

A guide · The $500 trillion PPP infrastructure opportunity

Launch a PPP program for Research Centers and Laboratories in Jordan

WHAT THIS GUIDE IS FOR

Your center launches a PPP program to research, test and certify the technologies that public-private partnership (PPP) projects will run on, from new materials and energy systems to AI and robotics, starting with Jordan's $86 billion and Aqaba's $46 billion of projects.

PREPARED FOR
Research Centers and Laboratories in Jordan

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INTRODUCTION

A century of infrastructure reaches the end of its useful life

Most of the roads, bridges, power plants, water networks, ports and airports the world runs on were built in the last hundred years, and much of that stock is wearing out at the same time.

The infrastructure of the twentieth century was designed, poured and left to age. It carried the growth of every modern economy, and it was built for a world with fewer people, far less data and a different climate. Pipes leak, grids strain under new demand, and assets designed for one purpose are asked to carry several. Replacing them is the largest building program in human history, and it has already begun.

Rebuilding and running the world's infrastructure will take about $500 trillion over the next fifty years. It is the largest investment humanity will make in that time. Public-private partnerships (PPPs) will carry a large share of it, because governments cannot fund, build and run the rebuild alone, and the private sector cannot do it without them.

How the $500 trillion adds up

	$300T	to build the physical assets: roads, rail, ports, grids, water, cities, schools and hospitals
+	$150T	to operate and maintain them across the life of each concession
+	$50T	for the sensors, compute and robotics that will sit inside them, the share of the rebuild that venture capital can fund
=	$500T	**in total to rebuild and run the world's infrastructure over the next fifty years**

INTRODUCTION

The next hundred years will build Earth's largest computer

For thousands of years the method has stayed the same: design it, pour it, forget it, and repair it when it fails. The next generation of infrastructure will carry a software layer specified alongside the concrete. Assets will monitor their own condition, predict their own failures and schedule their own maintenance, and fleets of machines will raise them with very few human hands involved.

The larger change is the connection between assets. When a port knows what the rail line is carrying before it arrives, a water utility prices its pumping energy against the grid in real time, and every contract and drawing on every project sits in one connected record, the built world starts to behave as one system. Joined across borders, the world's roads, grids, ports, water networks, data centers and satellites become one globally connected, superintelligent computer.

Future infrastructure will be self-building, self-monitoring and self-healing. A road that senses its own cracks can schedule its own repair and use the savings to fund the next stretch. A water network that finds its own leaks can put the recovered water into meters on the next street. Each asset leaves behind the money, the data and the proof for the asset that follows it, so each new project starts further ahead than the last.

The point where the built world starts improving itself faster than anyone can direct it is the infrastructure singularity. Three technologies bring it closer: artificial intelligence designs and runs the assets, robotics builds and maintains them, and tokenization finances them and opens their ownership to everyone. Each of the three has to be tested before a government will trust it on a public asset, and testing is the work research centers and laboratories already do.

Infrastructure has long been built with methods proven decades ago, because a new material, machine or model has had few places to prove itself on a real asset. The projects of the next fifty years will be built and run with technologies that are still in the lab today, and the centers that test and certify them will decide which ones reach the field. This guide invites research centers and laboratories in Jordan to launch a PPP program, starting with the projects at home.

THE GUIDE

Research and test the $500 trillion PPP infrastructure opportunity

Your center opens a dedicated PPP program, a team and a set of services that research, test and certify the technologies PPP projects need, run the PPP research labs this guide proposes and license what they prove, starting with Jordan's $86 billion of projects and the $46 billion anchored in Aqaba.

01 **A PPP research team.** A dedicated team that knows how PPPs are prepared, procured and financed turns the center's research and testing into services that contracting authorities, sponsors, contractors and operators can buy, and it follows every project in Jordan's pipeline from the first market sounding.

02 **Testing and certification.** Materials, structural, energy and water labs test the new concretes, solar systems, pipes and sensors that bidders propose, and certify them against the standards a contract sets, so a contracting authority can accept a new method with evidence behind it.

03 **Running the PPP research labs.** The center can bid to design and operate the sector labs this guide proposes, running ten small PPP pilots a year for a ministry or authority, measuring every result and publishing what worked and what failed.

04 **Applied research and licensing.** AI, robotics and materials teams take on problems drawn from live projects, such as leak detection, asset inspection and low-carbon construction, and license the methods, software and designs they prove to the companies that deliver PPPs.

05 **Small-scale PPPs and direct proposals.** Jordan's PPP Regulation No. 9 of 2024 defines small-scale PPPs below $14.1 million, which can be bundled into one feasibility report and one tender, and PPP Law No. 19 of 2023 accepts direct private proposals under Article 15. A center and its private partners can propose a tested technology as a project and prove it at small scale first.

JORDAN AND AQABA

An $86 billion pipeline to start with

Jordan has 243 PPP and infrastructure projects in development, worth about $86 billion, of which $46 billion is anchored in Aqaba. Every one of them will need tested materials, certified equipment and research that shows new methods work before they are built.

$86 billion
of PPP and infrastructure projects in development across Jordan

$46 billion
anchored in Aqaba, Jordan's only port and its gateway to the Red Sea

SECTOR	PROJECTS	VALUE	WHAT THE PROJECTS WILL BUY
Energy	33	$28.3 billion	Grid and demand forecasting, solar and storage analytics, robotic panel cleaning, predictive maintenance
Tourism	40	$13.8 billion	Visitor flow and demand forecasting, resort and heritage-site operations, booking and payment rails
Urban development	17	$13.8 billion	Digital twins of new districts, digital permitting, modular construction, district operations
Transport	33	$11.7 billion	Traffic and fleet AI, tolling and payments, inspection drones for roads and rail
Industry	31	$8.1 billion	Factory automation, quality verification, industrial sensors and energy management
Water	29	$7.6 billion	Leak detection, pressure management, smart metering, pipe-inspection robots
Mining	15	$1.2 billion	Autonomous drilling and haulage, drone surveying, ore sorting
Health	12	$1.0 billion	Hospital operations AI, patient flow, equipment monitoring
Agriculture	10	$310 million	Precision irrigation, farm robotics, crop and soil monitoring
Environment	15	$270 million	Waste-sorting robotics, emissions monitoring, circular materials
Digital	6	$270 million	Data centers, connectivity, sovereign compute
Education	2	$20 million	School and training campus PPPs, digital learning, building operations and energy retrofits

A Jordanian research center that tests and certifies one project at home can carry the same methods to the next one across the region. Aqaba concentrates ports and terminals, logistics, rail to the port, industry, energy, water and tourism inside the Aqaba Special Economic Zone, which makes it a single place to test port automation, logistics software, desalination and energy technology on assets that connect Jordan to the world.

SECTOR GUIDES

Jordan's $86 billion, sector by sector

Jordan is investing in and advancing 23 sectors at once, and together their projects make up the $86 billion. A sector guide for each lists every project in it, its link to the infrastructure singularity and the ways a partner can take part.

The sectors closest to research centers and laboratories

Nuclear Energy	JAEC runs the Jordan Research and Training Reactor and the nuclear power program. 6 projects, $835m of forward investment. www.JordanPPP.com/sectors/nuclear
Agriculture and Food	NARC (founded 1985) researches crops, livestock and food security. 28 projects, $400m of forward investment. www.JordanPPP.com/sectors/agriculture
Water	RSS's Water, Environment and Climate Change Centre; NARC researches rainwater harvesting. 29 projects, $6.7bn of forward investment. www.JordanPPP.com/sectors/water
Solar Power	SESAME runs on its own solar power plant; RSS hosts the National Energy Research Centre. 18 projects, $326m of forward investment. www.JordanPPP.com/sectors/solar
Urban Development	RSS's Building Research Centre tests construction materials. 30 projects, $12.8bn of forward investment. www.JordanPPP.com/sectors/urban

All 23 sector guides

Oil, Gas and Power	$15.1bn	Wastewater and Reuse	$946m
Tourism	$13.8bn	Nuclear Energy	$835m
Urban Development	$12.8bn	Agriculture and Food	$400m
Green Hydrogen	$10.6bn	Solar Power	$326m
Transport	$8.1bn	Digital and AI	$243m
Water	$6.7bn	Circular Economy	$189m
Fertilizers and Chemicals	$6.5bn	Wind Power	$186m
Ports and Logistics	$3.6bn	Pharmaceuticals	$128m
Manufacturing	$2.4bn	Creative Industries	$47m
Storage and Grids	$1.4bn	Defense	$10m
Mining and Minerals	$1.2bn	Education and Skills	$7m
Health	$986m		

Every sector guide can be read and downloaded at www.JordanPPP.com/sectors.

ARTIFICIAL INTELLIGENCE

AI designs, structures and runs it

A PPP takes about seven years from concept to financial close and costs roughly 10% of capex to structure. Almost all of that work is documents and models, which is the work AI does well.

What changes

When the cost of intelligence approaches zero, the cost of preparing a project falls with it. Feasibility studies, options appraisals, cost plans, risk matrices, financial models and tender documents can be produced and tested in days, and contracts can be drafted and stress-tested in hours. PPP projects will soon appoint an AI technical advisor alongside the human ones. Once an asset is running, the same intelligence operates it: a digital twin models the asset in real time, sensors report wear and faults early, and maintenance follows the data.

Jordan arrives late to PPP software, and that is an advantage. With few legacy systems to migrate off, AI-native tools can be built from the ground up, and the reasoning behind each decision can be captured inside the transactions being structured today.

What it means for research centers and laboratories

AI gives a research center a new field and a new tool. Labs can build and test models that read sensor data, predict failures and check designs, and they can act as the independent party that validates an operator's AI before a contracting authority relies on it. Each test adds Jordanian data on materials, climate and asset condition that makes the next model more accurate.

What will be built

Project preparation	Software that turns feasibility studies, cost plans and tender documents into a repeatable process, so the years spent before tender shrink to months.
Procurement	Tools that let ministries compare bids on whole-life cost and deliverability.
Cost estimation	A national benchmark database that prices every project against real Jordanian rates.
Contract intelligence	Assistants that read, compare and answer questions on every contract, drawing and instruction on a project in plain language.
Asset monitoring	Sensors and digital twins that tell an operator what will fail before it fails.
Permits and approvals	Digital workflows that replace the paper trail across ministries, municipalities and utilities.

ROBOTICS

Robots build it and keep it running

Most of the $500 trillion of infrastructure due over the next fifty years will be built by machines, and people will design, train and supervise those machines.

What changes

Autonomous software combined with autonomous machines produces autonomous infrastructure. Tunneling machines, construction robots, drones and modular factories already raise structures with far fewer people on site. The machines then stay with the asset: drones inspect bridges and power lines, robots travel inside pipes to find leaks, and cleaning robots keep solar fields at full output.

Robotics also changes who can compete. A small company with the right machines can build what once needed a thousand-person contractor, and it can prove its method on a pilot before anyone asks for a track record, which opens PPP work to new companies for the first time.

What it means for research centers and laboratories

Robots on a PPP asset need somewhere to be built, tested and certified before they reach a live site. A research center can run the test rigs where inspection drones, pipe crawlers, construction robots and solar-cleaning machines prove their accuracy and safety, and certify each machine for the work a contract asks of it.

What will be built

Water networks	Robots and acoustic sensors that find leaks inside the network, in a country that still loses about 41% of its water to leaks, theft and faulty meters.
Construction	Modular methods, on-site automation and quality verification suited to Jordan's labor market.
Inspection	Drones and crawlers that survey roads, bridges, rail, power lines and pipelines and report defects automatically.
Energy	Robotic cleaning and maintenance for solar fields, and retrofit technology for public buildings, street lighting and water pumping.
Mining	Autonomous drilling, haulage and drone surveying for phosphate, potash and new mineral projects.
Ports and logistics	Automated handling, yard robotics and drone delivery for Aqaba's terminals and Jordan's dry ports and border crossings.

TOKENIZATION

Tokenization finances it and opens its ownership

A PPP absorbs capital over four years and releases it over thirty. Today's investors expect to enter and exit easily, and tokenization gives them that option.

What changes

A concession is a long-dated, contracted, inflation-linked cash flow, the kind of asset a token represents well and an ordinary investor has rarely been able to hold directly. Tokenization lets a small pilot be funded by a few hundred investors, with returns paid automatically from the asset's own revenue and no lender between them.

The rails already exist in the region. ADGM regulates tokenized securities, the Dubai Land Department records tokenized title deeds on its own register, and Jordan adopted a national Blockchain Technology Policy in December 2024. Tokenized concession revenues are still rare, so the first tokenized PPP in Jordan is open to whoever builds it.

PPP companies will be tokenized before PPP projects, because a developer already gathers projects, risks and revenues into one entity. People will own the builders first, then the portfolios, then the projects, and at the end of that sequence sits a stock exchange for the physical world.

What it means for research centers and laboratories

A tokenized PPP pays its holders from the asset's own revenue, and investors need independent evidence that the asset performs as reported. A research center can supply that evidence, testing the meters and sensors behind each payment and certifying the performance data sent to the registry. Its own patents and licenses can be tokenized too, with holders paid from royalties.

What will be built

Issuance	Compliant token issuance for PPP companies, infrastructure funds and small pilots.
Investor onboarding	Identity checks, suitability and custody built for Jordanian and regional investors.
Revenue distribution	Smart contracts that pay holders from tolls, tariffs and availability payments as the money arrives.
Registries	Shared records of contracts, milestones and asset performance that every party can trust.
Secondary markets	Venues where holders can buy and sell stakes in operating infrastructure.
Citizen participation	Tools for citizens to propose projects, vote them up and invest small amounts in what gets built.

SMALL PPPS IN PARALLEL

A thousand small PPPs teach more than one large one

The World Bank counted 315 private infrastructure projects reaching financial close across all low- and middle-income countries in 2024, only a few per country. No country can learn quickly at that pace, and each lesson arrives years after the technology behind it has moved on.

Each of those projects is too large, too slow and too expensive to try anything new on, and every approval, guarantee and stakeholder on a $1 billion project pulls it toward the way things were done before. Small projects are where a new idea can afford to be wrong, because the downside is small, the learning cycle is fast and the bureaucracy is thin.

Run them in parallel

Software has already moved from building one idea at a time to building ten at once, and infrastructure can follow. Picture 100 small schools built within six months, each delivered through its own PPP and each testing a slightly different legal structure, financing model, construction method and operating approach. Performance data arrives quickly, the models that work are copied, the weak ones are retired early and policy improves with every round, so a thousand small projects teach a country tens of thousands of lessons where one large project teaches a few.

$10M	spent preparing a single $100 million PPP, enough to build 100 pilots at $100,000 each
780	small PPPs a year in Jordan at $100,000 each, from 1% of the budgets of its 40 contracting authorities, about $78 million, in a country that closes only a handful of PPPs a year today
97,500	small PPPs a year if every country ran 500 at $100,000 each, for $9.75 billion, less than the price of one metro line

The PPP singularity

The PPP singularity is the point at which it becomes cheaper to build the pilot than to conduct the study. One feasibility study can make a project look feasible, another can make it look unfeasible, and the decision still comes down to judgment, while a pilot settles the argument with evidence. Governments that work this way become portfolio managers of experimentation: they set the objectives and the guardrails, standardize contracts that can adapt, collect the data and publish every pilot, every cost and every failure on one public website.

PPP RESEARCH LABS

Pilots need somewhere to live

PPP innovation needs the public and private sectors working together, so each lab is built the way a PPP is built: the public sector spearheads it and the private sector designs, finances, builds and operates it.

One lab per sector	Water, power, transport, aviation, health, education, agriculture, digital, tourism and urban development each get a lab inside the ministry or authority that runs the sector.
A one-line brief	Run ten small PPP projects a year at up to $100,000 each, testing new technologies, new PPP frameworks, new construction methods and new financing structures.
A PPP itself	The ministry tenders the lab, and private companies bid to design, finance, build and operate it with their own capital, effort and technology.
Funding	About $1 million a year per lab, found by moving 1% of an authority's budget away from inefficient spending. Ten labs can run a hundred experiments a year on a modest budget.
Open results	Every result is published as it happens, including the failures: what worked, what failed and what the contract should have said. The lessons go straight into the large PPPs already running and the ones still to come.
Room to explore	Labs carry no fixed deliverables, because predetermined outputs defeat the purpose of research, and they are judged on engineering results.

Who builds and who funds

Small projects open PPPs to founders and small companies. On a large concession a bid costs 3% to 5% of capex, prequalification asks for a decade of comparable projects and performance bonds run to tens of millions. AI cuts the bid cost, robotics cuts the crew a project needs and tokenization lets a few hundred investors fund a pilot, so a small PPP moves at the speed of the founders running it. Venture capital funds the technology, infrastructure funds finance the assets, and a $10 billion fund raised by both, deploying $2 billion in its first year, could back 20,000 small PPPs, about 100 in every country.

What it means for research centers and laboratories

A research center is a natural operator for a lab. It already runs test rigs, measures results and publishes them, so it can bid to run a ministry's lab, take ten small PPP pilots a year from design to result and turn each finding into a standard, a certificate or a license that larger projects can use.

UNSOLICITED PROPOSALS

Jordanian law accepts unsolicited PPP proposals

Any private company can take its own PPP idea to government. Article 15 of PPP Law No. 19 of 2023 lets a proposer submit a direct proposal to the Ministry of Investment or a public authority, and PPP Regulation No. 9 of 2024 sets out how it is assessed.

How a direct proposal works

Conditions	The proposal offers an innovative solution for a public service, is prepared on the proposer's own initiative, gives value for money, fits government programs, covers the government's obligations from project revenues and discloses any conflict of interest.
Contents	The scope, the proposer and its experience, a pre-feasibility study with the innovation and intellectual property behind it, the fiscal implications and any support or guarantees sought, and the cost of preparing the study.
Review	A public authority or municipality that receives a proposal refers it to the Ministry, which has 60 days to take it up for study or return it unopened, and can charge a study fee of at least $7,050.
Registry	A qualifying proposal is listed as a PPP project in the national registry of public investment projects, and one that falls short is rejected.
Tender	If the project goes to tender, the proposer can match the best offer, and if another bidder wins, the winner repays the proposer's direct study costs.
Small projects	Projects with a capital cost below $14.1 million are small-scale PPPs, and similar ones can be bundled into one feasibility report and one tender under simpler procedures.

Limitless ideas

This is the Swiss Challenge approach: the proposer brings the idea, the market competes on it and the proposer keeps the right to match the best offer. Many of the projects in Jordan's $86 billion pipeline are still early enough for a partner to shape the deal or bring its own idea, and a direct proposal can be as large as a mini city built and operated under one contract or as small as a $100,000 pilot. The PPP research labs can be proposed the same way, and every company with an idea for a public service becomes a possible project sponsor.

What it means for research centers and laboratories

Article 15 asks for an innovative solution for a public service, and a technology a center has researched and tested can be one. A direct proposal lets the center and its private partners bring a proven material, sensor network or AI service to a ministry as a project of its own, protect the intellectual property behind it and keep the right to match the best offer at tender.

WHY RESEARCH CENTERS

Research centers turn new ideas into evidence a contract can rely on

A PPP runs for decades, and a contracting authority will accept a new material, machine or model only when independent tests show it works. Research centers and laboratories produce that evidence, and the same labs then monitor the asset for the life of the concession.

Where research centers fit in a PPP

Preparation	Site investigations, materials studies and technology reviews that make feasibility studies and cost plans more accurate.
Tender	Independent tests of the materials, equipment and methods that bidders propose, against the standards the contract sets.
Construction	Quality control of concrete, steel, asphalt and building systems as they are delivered and installed.
Operation	Monitoring, testing and certification of the asset's performance for the life of the concession.
Innovation	Applied research, PPP research labs and licensed technologies that carry results into the next projects.

Jordan already has the labs

The Royal Scientific Society, founded by Royal Decree in 1970, runs the Building Research Centre, the National Energy Research Centre and testing and calibration laboratories accredited to ISO/IEC 17025. The Jordan Standards and Metrology Organization accredits testing laboratories and grants the Quality Mark, the Higher Council for Science and Technology funds and directs research within national priorities, and SESAME, the synchrotron light source in Allan, opened in May 2017.

Why a program, and why now

Every new road, plant, network and building in Jordan's pipeline will need tests, certificates and research behind it. A program gives a center a team, a set of services and the partners to deliver them, and the center that tests Jordan's first PPP technologies will set the standards the next projects follow.

THE PROGRAM

How the program could work

The program can sit inside the center's research and testing divisions, with a PPP lead at its core and services built from the labs and teams the center already runs.

PPP team	A small team of researchers, test engineers and business development people that covers every PPP in Jordan's pipeline from the first market sounding.
Testing	Materials, structural, energy, water and equipment tests priced for PPP tenders, construction and whole-life monitoring.
Certification	Certificates for new materials, energy systems, sensors and robots against the standards a PPP contract sets.
Research labs	Bids to design and run the PPP research labs for ministries and authorities, with ten small pilots a year and open results.
Licensing	Patents, software and designs from the center's research licensed to developers, contractors, operators and spinouts.
Direct proposals	Projects built on tested technologies brought to government under Article 15, including small-scale PPPs below $14.1 million.
Partners	Agreements with ministries, universities, developers, contractors, operators and technology companies that need research and testing inside their projects.

What the center gains

The center gains testing, certification and research contracts that last as long as the concessions they serve, paid by governments, sponsors, contractors and operators. Every project adds data, a reference and a route into the next consortium, in Jordan and across the region.

It also gains a place at the front of a new discipline. The first research center in the region to test, certify and license the AI, robotics and materials that run PPP assets will set the standards later projects are written around, and its licenses will earn from every project that uses them.

ABOUT

Jordan PPP

Accelerate Jordan
Accelerate the infrastructure singularity
Accelerate the Jordan PPP singularity

AMMAN, JORDAN WWW.JORDANPPP.COM

Jordan PPP helps every kind of organization in Jordan launch a public-private partnership (PPP) program of its own. It publishes 96 guides, one for each kind of organization, from the Royal Hashemite Court and Parliament to banks, contractors, universities, humanitarian organizations, companies in twenty-one sectors and organizations in twelve governorates.

Its vision is the infrastructure singularity, when roads, grids, ports and water networks become one globally connected, superintelligent computer, built by robotics, run by artificial intelligence and financed by tokenization. Rebuilding and running the world's infrastructure will take about $500 trillion over the next fifty years.

Its method starts small: a PPP program for every organization, small PPPs run in parallel, a research lab in each sector and direct proposals under Article 15 of PPP Law No. 19 of 2023, starting with Jordan's $86 billion and Aqaba's $46 billion of projects.

JORDAN PPP

What Jordan PPP offers

The guides

One for every organization

96 guides, each with the case, the program and six first steps.

www.jordanppp.com/guides →

The summary

All guides in one document

Every guide, its organization and its ask, in one place.

www.jordanppp.com/summary →

Futureproofing

AI, robotics, tokenization

What the three technologies change for every organization.

www.jordanppp.com/futureproofing →

The opportunity

$500 trillion

The $500 trillion PPP infrastructure opportunity, from the crisis to the exchanges.

www.jordanppp.com/opportunity →

NEXT STEPS

How a research center can start

Any research center or laboratory in Jordan can take this guide forward. The first steps use the labs, researchers and accreditations the center already has.

Mandate	Board approval for a PPP research program, with its services, its research themes and its first-year goals.
Team	A named program lead, with researchers, test engineers and business development people drawn from the center's existing teams.
Pipeline	A map of Jordan's $86 billion of projects by sector and stage, and early meetings with the authorities, sponsors and contractors that will buy testing.
Services	Testing, certification, research and licensing packaged into one PPP offer and priced for whole-life contracts.
Partners	Ministries, universities, developers, contractors, operators and technology companies across Jordan and the region.
Pilot	A first PPP research lab bid or research-led direct proposal, taken from idea to submission.

Jordan has the projects, accredited laboratories and a law that lets a private partner propose its own projects. A PPP program puts your center at the point where the superintelligent infrastructure future is tested, certified and proven, starting with Jordan's $86 billion and Aqaba's $46 billion of projects.

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