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Sharon Branch, Lynsey Ward and Allan Wright

The Evolution of SandDollar

Decentralised finance (DeFi) and financial technology (FinTech) are buzzwords that have been used in the financial arena in recent years, as experts and novices seek to advance financial innovation. One phenomenon that has risen to prominence in the FinTech discussion is the subject of digital currency and its implications towards financial inclusion. In particular, the discussion of a central bank digital currency (CBDC) has gained traction, particularly over the last few years, as a means to improve payment efficiency as well as to reduce the use of physical cash.

A CBDC is defined as a widely accepted digital version of a national currency issued by the central bank. It is denominated in the sovereign currency of the country and is a direct liability of the central bank. There are two types of CBDCs, wholesale and retail. Wholesale CBDCs are used to settle large value financial transactions primarily between regulated financial institutions, such as interbank transfers and reserve settlements. Retail CBDCs on the other hand, are used more broadly by households and businesses.

It is important to note that CBDCs are not a type of cryptocurrency. The primary difference between a CBDC and a cryptocurrency is the fact that a CBDC is regulated by the central bank, whereas cryptocurrencies are decentralised and unregulated. In addition, CBDCs are pegged to the national currency on a 1:1 basis, while cryptocurrencies lack intrinsic value and carry high rates of volatility, given that they are not backed by anything.

With regard to design features, there are key principles and elements of instrument designs that CBDCs should embody. According to a Bank for International Settlements

(BIS) report on foundational principles and core features of CBDCs, a group of seven central banks¹ suggested that the three core principles of a CBDC should include: i) the issuance of a CBDC should not compromise monetary or financial stability; ii) a CBDC should coexist with and complement existing forms of money; and iii) a CBDC should promote innovation and efficiency (BIS, 2020).

When designing the instrument, central banks can decide which features they want to link to the digital currency. For example, central banks may decide whether they will place caps or limits on the amount of CBDC individuals can hold at any one time, and whether or not it will bear interest. These features are particularly important to consider in relation to monetary policy, and in particular, its impact on money supply and financial intermediation. To elaborate, making the CBDC interest-bearing will help to spur demand for the digital currency; however, it can also make the CBDC a direct competitor to bank deposits, which has the potential to cause a possible run on banks and thus lead to financial disintermediation. It is equally important that CBDCs are low cost, easy to use, convenient and interoperable to ensure widespread adoption.

Over the last few years, interest in the exploration of a CBDC has grown. In fact, in May 2020 only 35 countries were considering a CBDC, and currently there are 114 countries, representing 95% of global GDP, exploring the digital currency (Atlantic Council, 2023). To date, 11 countries have fully launched a CBDC. In the Caribbean, three CBDCs have been launched, including The Bahamas' SandDollar, Jamaica's JAM-DEX and the Eastern Caribbean Currency Union's D-Cash. Throughout 2023, over 20 countries are expected to take significant steps towards piloting a CBDC, including Australia, Thailand, Brazil, India, South Korea and Russia (Atlantic Council, 2023).

The purpose of this contribution is to present an exploration of the evolution of the SandDollar and assess the trade-offs between cash and the SandDollar within the Bahamian economy using a New Keynesian model. This article first explores the motivation behind the launch and implementation of the SandDollar and considers the progress of adoption thus far. Subsequently, it presents the model used to assess the trade-offs between cash and

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¹ The Bank of Canada, the European Central Bank, Bank of Japan, Sveriges Riksbank, Swiss National Bank, Bank of England and Federal Reserve Board of Governors.

CBDC in The Bahamas and discusses some early lessons. The paper concludes with some steps forward, including adoption expansion and future policy considerations.

Motivation

The concept for advancing the national payments infrastructure to include a CBDC in The Bahamas began in the late 1990s, with the Central Bank's push to modernise the domestic payments system to not only align with international standards, but also to serve the development needs of all sectors of the economy. Following this, in early 2000, the Bahamian Payments Systems Modernization Initiative (PSMI) was established with the objective of improving financial inclusion and access, thereby making the domestic payments systems more efficient and non-discriminatory in access to financial services across the entire country. In line with this, the implementation of a retail CBDC acts as an extended phase of the PSMI.

Despite the strides The Bahamas has made in modernising its payments system, there is still a significant portion of the population that remains unbanked. In fact, a 2018 study by the International Monetary Fund (IMF) showed that some 18% of the adult population is considered unbanked (Wright et al., 2022).

The reason behind this high number is twofold. First, given the archipelagic makeup of The Bahamas, the far dispersion and small population of its 700 islands and cays makes the cost of doing business on the outer islands significantly more expensive when compared to the capital, Nassau. Further, de-risking began in 2015 and resulted in the loss of Correspondent Banking Relationships (CBRs) globally, with the World Bank (2015) citing the Caribbean as the most impacted region. As a result of the loss of CBRs, combined with the high cost of doing business, many of the international banks in the domestic sector that had a presence on these islands decided to wind up their operations, leaving the residents there without access to banking services.

Secondly, opening traditional bank accounts is often seen as an arduous task, given the amount of documentation requirements, the long turnaround time and the cost associated with this service. Hence, individuals are less inclined to open bank accounts. Also, in some cases, persons lack the necessary documents required to open bank accounts due to their migrant status and are then excluded from the banking sector.

Therefore, to provide a payments solution for those who do not have access to banking services, as well as to

continue the broader payments systems modernisation efforts, the Central Bank of The Bahamas launched the SandDollar in October 2020, becoming the first national retail CBDC in the world.

The broad objectives of the SandDollar are to i) increase the efficiency of the Bahamian payments system through more secure transactions and faster settlement; ii) provide non-discriminatory access to payment systems without regard for age, immigration or residency status; iii) achieve greater financial inclusion and cost-effectiveness, and provide greater access to financial services across all of The Bahamas; and iv) strengthen national defenses against money laundering, counterfeiting and other illicit ends by reducing the ill effects of cash usage.

Implementation and adoption of the SandDollar

The launch of the SandDollar began with a pilot in December 2019 in Exuma, a southern island in The Bahamas that represents a microcosm of the country, given its archipelagic features. Ahead of the pilot, a survey was conducted to ascertain the level of financial inclusion on the island, as well as to get a sense of residents' appetite for electronic payments. The results of the survey showed that 93% of Exuma's residents had high access to basic bank accounts. Some 17% of residents chose not to use bank accounts, and this was due to a lack of trust in the institutions or the inconvenience of getting to a physical bank. The results of the survey also showed that 96% of the residents in Exuma owned mobile devices, 40% of which used their mobile devices to perform some form of bill payment or online banking transaction. Further, while nearly two-thirds of the respondents had a willingness to use their smartphones for payments, there was a reluctance to use electronic banking (mostly among older respondents) due to distrust in electronic platforms and cybersecurity concerns.

Against this backdrop, the pilot was largely successful, notwithstanding setbacks associated with the COVID-19 pandemic, which hit three months after the initial rollout. Following the passage of Hurricane Dorian in 2019, the pilot was extended to Abaco in February 2020, one of the most heavily impacted islands, to help restore its financial system. To operationalise wallets, all Supervised Financial Institutions (SFIs) were given the opportunity to become Authorized Financial Institutions (AFIs), which would act as dealers of the SandDollar. Payment Service Providers (PSPs) were the first to apply, and therefore make up the bulk of AFIs.

The process is quite simple. Once users download the app on their smart devices, they must be onboarded by

an AFI – there are currently seven active AFIs – which validates the required Know Your Customer (KYC) documents. Once the AFI validates the account, users can upload money to their wallets either via bank transfer or via a cash deposit with the AFI. After that, users are free to use their SandDollars for purchases, similar to other electronic means of payment.

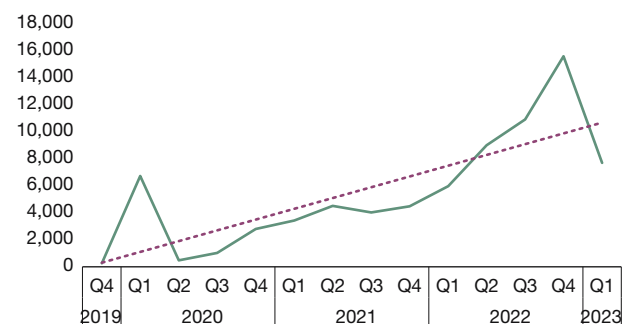
The SandDollar wallet has three tiers, with varying degrees of requirements. Tier 1, or basic wallet, does not require the user to submit any KYC documents. It allows the user to hold up to 500 SandDollars and limits transactions to no more than 1,500 SandDollar per month. The Tier 2, or premium wallet, allows the user to hold up to 8,000 SandDollars, with a 10,000 SandDollar monthly transaction limit. Under this tier, users must have a valid government-issued ID and have the option to link the wallet to a bank account. The Tier 3 wallet is considered a merchant account and allows users to hold between 8,000 and 1,000,000 SandDollars, without transaction limits. To open this wallet, the user must tie the wallet to a bank account and produce a valid business license and a value added tax certificate to the AFI for enrollment.

In order for the SandDollar to achieve its end goal, there were a number of design elements that had to be considered. Firstly, it was important to ensure interoperability between the SandDollar and the various e-wallets offered by the AFIs; that way, users would be able to send and receive SandDollars from each other, no matter which e-wallet developer they were using. Secondly, it was critical that transparency and accessibility were embedded in the platform, as well as real-time transaction processing, point-of-sale support for businesses that would accept the SandDollar, and a fully auditable non-anonymous transactions trail.

As mentioned above, one of the reasons that people chose not to use digital payments was distrust in electronic platforms and cybersecurity risks. Hence, to mitigate this fear, the Central Bank made robust efforts to ensure that every touchpoint of the SandDollar was secure with end-to-end encryption, from the Central Bank's digital currency ecosystem to the e-wallets usability. When institutions apply to be SandDollar distributors, they have to be assessed by an international third party to ensure that their systems are adequate and have the necessary security measures before they are approved as an AFI. At the user level, wallets require multi-factor authentication to gain system access or complete transactions.

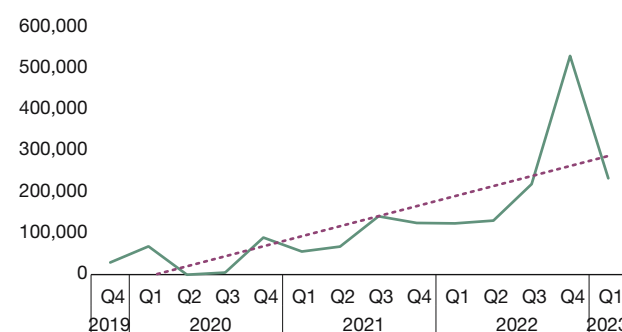
The use of the SandDollar is restricted to domestic transactions only, as a way of mitigating the risk of illicit financial flows, as well as to monitor fraud detection. With regard to

Figure 1
Number of SandDollar transactions, quarterly data



Source: The Central Bank of The Bahamas.

Figure 2
SandDollar transaction value, quarterly data



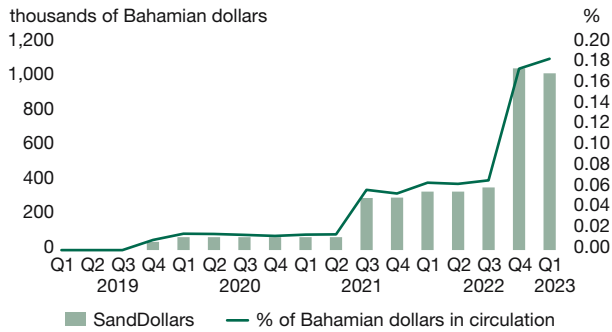
Source: The Central Bank of The Bahamas.

monetary policy considerations, SandDollars are non-interest bearing, with balance caps to alleviate any near-term risks of bank runs, or financial disintermediation.

During the initial rollout, the take-up was low, averaging monthly transactions of some 15,000 SandDollars (see Figures 1 and 2). However, as the impact of COVID-19 began to weaken and the Central Bank resumed its education and promotional campaigns, there was a pickup in 2021, with monthly transactions increasing by 119% to some 33,000 SandDollars. In 2022, transactions continued to trend upwards, averaging roughly 85,000 SandDollars per month by the end of the year, representing an increase of 160% over the previous year.

Further, total SandDollars in circulation surpassed the million mark in December 2022, and as of March 2023, there were approximately 1,024,169 SandDollars in circulation. However, SandDollars still represent less than 1% of the total Bahamian dollars in circulation (see Figure 3).

Figure 3
SandDollars in circulation



Source: The Central Bank of The Bahamas.

There are just over 100,000 wallets, and approximately 1,440 of those are merchant wallets (see Figure 4). At the end of 2022, existing wallet holders represented between 20% and 25% of transactional account holders within the banking system. With regard to transaction types, peer-to-peer and peer-to-business payments were valued at \$55.7 million in 2022, although SandDollars represented only a marginal portion of this.

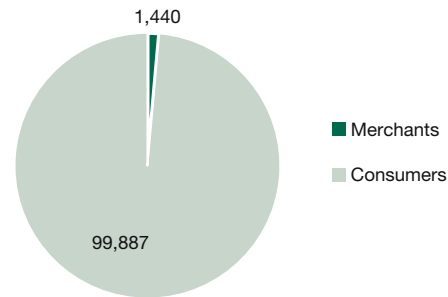
To increase adoption, the Central Bank featured the SandDollar at a number of national festivals in 2022. In addition, the Central Bank partnered with a reputable charity – the Salvation Army – during the holidays and allowed persons to donate in SandDollars, which also helped to boost transactions, if only marginally.

During 2022, the Central Bank completed the integration of the SandDollar into the Automated Clearing House (ACH) system, which allows consumers with Tier 2, i.e. premium wallets, and above to move SandDollars between their e-wallet and bank accounts seamlessly. To complete top ups or withdrawals to and from bank accounts to e-wallets, users can log in to their online banking profile with their respective commercial bank. Additionally, all AFIs allowed the two-way movement of funds to bank accounts on their applications by the end of the first quarter of 2023.

The Central Bank is now in the process of rolling out Wallet 2.0, which seeks to enhance the user experience of the SandDollar. In this phase, the bank is working on making improvements to the technology that will allow activation to be done on the app itself for Tier 1 wallets, thereby alleviating the need for users to contact an AFI to activate their wallets and enabling self-onboarding.

In addition, Wallet 2.0 will address transactions and wallet visibility by AFIs, feature enhanced anti-money laundering/combating the financing of terrorism risk management, and enable convenient portability of accounts

Figure 4
SandDollar wallets as of March 2023



Source: The Central Bank of The Bahamas.

between financial institutions. Further, it will address anticipated point-of-sale needs for medium and large businesses that require multiple payment terminals, and allow AFIs to offer fee-based merchant services from within the core platform. This is expected to be released by September 2023.

Assessing the trade-offs between cash and the CBDC in The Bahamas

Adopting the model used by Mishra and Prasad (2023) with a banking sector, a general equilibrium model was employed to assess the trade-offs between cash and CBDC in The Bahamas. The parameters were adjusted to accurately depict the Bahamian economy. In the model, it is posited that households and businesses are the two main economic agents, deriving utility by choosing private goods for consumption (c_t), public goods for consumption (c_t^g), physical capital (k_t), bond holdings (b_t), cash (ca_t) and CBDC (dc_t). β represents the discount rate. It is also assumed that the economy is closed, given that CBDC in The Bahamas cannot be used to settle international trade.

$$\max \sum_{t=0}^{\infty} \beta^t [u(c_t) + v(c_t^g)] \quad (1)$$

subject to

$$\begin{aligned} c_t + c_t^g + i_t + b_t + \phi \left(c_t, \frac{ca_{t-1}}{1 + \pi_t}, \frac{dc_{t-1}}{1 + \pi_t} \right) + m\phi \left(\frac{ca_{t-1}}{1 + \pi_t} \right) \\ + ca_t + dc_t + \frac{\tau}{1 + \pi_t} dc_{t-1} \\ \leq f(k_{t-1}) + \frac{l_{t-1}^b}{1 + \pi_t} b_{t-1} + \frac{l_{t-1}^d}{1 + \pi_t} dc_{t-1} + \frac{ca_{t-1}}{1 + \pi_t} \end{aligned} \quad (2)$$

$$k_t - (1 - \delta)k_{t-1} \leq i_t \quad (3)$$

$$c_t \leq \frac{ca_{t-1}}{1 + \pi_t} + \frac{dc_{t-1}}{1 + \pi_t} \quad (4)$$

Equation (2) represents the budget constraint, with π_t denoting inflation, and τ denoting the tax rate. Mishra and Prasad (2023) assumed the function \emptyset controls the transactions costs of cash and CBDC, while φ determines the amount of penalty associated with tax avoidance. It is assumed that the relative price of public goods for consumption to private goods, and that the price of investment to private consumption goods is one. Equation (3) shows the evolution of physical capital, with δ representing depreciation, while equation (4) shows a liquidity constraint in that the purchase of private goods for consumption cannot be larger than the amount of cash and CBDC holdings at the beginning of the period.

Table 1 shows the respective values of the parameters used to calibrate an economy akin to The Bahamas.

Discussion

Four autoregressive shocks are employed to ascertain the impact on the economy: a cash, a CBDC, a productivity and a monetary policy shock. The results show that when there is a positive shock to cash (such as a fiscal stimulus payment in the aftermath of a natural disaster), cash usage decreases sharply over the short term, before normalising to trend over the medium term, while CBDC usage has the inverse effect, increasing significantly over the short term and returning to trend in the medium term (quarterly calibration). Comparatively, commercial bank deposits show a sharp spike initially, followed by a decline in the short term, indicating immediate consumption following the cash injection.

In the case of a positive CBDC shock (that is, helicopter drops of SandDollars to e-wallets in The Bahamas), the results show a fall-off in cash usage over the short to medium

Table 1
Parameters for the calibration of an economy akin to The Bahamas

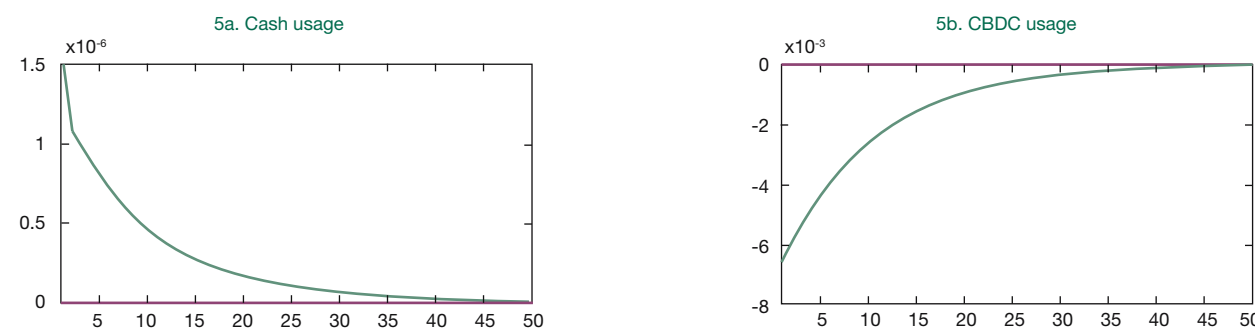
Parameter	Description	
β	Discount factor	0.95
η	Proportion of government spending on public goods	0.80
ϵ_c	Inverse of IES for private consumption goods	2.00
ϵ_g	Inverse of IES for public consumption goods	1.50
m	Probability of monitoring	0.15
τ	Tax rate	0.08
$\bar{I}d$	Steady state nominal rate of return on CBDC	1.05
μ	Growth rate of money supply	0.01
α	Capital share	0.33
A	Productivity	1.00
δ	Depreciation rate	0.10
θ_1	Level parameter of transaction function	2.00
a	Transaction costs for consumption goods	2.00
γ	Transaction efficiency for cash	1.05
ρ	Transaction efficiency for CBDC	1.75
θ_2	Level parameter of penalty function	2.00
v	Sensitivity to cash in penalty function	3.00

Note: IES is intertemporal elasticity of substitution.

Source: Authors' estimates.

term, with usage normalising to trend over a longer period of time (see Figure 5a). CBDC usage, on the other hand, increases over the short to medium term, before normalising to trend over the long term (see Figure 5b). In line with this, consumption spikes before declining sharply, representing immediate spending by households following the CBDC wallet top-ups. Commercial bank deposits show a sharp decline in the short term, normalising to trend faster than cash usage, indicating perhaps that in the event of a

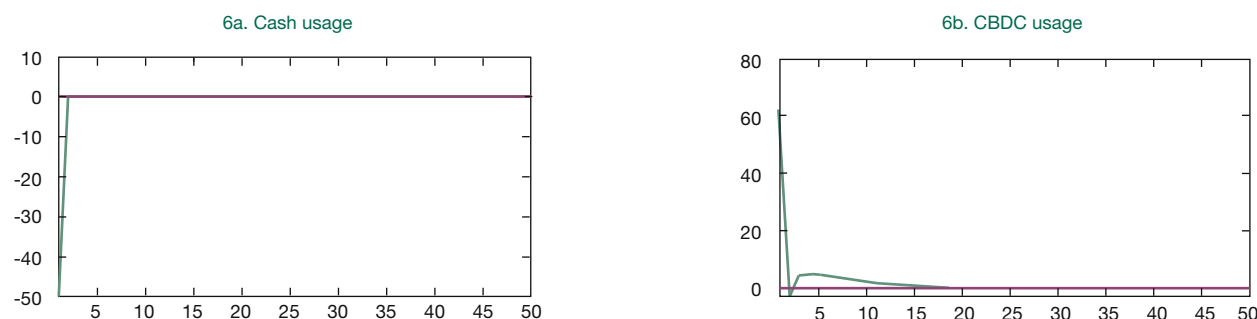
Figure 5
Positive shock to a central bank digital currency



Notes: A positive shock to CBDC would result in a decline in cash holdings and an increase in CBDC holdings. The purple line shows the long-term trend.

Source: Authors' elaboration.

Figure 6
Positive shock to monetary policy



Note: A positive shock to monetary policy would drive an increase in cash usage; CBDC usage would decline initially, followed by a marginal rise, before returning to trend. The purple line shows the long-term trend.

Source: Authors' elaboration.

CBDC shock, persons are more likely to use digital means of payment, as opposed to reverting to cash.

A positive shock to productivity would drive a spike in cash usage, which is intuitive in that, with higher productivity, persons are earning more and subsequently using more cash. Inversely, CBDC usage would decline sharply, although it would return to trend relatively quickly. In addition, commercial bank deposits would dip initially, before increasing over the long term, while consumption would increase in the immediate to short term and remain elevated over the review period.

Finally, a positive shock to monetary policy would drive an increase in cash usage, although CBDC usage would decline initially, followed by a marginal rise, before returning to trend (Figures 6a and 6b). Consumption, however, would increase and remain elevated, corresponding with a decline in commercial bank deposits, although levels would return to trend.

These results demonstrate the importance of understanding the trade-off between holding cash and CBDC. A follow-up project will examine welfare implications of this trade-off.

Early lessons

While digital payments have made strides in recent years, the reality is that CBDCs are still operating in a nascent space. That being said, any marks towards progress will not be without restraints or limitations. Three years into the rollout of the SandDollar, early lessons can be drawn from three broad areas: technology efficiency, interlinkages between education and adoption, and metrics.

Firstly, at the helm of any successful digital payment innovation is robust, efficient and resilient technology.

Without a proper functioning technological support system, the rollout of any digital payment solution will fail, including a CBDC. The SandDollar has a strong technological framework, using a Hyper Converged Infrastructure (HCI) that is designed to provide full end-to-end encryption and two layers of secure data storage – the second being Distributed Ledger Technology (DLT), which allows for tokenisation. However, despite how robust the platform may be, without the proper information and communication technology (ICT) infrastructure, merchants and consumers will not have the most optimal experience, which can have a negative impact on adoption and payments efficiency. Hence, the Central Bank has prioritised working with the government to strengthen ICT infrastructure, which is also in line with their push towards digitisation.

Equally, the criticality of the interlinkage between education and adoption became increasingly clear during the rollout. If persons lack a general understanding of financial terms and services, they are less likely to use new payment solutions. Also, when persons do not understand how a financial services firm is conducting business or the technology used to provide payment services, a lack of trust generally follows, and discourages them from using alternative sources of payments. Therefore, the Central Bank has made user education a major focus area in its adoption efforts.

Lastly, despite the three-year-old rollout, it is still too soon to see the impact of the SandDollar on financial inclusion. The pandemic-imposed restrictions made it difficult to ramp up implementation efforts, and also made data collection – a challenge in The Bahamas – problematic to pursue. Now that the restrictions have eased, the Central Bank will crystallise its data goals and efforts by defining its us-

age metrics more clearly so as to be able to ascertain the progress the country has made from the baseline in 2018.

Next steps

Moving forward, the Central Bank is focused on advancing its efforts towards adoption. The bank will increase educational and promotional campaigns on the ground, with the main aim of bringing more users on board. In particular, efforts will focus around three main pillars: i) building a network of merchants that accept and encourage the use of the SandDollar, ii) enlisting participation from the traditional banking sector and credit unions, and iii) the importance of user education and inspiring user confidence.

The Central Bank of The Bahamas has staffed an Adoption Unit, which operates under the Currency Department, and has responsibility for the marketing and promotional efforts surrounding SandDollar, along with operational oversight. Throughout the remainder of 2023 and into 2024, the Adoption Unit will undertake various marketing campaigns throughout the Capital and Family Islands to promote the use of SandDollar.

Further, the bank is also working with commercial banks and credit unions to integrate the SandDollar into their operations, so that they too can become AFIs. The benefits include increasing the avenues by which consumers can create and use SandDollar wallets, which will promote more adoption on the one hand, and, on the other hand, create a more efficient payments space by providing new, innovative payment alternatives and fair competition. The first commercial bank officially became the latest AFI, and is expected to begin offering wallet services in the near future.

On the technology front, the Central Bank is working on moving towards offline functionality, which would allow users to transact in SandDollars without having access to the internet. This is critical to the discussion on financial inclusion. Given infrastructure setbacks, some persons lack access to quality and consistent electricity and internet services. By allowing offline functionality, those without access to connectivity will still be able to complete transactions. This will also assist in the aftermath of a natural disaster, where infrastructure may be temporarily damaged, leaving persons offline. With offline functionality, persons will be able to send payments to and from family members between islands, as opposed to being restricted by delayed restoration timelines.

Finally, the bank has prioritised educating users in an effort to improve the level of financial literacy in The Bahamas, as well as to support increased local adoption of

CBDC. Without education on how a CBDC works, persons will be less inclined to use it, thereby restraining adoption. Hence, the bank has committed resources to improving the knowledge of financial products even outside of the scope of the CBDC, in an effort to spur adoption, both on the merchant and consumer sides.

As for policy considerations, the Central Bank will continue to monitor the evolution of the SandDollar and its impact on financial inclusion to determine which policies are most optimal. This includes taking into account considerations around remuneration and cross-border settlement, among others.

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