

Smart Banknotes Defined: Features and Criteria

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Overview

A smart banknote (SBN) is a physical banknote on a paper or polymer substrate that can communicate with an electronic network. A smart banknote is denominated and has the physical properties of a traditional banknote in size, feel, appearance, and etc. It is not a rigid, plastic card such as may be used in present credit or debit transactions. The purpose of a smart banknote is to act as a hybrid that can function either as a definitive or an electronic instrument, depending upon the immediate need. Such functionality will allow a smart banknote to act as a transitional device between traditional payment systems and electronic and crypto-based payment systems.¹

Smart Banknotes v. Paper Wallets

A smart banknote is not a paper wallet used with cryptocurrency. A paper wallet is a paper or polymer item that contains the private and public keys needed to access a single cryptocurrency address or account and the funds therein. Such an item can be replicated any number of times but will only give access to one, specific address. And, it can only do so via an electronic network. Otherwise, a paper wallet conveys no value.

A smart banknote functions largely as a traditional banknote. A banknote is a paper or polymer item that acts as a token of a currency. Its visible denomination presents its discrete value, *prima facie*. Every banknote is unique and cannot be replicated without creating a double-spend problem. A smart banknote conveys value without the need to connect to an electronic network. However, it is capable of doing so and acting as an electronic payment vehicle.

Background

The idea of electronic features on banknotes appears to have arisen in the early 2000s. However, such measures were seen as new security features, ensuring the authenticity of the notes.²

By 2010, and the rise of cryptocurrencies, thinking about electronic features on banknotes had expanded to include the thoughts of a smart banknote, acting as a transition between

¹ The need for a hybrid or transitional device between cash and digital money has been recognized by the European Central Bank, European Central Bank, *Report on a Digital Euro* (October 2020), 11: www.ecb.europa.eu/pub/pdf/other/Report_on_a_digital_euro~4d7268b458.en.pdf.

² Jon Evans, "Banknotes go electric to outwit counterfeiters," *New Scientist* (15 December 2010), URL: www.newscientist.com/article/mg20827915-200-banknotes-go-electric-to-outwit-counterfeiters/?ignored=irrelevant (accessed 6 October 2020).

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traditional banknotes and cryptocurrencies. Such a perspective was expanded in work performed for the Bill & Melinda Gates Foundation by Ignacio Mas and Consult Hyperion, represented by Paul Makin and Andrew Whitcombe who are credited with creating the term “smart banknote.”³

These smart banknotes were envisioned as traditional, denominated banknotes with RFID chips embedded in them. The chips allowed the smart banknotes to communicate with electronic networks and to “activate” or “deactivate” the note, meaning to validate or invalidate the banknote’s value. It was envisioned that smart banknotes could repeatedly move between these states, having the denominated value of the note transferred to and from the smart banknote as needed. And, the note would physically show without connection to an electronic network whether it was activated or deactivated, whether it had value or not.⁴

Meanwhile, Paul Makin and Consult Hyperion envisioned a smart banknote that acted more as a debit card. A banknote on a polymer substrate would contain an RFID chip. Through this chip, the note would communicate with an electronic network. And, while the note would be denominated with a maximum value, value could be subtracted from the smart banknote via electronic transactions. The current value would be displayed on the note via an electronic ink. Conceivably, the value of the note could also be increased to its maximum face value through electronic transfers to the note.⁵

It did not take long for others to attempt the practical implementation of the idea of a smart banknote. However, these smart banknotes were takeoffs on Bitcoin and the conception of a paper wallet. In 2011, for example, plastic bitbills cards appeared on the market. Based on Bitcoins, these were denominated payment cards, bearing public keys and private keys covered by a tamper-evident sticker.⁶ These were followed in 2013 by notes issued by Bitcoin Suisse AG. Again, denominated in Bitcoins, these Bitcoin Suisse Crypto Certificates held a private key sandwiched between sheets of polymer paper, requiring destruction of the note to access it.⁷ In 2016, BitNotes appeared on the scene. Like bitbills and Bitcoin Suisse Crypto Certificates, these smart banknotes were based on Bitcoin, bore denominations, and used QR Codes to interface with an electronic network.

³ Ignacio Mas, “Smart Banknotes: A Proposal for Bank Notes that Bridge the Gap Between Physical and Electronic Money,” *The Futurist*, 5, 1 (Jan-Feb 2011), papers.ssrn.com/sol3/papers.cfm?abstract_id=1687368; “Smart Banknote Design Competition,” *Consult Hyperion* (12 January 2011), URL: chyp.com/2011/01/12/smart-banknote-design-competition/ (accessed 6 October 2020).

⁴ Mas, “Smart Banknotes;” Sara Corley, “LISTEN NOW: Smart Banknotes and the Future of Money,” *Digital Frontiers Institute* (29 March 2019), URL: digitalfrontiersinstitute.org/2019/03/29/webinar-smart-banknotes-ignacio-mas (accessed 6 October 2020).

⁵ “Smart Banknote Design Competition,” *Consult Hyperion* (12 January 2011), URL: chyp.com/2011/01/12/smart-banknote-design-competition/ (accessed 6 October 2020); “Plastic Banknotes,” *Consult Hyperion* (9 October 2013), URL: chyp.com/2013/10/09/plastic-banknotes/ (accessed 6 October 2020);

⁶ All that remains of this effort is a single webpage with an image of bitbills, URL: bitbills.com (accessed 6 October 2020); Peter Sobotka, *Physical Bitcoins with Distributed Issuance and Offline Verification*, 29 October 2016, 1-2: www.bitnotes.org/bitnotes.pdf.

⁷ Sobotka, 2.

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However, BitNotes were designed to be printed at home using blanks provided by BitNote. The point of this design was to increase security by removing the manufacturer from providing the private key.⁸

In 2018, thanks to advancements in chip and cryptographic technology, the first mass-use smart banknote was issued by the company Tangem. However, while denominated, the note has more of the look and feel of a payment card than a traditional banknote. Yet, this smart banknote was adopted by the Republic of the Marshall Islands as a national currency, existing alongside the US Dollar.⁹

A year later, Bitcoin Suisse released a new series of Bitcoin Suisse Crypto Certificates. These 2019 smart banknotes are available in various denominations and cryptocurrencies and bear a private key under a scratch-off sticker.¹⁰ These certificates have the look and feel of traditional banknotes.

Smart Banknote Criteria

To act as a transitional device between traditional banknotes and electronic currency, a smart banknote has to have the physical characteristics of traditional banknotes and not those of a plastic payment card. There are basically two reasons for this: popular acceptance and the need for the note to be produced, issued, used, and handled by the existing cash industry.

A smart banknote that most resembles existing banknotes will be the most readily accepted by the public. This means that the notes, as much as possible, have to have the same look and feel as existing cash. Smart banknotes will be printed on a paper or polymer substrate with intaglio and offset printing methods, security features, vignettes, serial numbers, seals, and etc. The notes must also be denominated. All these elements connote familiarity as well as trust and security in banknotes.

Such features will also make public education campaigns, supporting the adoption of the new smart banknotes, easier to undertake. Also, a familiar looking banknote will promote

⁸ Sobotka, *passim*; BitNotes, URL: www.bitnotes.org/ (accessed 6 October 2020).

⁹ Stephanie Palmer-Derrien, "The bank of blockchain: Startup to print crypto banknotes for world first digital national currency," *Smart Company* (30 January 2019), URL: www.smartcompany.com.au/startupsmart/news/bank-blockchain-startup-crypto-banknotes/ (accessed 6 October 2020); Megax, "Introducing Tangem, The First Smart Banknote for Digital Assets," *Medium* (3 May 2018), URL: medium.com/megax/introducing-tangem-the-first-smart-banknote-for-digital-assets-1975a209faa1 (accessed 6 October 2020); Kevin Helms, "Bitcoin Smart Banknotes Launched in Singapore," *Bitcoin.com* (4 May 2018), URL: news.bitcoin.com/bitcoin-smart-banknotes/ (accessed 6 October 2020); Hackernoon, "Portfolio: These Smart Banknotes Could Bring Crypto to the Masses," *Solinus* (29 January 2018), URL: <https://www.solinus.consulting/portfolio-and-blog/2019/1/11/portfolio-medium-post-2> (accessed 6 October 2020).

¹⁰ "Crypto Certificates," *Bitcoin Suisse*, URL: www.bitcoinsuisse.com/crypto-certificates (accessed 6 October 2020); "Bitcoin Suisse Launches All-New Crypto Certificate Series," *Bitcoin Suisse*, URL: www.bitcoinsuisse.com/news/bitcoin-suisse-launches-new-crypto-certificate-series (accessed 6 October 2020); "Bitcoin Suisse Launches All-New Crypto Certificate Series," *Bitcoin Schweiz News* (20 September 2019), URL: bitcoinnews.ch/17777/bitcoin-suisse-launches-all-new-crypto-certificate-series.

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daily use through familiarity and trust. Further, a paper or polymer smart banknote will also allow for their continued use in vending machines and other machines with note readers, minimizing the cost of conversion in the vending industry.

Such a smart banknote would also minimize the impact of the transition to electronic money on the cash industry. Having a paper or polymer note with the usual appearance and security features will help minimize the retooling needed to print the notes by banknote manufacturers. Also, the existing cash distribution and safe-keeping businesses will remain largely intact as the new smart banknotes will essentially be the same as traditional notes.

The challenge of smart banknote design will be including the device that will enable it to communicate with an electronic network. New inks may need to be developed. If QR codes are used, an advanced numbering-type machine will be needed to apply billions of different codes to the smart banknotes. Imbedded chips will present challenges to presses, substrate manufacturers, and processing equipment downstream from printing operations. However, to function as a transitional device, a smart banknote must be able to connect to an electronic network in a way that is secure and distinguishes the uniqueness of each note.

Conclusion: The Promise of Smart Banknotes

Smart banknotes may seem new and radical, but they are not the first instruments to act as hybrid instruments. During the 1970s, hybrid US Treasury securities existed. These securities were meant to bridge the transition from physical (definitive) securities to electronic ones handled in the new book-entry system. This began with Treasury Bills and was slowly expanded to include Notes and Bonds. These physical securities were entered in the book-entry system but were still issued in paper form bearing their CUSIP numbers. This was a hybrid, transitional security able to work in both worlds.¹¹

Given that 50 years ago the US Treasury was issuing hybrid definitive/electronic securities, it does not take a great stretch of the imagination to believe that a smart banknote could be produced today, acting as a transition between definitive and electronic cash.

Such smart banknotes will provide the cash-using public with a familiar product, having all the distinct features of cash, and minimize the impact on the cash industry of the technological move to electronic currency. However, at the same time, these notes will also allow a central bank or cryptocurrency to exploit the advantages of electronic money.

¹¹ Franklin Noll, "When Treasury Securities Went Digital," *Noll Historical Consulting Blog* (15 September 2020), URL: <https://www.franklinnoll.com/blog/when-treasury-securities-went-digital> (accessed 7 October 2020).