



Introducing iAMP-Hydro: Towards Intelligent Hydropower Systems

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101122167.



Development of digital solutions for existing hydropower operation and maintenance



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EXPECTED OUTCOMES

3

Facilitate market penetration of renewables and getting closer to the European Green Deal and climate and energy targets for 2030 by increasing the flexibility, sustainability and predictability of existing hydropower



Enabling more renewables



Supporting the European Green Deal



Contributing to 2030 climate & energy targets



More flexibility, sustainability & predictability



System flexibility



Sustainability



Predictability



Societal benefits

4

Improve environmental and socio-economic sustainability of the existing hydropower fleet.



Healthy aquatic ecosystems



Sustainable water management



Positive impacts on local communities



Jobs, skills and regional development



Responsible governance and stakeholder engagement



Existing hydropower assets are critical for Europe's energy system but face increasing complexity, environmental pressures and aging infrastructure.

THE CHALLENGE



Increasing climate variability and extreme events affect water availability and plant performance



Pressure on ecosystems and biodiversity requires better understanding and protection



Aging infrastructure needs smarter operation and predictive maintenance to ensure reliability and reduce costs

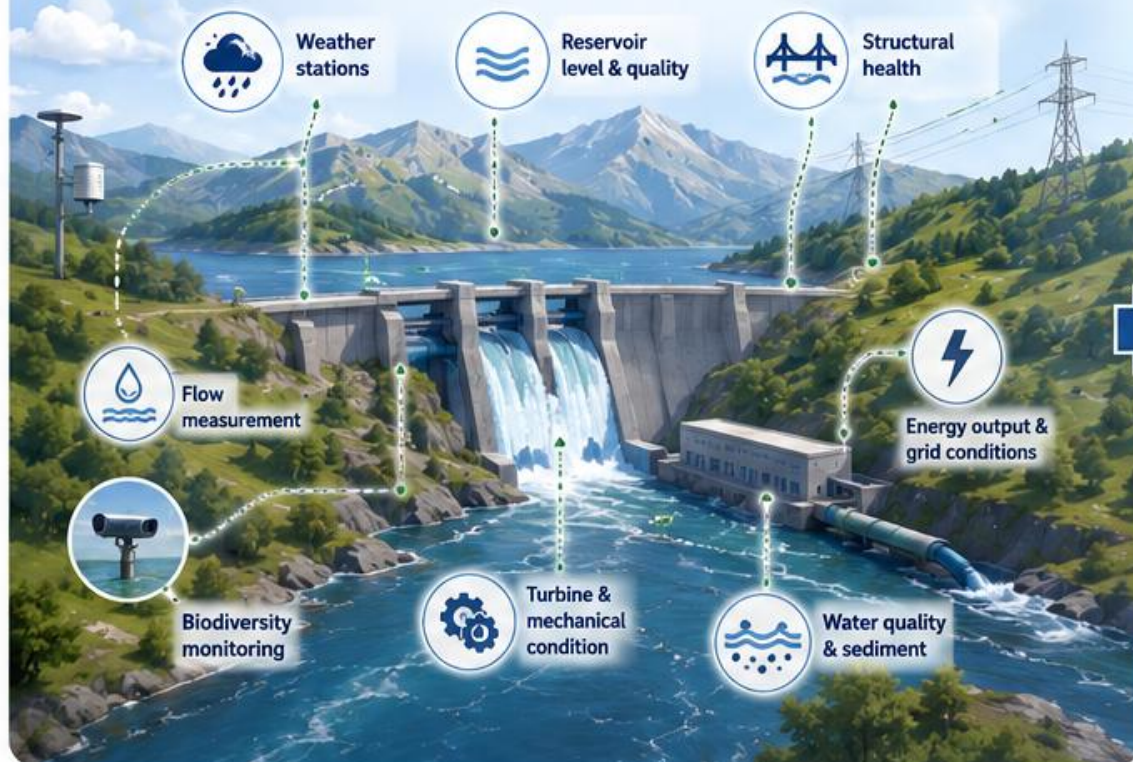


Complex decision-making in energy markets requires real-time data and advanced analytics



Operational data is sensitive and fragmented, limiting innovation and collaboration

SMART SENSING ACROSS THE HYDROPOWER SYSTEM



DIGITAL SOLUTIONS & AI ANALYTICS



WEATHER & FLOW FORECASTING

High-resolution forecasts improve planning and operation



BIODIVERSITY MONITORING

AI-powered image and acoustic analysis to protect aquatic life and habitats



PREDICTIVE MODELLING

Physics-based models and digital twins to simulate scenarios and optimise performance



AI FOR DECISION SUPPORT

Advanced analytics convert data into actionable insights for operators



BETTER DECISIONS, SUSTAINABLE OUTCOMES



Optimised operations and energy production



Enhanced resilience to climate variability and extreme events



Protection of biodiversity and river ecosystems



Reduced downtime and maintenance costs



Compliance with environmental targets and regulations



Greater flexibility in energy markets

SECURE AND OPEN DIGITAL PLATFORM



Secure data management

Protection of sensitive operational data



Data ingestion from heterogeneous sensors and sources



INTEROPERABLE PLATFORM
Data storage • Processing • APIs



Open interfaces and standards enable integration and innovation



Operators



Asset managers



Regulators



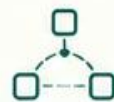
Researchers & innovators

TRANSPARENCY & OPENNESS BY DESIGN



OPEN ASSUMPTIONS

Clearly document methods, models and assumptions



OPEN ARCHITECTURE

Interoperable, modular and standards-based system design



OPEN CODE

Well-documented, version-controlled and auditable code



OPEN DATA (WHERE POSSIBLE)

FAIR principles: Findable, Accessible, Interoperable, Reusable



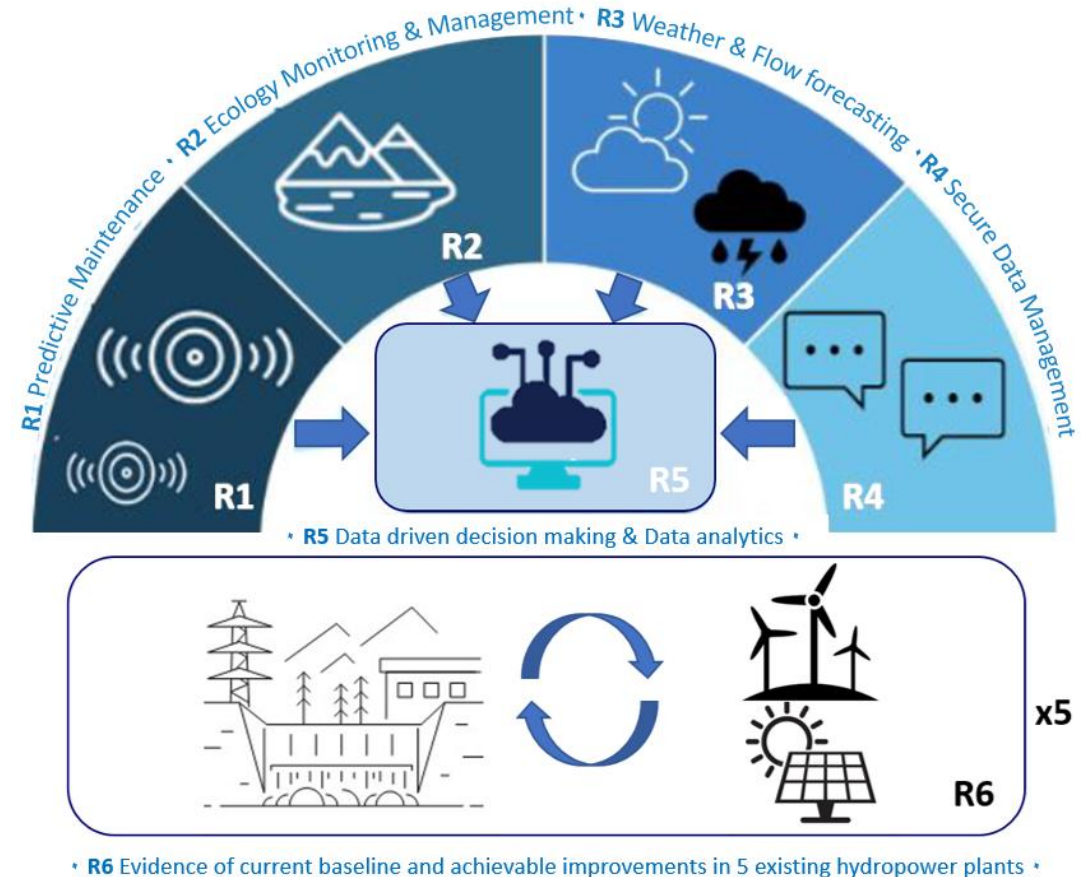
BUILDING TRUST

Enabling collaboration, replicability and wide uptake across Europe

Project Objectives

1. **Co-develop** and **validate** novel condition monitoring and predictive maintenance digital solution at TRL5 for hydromechanical and electrical equipment.
2. **Co-develop** and **validate** advanced sensors and models for the monitoring of biodiversity parameters for an ecologically optimised hydropower operation to improve biodiversity, environmental and socio-economic sustainability of existing plants
3. **Co-develop** and **validate** enhanced weather and flow forecasting models for improvement in reservoir inflow, outflow and water balance prediction accuracy

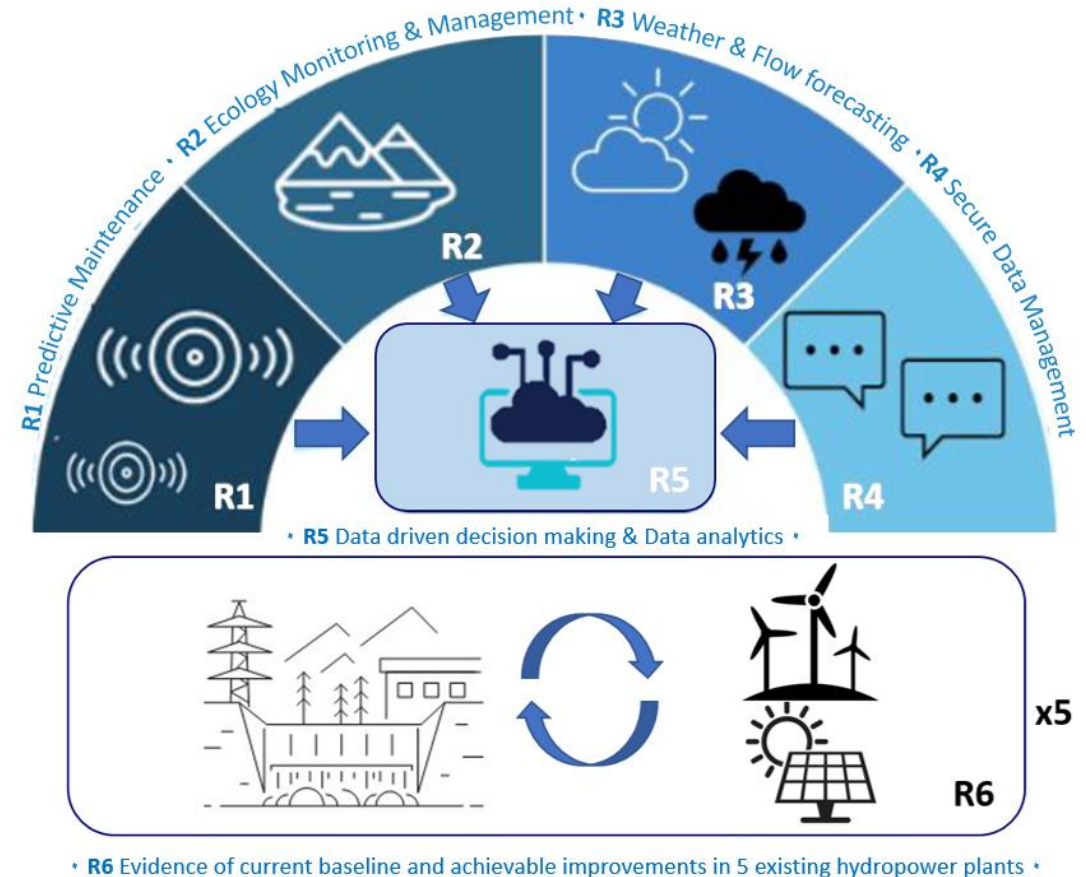
intelligent Asset Management Platform



Project Objectives

4. **Co-develop** secure data collection, communication, storage and sharing protocols and standards to enable trusted data-driven operation and maintenance, and interoperability between hydro operators, and with other renewable energy sources
5. **Co-develop** and **validate** iAMP decision-making algorithms for data-driven O&M, including integration of operations with other renewable energy sources to increase flexibility and optimise hydro positioning in energy markets
6. Widespread dissemination and communication of the potential benefits of digital solutions & gathering evidence for policy makers

intelligent Asset Management Platform



Methodology

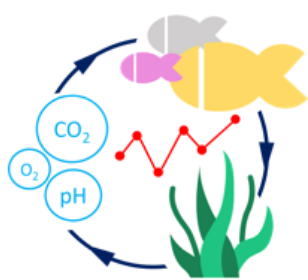
Digital Solutions

Advancing the Scientific Basis, technology base & leadership



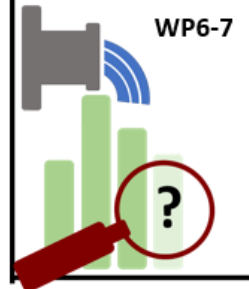
WP2-3

R1. Condition Monitoring & Predictive Maintenance



WP4-5

R2. Ecological Status Monitoring & Management



WP6-7

R3. Weather & Flow forecasting



WP8

R4. Data Standards & Protocols

R5. Intelligent Asset Management Platform

WP9 10 & 11

integration



Validation

Increasing the technology competitiveness of the existing hydropower fleet



Validation

WP12



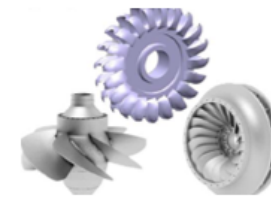
Wet & Dry Climates



Large & Small Hydro



Multi-purpose

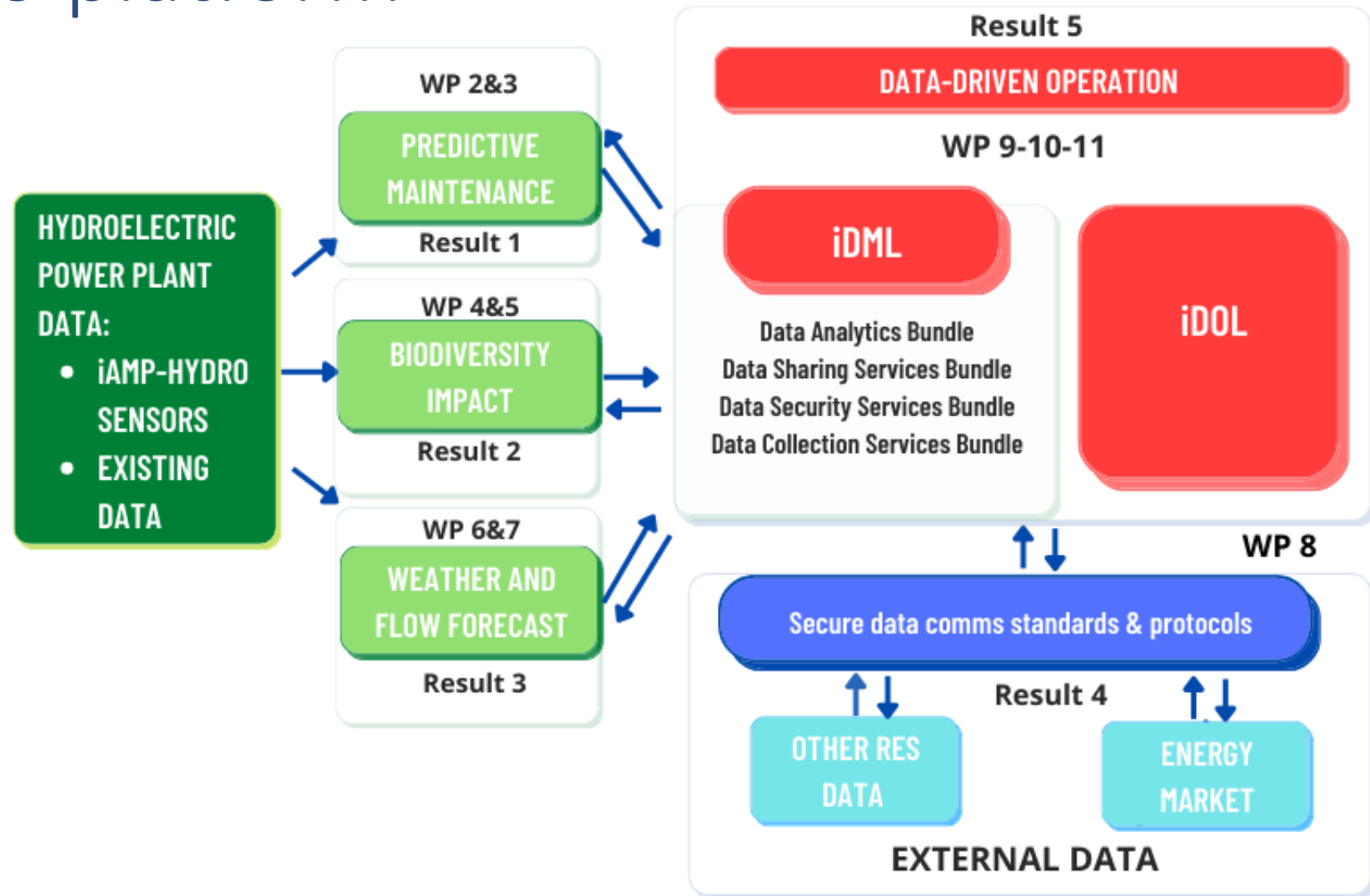


Differing Machine types

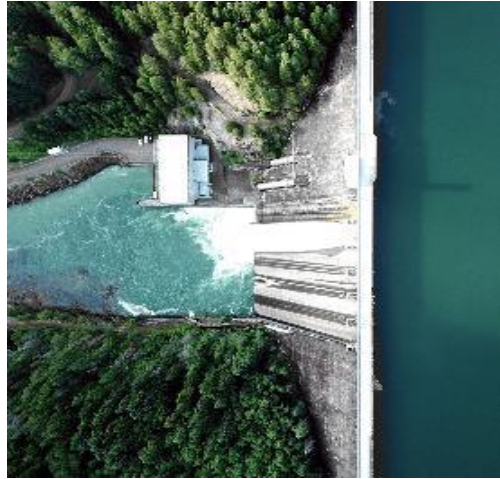


Differing flow regimes

iAMP-Hydro platform



iAMP-Hydro Validation Site



Berchules (0.8 MW)



Bermejales (2.1 MW)



La Vega (2.4 MW)

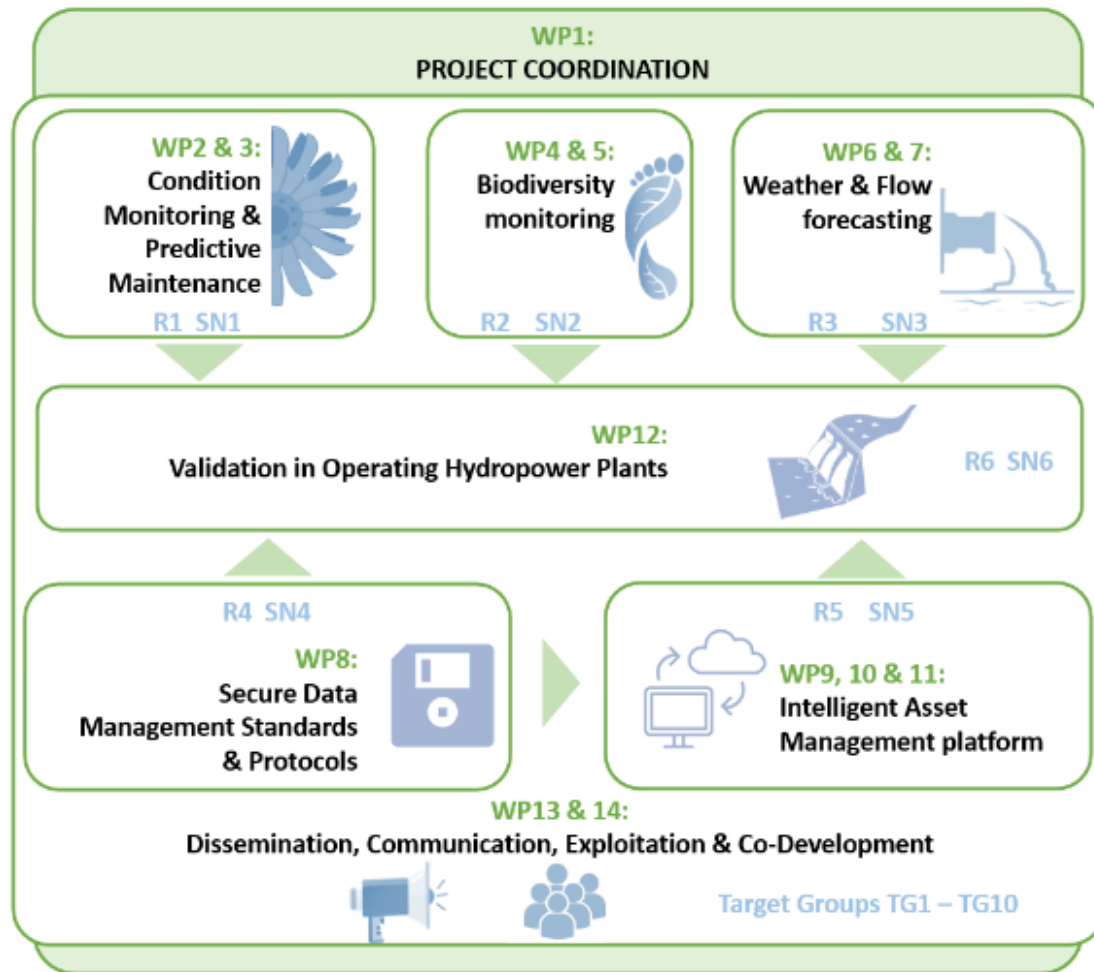


Makrochori (10.8 MW)



Asomata (108 MW)

iAMP-Hydro Work Packages and Partnership





Thank you!

Contact

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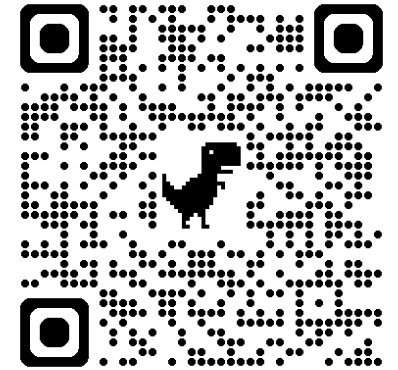
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Partners

