



**Tailored CBDC technical assistance
in emerging markets: a critical gap in
the pursuit of reaching the SDGs**

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Registered offices:
Bonn and Eschborn, Germany
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany

E info@giz.de
I www.giz.de/en

Authors:
Antonia Esser, Barry Cooper, John Kiff, Kgotsso Mofulatsi (cenfri)

Responsible:
Klaus Prochaska/GIZ

Design:
kipconcept gmbh, Bonn, Germany

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Introduction

CBDC's potential impact on the financial system worldwide is transformational. The concept of money has evolved over several centuries and with it the infrastructure that supports it. Central bank digital currency (CBDC) is one of the latest innovations in the monetary system.¹ Its exploration is gaining momentum across the globe. Along a wide spectrum and degree of resource allocation, an increasing number of central banks are investigating the potential of CBDC for digital payments efficiency, its risks to the financial system, its necessary preconditions, its cost, as well as its monetary and fiscal policy implications – the list of angles is growing constantly. While few CBDCs have actually launched, the hype is warranted: the likely impact on financial systems worldwide is immense and is further transforming the way we think about monetary systems, the concept of money, and the concept of transacting using identity at the core of a system.

The impact of CBDC is contextually different; global connectedness allows for practical CBDC learnings to be shared in real time. CBDC sits at the centre of a fully digital economy infrastructure and organises the digital veins or rails of any digital payment in a country or region so that ideally every person or entity can use their identity features to transact seamlessly with one another. The extent of impact of CBDC depends on the existing country/regional context, which makes the tailoring of the CBDC design an imperative. But how can such a system be optimally designed so that it overcomes the well-known challenges related to digital payments today, especially in lesser digitised markets? How can new risks that arise, related to issues such as cybercrime, consumer protection and the misuse of identity information,

be mitigated? The answer to many of the questions is discovered through trial and error, and many iterations, given the uncharted territory. Thanks to the availability of near real-time information today, peer learning on technology innovations is much faster than it used to be, and learnings on the above questions can be analysed, synthesised and distributed a lot quicker on many different platforms.

The future is now: central banks can draw on a wide range of support in exploring the topic today.

As with any innovation on this potential scale, a host of development organisations, standard setting bodies, think tanks, academia, private sector players, and technical providers are actively supporting the national and regional authorities through funding, knowledge creation, and/or technical assistance on their CBDC feasibility, pathway and implementation journeys.

LMICs stand to benefit most from the financial infrastructure modernisation that CBDC entails. For lower- and middle-income countries (LMICs) this support is especially crucial given the limited human and financial resources, and technical in-house capabilities to fully investigate and appropriately design a CBDC system that speaks to the economic actors' needs while mitigating the emerging risks. This chance to modernise the financial infrastructure and move many LMICs fully into the digital age is pivotal: if countries are not given the appropriate support, the risk of being left behind on crucial matters such as cross-border trade, the risk to their own financial systems due to spill over effects of more efficient CBDCs, and the inability to fully participate in the global financial system, is high. Many developed countries already have modern financial infrastructures and the gains from introducing a CBDC can be a lot more marginal compared to LMICs.

1 "A CBDC is cash but in digital form. Similar to physical cash, it is issued by the central bank and guaranteed as a claim on the central bank reserves, can be accepted broadly and results in instant transfer of value. However, unlike cash, it is digital in nature, meaning that with the right infrastructure, a population with the adequate set of (digital and financial) skills can use it to interact seamlessly with other digital instruments and tools" (AFI, 2022).

Purpose of this note: stocktake of the degrees of CBDC technical assistance support for LMICs. This note therefore highlights the different options for CBDC support, and specifically technical assistance (TA) and capacity building, for LMIC authorities in their general-purpose/retail and wholesale CBDC exploration journeys. It also shows how demand outstrips supply in fit-for-purpose assistance and the important role of development partners in closing this gap in order

to ensure that CBDCs can meet the expectations in relation to achieving the Sustainable Development Goals (SDGs). The note makes the link between CBDC and financial inclusion in LMICs before categorising the different TA and capacity building offerings today. The resulting recommendations are aimed at highlighting the remaining gaps in optimally equipping authorities in LMICs in their CBDC pursuit.

CBDC and financial inclusion in LMICs: a main goal

Theoretical link between the SDGs and CBDC is strong: financial inclusion through payments efficiency in LMICs. Financial inclusion is a key enabler of the 2030 Sustainable Development Goals (SDGs): it is recognised as a target in eight of the seventeen goals.² Recognising the importance of digital payments to contribute to financial inclusion, central banks in LMICs are increasingly looking to address the remaining payment needs

of citizens and businesses. CBDC, both in its general-purpose and wholesale form, is one innovation that is receiving attention on a global scale for its potential in achieving financial inclusion, and the SDGs, through digital payments efficiency. Figure 1 shows the growth in CBDC attention. Over the past five years, CBDC exploration in LMICs has more than tripled (CBDC tracker, 2022).

Figure 1: CBDC exploration among LMICs



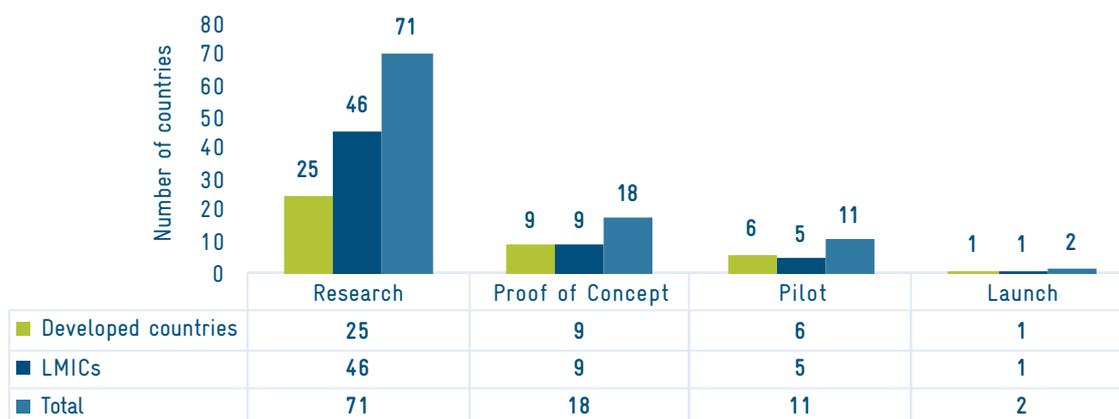
Source: CBDC tracker, 2022

² SDG 1, on eradicating poverty; SDG 2 on ending hunger, achieving food security and promoting sustainable agriculture; SDG 3 on promoting health and well-being; SDG 5 on achieving gender equality and economic empowerment of women; SDG 8 on promoting economic growth and jobs; SDG 9 on supporting industry, innovation, and infrastructure; and SDG 10 on reducing inequality. Additionally, in SDG 17 on strengthening the means of implementation there is an implicit role for greater financial inclusion through greater savings mobilization for investment and consumption that can spur growth (UNCDF, 2022).

LMIC exploration at the forefront: financial inclusion as a goal. Figure 2 shows that 46 LMIC central banks are currently in the research phase of exploring CBDC, suggesting that many of the initial learnings for CBDC will come from

LMICs. The top motivation for this exploration, according to recent surveys by the Bank of International Settlements (BIS) as well as Alliance for Financial Inclusion (AFI), is financial inclusion (Boar & Wehrli, 2021; AFI, 2022).

Figure 2: CBDC exploration by countries and stages



Source: CBDC tracker, 2022

LMICs require appropriate assistance to ensure theoretical benefits can be reaped. CBDC will not automatically advance financial inclusion, and if not designed appropriately and fit-for-purpose for the country’s context, could reinforce existing barriers³ (AFI, 2022). The appropriate and extensive support in CBDC research, proof of concept and design for LMICs is therefore crucial to avoid risks and worsening exclusion. Given the lengthy undertaking in carefully identifying and designing CBDCs to fill payments efficiency gaps, understanding and balancing the effects on financial stability, the regulatory and legal system, and knock-on effects on the global payments markets, among others, the development community and its supporting stakeholders are well-advised to appropriately support LMICs on their CBDC journey.

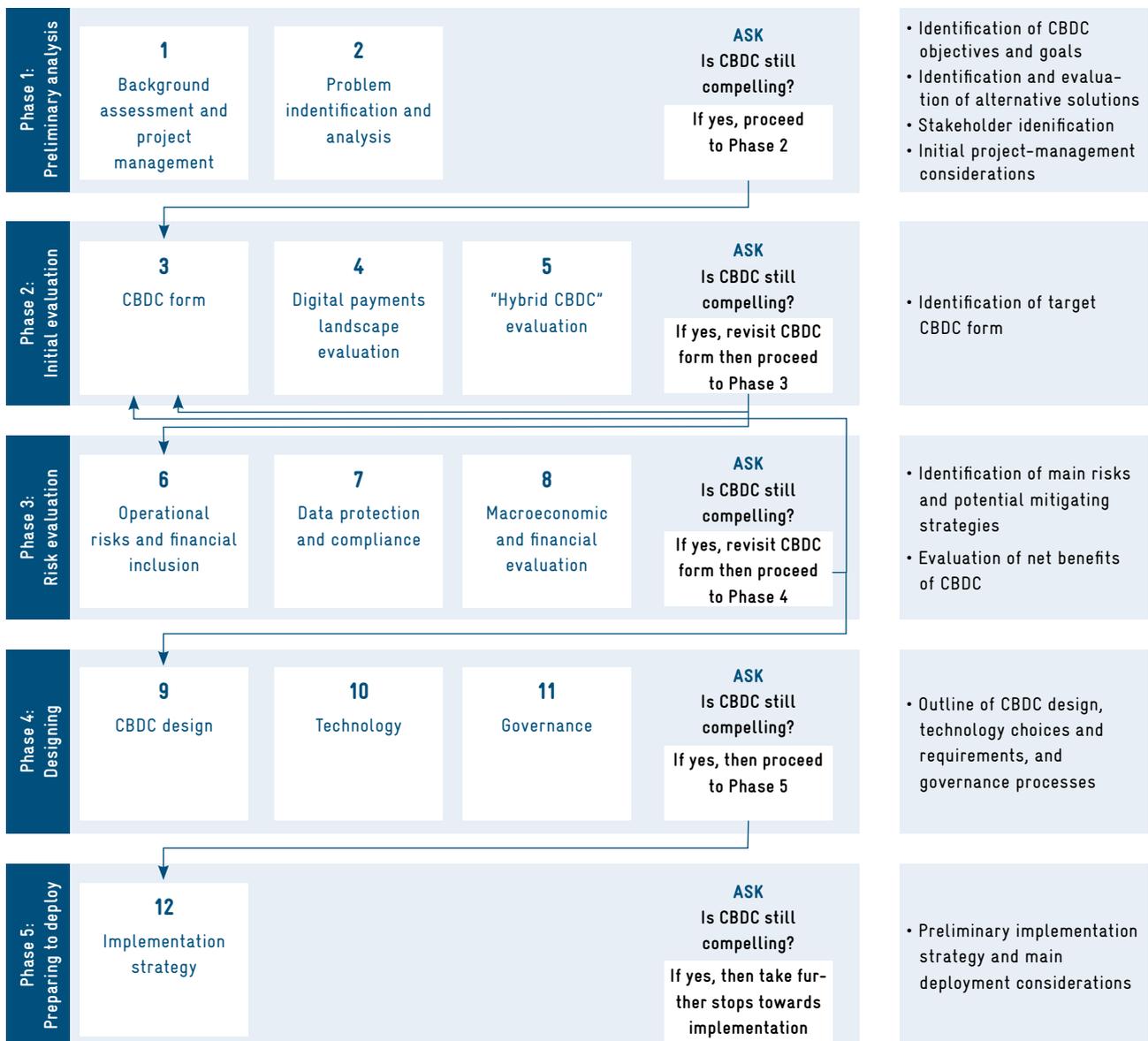
³ For example, pre-existing low levels of digital literacy could disincentivise CBDC adoption or populations could opt out of formal financial systems due to a lack of trust in national governments and could inadvertently increase the costs of payments (AFI, 2022).

CBDC exploration phases requiring different types of support

Different TA and capacity building requirements depending on exploration phase. Public authorities have a growing depository of theoretical frameworks at their disposal to guide their CBDC exploration journey from the onset. Figure 3 outlines one such framework, compiled by the World Economic Forum (WEF). The CBDC journey is divided into five different phases that

can guide central banks and supporting actors in the necessary steps and decisions to be taken from conceptualising to implementing a CBDC in a holistic process. Each phase consists of key questions to be answered to proceed to the next phase. Within each phase there are different topics to be examined, different studies to be conducted, and different stakeholder discussions to be facilitated.

Figure 3: CBDC decision flow chart



Source: WEF, 2020

Partnerships to bring different skillsets together in tailored CBDCs are essential. This framework highlights the necessity yet complexity of a full CBDC project and illustrates that CBDC exploration is human- and financial-resource intensive, as discussed above. While some phases require in-depth analysis of the status quo to pinpoint the design features that will achieve the overall goals and remove barriers, other phases are resource intensive in that they rely on persistence

in stakeholder motivation, negotiation skills, and diplomatic discourse facilitation. Other parts call for deeply technical understanding of system engineering or regulatory analysis skills. The skillsets required vary and a collaboration between different entities that can bring these skills to the table is practically inevitable. Each of the phases and their high-level support requirements are briefly described in Figure 4.

Figure 4: Phases of CBDC exploration and required support



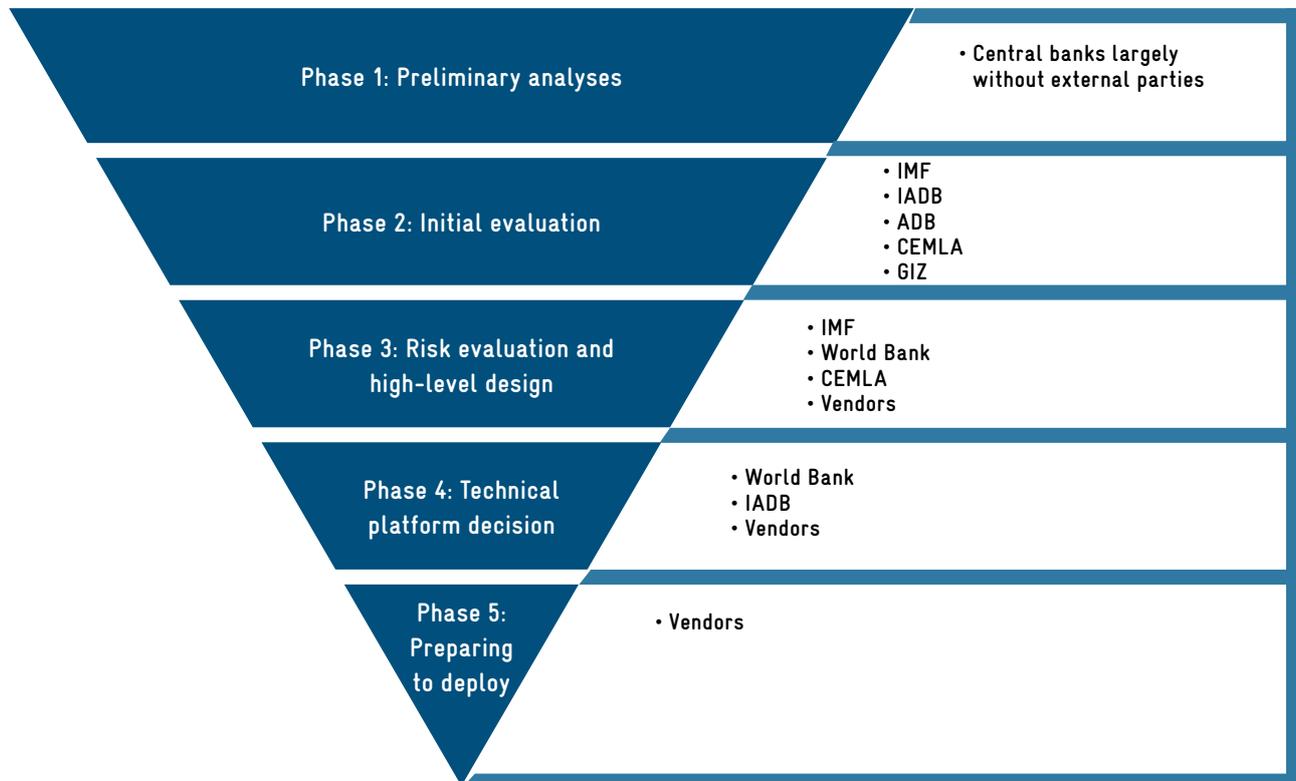
Source: adapted from WEF, 2020

The existing avenues for technical assistance for LMICs

IMF the most prolific TA provider yet demand outstrips supply. The mapping exercise of TA and capacity building providers, outlined in Figure 5 and in more detail in the annex, reveals that there is currently no entity that supports a central bank or public authority throughout the full spectrum of phases. This is logical given that different required skills as discussed, and the high resource intensity. The International Monetary Fund (IMF), however, provides the most comprehensive bilateral TA programme available to interested central banks to date. Based on need, a technical assistance programme is put together that supports central banks in various capacities, mostly in Phase 2 and Phase 3. The needs vary from basic concept exploration to a more substantial range of

e.g., regulatory capacity building. The assistance varies in form and timeframe, lasting from weeks to several years. There is clear interest from central banks for this kind of support: the demand for such assistance is currently high and outstrips the supply manyfold (Stakeholder interview, 2022). The IMF programme includes access to adequate technical experts around the globe across a range of legal, security, data privacy and technological topics, but funding and the pool of experts, while growing, cannot yet meet the high demand to support all those central banks that would like assistance. There is a clear opportunity for other CBDC support entities to assist in the expansion of the IMF programme, both in terms of technical expertise and in terms of funding.

Figure 5: Available TA support by phase



Source: Authors' own

Development banks also play an important role in providing bilateral TA. International development banks, such as the Inter-American Development Bank (IADB) and the Asian Development Bank (ADB) are also supporting a small number of central banks in their regions with bilateral TA and capacity building. These programmes are newer and less is known about the extent of support. However, research suggests that the ADB activities cover feasibility studies and capacity building workshops, among specific technical questions, while the IADB plays a larger role in Phase 4, the technical platform decision. This is also where the World Bank with its technology and innovation lab fills a gap. The lab is an “internal technology advisor, and a knowledge and exploration hub around operationalizing emerging technologies for development impact” (World Bank, 2017). While the lab is not limited to CBDC solution exploration, its focus on the full spectrum of emerging technologies for various use cases allows for the application of blockchain and others to CBDC. In addition to the lab, the World Bank also offers TA to central banks in Phase 2 if CBDC emerges as a potentially suitable innovation as part of the World Bank financial sector support programmes in the various countries.

Niche actors can play a key role in Phases 2 and 3. Shorter programmes, specific workshop and capacity building activities, in addition to regulatory reviews and financial sector diagnostics are offered ad-hoc, on a smaller scale, and often in response to request for proposals by central banks. Providers include the Center for Latin American Monetary Studies (CEMLA) in Latin America and GIZ in Africa.

Vendors have the technical know-how but gap analyses can be limited and multi-vendor sandbox is needed. CBDC vendors walk the path with central banks on the back of request for proposals, largely from Phase 3 onwards. As the technical solution is already built at that stage and the choice of technology practically pre-determined, the approach by vendors is to explore the extent of tailoring needed to meet the country’s needs and risk profile, and to test their solutions in a pilot form. As the choice of technology should ideally only be determined based on a solid gap analysis to ensure that financial inclusion goals can be met

(e.g., the need for offline capabilities in unstable electricity environments), allowing a number of technology providers to demonstrate the effectiveness of their solution in a controlled environment before a final decision could ensure that central banks do not lock themselves into a commercial arrangement prematurely. This kind of sandbox lab where central banks and a suite of providers can plug and play is a clear gap in the offering today.

Several TA providers are focused on Phase 2 yet other phases run the risk of being overlooked – both need expansion. The longer-term support of LMIC central banks throughout the various stages of CBDC exploration is undoubtedly the most effective in ensuring that a fit-for-purpose CBDC can meet payment efficiency and therefore financial inclusion goals. Given the extent to which LMICs are exploring the topic, the need for this type of assistance is expected to skyrocket. This provides an opportunity for partnerships to be formed to meet the increasing demand for initial and holistic gap analyses. Most support is available in these earlier phases of the journey today, and specifically in Phase 2 where the number of TA providers is highest. There is a risk that central banks could be receiving conflicting or duplicate support and attention as well as resources could be fragmented. Furthermore, the type of activity that is funded, e.g., feasibility studies that are not detailed or tailored enough to the country context could result in ill-designed CBDC models that do not speak to the financial inclusion goals. This further illustrates the opportunities for partnership and targeted funding to ensure that central banks can make informed design choices. Phases 3 onwards receive relatively less support and there is a gap that needs to be filled by TA providers going forward in order to support central banks in their more advanced stages of CBDC refinement.

Further capacity building avenues exist that are critical in catalysing learnings

Workshops and courses: opportunity for deeper regional engagements and concept exploration. Six entities are actively providing regular or ad-hoc workshops, both domestically and regionally, to central banks and other key stakeholders in the various LMIC economies. These workshops and conferences focus on the key concepts of CBDC to inform and educate a country's or region's stakeholders as well as specific deep-dive topics such as CBDC design, the necessary regulatory environment, interoperability and payment system efficiency considerations. There is also an online course offered by the Digital Frontiers Institute as well as the Cambridge Centre for Alternative Finance that focus on CBDC concepts and implications for financial stability and inclusion. In addition, increasingly post graduate courses in select countries focus on innovative payment system technologies and currencies, such as CBDC. This focus is crucial in ensuring that the much-needed next generation of technical experts can access CBDC-specific concepts. Given the continuous development in the CBDC space and emerging learnings from the field, workshop, courses and conferences need to be multiplied and made regularly accessible for LMICs to ensure that new findings and learnings can permeate across the regions. The importance of the topic as well as the implications for the global monetary system call for increased exchange between jurisdictions via international platforms.

Applied research: universities, central banks and providers collaborate. Large universities such as MIT, Stanford University, and University of Cape Town have launched CBDC-focused labs to bridge the gap between academia, CBDC experts, central banks and, at times, CBDC providers. These labs allow for focused and in-depth research on pertinent topics with the support of central bank and/or provider data, as well as by convening CBDC experts. Several of these endeavours are nascent yet crucial and require continuous funding support to ensure that co-creation of feasible and fit-for-purpose CBDC design is enabled.

Written guidance: a growing depository of knowledge. In addition to the above, there is a growing body of literature that LMIC institutions can access and consult. This technical literature can be divided into three types: guidance papers, feasibility toolkits and CBDC pilot progress reports. A non-exhaustive list of publications can be found in the annex.

- **Guidance papers.** Guidance papers are the largest category of CBDC literature and offer the widest range of choice for LMIC stakeholders. The guidance ranges from summaries of progress to date in the different stages of CBDC exploration across the globe as well as regionally, to CBDC principles that are important to consider throughout the different stages. Entities including the BIS, IMF, World Economic Forum, the World Bank, the G7, and many others, have released such papers to define CBDC concepts and offer insights into the theoretical implications for CBDC vis-à-vis financial and monetary stability, cross-border transactions, and financial inclusion, among others. The IMF has launched a longer-term initiative with the development of a CBDC handbook on all relevant aspects to consider, which will be continuously updated by technical CBDC experts over the years. Many more guidance papers are currently under development than what is outlined in the annex.
- **Feasibility toolkits.** In a further step to the guidance papers, feasibility toolkits offer templates, decision trees and how-to guides on the various stages of CBDC exploration. Given the limited number of countries that have launched a CBDC, these toolkits are expected to be refined as new learnings emerge. This also implies that these toolkits still need to be tested on the ground to ensure that they achieve the desired outcomes. In addition to technical assistance, they provide an important practical link to assisting LMICs in their CBDC journey.

- CBDC pilot progress reports. Several central banks have released progress update reports to share their experience with the public, including from Uruguay, China, and Thailand. In addition, entities such as the IMF, the World Bank, and CEMLA have compiled cross-cutting overviews of CBDC launches and pilots.

As more central banks are moving into pilot and launching stages, this body of literature is expected to grow. It is particularly useful as it shows CBDC insights that are context-specific and therefore hold practical implications for LMICs.

Conclusion and recommendations: expand depth of bilateral assistance, funding, and partnerships for shared testing grounds to meet the SDGs

Comprehensive support for LMICs is fundamental to meet the SDGs through CBDC. If LMIC central banks are late CBDC adopters, the risk is that they would be negatively impacted by spill-over effects, particularly where national currencies have the potential to be displaced in their own jurisdictions by stronger neighbouring digital currencies, digitised dominant trade currencies or as part of a currency union. LMICs cannot be made worse off or left behind if payment efficiency goals, financial inclusion targets, and SDGs by extension, are to be realised.

Depth of support determines the true potential of CBDC to meet financial inclusion goals. The disproportionate demand for technical assistance, when compared to supply, combined with the urgency of LMIC countries to advance a CBDC programme causes LMIC central banks to proceed within their own resources and capacity in relative isolation. This is evidenced in the structure of technical assistance and feasibility studies being done explicitly in conjunction with a vendor or where research outcomes are geared to accommodate predefined solutions or vendors. LMIC central banks should not be forced into inappropriately quick decisions around design and CBDC configurations as the knock-on effects in terms of the various risks can be large.

Coordination, partnerships, and a fit-for-purpose range of support mechanisms offer great value to LMICs. There is still room and need to expand regional leadership and coordination, particularly where LMICs are situated to lessen the risk of spill-over effects and hence to create space for LMICs to develop fit-for-purpose CBDC solutions that are well-considered and appropriate in their respective realities. Further development partner coordination, where not already in place, around the range of technical assistance that can be accessed by or is offered to a LMIC is key given the importance of these key support partners in the CBDC space. A distortion in the focus on payment system upgrades and the required resources can lead to inertia or wasted resources (for example, the decision between a CBDC and a non-CBDC instant payment system). CBDC may not be the most appropriate tool for all LMICs, however it should be given thorough thought and room for exploration, especially considering the likely upgrades of neighbours or key regional and/or global trading partners. Considering it as part of a portfolio of different payment efficiency tools and conducting the appropriate ecosystem diagnostic as part of or followed by technical assistance of experts will be key to a holistic decision-making framework. These LMIC programmes require continuous funding, sharing/consolidation of

learnings through publications, and access to expertise – a call to action for all development partners.

The next frontier: a shared platform for technical CBDC solution exploration. The concepts of lab tests and sandboxing innovations has taken hold in a majority of LMIC central banks that have been surveyed in this and other related studies (AFI, 2022). However, the form, content and efficacy vary significantly.

A key factor that limits CBDC testing and sandboxing is that the cost of setting up a lab and sandbox with different providers and different configurations can be multiples of a single vendor-led solution pilot or rollout. Unlike conventional sandboxing of value-added services, with CBDC labs and sandboxing, the tests are tailored to national requirements and should be quite extensive given the risks. Consequently, set-up costs are significant per different configuration to be tested and then multiplied by the number of vendors. Given that there is likely only one successful vendor, the exercise becomes impractical for most of the parties unless there is a substantial contribution to vendor costs. The considerable costs also raise the possibility of limited testing scope and depth.

The imperative therefore would be to attract vendors to a shared lab and sandbox environment, able to test most of the core configurations and where there are significant prospects for vendors to be successful with multiple LMICs in the most efficient application utilisation of testing resources. There would need to be a graduated flow from the lab to targeted sandbox pilot tests. Ideally the lab and sandbox activity would be more appropriate onwards from Phase 4: Technical platform (Figure 4 above), and practically it should contain a TA component which can provide an arm's length review of the particular pathway each central bank has adopted. It could also advise on any material remedial adjustments (Phases 1 through 4) or interventions that can better ensure intended outcomes. This could operate as failsafe for those central banks that have followed largely internal or vendor-led processes, prior to sandboxing.

Such facilities would ideally need to be configured with a consortium of development partners, regional development banks, vendors, academia and niche research institutions. The lifespan of the testing ground would ideally be medium term to facilitate the foreseeable ramp up of CBDC programmes and then a tail end for the upgrade or realignment of some of the early CBDC schemes in the light of the iterative learnings that are already manifesting over time.

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Annex

	ORGANISATION	DESCRIPTION
1. Technical assistance or capacity building programmes	IMF	Bilateral longer-term more intensive engagements aimed at staff of central banks working in the payment, legal, technology, monetary policy, and financial stability departments
	World Bank (ad-hoc: bilaterally offered)	Bilateral longer-term more intensive engagements aimed at staff of central banks working in the payment, legal, technology, monetary policy, and financial stability departments
	Center for Latin American Monetary Studies	Providing technical assistance to the central banks of Guatemala and Bolivia. It addresses “general aspects of Central Bank digital currencies; characteristics of CBDCs; retail, wholesale and hybrid CBDCs; the consensus protocol in CBDCs; functions of Distributed Ledger Technology (DLT) and Blockchain; risks associated with CBDCs; benefits of CBDCs to Payment Systems; motivations and challenges of Central Banks to implement CBDCs; impact of CBDCs on monetary policy and financial stability; regulatory framework applicable to CBDCs; and, the experience in Latin America and the Caribbean about CBDC-related projects” (CEMLA, 2022).
	Inter-American Development Bank	IADB is offering technical assistance to Latin American central banks. The full extent is unknown (Stakeholder interviews, 2022)
	Asian Development Bank	CBDC TA programme for member central banks (Stakeholder Interviews, 2022)
2. Workshops/capacity building	IMF	One-week regional workshops held several times a year aimed at staff of central banks and other government agencies dealing with the regulation of the financial sector
	Digital Frontiers Institute	CBDC workshop tailored towards emerging market and developing economies which is held over 3 days and seeks to help financial authorities with their strategic approach to CBDC (DFI, 2021)
	Finreg Learn	Finreg Learn is a 5-day capacity building program which covered CBDCs, API and Open Banking, and Regulatory Sandbox Framework in Nigeria. The CBDC component is geared to showcasing how regulators and regulated entities can “deliver modern digital payment infrastructure and services for financial inclusion and market resilience through CBDCs (Finreg Learn, 2022)
	Cambridge Centre for Alternative Finance	The FinTech and Regulatory Innovation programme is a tutor-led online programme delivered to senior policy-makers and regulators at central banks, security agencies and ministries of finance, including CBDC Over eight weeks, participants learn essential concepts concerning the technologies and business models that are transforming the financial industry. The focus of the programme is on formulating evidence-based regulatory, supervisory and policy responses to the development of financial technology.

	ORGANISATION	DESCRIPTION
2. Workshops/capacity building	GIZ (ad-hoc: bilaterally offered)	GIZ has offered capacity building workshops on the concept of CBDC to select central banks in the past as part of ongoing country programmes.
	CBDC Conference	The annual CBDC Conference includes several sessions on CBDC capacity building
	CBDC Think Tank	An organization that has its own CBDC sandbox and has recently hosted the CBDC Summit 2022 which included a series of workshops and masterclasses on CBDC (CBDC TT, n.d.)
3. Applied research	MIT Digital Currency Initiative	The Digital Currency Initiative is a research community at the MIT Media Lab focused on cryptocurrency and blockchain technology.
	Africa Cybersecurity Resource Centre for Financial Inclusion (forthcoming)	The project will include Cybersecurity CBDC capacity building requirements identification and capability mapping for financial regulators (includes Central Banks, consumer protection and prudential regulators)
	UCT-Algorand Fintech Innovation Hub (forthcoming)	The Fintech innovation hub will have a dedicated research programme on CBDCs in Africa and will advise government and private sector participants on CBDCs. The organization also launched a CBDC dashboard.
	Hyperledger Foundation	Developed a platform that was used by Bitt and Nigeria for their CBDC pilots
	G&D Filia	Is assisting Ghana in their e-Cedi pilot and is developing Thailand's CBDC proof of concept. The organization also provides support such as sandboxes, consulting, hardware, security evaluation and economic simulations for CBDC (G&D Filia, n.d.)
	EMTECH	Organization that includes an API platform which can be used as a regulatory sandbox. Also provides infrastructure for "CBDC to transition from paper to trusted tokens" (Emtech, n.d.)
	ProgressSoft	Offers a CBDC solution which "maintains a one-to-one exchange rate with fiat money and is designed by international experts in economy, finance and regulation complemented with decades of experience in national payment systems to offer a bespoke advanced form of national money." (ProgressSoft, n.d.)
	Christodorescu et al., 2020 (Visa)	Wrote a working paper that proposes an offline payment system (OPS) protocol for CBDC that enables users to make digital payments to other users while they are both temporarily offline and cannot connect to payment intermediaries or the internet (Christodorescu, 2020)

	ORGANISATION	DESCRIPTION
4.a Guidance papers	BIS, 2022	The report outlines findings in three areas which include: "existing barriers to financial inclusion that could be addressed by a CBDC; CBDC design features that many jurisdictions view as critical to addressing these barriers; and the challenges foreseen, along with legal and regulatory changes needed for CBDC implementation." (Hall, 2022)
	World Bank, 2021	It is a guidance note intended to "assist central banks and other relevant public authorities by providing a decision-making framework to be used they investigate the potential use of CBDC as an instrument to strengthen or modernize their NPS" (World Bank, 2021)
	WEF, 2021	A compendium of 8 white papers covering regulatory choices, value proposition for the underserved and technology choices for policy makers and industry to consider in implementing CBDC and stablecoins. (WEF, 2021)
	Inter-American Development Bank	Paper discusses a proof of concept that "demonstrate cross-border payments between entities in different countries that involve currency exchange, using digital money represented by tokens -tokenized money- in the LACChain Besu Blockchain Network." (IADB, 2022)
	Kiff et al., 2020	"Paper examines key considerations around central bank digital currency (CBDC) for use by the general public, based on a comprehensive review of recent research, central bank experiments, and ongoing discussions among stakeholders. It looks at the reasons why central banks are exploring retail CBDC issuance, policy and design considerations; legal, governance and regulatory perspectives; plus cybersecurity and other risk considerations." (IMF, 2020)
	G7, 2021	The report provides public policy principles for Retail CBDCs for the purpose of supporting and informing policy deliberations around CBDCs among G7 countries and others (MoF, 2021)
	Arab Monetary Fund, 2022	The guidance note is meant to "support Arab central banks in their journey exploring CBDCs that matches best for each jurisdiction, and are well suited for the central bank objectives, available resources, targeted implications, taking into consideration country-specific conditions, infrastructure and as well as respective legal and regulatory frameworks." (AMF, 2022)
	Asian Development Bank, 2021	The policy brief asks whether CBDCs can promote financial inclusion across the Pacific Islands. It states the key financial inclusion challenges that Pacific Island countries face and goes on to describe the design choices for CBDCs, opportunities, and challenges for CBDCs in the region. (Didenko and Buckley, 2021)
	Stellar Development Foundation, 2021	"This paper aims to provide an overview of the policy and regulatory considerations for central banks to build and issue a Central Bank Digital Currency (CBDC) and highlights the benefits of open networks."
	Duffie et al., 2021 (Stanford University Future of Digital Currency Initiative)	The document "provides a high-level overview of some principles of CBDC and key factors supporting those principles that should be considered when choosing and implementing a technology to support CBDC."

	ORGANISATION	DESCRIPTION
4.a Guidance papers	Ali and Narula, 2020 (MIT Digital Currency Initiative)	The paper seeks to review technologies that have been developing in cryptocurrencies in the last decade and think about how they may be able to address concerns around centralization, competition, risk, surveillance, and privacy when designing CBDCs/DFCs, or a stablecoin.
	AFI, 2022	Issued a report on the potential that CBDCs have for financial inclusion in developing and emerging economies. It also provides an overview of the key imperatives for CBDC as a financial inclusion tool (AFI, 2022) Will issue a special report that will "introduce members to CBDCs from a financial inclusion context, deliver an understanding of the underlying motivation, design choices and approach, risk mitigation options and provide insights into policy and regulatory implications to be considered in the evaluation of CBDC within an inclusive, sustainable, and secure financial system context. The work will be led by DFSWG and supported by other relevant working groups." (AFI, n.d.)
	ITU digital currency global initiative, 2022	The report provides an overview of private digital currencies and CBDCs. It argues that CBDCs can promote financial inclusion and lists eight policy principles to maximize the benefits of digital currencies while mitigating risks based on which technical standards can be developed
	Buckley et al., 2021	"The paper focuses on how technology might reshape payments going forward. It considers the policy issues and choices associated with crypto-currencies, stablecoins and sovereign digital currencies and emphasises that there is no single model for sovereign digital currency design." (Buckley et al., 2021)
	IMF (forthcoming)	CBDC handbook - live document that will be continuously updated on all crucial aspects of CBDC, including cybersecurity
	IMF (forthcoming)	Policy notes and fintech notes on how to protect privacy with CBDC, liquidity management, foreign exchange, among others
	Africa Cybersecurity Resource Centre for Financial Inclusion (forthcoming)	Organization intends to write a white paper on the cybersecurity risks in CBDC for central banks as well "elaborate several CBDC Cybersecurity Risk Management Note for the key stakeholders (Central Banks, Financial Service Providers and Digital Financial Service Providers including payment cards providers, Consumers) for domestic and cross border operations"
	Digitax (forthcoming)	Paper on the implications of retail CBDC on revenue authorities in emerging markets
	Chaum et al., 2021	Issued a working paper on how Central Banks can issue a CBDC by recommending a token-based system without distributed ledger technology. (Chaum et al., 2021)

	ORGANISATION	DESCRIPTION
4.b Feasibility toolkits	Brookings, 2020	The working paper states the “fundamental technical design challenges” that CBDC designers face and discusses the technologies that can be used to address the challenges involved. It also presents the range of functionalities and use cases that a “well-designed CBDC platform” can offer users (Allen et al., 2020)
	WEF, 2020	The toolkit addresses the need for “a concise high-level CBDC decision framework that provides comprehensive and risk-aware information to policy-makers.” “The document serves as a guide to ensure that any CBDC deployment is cautious and fully considers alternative solutions, risks, deployment and governance strategies, multi-stakeholder input and other salient factors. Notably, it is intended to serve as a complement to additional research that any policymaker considering CBDC should conduct” (Lannquist, 2020)
	World Bank, 2021	This report discusses the main technical features of domestic retail CBDC and its potential implications. It also discusses the implications of CBDC for monetary policy, financial stability, financial intermediation, payments and settlements, financial integrity, and general financial inclusion, particularly in development economies’ context. It also discusses the legal and regulatory aspects of CBDCs (World Bank, 2021)
	BIS (Innovation Hub), 2020	The report “advances the foundational international work by outlining common principles and the key features a CBDC and supporting infrastructure would need in order to contribute to central bank public policy objectives.” (BIS, 2020)
	BIS (Innovation Hub), 2021	“This report explores central banks’ considerations for designing a potential general purpose (retail) central bank digital currency (CBDC) system. This includes an overview of the potential functions in a broad ecosystem, the different possible roles in a private-public collaboration, how interoperability could be a core feature and a central bank’s options in how an interoperable CBDC system could be implemented.” (BIS, 2021)
	Atlantic Council, 2022	The report considers the challenge of cybersecurity to CBDCs. It discusses the various CBDC design variants and choices and provides policy recommendations for legislation and regulation pertaining to CBDC cybersecurity. (Fanti et al., 2022)
	IMF, 2019	The working paper studies the “optimal design of CBDCs “in an environment where agents sort into cash, CBDC and bank deposits according to their preferences over anonymity and security; and where network effects make the convenience of payment instruments dependent on the number of their users.” (Agur et al., 2019)
	Oliver Wyman Forum and Amazon Web Services, 2022	“The paper provides a “ for central bankers, technologists, and impacted stakeholders to discuss together whether and how a CBDC solution can be designed and evolve to fit their policy goals.” (de Lima and Salinas, 2022)

	ORGANISATION	DESCRIPTION
4.c CBDC pilot progress reports	IMF, 2022	The report studies six countries that have advanced CBDC projects to highlight their experiences and lessons to assist other IMF countries that are considering or well underway in implementing CBDCs in their jurisdictions (Soderbeg et al., 2022)
	Bank of Thailand, 2021	The central bank of Thailand issued a paper that discusses their approach to Retail CBDC issuance
	CEMLA, 2020	"This report summarizes the main findings of the Peer Review of pilots in Bahamas, Sweden and Uruguay. It is focused on lessons drawn with the expert judgment of CBDC WG members on retail CBDC pilots, especially in aspects of design (technological) and implementation (operational)."
	BIS, 2022	The paper is a compilation of the experiences emerging economies have had pertaining to CBDCs and covers key considerations and design choices within each case study and a high level overview for other emerging economies
	World Bank, 2021	"This report discusses the use of CBDCs for cross-border payments. The report reviews the models that have been developed for this purpose to date and discusses critical legal issues that arise in the context of cross-border use of CBDC" (World Bank, 2022)
	Sarmiento, 2022	An academic paper published on Uruguay's Central Bank website that provides 7 key lessons from their e-Peso Pilot plan for future consideration and implementation of CBDCs (Sarmiento, 2022)
	People's Bank of China, 2021	A progress report on the e-CNY research and development which explains the background, objectives, vision, design framework and policy considerations for e-CNY.
	Central Bank of Kenya, 2022	Discussion paper on the use cases and opportunities and risks of CBDC in Kenya
	National Bank of Kazakhstan, 2021	Progress report on the phase one of the Digital Tenge project. It looks at the Implications, benefits, risks, and organizational and technological opportunities of the Digital Tenge (NBK, 2021)
	Bangko Sentral ng Pilipinas, 2020	Paper on CBDC's implications on the Philippines' central banking pillars such as monetary policy and price stability. The paper also looks at CBDC's legal aspects and potential to boost financial inclusion. (BSP, 2020)
	Bank of Ghana, 2022	The paper "gives an overview of the motivations of issuing the eCedi, the potential benefits for stakeholders, the design principles of the eCedi, including the governance, accessibility, interoperability, requisite infrastructure and security" (Bank of Ghana, 2022)



Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn

Friedrich-Ebert-Allee 32+36
53113 Bonn, Germany

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany

T +49 228 44 60-0
F +49 228 44 60-17 66

T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de