Informatics and Information Technologies 2023

Student Research Conference
PwC Slovakia, Karsten Hegel
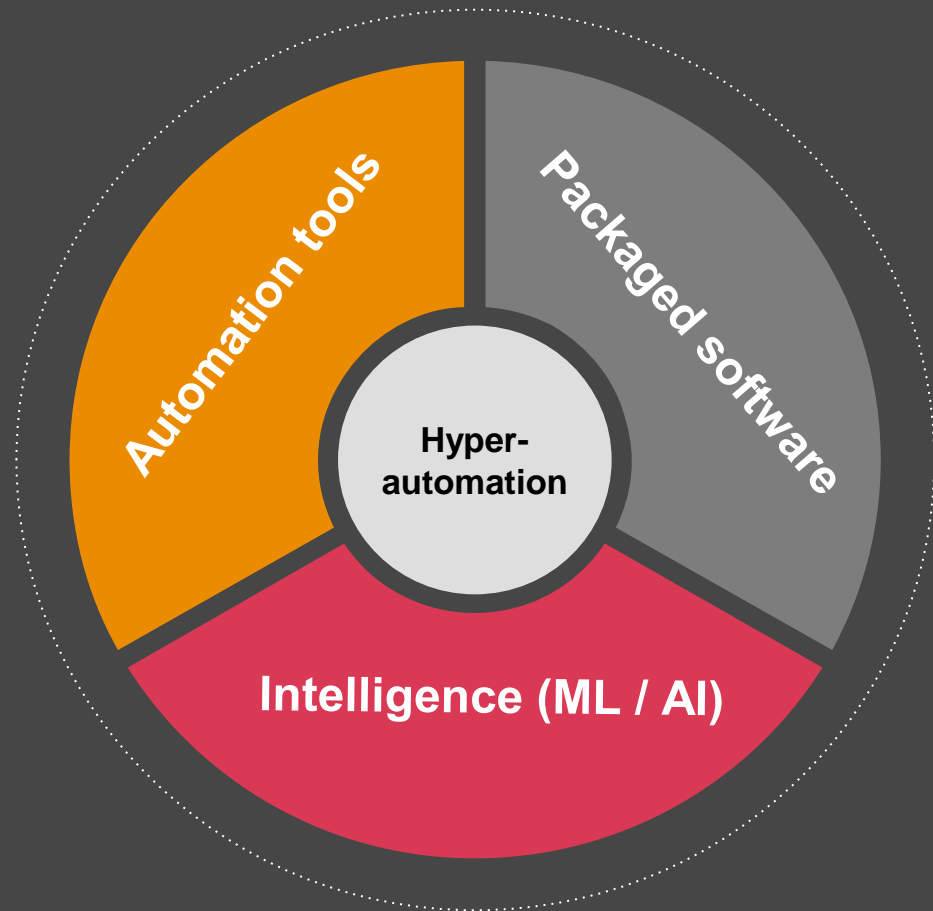
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Summary

Hyperautomation

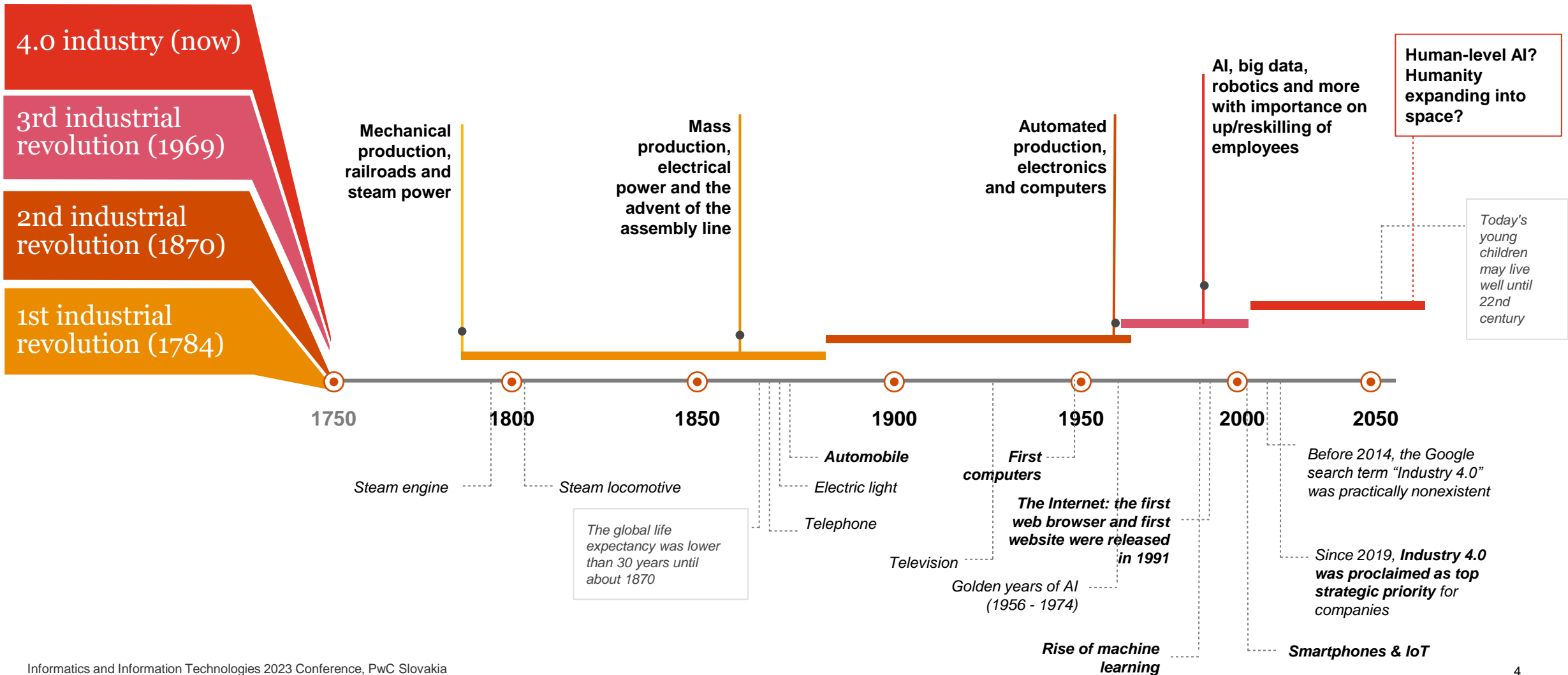**Evolution of BPA & AI**

Computer vision & remote sensing

Hyperautomation

PwC

Evolutionary reminder - from the first industrial revolution to 4.0 industry

4.0 industry (now)

3rd industrial revolution (1969)

2nd industrial revolution (1870)

1st industrial revolution (1784)

Mechanical production, railroads and steam power

Mass production, electrical power and the advent of the assembly line

Automated production, electronics and computers

AI, big data, robotics and more with importance on up/reskilling of employees

Human-level AI? Humanity expanding into space?

Today's young children may live well until 22nd century

1750   1800   1850   1900   1950   2000   2050

Steam engine

Steam locomotive

The global life expectancy was lower than 30 years until about 1870

Automobile

Electric light

Telephone

First computers

Television

Golden years of AI (1956 - 1974)

The Internet: the first web browser and first website were released in 1991

Before 2014, the Google search term "Industry 4.0" was practically nonexistent

*Since 2019, **Industry 4.0 was proclaimed as top strategic priority** for companies*

Rise of machine learning

Smartphones & IoT

Hyperautomation - automation reimagined, work redefined

Hyperautomation is a **business-driven, disciplined approach** that organizations use to rapidly identify, vet and **automate as many business and IT processes as possible**.

It **combines multiple technologies**, tools or platforms, including:

- Artificial Intelligence (AI),
- Machine learning (ML),
- Robotic process automation (RPA),
- Business process management (BPM) and intelligent business process management suites (iBPMS),
- Integration platform as a service (iPaaS),
- Low-code/no-code tools,
- Packaged software.

One of the key differentiators of hyperautomation is its **ability to loop humans into the process**.

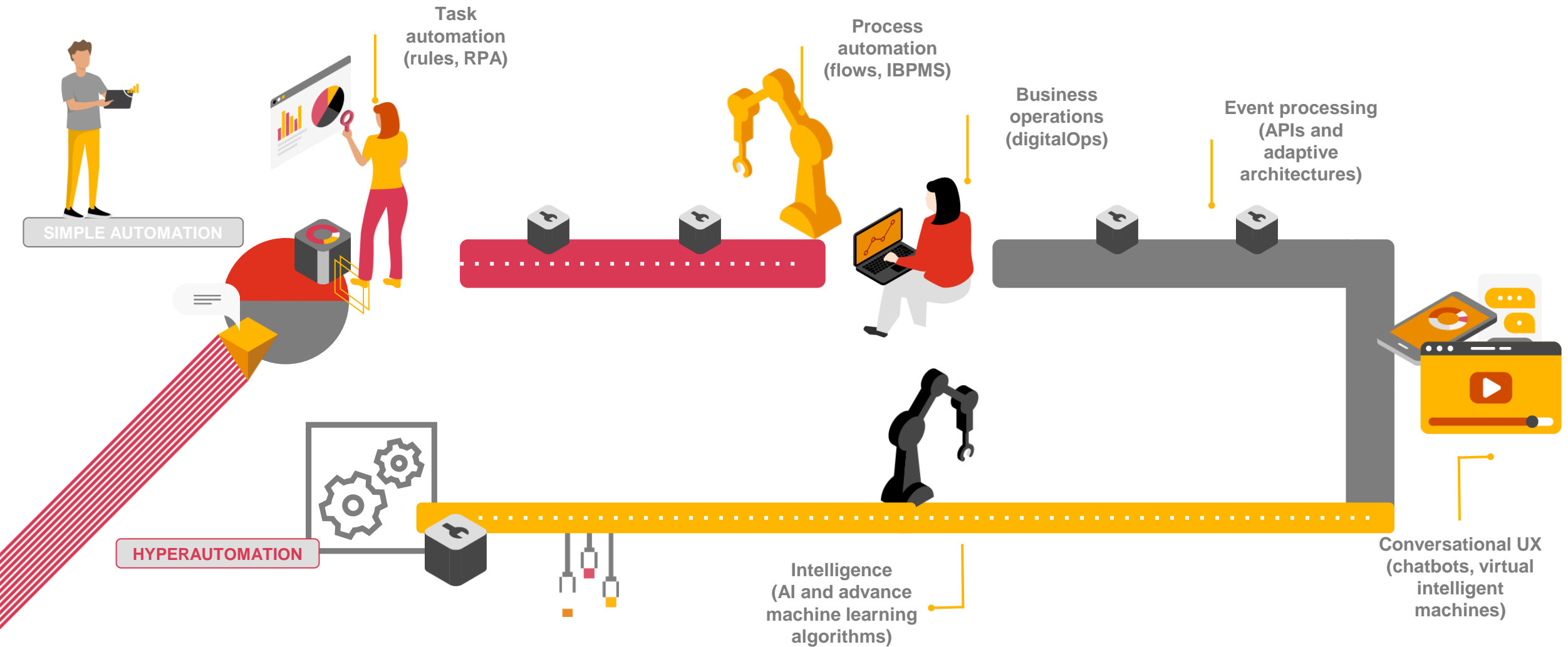# Hyperautomation usually consists of 3 main building blocks driving the ROI and further value in automation.
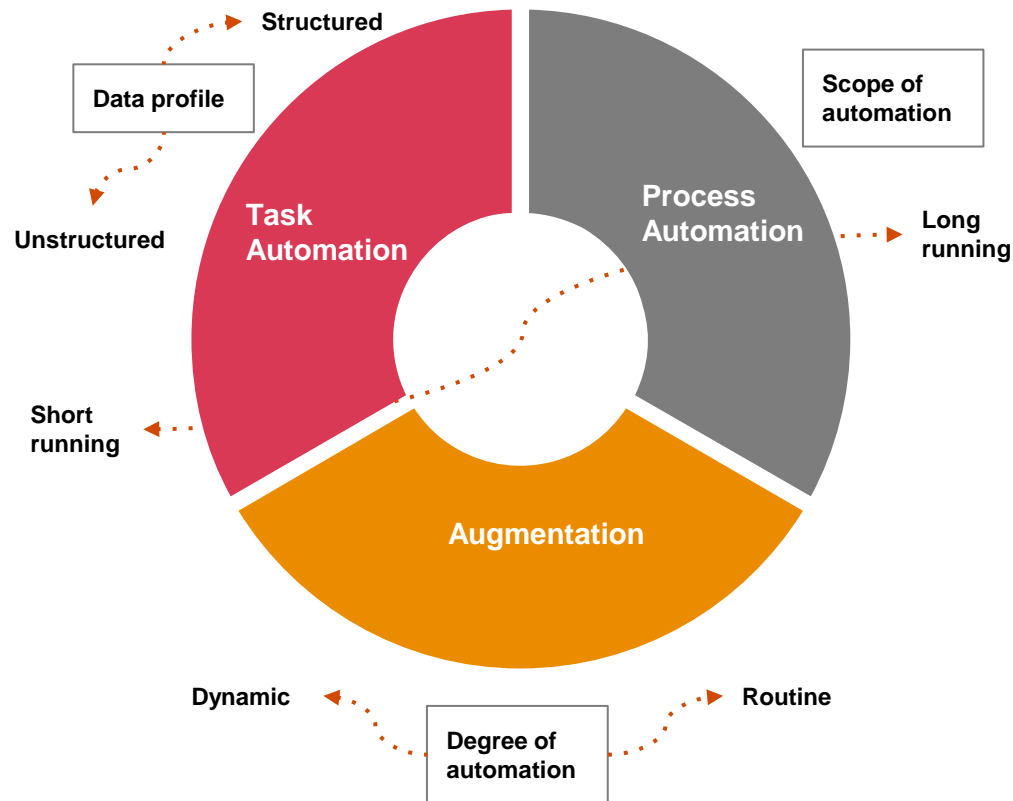
To drill down for the specific requirements and business use case, it is necessary to align the hyperautomation within 3 main categories:

- Task automation. Deliver quick benefits by automating short-running, routine tasks.

- Process automation. Deliver higher business value by orchestrating and automating long-running processes.

- Augmentation. Empower knowledge workers with intelligent capabilities and enable self-service for business technologists and customers.
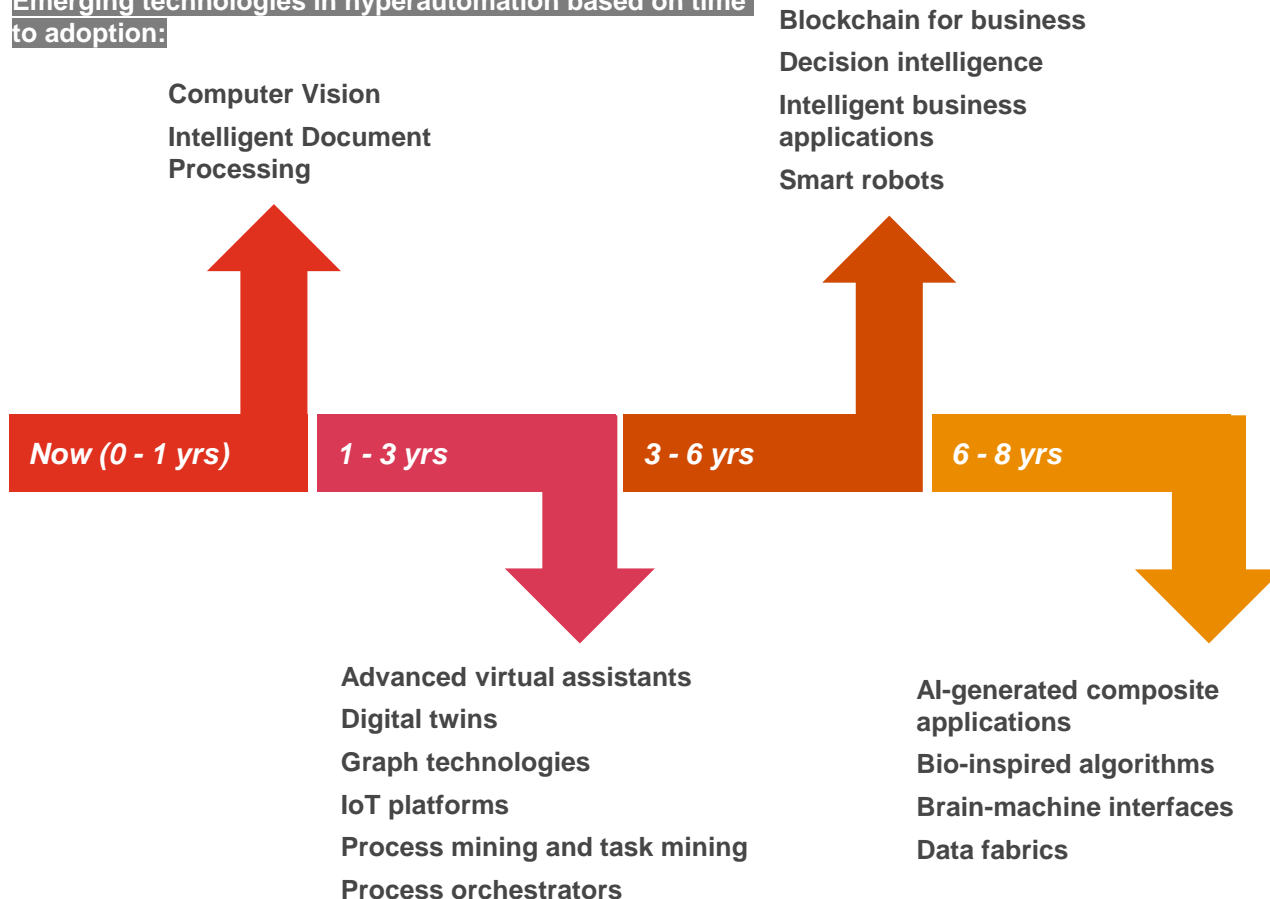
Detailed visibility to the business process is critical in determining the business case for its implementation. Hence, the challenge lies in **determining of the processes that need automation**. This can drive ROI and carry further value in automation.

The road to hyperautomation consists of several automation and process steps.

Task automation (rules, RPA)

Process automation (flows, IBPMS)

Business operations (digitalOps)

Event processing (APIs and adaptive architectures)

SIMPLE AUTOMATION

HYPERAUTOMATION

Intelligence (AI and advance machine learning algorithms)

Conversational UX (chatbots, virtual intelligent machines)

The emerging technologies in hyperautomation are being predicted for next 10 years with estimating the business value.

Computer Vision

Intelligent Document Processing

Blockchain for business

Decision intelligence

Intelligent business applications

Smart robots

| Now (0 - 1 yrs) | 1 - 3 yrs | 3 - 6 yrs | 6 - 8 yrs |

Advanced virtual assistants

Digital twins

Graph technologies

IoT platforms

Process mining and task mining

Process orchestrators

AI-generated composite applications

Bio-inspired algorithms

Brain-machine interfaces

Data fabrics

Common use cases for hyperautomation are found in **most front-, middle- and back-office processes**, predominantly customer onboarding, order taking, payments, returns and customer data updates, all of which are typically highly manual and feature multiple systems.

Hyperautomation can be used in sectors or industries where **businesses want to reduce manual and repetitive activities to boost productivity** and the bottom line. It has the potential to change business processes and results in better customer service, increased efficiency, and cost savings in a variety of industries.
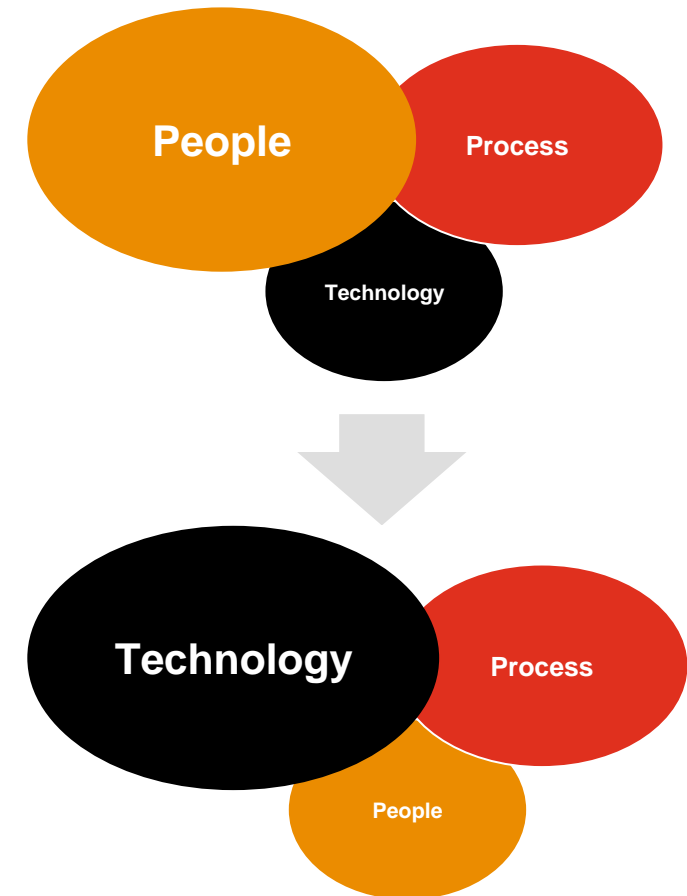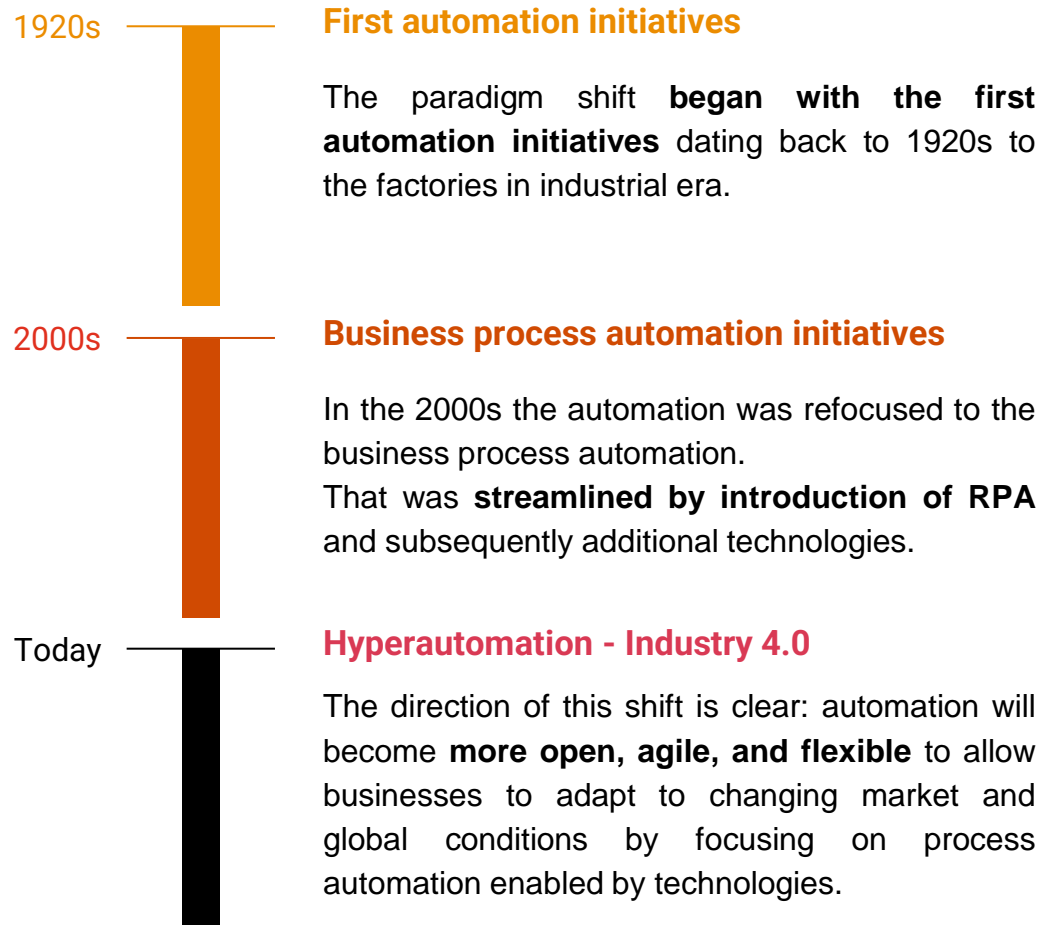
Further advantages are as well:

- No manual intervention, unless flagged
- Faster turnaround time
- Reduced cost of data processing
- Highly accurate
- Easy to deploy & run

Paradigm shift from people to technology is a constant process from 1920's to now.

A paradigm shift is a fundamental change in the basic concepts and practices of any discipline.

1920s — **First automation initiatives**

The paradigm shift **began with the first automation initiatives** dating back to 1920s to the factories in industrial era.

2000s — **Business process automation initiatives**

In the 2000s the automation was refocused to the business process automation.
That was **streamlined by introduction of RPA** and subsequently additional technologies.

Today — **Hyperautomation - Industry 4.0**

The direction of this shift is clear: automation will become **more open, agile, and flexible** to allow businesses to adapt to changing market and global conditions by focusing on process automation enabled by technologies.

People

Process

Technology

Technology

Process

People

Evolution of BPM & AI

Task automation (low complexity)

Knowledge augmentation (high complexity)

RPA

- Rule-based decision
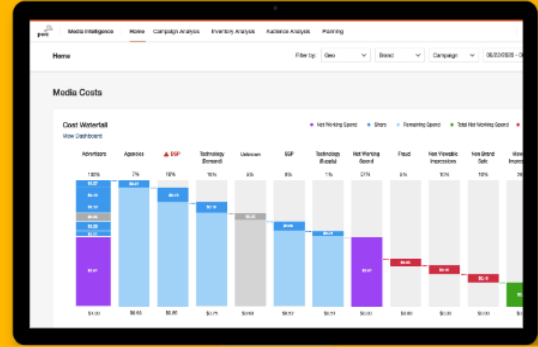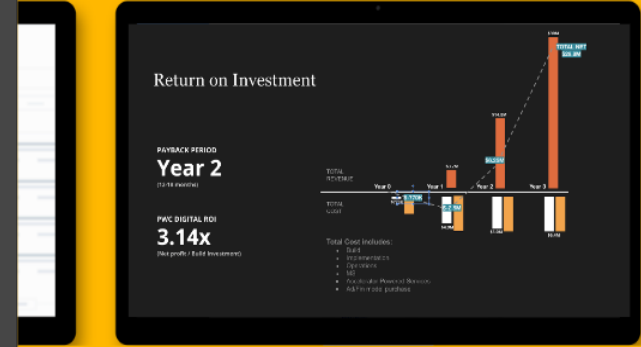- Task-oriented automation
- Operational within existing processes

BPA

- Automates entire business processes
- More complex and time consuming
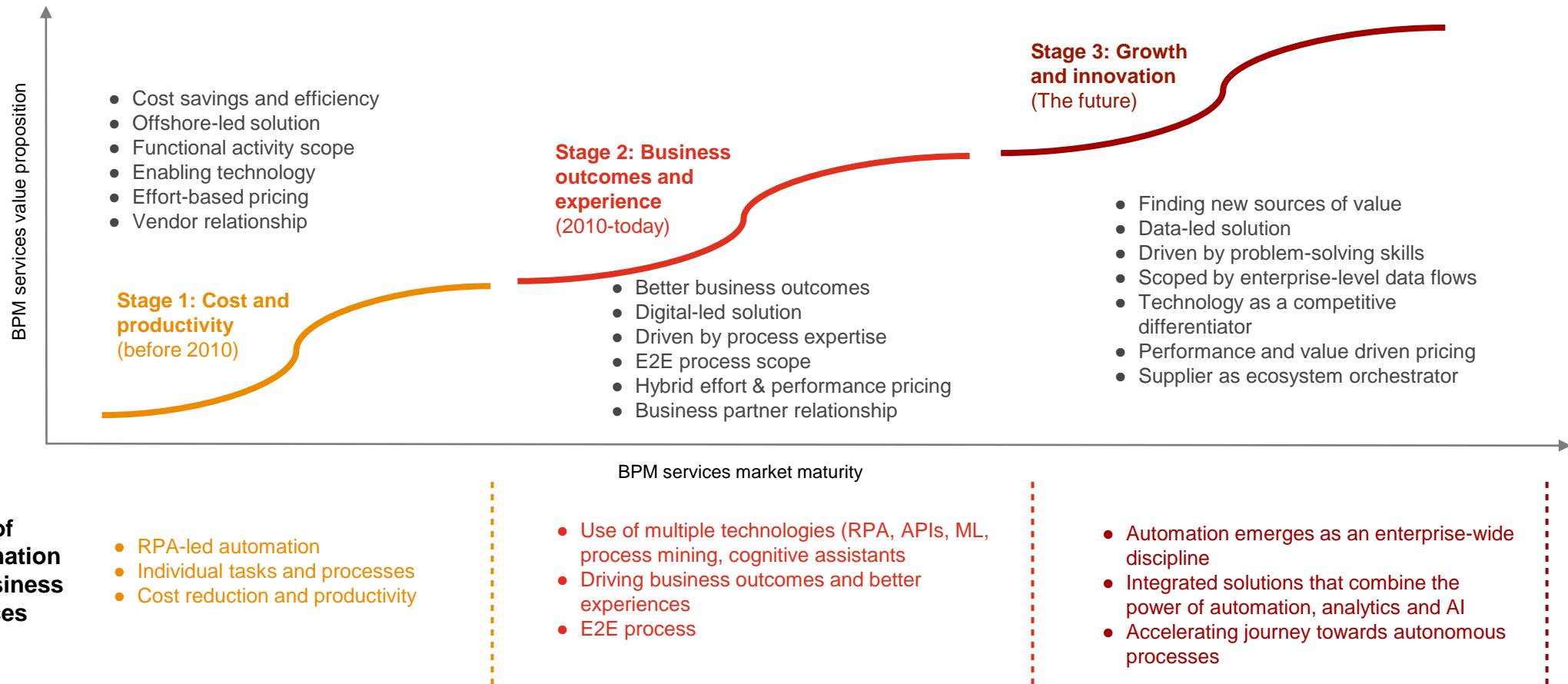- Analytical thought for end-to-end automation

AI

- Minimal human intervention
- Uses deductive analytics and reasoning
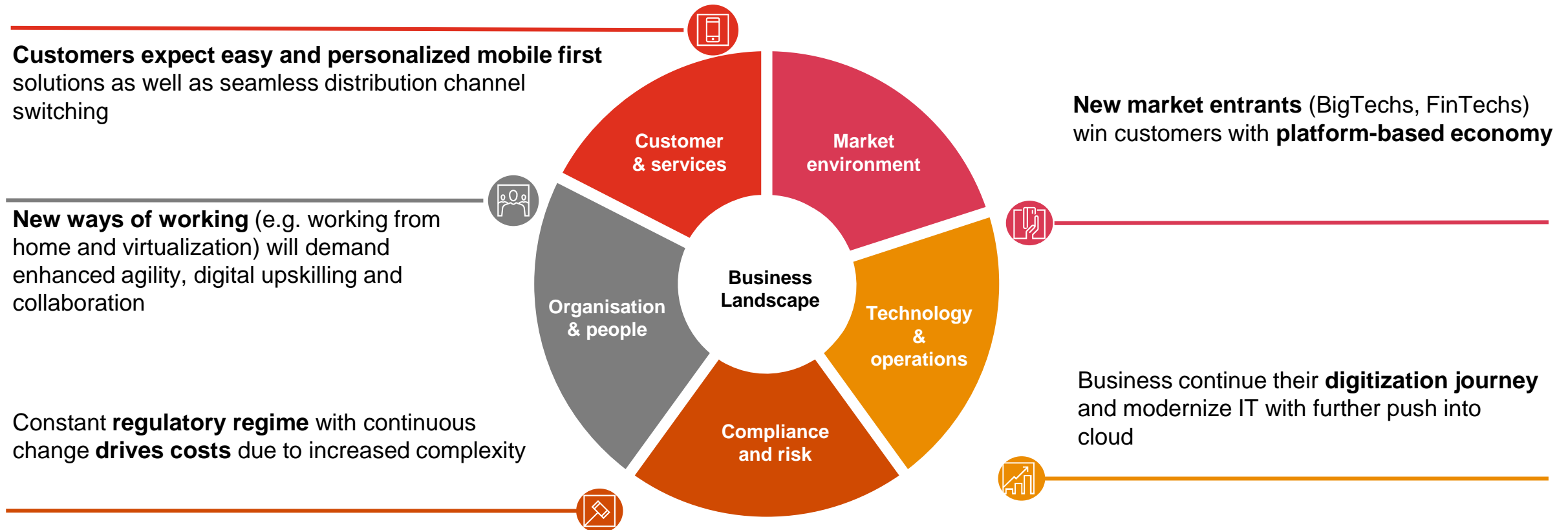- Self-learning and adaptive
- Data-driven decision making

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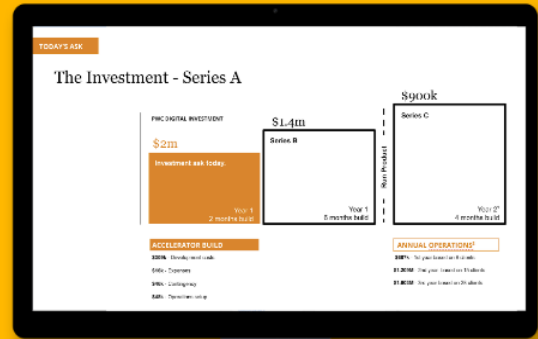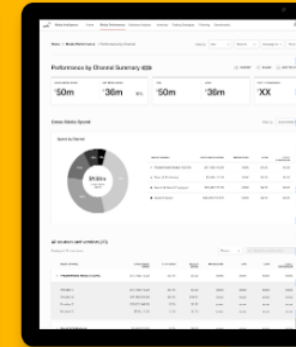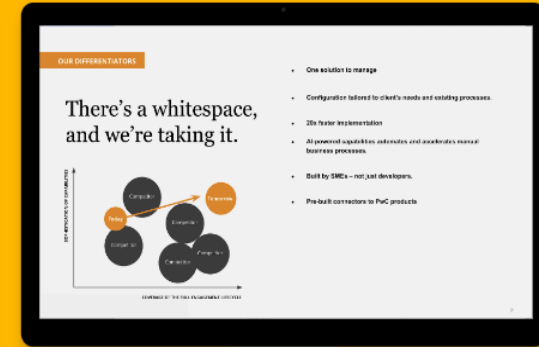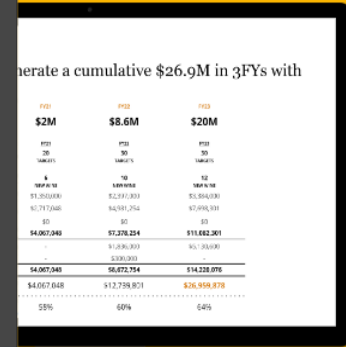
Evolution of BPM & AI is continuing in accordance to BPM market maturity increase.

The rise of Robotic Process Automation (RPA) in the early 2000s, changed the way enterprises processed structured data, and this enabled a range of automated processes thanks to rule-based automation.

BPM services value proposition →

Stage 3: Growth and innovation
(The future)

- Cost savings and efficiency
- Offshore-led solution
- Functional activity scope
- Enabling technology
- Effort-based pricing
- Vendor relationship

Stage 2: Business outcomes and experience
(2010-today)

- Finding new sources of value
- Data-led solution
- Driven by problem-solving skills
- Scoped by enterprise-level data flows
- Technology as a competitive differentiator
- Performance and value driven pricing
- Supplier as ecosystem orchestrator

Stage 1: Cost and productivity
(before 2010)

- Better business outcomes
- Digital-led solution
- Driven by process expertise
- E2E process scope
- Hybrid effort & performance pricing
- Business partner relationship

BPM services market maturity →

Role of automation in business services

- RPA-led automation
- Individual tasks and processes
- Cost reduction and productivity

- Use of multiple technologies (RPA, APIs, ML, process mining, cognitive assistants)
- Driving business outcomes and better experiences
- E2E process

- Automation emerges as an enterprise-wide discipline
- Integrated solutions that combine the power of automation, analytics and AI
- Accelerating journey towards autonomous processes

In the last decade, the business landscape has dramatically changed - adaptation to fast change will be crucial.

Customers expect easy and personalized mobile first solutions as well as seamless distribution channel switching

New ways of working (e.g. working from home and virtualization) will demand enhanced agility, digital upskilling and collaboration

Constant **regulatory regime** with continuous change **drives costs** due to increased complexity

New market entrants (BigTechs, FinTechs) win customers with **platform-based economy**

Business continue their **digitization journey** and modernize IT with further push into cloud

Customer & services

Market environment

Organisation & people

Business Landscape

Technology & operations

Compliance and risk

At PwC Slovakia, we deploy intelligent automation in various areas

Computer vision & Remote sensing

Low code tools

Natural Language Processing

AI Analytics for Financial Sector

Web applications development

Data extraction & document processing

PwC

Where the BPM fits into the architecture

BPM layer is optimising the connectivity and business processes across the enterprise.
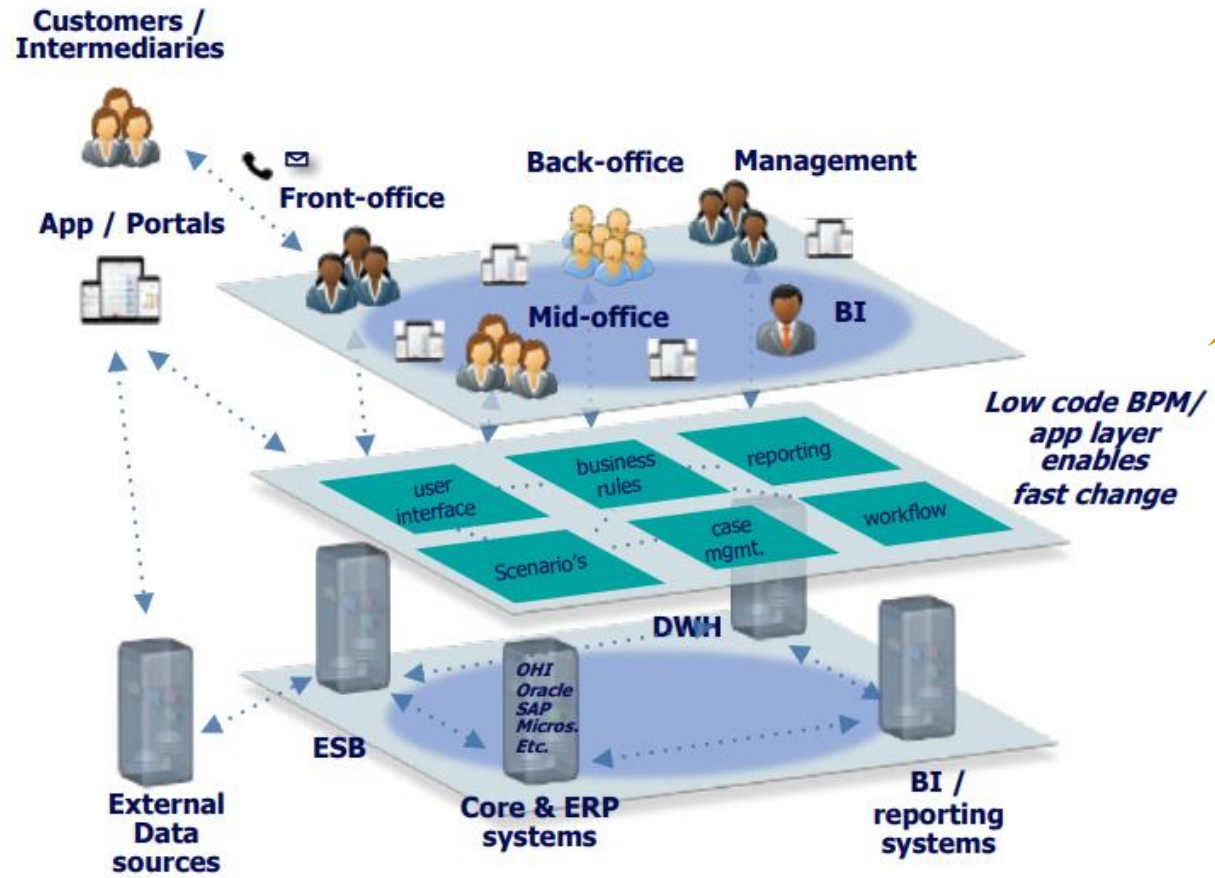
BPM Layer provides the digital canvass across existing data and applications

Low-code platforms technologies solve various challenges

Process Inefficiencies

Slow manual processes with delays errors and high costs

No standard process

Lack of a standardised set of process steps and activities

Data everywhere

Data held in different systems and not aggregated

Activities managed via email

Plethora of emails, templates, and phone calls

Myriad of systems

No single collaboration platform

No Visibility of process

Lack of visibility of stages or end to end process

No view on status

No target dates, status notifications or alerts

Various versions of the truth

Different versions of documents, checklists etc

Low-code platform technologies are used in various cases - from creating new enterprise applications, extending current systems with new processes, to unifying existing applications and data (including AI and Robotics). All with one target - scale up the businesses.

The transformation and the streamlining of the business processes is evident in reducing the complexity.

Before

After
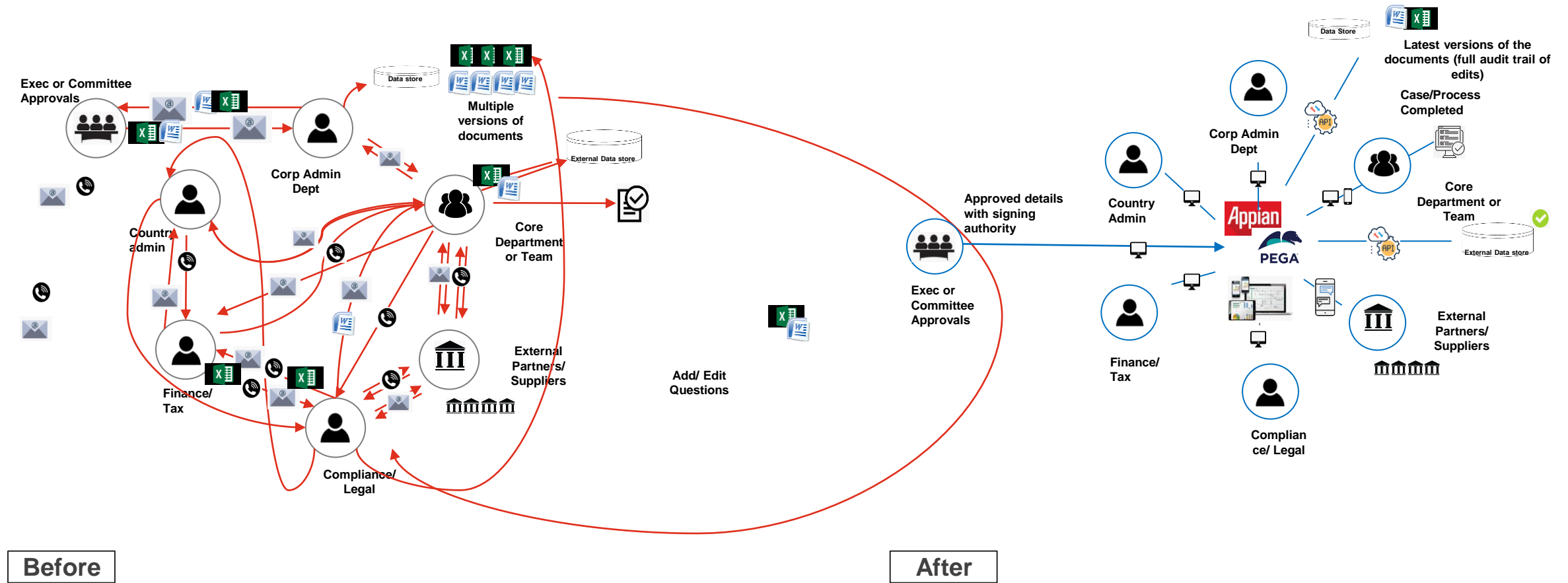
AI presents a significant contribution to the global & local economies

➔ AI can **transform the productivity and GDP potential of the global economy**. Strategic investment in different types of AI technology is needed to make that happen.

➔ Our research also shows that 45% of total economic gains by 2030 will come from product enhancements, stimulating consumer demand.

➔ The greatest **economic gains from AI will be in China** (26% boost to GDP in 2030) and **North America** (14.5% boost), equivalent to a total of $10.7 trillion and accounting for almost 70% of the global economic impact.

➔ The adoption of 'no-human-in-the-loop' technologies will mean that **some posts will inevitably become redundant**, but **others will be created by the shifts in productivity** and consumer demand emanating from AI

$15.7tr

+26%

Potential **contribution to the global economy** by 2030 from AI

Up to 26% **boost in GDP for local economies** from AI by 2030

On avg.
15%
of a company's workforce is at risk of disruption up to 2025

85 million displaced vs. 97 million created
number of *'jobs of tomorrow'* created will surpass the displaced jobs
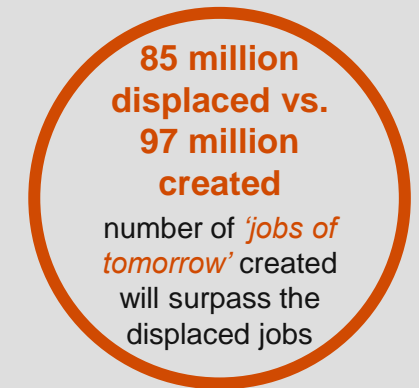
Increasing demand, 'jobs of tomorrow'	Decreasing demand
1. Data analysts and scientists	1. Data entry clerks
2. AI and machine learning specialists	2. Administrative and executive secretaries
3. Big data specialists	3. Accounting, bookkeeping and payroll clerks
4. Digital marketing and strategy specialists	4. Assembly and factory workers
5. Process automation specialists	5. Business services and admin managers

Source: PwC

What role can AI play in today's business?

AI employs intelligent strategies and heuristics to bring a human-like intelligence to solving problems like any other computer program.

From automated customer service bots and natural language processing systems to sentiment analysis and facial recognition, **AI can be a productive force** helping companies run smoother operations and stay one step ahead of the competition. One the other hand, AI can be used in **disruptive manner** raising ethical questions.

Healthcare
- predictive healthcare
- scan analysis via image recognition
- chatbots

Customer service / experience
- chatbots and helplines
- recommendation engines

Transportation
- Self-driving technologies
- Image processing

Logistics
- Image recognition algorithms
- predictive analytics

Marketing
- Personalised messaging
- Recommendation engines

Defense
- Autonomous weapons
- Image, video recognition

Retail
- Collection and analysis of customer data
- Self shop stores (Amazon Go)
- predictive analytics

Banking, financial services & insurance
- Automation of paperwork
- Predictive analysis, data mining
- predictive analytics

Amazon Go: Sensor fusion, person and object detection, activity analysis

Streaming devices, mobile applications: algorithms and predictive analytics

Fake news: disruptive use of AI
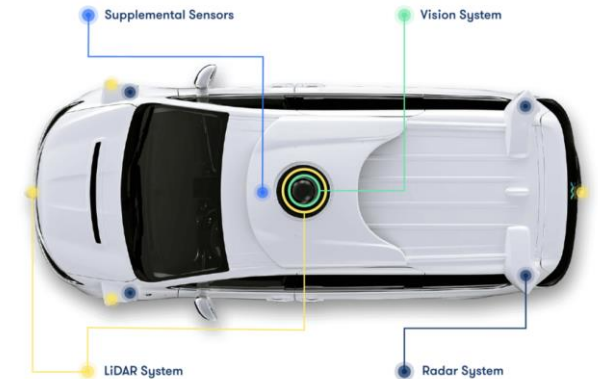
Google self-driving car: Radars, deep-learning architecture

How far can AI go? Usability of AI is limited by practicality and risks associated.

Ensuring socially preferable outcomes of AI relies on resolving the tension between incorporating the benefits and mitigating the potential harms of AI, in short, simultaneously **avoiding the misuse and underuse** of these technologies.

AI is generally associated with these types of risks:

Performance risk
- Errors
- Bias
- Opaqueness
- Performance instability

Security risk
- Adversarial attacks
- Cyber intrusion & privacy risks
- Open source software risks

Control risk
- Lack of human agency
- Detecting rogue AI and unintended consequences
- Lack of clear accountability

Application- level risks

Business- and national-level risks

Enterprise risk
- Reputation
- Financial performance
- Legal and compliance
- Discrimination
- Value misalignment

Economic risk
- Job displacement
- Enhancing inequality
- "Winner takes all" power concentration

Societal risk
- Misinformation and manipulation
- Intelligence divide
- Surveillance and warfare
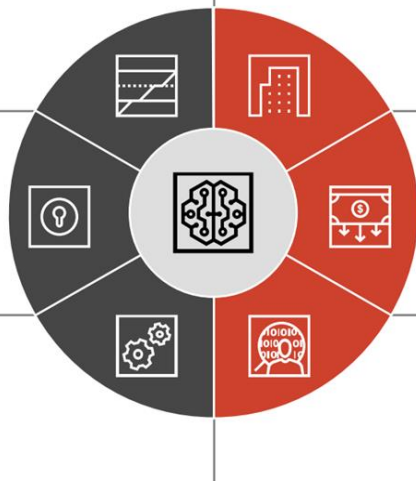
Known limitations

- Data labeling and supervised learning which can be error prone
- Obtaining massive training data sets
- Explainability (larger and more complex models make it hard to explain, in human terms, why a certain decision was reached)
- Generalizability of learning (difficulty carrying their experiences from one set of circumstances to another)
- Bias in data and algorithms

Ethical AI principe defined by PwC

AI is becoming essential across industries to help boost human productivity and decision-making, but there is a question whether the benefits to the bottom line outweigh the potential impact to society. There are various examples of Ai's disruptive potential as well as negative consequences from its underuse, misuse and abuse.

The epistemic principle

Interpretability (Explainability, transparency, provability)
An AI system should be able to **explain its model decision making overall**, as well as what drives an individual prediction to different stakeholders.

Reliability, robustness, security
AI systems should be developed so that they will **operate reliably and safely over long periods of time** using the right models and datasets.

The general ethical AI principles

Accountability
All stakeholders of AI systems **are responsible for the moral implications** of their use and misuse. There must also be a clearly identifiable accountable party, be it an individual or an organizational entity.

Data privacy
Individuals should have the right to manage their data when it's used to train and run AI solutions, as well as managing how that data is reused for other purposes

Lawfulness and compliance
All the stakeholders in the design of an AI system must always act in accordance with the law and all relevant regulatory regimes.

Beneficial AI
The development of AI should promote and reflect the common good, such as sustainability, cooperation and openness.

Human agency
The degree of human intervention required as part of AI solutions' decision-making or operations should be dictated by the **level of perceived ethical risk severity**.

Safety
AI systems **should not compromise the physical safety** or mental integrity of humans.

Fairness
The development of AI should result in individuals within similar groups being **treated in a fair manner**, without favoritism or discrimination. AI should also **maintain respect for the individuals** behind the data and refrain from using datasets that contain discriminatory biases.

20

Artificial Intelligence use case

Computer vision & Remote sensing

PwC

AI-powered Satellite Monitoring

Can you know what is happening in the world without leaving your desk?

Credit: Warcraft II

An early attempt...

Credit: NASA

...improved over time

Credit: NASA

Can you know what is happening in the world without leaving your desk?

Thanks to satellites, yes, you can.

Google

Unprecedented quality and availability

Credit: ESA

Unprecedented quality and availability
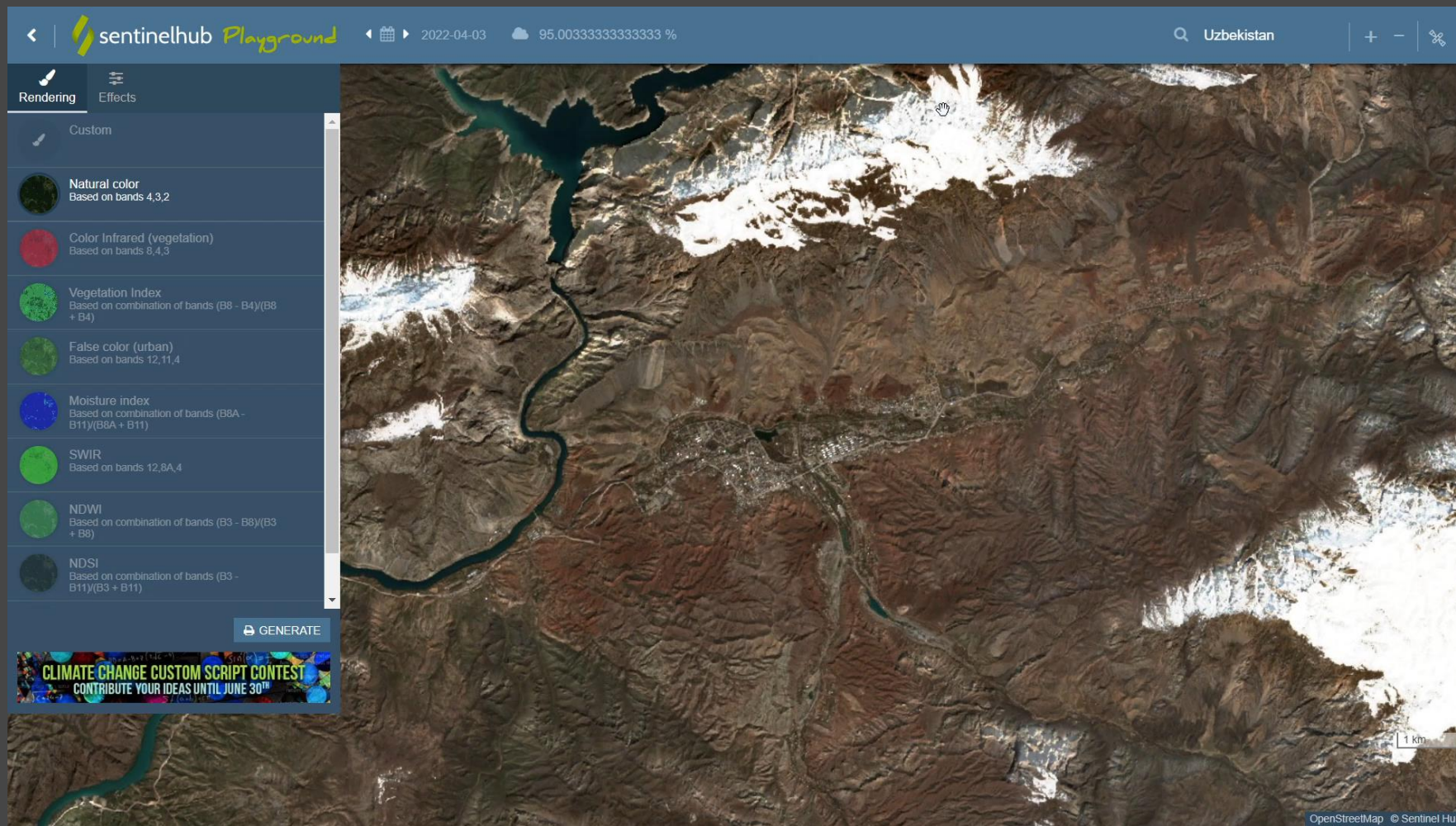
Unprecedented availability and accessibility
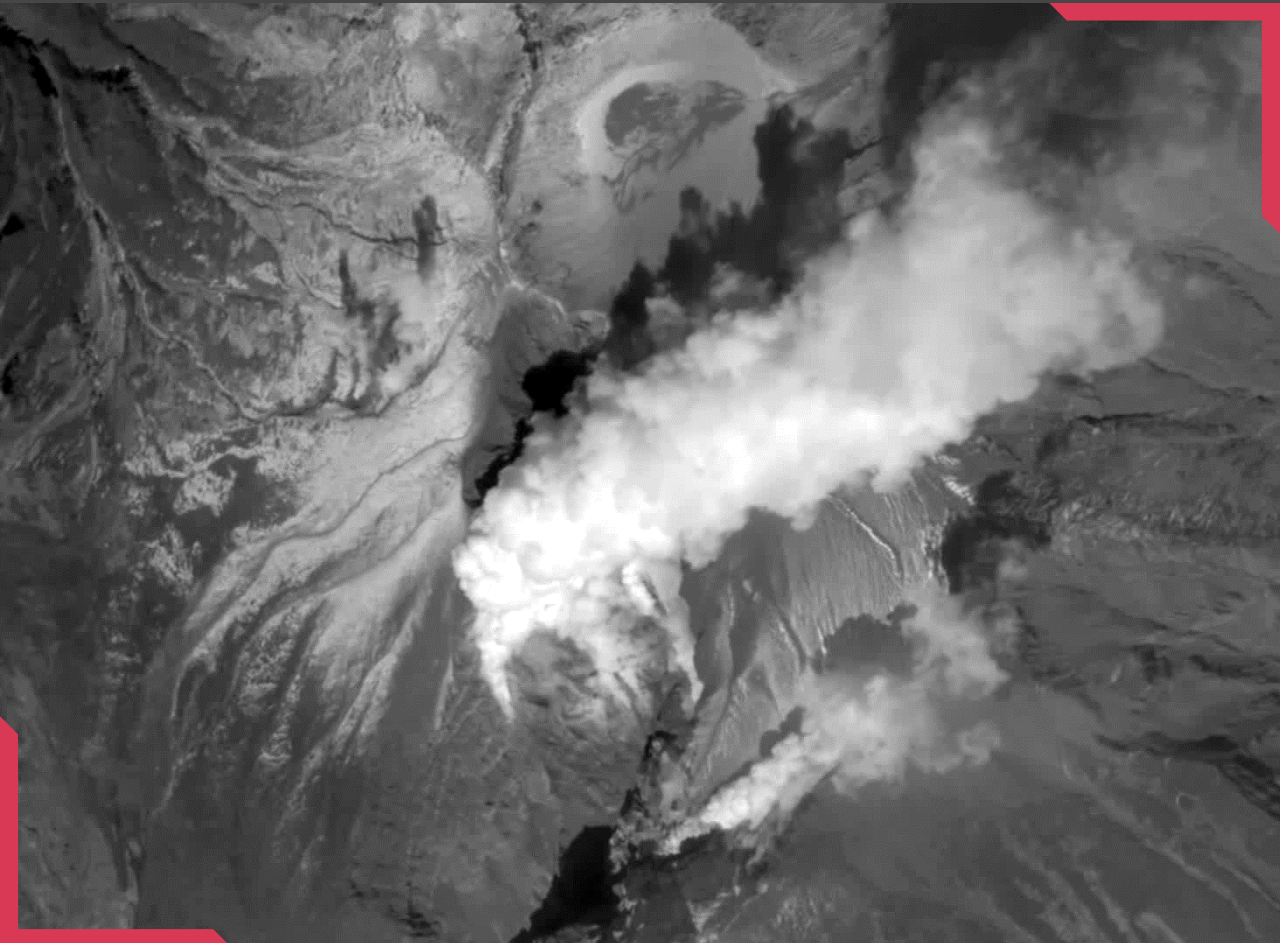
Credit: Planet / Terra Bella

Can you know what is happening in the world without leaving your desk?

Thanks to satellites, yes, you can.
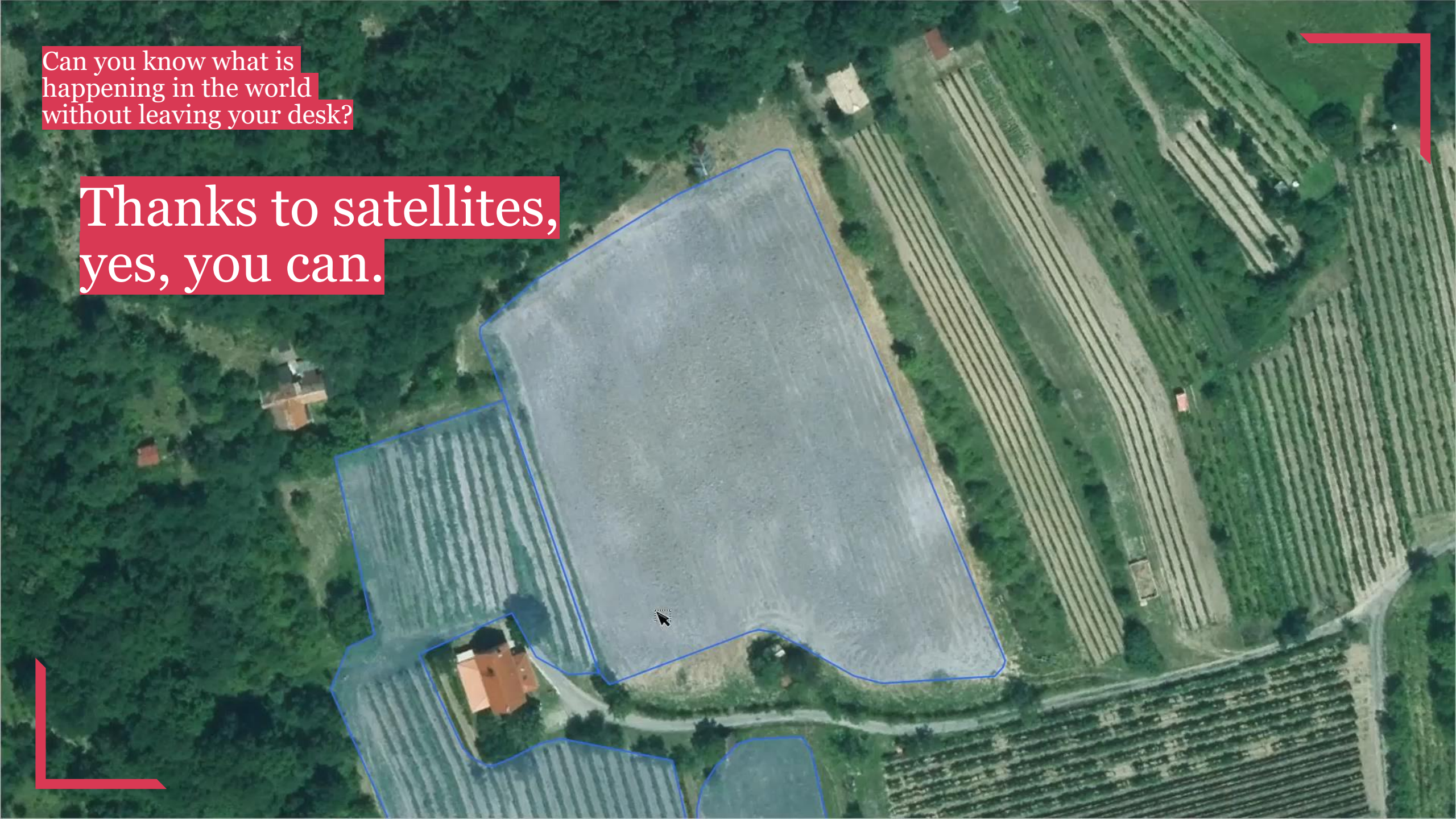
Can you know what is happening in the world without leaving your desk?

~~Thanks to satellites, yes, you can.~~

You can't look everywhere

You can't look everywhere

...computers can

Computer Vision allows computers to understand visual inputs

Credit: Pixabay
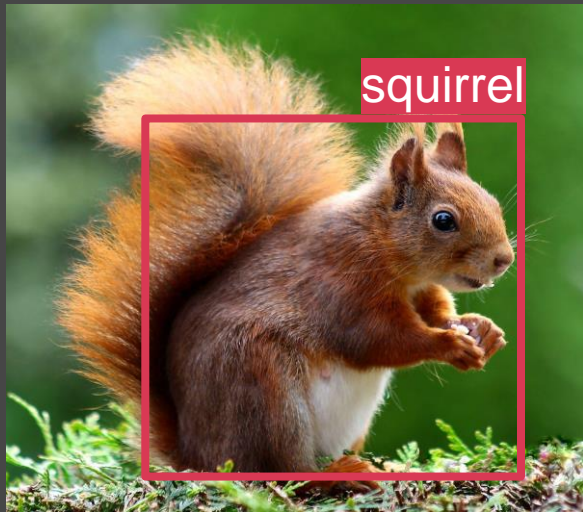
Object detection/ Classification

Image segmentation

Change detection

Repetition is the mother of learning
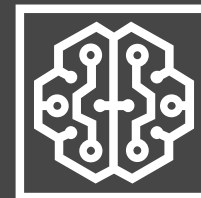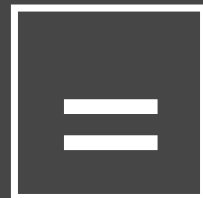
Repetition is the mother of learning
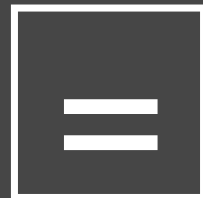
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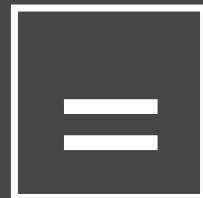
Satellite imagery

Computer Vision

Project 1: *Stormwater fee*

Fully automated process

Fully automated process
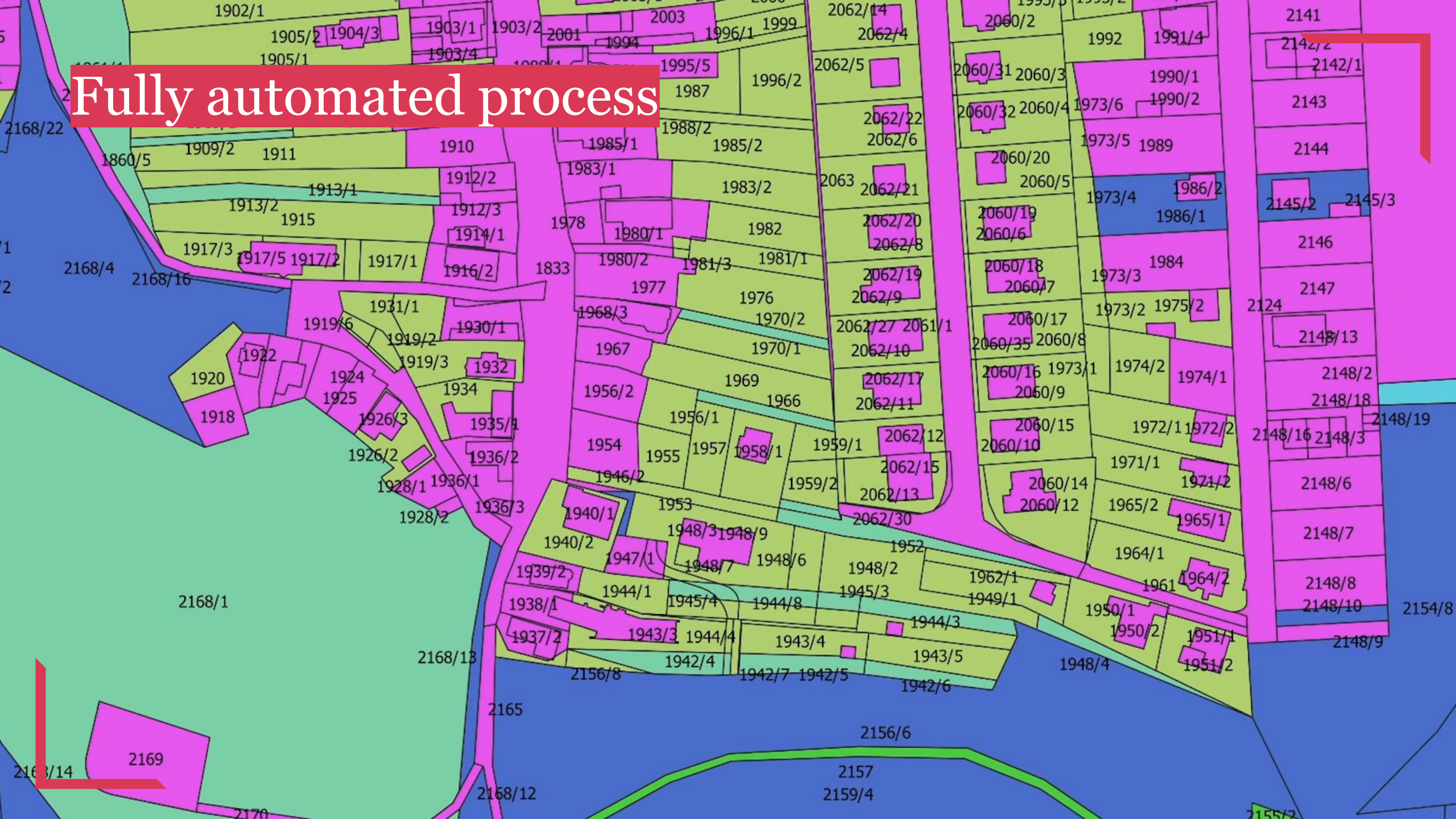
Fully automated process
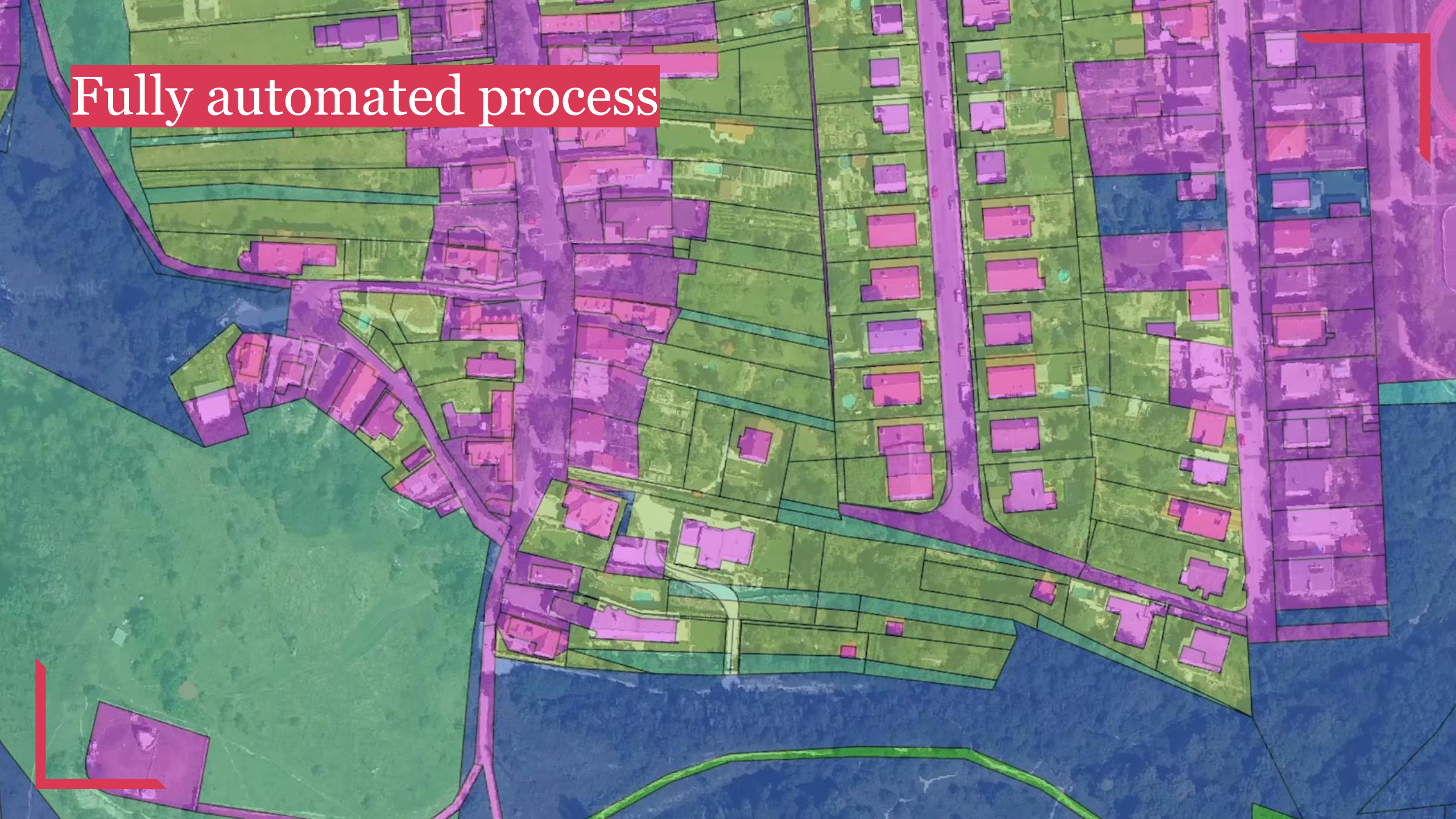
Project 2: *Property tax evasions*

Property tax evasion
- family house, 2 floors
- 200 m^2

Property tax evasion
- family house, 1 floor
- 150 m^2

Property tax evasion
- garage, 1 floor
- 60 m^2

Different inputs, same process

Flash Quiz!
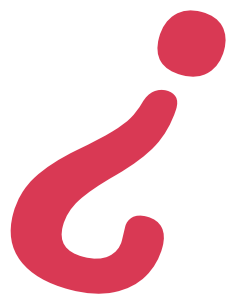
What is this?

?

A. **House**

B. **Garden**

C. **Garage**

What is this?

A. **Vineyard**

B. **Road**

C. **House**

What is this?

A. **Vineyard**

B. **Garden**

C. **Farmland**

What's the area of the building?
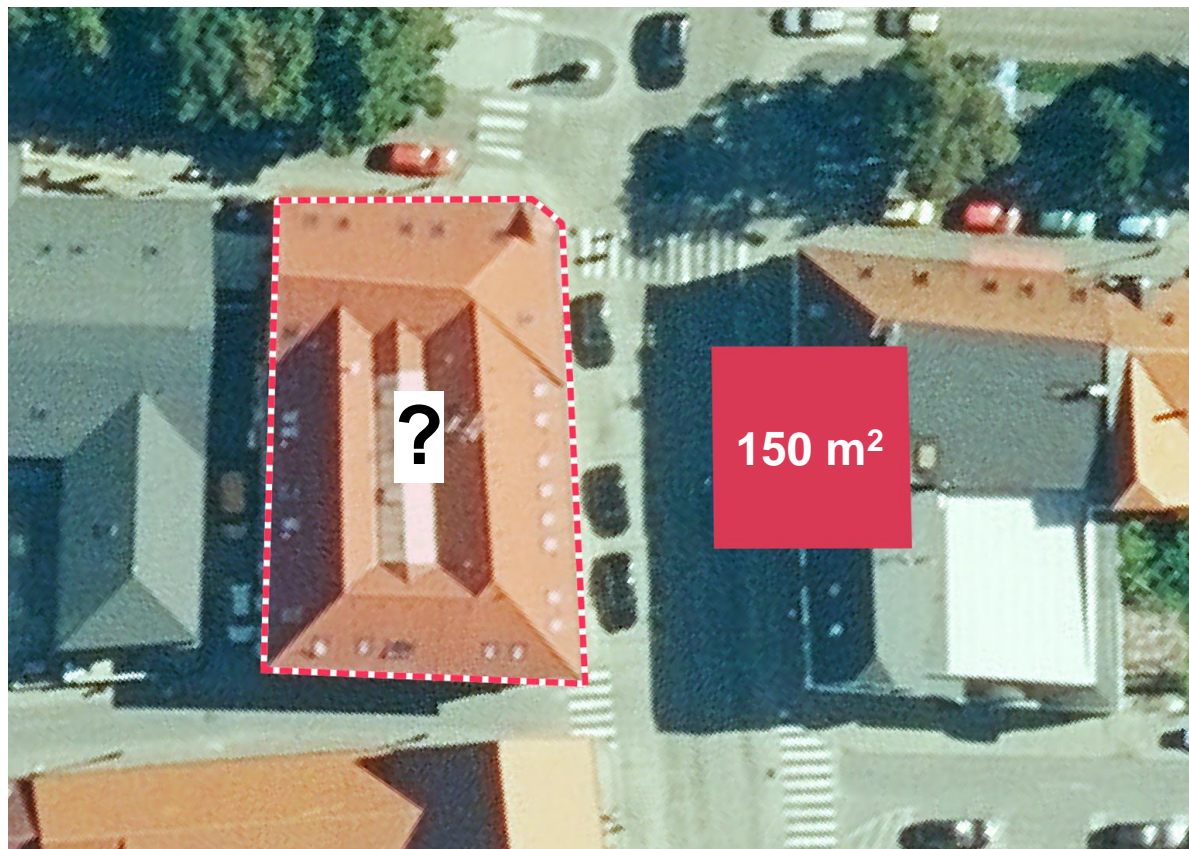
A. 93 m^2

B. 500 m^2

C. 200 m^2

What's the area of the building?

275 m²

?

A. **270 m²**

B. **20 m²**

C. **500 m²**

What's the area of the building?

?

107 m²

?
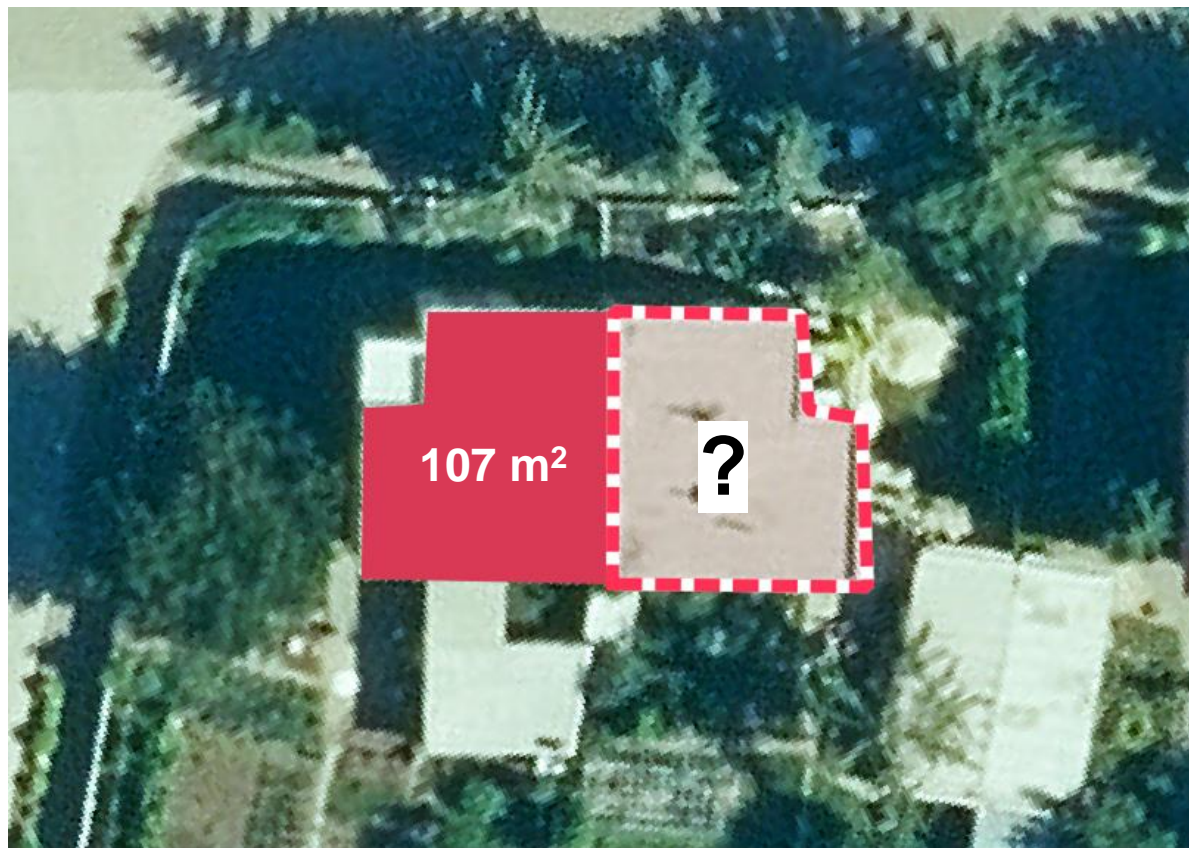
A. **123 m²**

B. **456 m²**

C. **789 m²**

Bonus round - What is this?

Concrete surface used as an airport
- or -
Grassland used for farming

Observing changes and trends over time

What crop is this?

What crop is this?

Series of images are turned into numerical time-series
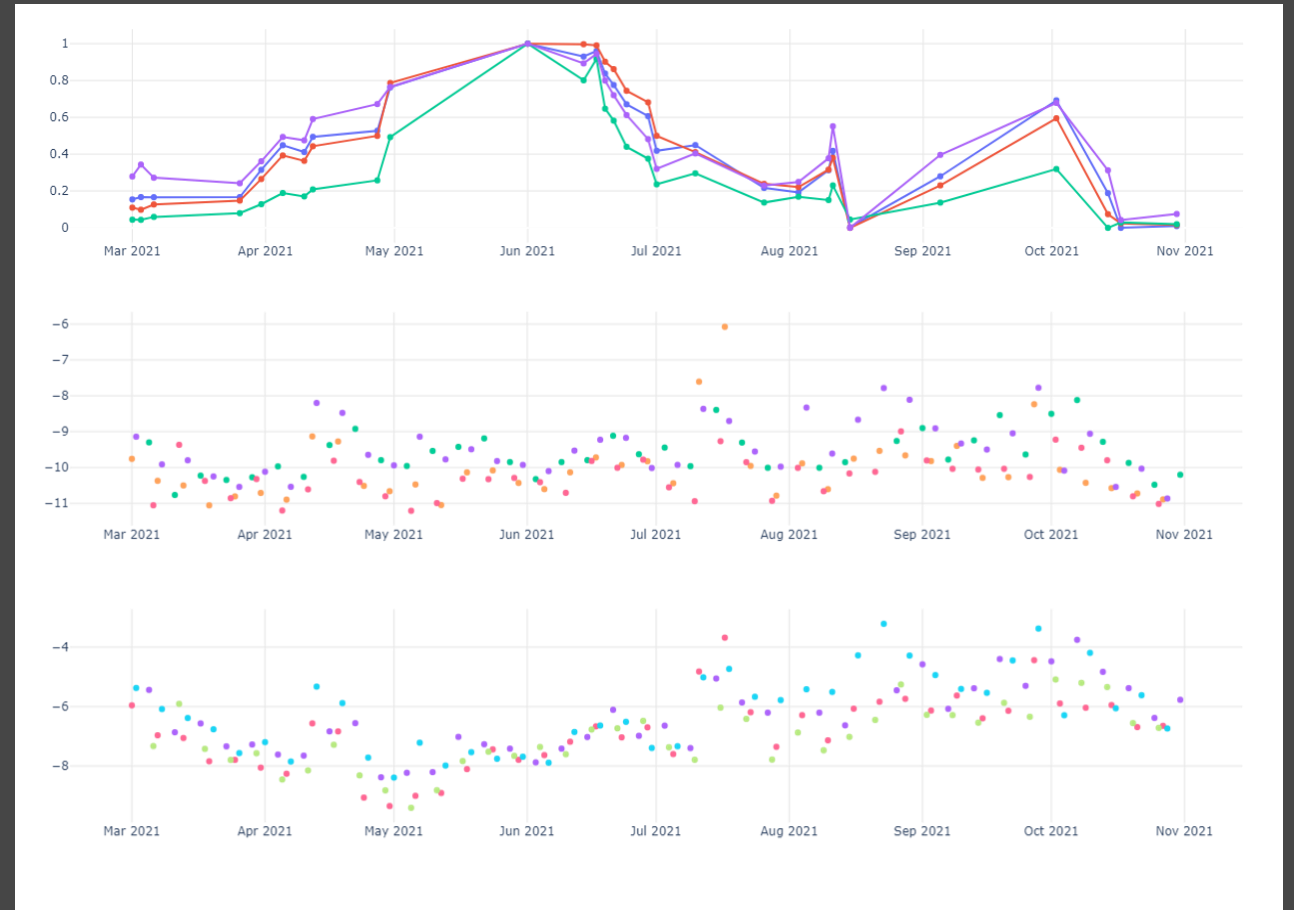
Project 3: *Automated Monitoring of Agricultural activities*
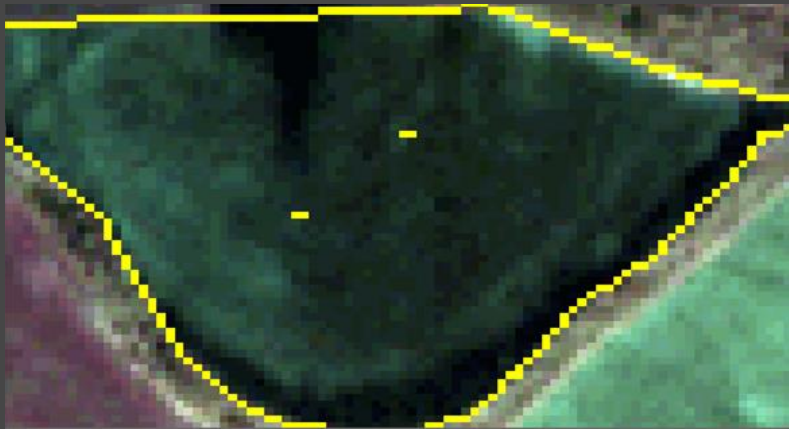
Continuous monitoring

Fully automated ✓
Complete coverage ✓
Crop type detection ✓
Mowing detection ✓
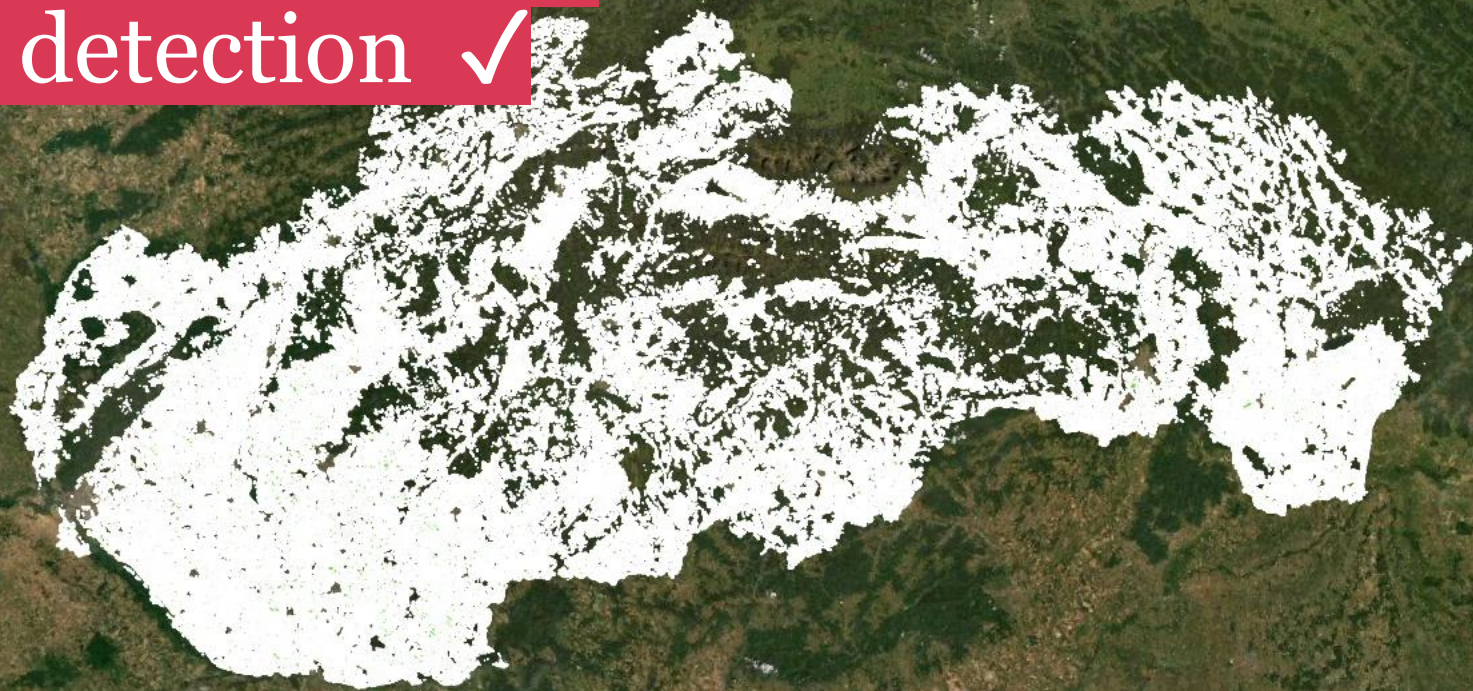
Supporting environmental protection efforts

Credit: ESA

Supporting environmental protection efforts

Credit: Planet

Supporting environmental protection efforts
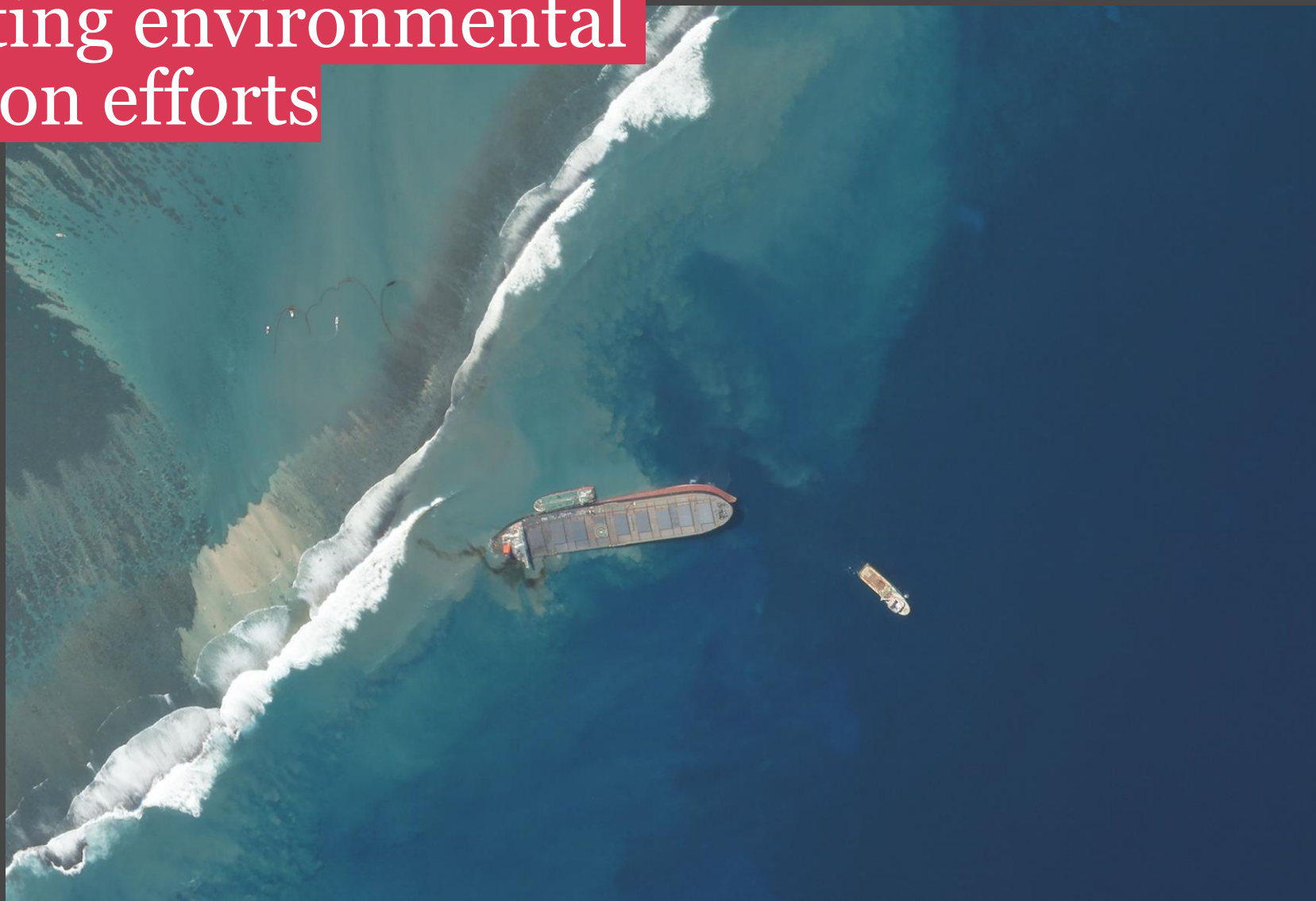
Credit: Planet

Supporting environmental protection efforts
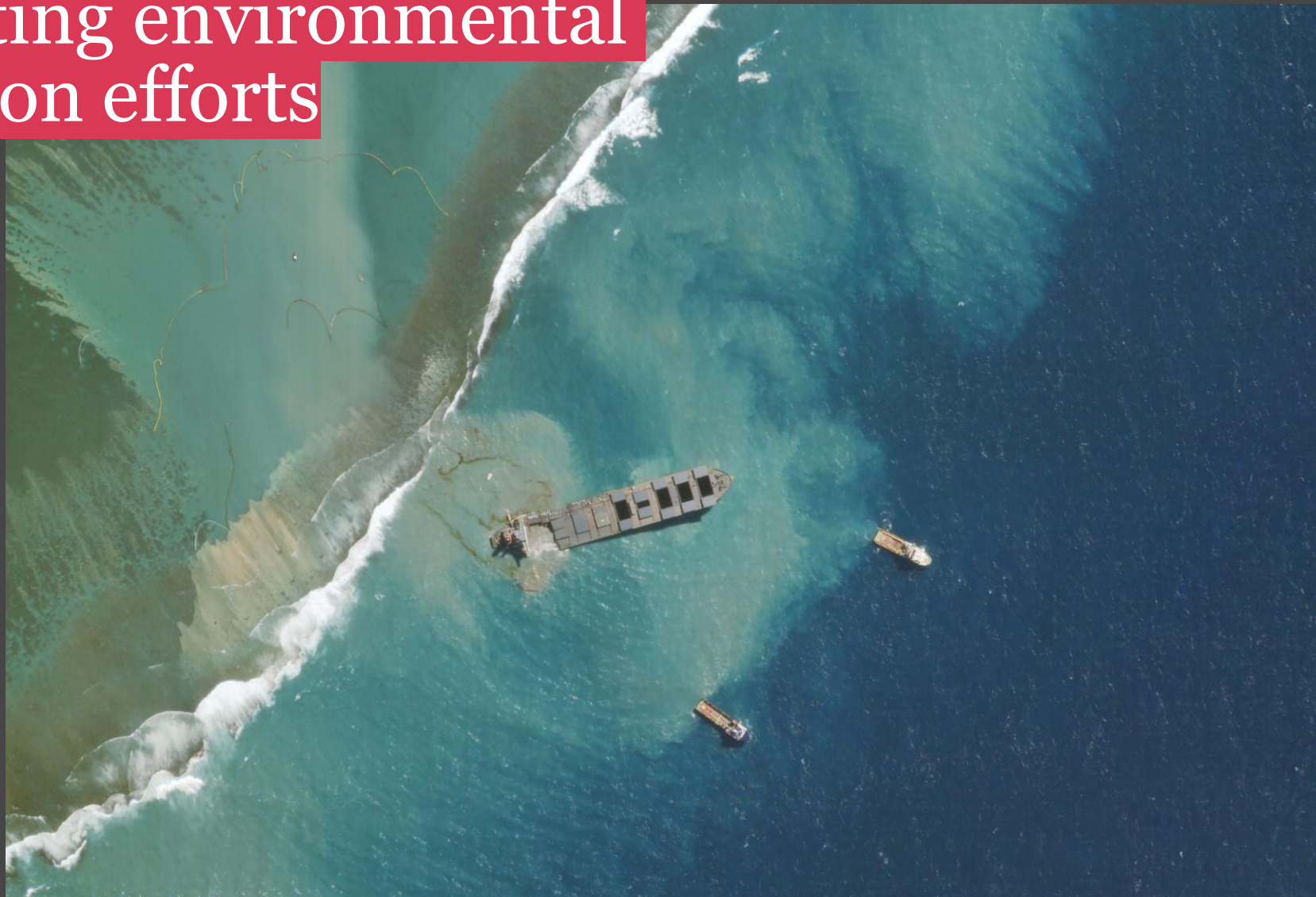
Credit: Planet

Supporting environmental protection efforts
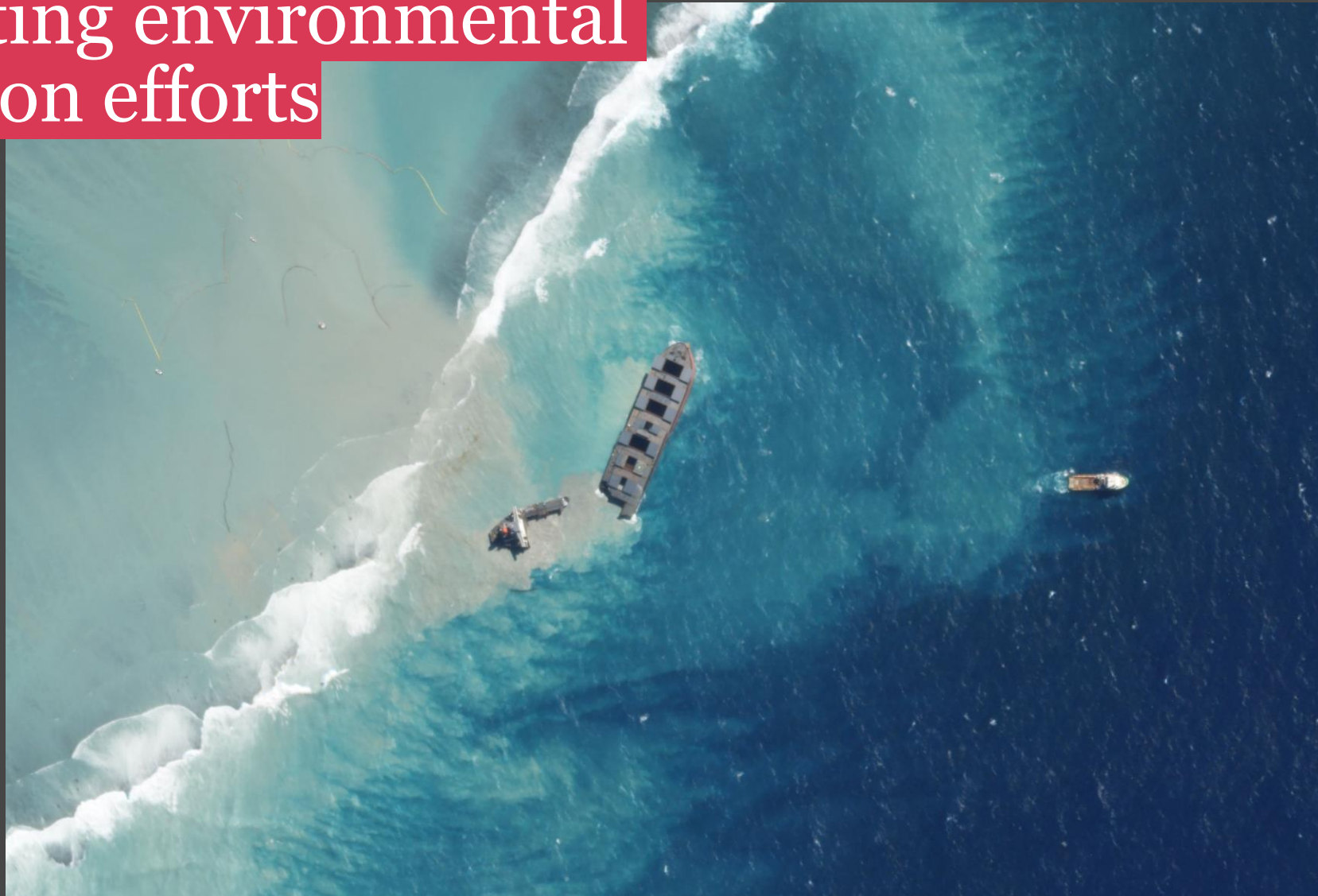
Credit: Planet

Supporting environmental protection efforts

Credit: Planet

Thank you for your attention!

pwc.com