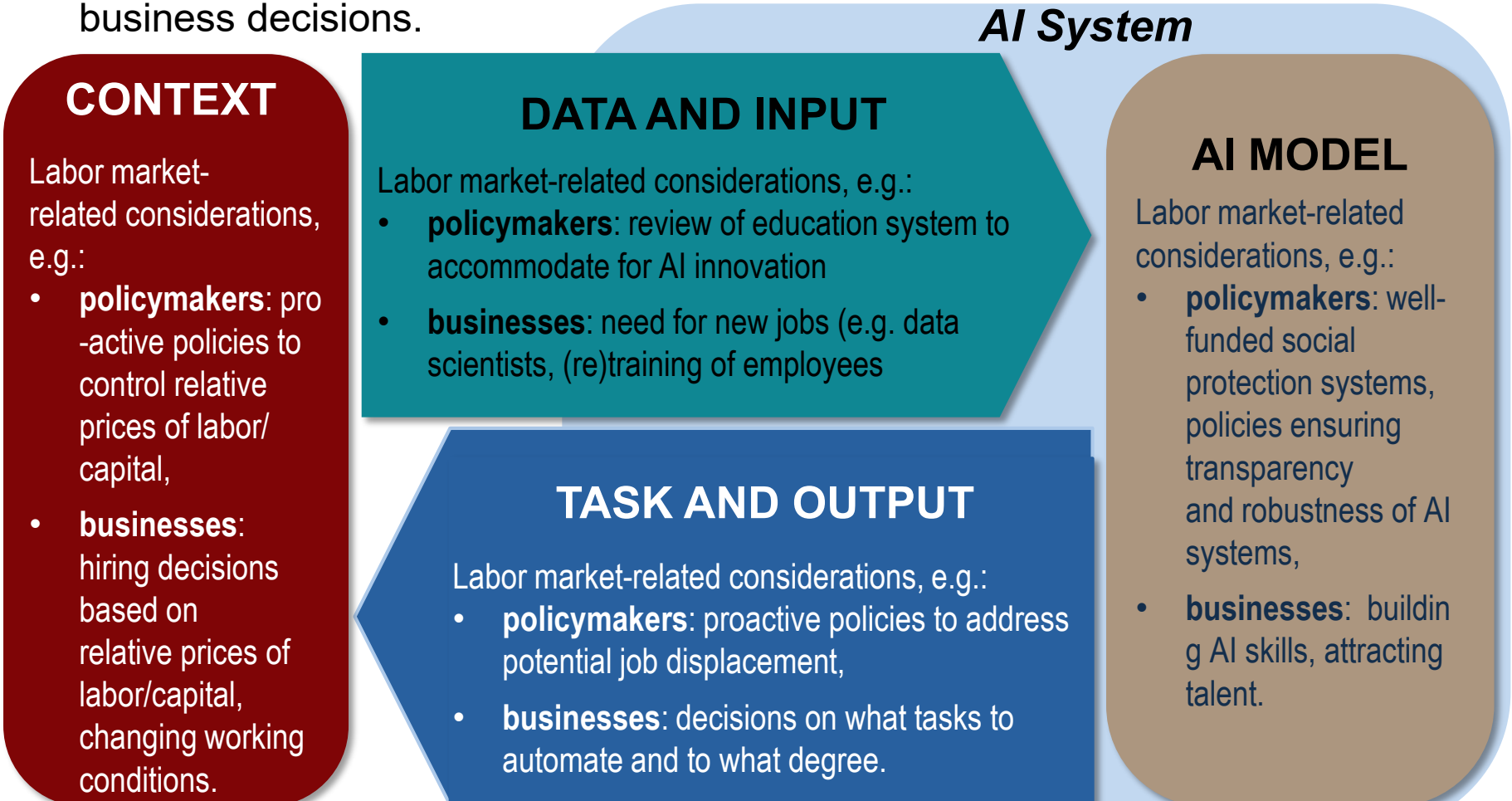
Applying the framework to assess labour market impacts

- Using the framework as a single reference point for all stakeholders, policymakers: policy considerations, businesses: AI-related business decisions.



Applying the framework to assess labour market impacts

- **Key issue**: Controlling technological innovation's impact in imperfect markets

Applying the framework to assess labour market impacts

➢ **Key issue**: Controlling technological innovation's impact in imperfect markets

- **AI is the latest wave of innovation so history can help**:
  - as a general-purpose technology, AI threatens (aspects of) jobs in all segments of economy,
  - it is difficult to anticipate impacts due to **differences to previous waves of innovation.**

Applying the framework to assess labour market impacts

➢ **Key issue**: Controlling technological innovation's impact in imperfect markets

- **AI is the latest wave of innovation so history can help**:
  - as a general-purpose technology, AI threatens (aspects of) jobs in all segments of economy,
  - It is difficult to anticipate impacts due to **differences** to previous waves of innovation.
- **Much depends on how we control AI innovation:**
  - in perfectly competitive markets innovation would make everyone better off (Pareto-improving).
  - but markets imperfect and structured by regulation,
  - market-structuring, regulations and market imperfections crucially determine the benefit society derives from innovation
  - Pareto-improving innovation is only possible with **redistributive regulation** (otherwise inequality rises/welfare decreases and AI will only amplify those effects).

Applying the framework to assess labour market impacts

➢ **Key issue**: Controlling technological innovation's impact in imperfect markets

- **Economy and market-structuring regulation form an interconnected system:**
  - ex post redistribution/piecemeal regulatory approaches merely symptomatic/futile treatment,
  - may even upset economic balance.

Applying the framework to assess labour market impacts

➢ **Key issue**: Controlling technological innovation's impact in imperfect markets

- **Economy and market-structuring regulation form an interconnected system:**
  - ex post redistribution/piecemeal regulatory approaches merely symptomatic/futile treatment,
  - may even upset economic balance.

➢ **A truly efficient solution only by systematic revamp of entire system of rules structuring economy:**

- tax policies, competition laws, IPR, financial regulation,
- corporate governance, international trade, monetary policy,
- labor market-related rules, structural discrimination,
- globalization, innovation, demographics, climate change...

Applying the framework to assess labour market impacts

➢ **Key issue**: Controlling technological innovation's impact in imperfect markets

- **Globalization poses extra challenge:** only **internationally coordinated** regulatory efforts efficient (domestic approaches may create inefficiencies/conflicts).

Applying the framework to assess labour market impacts

➢ **Key issue**: Controlling technological innovation's impact in imperfect markets

- **Globalization poses extra challenge:** only **internationally coordinated** regulatory efforts efficient (domestic approaches may create inefficiencies/conflicts).

➢ AI **classification framework** could serve as **common benchmark** helping international/multi-stakeholder **coordination.**

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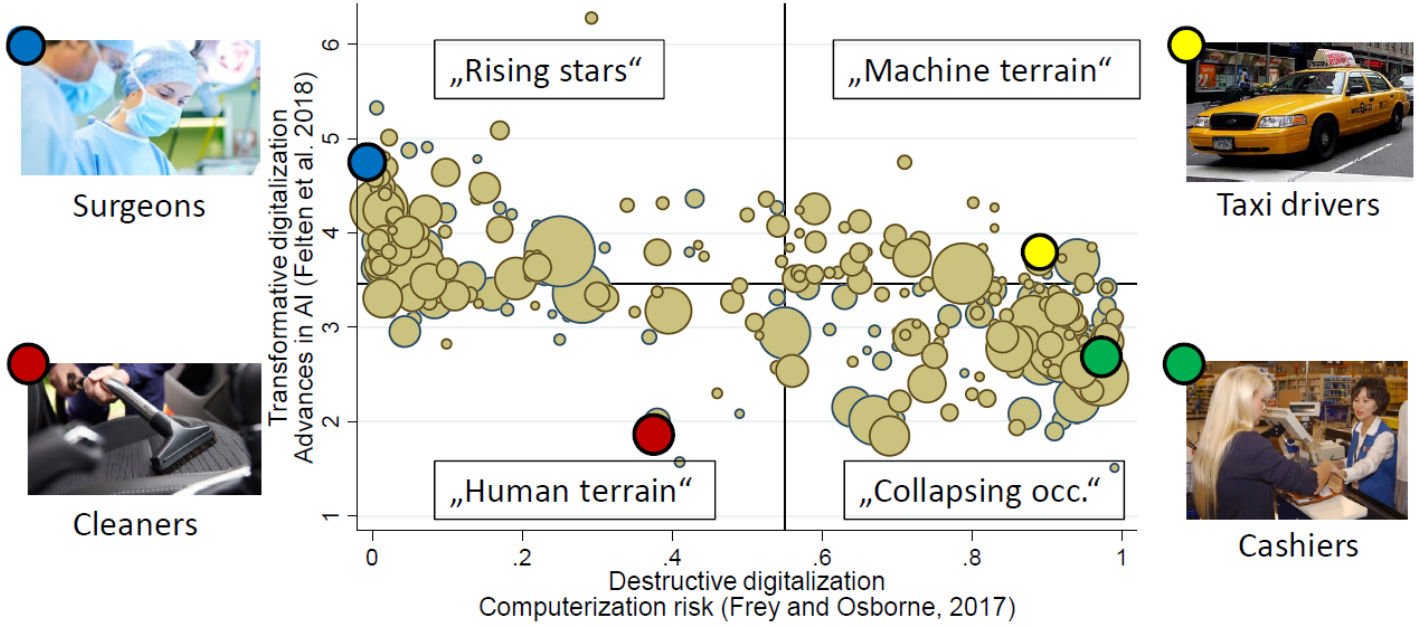
Another framework for classifying AI according to labour market impact

What?	A **framework** for classifying AI according to labour market impact
Why?	To delve deeper into the likely impact of AI on **labour market outcomes:** wages, employment, the work environment, inclusiveness...
For whom?	Policymakers, businesses, unions, workers, researchers...
By whom?	Researchers in the OECD Directorate for Employment, Labour and Social Affairs

Destructive and Transformative Effects of AI on Jobs



Source: based on Fossen and Sorgner (2019)

How is it related to the AI Systems Classification Framework?

- Matching AI System's tasks with job-specific tasks (e.g. image recognition, event prediction)
- AI System's level of autonomy may create destructive effects (depends on the relevance of the task in a job).
- Effects of AI on labour markets may depend on the context (e.g., industry, region, formal institutions)

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THANK YOU

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- The OECD programme on Work, Innovation, Productivity & Skills: oecd.ai/wips
- The AI Wonk blog: oecd.ai/wonk
- Network of Experts: oecd.ai/network-of-experts
- Trends and data: oecd.ai/trends-and-data
- Latest research in AI policy: oecd.ai/policy-areas
- Database of country AI initiatives: oecd.ai/dashboards