



Financing Digital Public Infrastructure: Models and Planning Considerations

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Introduction and Abstract

This document, "Financing Digital Public Infrastructure: Models and Planning Considerations," explores the complexities of funding Digital Public Infrastructure (DPI) by aligning public policy, operational capabilities, stakeholder management, and governance. It emphasises that the choice of financing model is crucial for the sustainable use and public value realisation of DPI.

The paper, a synthesis from Genesis Analytics, highlights a policy framework for DPI financing that balances public value, operational feasibility and political support and feasibility. It details planning considerations such as capital versus operational costs (which can exceed initial capital for software-based DPIs), greenfield versus brownfield projects (with examples from India, South Africa, Eswatini, and Malawi), and economies of scale. The scarcity of reliable cost estimates for DPIs is also noted as a challenge.

The document identifies public, private, and philanthropic sectors as key funding sources. Public sector financing is suitable for foundational, high-risk DPI, while the private sector excels in building applications on top of core infrastructure. Philanthropic capital often supports early-stage research and standard development.

Two main funding models are discussed: blended finance, which combines various capital sources to de-risk projects, and Public-Private Partnerships (PPPs), which leverage private sector efficiency with government oversight. Multilateral Development Banks (MDBs) like the World Bank Group, African Development Bank (AfDB), and Asian Development Bank (ADB) play a critical role through financing, technical assistance, de-risking and global coordination. A comparative analysis of these MDBs suggests their suitability depends on the project's scale, regional focus and development priorities.

Finally, the document proposes a structured approach for national leadership to finance DPI, involving a foundational assessment (defining purpose and public value), contextual analysis (evaluating economic status, digital maturity, and institutional capacity), and mapping financing models to the national context. It recommends a phased approach, where different financing models are used for development, adoption, and long-term maintenance and regulation of DPI.

Financing Digital Public Infrastructure: Models and Planning Considerations

Financing Digital Public Infrastructure (DPI) is a complex undertaking. It moves beyond simple capital injection to involve a strategic alignment of public policy objectives, operational capabilities, stakeholder management, and governance frameworks¹. The choice of a financing model is not merely a technical decision; it is integral to the sustainable use of the DPI and the successful realisation of its intended public value.

Policy Framework for Financing DPI²

DPI financing should align three key elements:

Public Value: This defines the primary objective of the DPI. Different DPIs can have different goals. For example, India's Unified Payments Interface (UPI) was primarily aimed at accelerating digital payments adoption and financial inclusion, while Brazil's Pix sought to catalyse market competition and innovation. South Africa focuses on social protection and access to tertiary education financing. Meanwhile, in eSwatini, Malawi and Mozambique, the key entry points for digitisation are financial inclusion, enhanced support for the informal sector, and increasing its coverage.

Operational Feasibility: This concerns the financial, technical, legal, and managerial viability of the project. The financing model is a core component of this. For instance, UPI is operationally funded by a consortium of banks, whereas Pix is funded by Brazil's central bank. A transaction-fee model, like Pix's for merchant transactions, will focus on strengthening markets, whereas a government-funded model like Aadhaar focuses on public service delivery and inclusion. South Africa's PayShap is free for instant payments below a certain value, and their online identity verification system charges a fee per verification.

Support & Political Feasibility: This involves building the necessary support and political will for the project's success. Without a clear government mandate, these projects are unlikely to get the traction within government that they need to succeed. Even philanthropic funding would require assurance of government commitment.

Planning for DPI Financing

Several factors must be considered when planning the financing of a DPI.

Capital vs. Operational Costs: Financing must cover not just the initial capital expenditure but also the recurring operational costs for maintenance, upgrades, addressing cyber threats, and managing scale. Unlike physical infrastructure, the lifetime operational costs of software-based DPIs will most-likely exceed the initial capital costs. Initial costs are often best served by public or philanthropic funding, while operational costs might be sustained by user fees or other models.

¹ Eaves, David, and Mansi Kedia. "Exploring Different Financing Models for Digital Public Infrastructure and Why They Matter." *T20 Policy Brief*, June 2023.

² Eaves, Manis DPI use of Mark H Moore, "Public Value Propositions and the Strategic Triangle", Harvard University, August 2013, <https://scholar.harvard.edu/markmoore/publications/public-valuepropositions-and-strategic-triangle>

Capital investments and operational costs would recur for each new product or service project that the DPI deploys. South Africa's recent rapid expansion of its smart ID, passport, application and biometric capturing to bank branches, apps, and retailers³ is an example of innovative use of existing private infrastructures to support government services. However, the government has proposed a price hike on the Smart ID online verification system, which aims to cover operational costs but has been widely critiqued as too expensive⁴. This criticism highlights the complexity of modern DPI funding models.

Greenfield vs. Brownfield: The cost and financing model will differ significantly depending on whether the DPI is a "greenfield" project built from the ground up (like India's Aadhaar or Brazil's Cadastro Ambiental Rural - CAR) or a "brownfield" project built upon existing systems (like many instant payment systems in Africa). Greenfield projects are often more capital-intensive and may require more direct government funding. By contrast, South Africa has largely pursued a brownfield path: building on existing assets such as PayIncs' (previously BankservAfrica) PayShap real-time payments infrastructure, the Department of Home Affairs' Smart ID programme, and National Treasury's data exchange and government payments systems. Pre-existing infrastructure can reduce upfront costs by leveraging existing institutional and technical capacity, while requiring careful integration and coordination across departments to avoid duplication and fragmentation. Eswatini and Malawi, by comparison, are closer to greenfield contexts where foundational identity or payment infrastructure is either absent or highly fragmented, requiring heavier reliance on donor financing and parallel institution-building. For example, Mozambique hosts two potential foundational identity solutions. This creates different cost profiles and sustainability risks: South Africa can focus on lifecycle cost modelling and incremental efficiency gains across existing systems, whereas smaller countries must prioritise capital mobilisation for new platforms while planning for long-term maintenance and enhancement and fiscal sustainability. South Africa's PayShap and Smart ID contrasts greenfield contexts like Eswatini and Malawi, where foundational digital identity or payment infrastructure is either emerging or highly fragmented.

Economies of Scale: The cost per person for a DPI can vary significantly based on population size. Countries with larger populations can benefit from economies of scale, distributing costs and lowering the average cost per user. This can make DPIs less financially viable for smaller, low-income countries, suggesting a need for shared infrastructure models in some regions or shared learning on how to down-scale the costs of DPI in a given country. This might include a greater need for developing cross-functional coordination capabilities across government. Likewise, the concept of DaaS (DPI as a packaged solution) discussed in the CDPI DPI Wiki⁵ and by Carnegie India⁶, may offer efficiencies for smaller economies, and accelerated development for larger ones.

Cost Estimates: Publicly available data on the cost of implementing DPIs is scarce, making planning difficult. Estimates suggest a digital identity programme might cost around US\$1 per person, while digital payment systems built on existing infrastructure are reportedly much lower. However, these figures often exclude significant costs like the coordination efforts required to drive adoption. Challenges in cost estimations are exacerbated by differences in local ICT capabilities and clear cost-benefit-impact analysis – all these factors combined often leads to: *how long is a*

³ <https://dailyinvestor.com/banking/100635/smart-id-and-passport-services-coming-to-pick-n-pays-across-south-africa/>

⁴ <https://www.dailymaverick.co.za/article/2025-06-30-we-want-this-resolved-properly-tymebank-ceo-decries-home-affairs-id-verification-fee-hike/>

⁵ <https://docs.cdpi.dev/initiatives/dpi-as-a-packaged-solution-daas/daas-in-a-nutshell>

⁶ <https://carnegieendowment.org/research/2024/02/the-future-of-digital-public-infrastructure-a-thesis-for-rapid-global-adoption?lang=en>

piece of string, costing will likely always be a country-level and complex exercise. This requires countries to balance aspirations and capacity, leverage but domesticate existing funding tools, and understand the importance of investing in permanent capacity.

Funding Sources & Models

DPIs are typically financed through a combination of public, private, and philanthropic capital, with each source having distinct strengths and weaknesses suited to different phases and objectives of a project.

Funding Sources

Public Sector Financing: The public sector, including national governments and state-owned entities, is uniquely positioned to provide high-risk capital for long-term, foundational elements of DPI, especially where returns are unpredictable. Public entities have the experience and resources to operate at scale, ensure neutrality for core components like registries, and catalyse private sector innovation. Government funding can come from the national budget, or loans and grants from Multilateral Development Banks (MDBs) like the World Bank. However, public entities can lack digital innovation experience, be prone to inefficiency, and face risks of politicisation. Securing this funding is complicated.

Private Sector Financing: Private entities bring entrepreneurial innovation, efficiency, and commercial expertise. They are often best suited to build applications and services "on top" of the core public infrastructure, driving competition and improving user experience, as seen with UPI in India. However, their profit motive means they may not prioritise public values like equity and access without the right incentives. Regulatory oversight is crucial to prevent vendor lock-in, monopolisation and consumer harm.

Philanthropic Capital: Philanthropic organisations often have a long-term perspective and can fund high-risk, early-stage activities like research, conceptualisation, and standards development where commercial incentives are lacking. They can play a neutral convening role, brokering partnerships between public and private actors and help countries bridge the gap between early implementations and long term public sector financing.

Funding Models

Blended Finance: This model strategically combines public, private, and philanthropic capital to de-risk projects and mobilise private investment. Catalytic capital from public or philanthropic sources is used to absorb initial risks through mechanisms like first-loss equity, making the project more attractive to private investors. This is particularly effective for overcoming the large, irrecoverable upfront costs often associated with infrastructure. MDBs often play a pivotal role as intermediaries in these structures, bringing credibility and fostering investor confidence. The 'blend' of finances may typically need to evolve - after a capital injection to establish core infrastructure has been made, the costs of operating and enhancement must be absorbed by the state to ensure sovereignty and avoid the risk of a financing cliff.

Public-Private Partnerships (PPPs): PPPs are long-term arrangements where the private sector finances, builds, and/or operates infrastructure, while the government retains control over policy and regulation. This model leverages private sector efficiency and innovation while reducing the

direct financial burden on the public purse, which may pay for services over time through availability or usage fees.

Each country's funding strategy will need to be context specific. Critically, a robust strategy requires clear institutional arrangements as large-scale budgeting must be allocated across government entities, chosen based on their mandate, capabilities and appetites. A country's funding strategy itself requires investment.

Box 1: Roles of Multilateral Development Banks

MDBs such as the World Bank, Asian Development Bank (ADB), and African Development Bank (AfDB) are key actors in financing DPI, particularly in developing countries.

Financing Instruments: MDBs provide billions in financing annually through loans, grants, and credit to governments for development projects. The World Bank's International Development Association (IDA), for example, provides concessional (low or no-interest) financing to the world's poorest countries. The International Finance Corporation (IFC), the World Bank's private sector arm, invests directly in private companies and provides advisory services.

Technical Assistance & Capacity Building: Beyond direct funding, MDBs provide crucial technical assistance, help strengthen institutional capacity, and support the development of enabling policies and regulations. This includes funding feasibility studies, developing legal frameworks, and offering training.

De-risking and Mobilising Private Capital: MDBs play a central role in blended finance and PPP structures. Their involvement lends credibility to projects, reducing perceived risk for private investors. They also offer instruments like political risk insurance through agencies like the Multilateral Investment Guarantee Agency (MIGA) to protect investors from policy shifts in volatile environments.

Global Coordination and Standards: MDBs help coordinate efforts across countries and promote the adoption of best practices and international standards, fostering interoperability and supporting cross-border initiatives.

The table below provides a comparative analysis of the World Bank Group, the African Development Bank (AfDB), and the Asian Development Bank (ADB). This analysis examines their regional priorities, typical project financing, and strategic focus on public versus private sector engagement.

Table 1: Comparative Analysis of a subset of MDBs

Feature	World Bank Group	African Development Bank (AfDB)	Asian Development Bank (ADB)
Geographic Scope & Regional Priorities	Global mandate covering Africa, Asia, Europe, Latin America, and the Middle East. Its strategy is to help countries fully integrate their climate and development goals. It has specific strategies for each region it operates in.	Africa-focused , comprising 54 African and 27 non-African member countries. Its "High 5's" strategy prioritises: Light up and Power Africa, Feed Africa, Industrialise Africa, Integrate Africa, and Improve the Quality of Life for the People of Africa.	Asia and the Pacific-focused , with 68 member countries. The largest borrowers are India, Philippines, Pakistan, China, and Indonesia. Its "Strategy 2030" guides engagement with developing member countries.
Public vs. Private Sector Focus	<p>Dual focus, operating through distinct entities:</p> <p>IBRD/IDA: Provides financing to public sector entities (governments) for infrastructure and policy support.</p> <p>IFC: Focuses exclusively on the private sector, providing financing, investment, and advisory services to businesses. It aims to create, deepen, and expand markets by mobilising private capital.</p> <p>MIGA: Offers political risk insurance to de-risk private sector foreign direct investment.</p>	Strong dual focus: Provides loans and grants to public sector entities (Regional Member Countries) for development projects. The private sector financing window is a key priority for reducing poverty and supporting sustainable growth, investing in commercially sound private and state-owned enterprises.	Primarily public sector-focused , with approximately 75% of its lending directed towards government projects and 25% to private projects. Its Private Sector Operations Department (PSOD) supports private and state-sponsored firms to catalyse and structure financing for commercially viable projects.
Key Sectors for Digital Transformation & DPI	<p>Broad and deep focus on digitalisation: · Digital Transformation Strategy: Prioritises digital infrastructure, financial services, ID systems, entrepreneurship, platforms (e-commerce, e-gov), and digital skills.</p> <p>ID4D Initiative: A major initiative supporting 49 countries with over US\$1.5 billion in financing for digital ID and civil registration ecosystems.</p>	<p>Integrated into strategic priorities: · Skills and Technology: A core operational priority is to modernise agriculture and other sectors with information and communication technology (ICT) to reduce costs and increase quality.</p> <p>Infrastructure: Finances ICT infrastructure to enable innovative health solutions and digital services.</p>	<p>Integrated across sectors: · Digital Technology Strategy: Focuses on creating an enabling policy environment, building human resources, and developing digital applications through ADB-supported projects.</p> <p>E-Development Focus: Incorporates ICT into policies and projects for agriculture, education, health, and public sector management.</p>

	<p>Digital Economy for Africa (DE4A): A dedicated initiative to support the African Union's digital transformation strategy.</p>	<p>Gender: Supports technical assistance to digital platforms to scale up and reach more women.</p>	<p>Private Sector Support: ADB Ventures was launched to provide patient capital to early-stage businesses deploying impactful technologies.</p>
<p>Financing Instruments & Typical Project Scale</p>	<p>Largest scale, lending over US\$60 billion annually across public and private sectors.</p> <p>IBRD: Market-rate loans for middle-income countries.</p> <p>IDA: Concessional financing (interest-free loans and grants) for the world's poorest countries.</p> <p>IFC/MIGA: Provides a full suite of private sector instruments including loans, equity, and guarantees. Utilises blended finance to de-risk projects in challenging environments.</p>	<p>Regionally significant scale, with an ambition to increase agricultural investment to US\$2.4 billion per year.</p> <p>AfDB: Debt financing for regional member countries.</p> <p>ADF: Provides concessional financing to 37 of the continent's lower-income countries.</p> <p>NTF: A self-sustaining fund for concessional financing to low-income members.</p>	<p>Regionally significant scale, lending approximately US\$32 billion per year. Provides loans, guarantees, grants, and technical assistance. Manages dedicated trust funds like the e-Asia and Knowledge Partnership Fund to support ICT initiatives. Employs co-financing and risk participation programmes to engage commercial banks.</p>
<p>Suitability for DPI Projects</p>	<p>Highly suitable for large, foundational, and complex DPI projects. Its global reach and specialised entities (ID4D, DE4A) make it a premier partner for digital ID and comprehensive government digital transformation. The separation of public (IBRD/IDA) and private (IFC) arms allows for clear, structured engagement depending on the project's nature. It is a key player in using blended finance to mobilise private capital in high-risk environments.</p>	<p>Ideal for DPI projects aligned with Africa's specific development priorities. Its deep regional expertise and focus on integration (e.g., through PAPSS) make it a strong partner for cross-border DPI and projects that support agricultural modernisation, energy access, and industrialisation. The Bank is a good fit for projects requiring a blend of public sector policy support and private sector execution.</p>	<p>Well-suited for DPI projects in Asia-Pacific that require integration into traditional infrastructure sectors like transport, urban development, and energy. Its established country partnership strategies provide a clear framework for alignment. The focus on both government and private projects makes it adaptable for various PPP models for DPI.</p>

This analysis suggests that:

For a **large-scale, foundational DPI project (e.g., a national digital ID system from scratch)**, especially in a low-income or high-risk country, the **World Bank Group** is the most suitable partner. Its dedicated initiatives like ID4D, immense financial capacity through IDA, and sophisticated blended finance tools via IFC and MIGA are unparalleled for such undertakings.

For a **DPI project focused on regional integration in Africa or one deeply embedded in a specific sectoral transformation (like agriculture or energy)**, the **AfDB** would be the preferred partner. Its regional mandate, established relationships with African governments, and "High 5's" strategy ensure projects are aligned with continental priorities.

For a **functional DPI project in Asia-Pacific that needs to be integrated with existing or planned physical infrastructure (e.g., a smart transport system or a digital platform for urban services)**, the **ADB** is an excellent choice. Its deep sectoral expertise and strong relationships with national planning and finance ministries facilitate a cohesive approach to blending digital and physical infrastructure investments.

Structured Approach to Financing Digital Public Infrastructure (DPI)

This framework provides a structured approach for national leadership to navigate the complexities of financing Digital Public Infrastructure (DPI) projects. It aligns a country's specific context with the most suitable financing models by evaluating **four key variables: Economic Status, Digital Maturity, Public Value Objective, and Institutional Capacity**.

Step 1: Foundational Assessment (The "What & Why")

Before selecting a financing model, leadership must clearly define the project's core purpose and scope.

Define the DPI Project: Is this a foundational system (e.g., national digital ID), a functional system (e.g., sector-specific payments), or both? Is it a greenfield project built from scratch, or will it be built upon existing systems like a civil registry?

Identify the Primary Public Value Objective: A clear objective is crucial as it defines financing choices. Is the primary goal:

- **Financial & Social Inclusion:** To accelerate digital adoption and bring underserved populations into the formal economy (like India's UPI). This often requires subsidised or free services initially.
- **Market Competition & Innovation:** To catalyse a competitive market for digital services (like Brazil's Pix). This may involve a transaction-fee model to ensure market viability.
- **Government Efficiency:** To improve the delivery of public services and reduce administrative costs (like Estonia's X-Road or Uganda's UGHub).

Step 2: Contextual Analysis (The "Where & Who")

This step maps the country's current landscape against four critical variables.

Variable	Key Questions & Considerations	Low Readiness	High Readiness
1. Economic Status	What is the country's income level (low, middle, high) and fiscal space? Is there high public debt? Can the government bear high upfront capital costs and long-term operational expenses for a public good?	Low-income, high public debt, limited fiscal space.	Middle-to-high income, stable economy, capacity for public investment.
2. Digital Maturity	How widespread is digital infrastructure (connectivity, energy)? What is the level of digital literacy and adoption among citizens and businesses? Do mature digital systems already exist (e.g., M-PESA in Kenya)?	Large digital divide, low internet penetration (<40%), unreliable energy.	High internet penetration, widespread digital literacy, existing digital platforms.
3. Institutional Capacity (Public Sector)	Does the government have the technical and managerial expertise to lead a complex digital project? Is there a history of successful large-scale public projects? Are there strong regulatory bodies (e.g., for data protection, competition)?	Limited technical expertise, path-dependent thinking, risk of politicisation.	Experienced agencies, strong regulatory frameworks, capacity for innovation and long-term R&D.
4. Institutional Capacity (Private & Non-Profit Sector)	Is there a vibrant ecosystem of private tech companies, innovators, and non-profits? Is there an active open-source community? Are philanthropic organisations active in the country?	Nascent tech sector, limited private capital for innovation.	Mature tech ecosystem, experienced entrepreneurs, active philanthropic and non-profit partners.

Step 3: Mapping Financing Models to National Context (The "How")

Based on the assessment in Step 2, leadership can identify the most suitable primary financing model. DPI financing involves both initial capital costs and recurring operational costs, which may require different funding sources.

Financing Model	Description & Strengths	Best Suited For (Context)	Key Risks to Mitigate
Public-Led Financing	Government funds the DPI entirely through national budgets, often supplemented by loans from Multilateral Development Banks (MDBs) like the World Bank. Strengths: Aligns with public good objectives, ensures neutrality and scale, can bear high-risk capital for long-term R&D.	High institutional capacity (Public), Inclusion-focused objective. Often used for foundational elements like digital ID (e.g., India's Aadhaar) that require neutrality and scale.	Inefficiency, slow innovation due to lack of market pressure, politicisation, and soft-budget constraints.
Private-Led Financing	The private sector designs, builds, finances, and operates the infrastructure, motivated by commercial outcomes. This is common in high-maturity economies. Strengths: Drives innovation, efficiency, and user experience.	High digital maturity, High institutional capacity (Private), Market-focused objective. Suitable for services built atop existing public infrastructure where a commercial case is clear.	Risk of market capture, monopolisation, and exclusion if commercial interests override public value. Requires strong regulatory oversight.
Philanthropic & Non-Profit Led	Philanthropic capital funds initial design, proof-of-concept, and standard-setting, often via non-profits. Strengths: Long time-horizon, neutrality, focus on research and building open-source "public goods".	Nascent projects needing high innovation. Ideal for conceptualisation and developing open standards (e.g., iSPIRT's role in India Stack, eGov Foundation's DIGIT).	Donor-driven agendas, lack of public accountability, potential for unsustainable funding if not transitioned to a long-term model.

Consortium/ PPP Model	A coalition of public, private, and/or non-profit actors share costs and responsibilities. E.g., India's UPI, operated by a non-profit consortium of banks. Strengths: Blends public oversight with private sector efficiency and innovation; distributes risk.	Mixed Institutional capacity, objective requires both scale and innovation. Effective where multiple stakeholders (e.g., banks) have a shared interest in the infrastructure's success.	Requires careful alignment of incentives and a strong, neutral governing entity to prevent stakeholders from favouring their own interests.
Blended Finance	Uses catalytic public or philanthropic capital (e.g., grants, first-loss equity, political risk guarantees) to de-risk projects and attract private investment. MDBs often play a key role. Strengths: Mobilises private capital for projects in high-risk environments.	Low economic status, Low digital maturity, High-risk environments. Particularly useful for closing the "Digital Funding Gap" in emerging economies.	Complexity in structuring deals; dependence on development partners; risk that private capital may not materialise despite public de-risking.

Adopting a Phased Approach

DPI will require different financing models for different stages:

- **Development & Deployment:** Initial design, creation, and testing. Often suited for public, philanthropic, or MDB funding due to higher risks.
- **Adoption & Cooperation:** Driving user uptake and building partnerships. May involve public subsidies or private sector marketing efforts.
- **Maintenance & Regulation:** Long-term operations and governance. Requires a sustainable revenue model (e.g., government budget, transaction fees) and a mandated entity for oversight.

Conclusion

Financing Digital Public Infrastructure (DPI) is a multifaceted challenge requiring a strategic blend of public policy, operational capabilities, stakeholder engagement, and robust governance. The selection of a financing model is paramount, directly influencing the DPI's sustainability and its ability to deliver public value. A comprehensive framework for DPI financing must consider three key elements: defining the public value, ensuring operational feasibility, and securing political and support feasibility.

Key considerations in DPI financing include distinguishing between capital and operational costs, evaluating greenfield versus brownfield projects, leveraging economies of scale, and addressing the scarcity of reliable cost estimates. Funding sources typically involve public, private, and philanthropic capital, each offering distinct advantages. Public sector financing is crucial for high-risk, foundational elements, while the private sector drives innovation and efficiency for services built atop this infrastructure. Philanthropic capital often supports early-stage research and standard development.

Effective financing models include blended finance, which strategically combines various capital sources to de-risk projects, and Public-Private Partnerships (PPPs), which leverage private sector efficiency while maintaining government oversight. Multilateral Development Banks (MDBs) like the World Bank, AfDB, and ADB play a critical role, providing financing instruments, technical assistance, de-risking mechanisms, and global coordination. The choice of MDB depends on the project's scale, regional focus, and specific development priorities.

Ultimately, a phased approach to DPI financing is essential, with different models suited to the development, adoption, and long-term maintenance and regulation stages. By aligning economic status, digital maturity, public value objectives, and institutional capacity, national leadership can navigate the complexities and secure sustainable financing for DPI projects, ensuring their successful implementation and the realization of their intended societal benefits.

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