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REPORT FOR NATION

COVID-19, Currency Usage & Analysis for Polymer Banknotes in India

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Abstract

Despite the increasing use of electronic payments, currency retains an important role in the payment system of every country. However, today, the crime of counterfeiting currency continues to present a potential danger to national economies and financial losses to consumers at large. Further, with the recent COVID-19 pandemic there has been a debate on the risk of spreading viruses & other infectious diseases through contaminated paper currency notes. This report examines the probability of disease being spread due to currency notes as well as the probability of polymer currency notes in India as an alternative to paper currency.

Image: Bank of Canda new vertical $10 banknote

Contents

1. Banknotes and COVID-19

This Whitepaper provides a summary of the expert perspectives on COVID-19, sharing the central bank and industry responses about banknotes that are in the public domain. It finishes with a review of the scientific literature in this area.

1.1 Are Banknotes Spreading COVID-19?

Official responses & expert opinions

While the entire world is facing the pandemic COVID-19, an apprehension started related to cash handling, when, the WHO was misquoted with the facts that banknotes are transmitting the coronaviruses.[1] Citing this article, other news outlets have made similar claims, which was later clarified as being a misquote by the WHO. Brandolini's (pseudo) law states that a disproportionate level of effort is now required to ensure that this early misinformation is not accepted as fact.

According to the Head of the Health Department in Frankfurt, Germany "To date, there is no evidence of the coronavirus having been spread via euro banknotes – and, if it had, the numbers of infection would be way higher."[2]

A 2014 Europe-wide Mastercard study found two-thirds of people think touching or using money is unhygienic, but only one in five Europeans wash their hands after encountering it. More than 9,000 consumers from 12 countries were surveyed.[3]

In the Indian scenario, the National Sample Survey (NSS) 76th round report, 2019, revealed that only 35.8 percent of households in the country practice handwashing with soap or detergent before a meal, while 60 percent households wash hands only with water.[4] So, given the number of surfaces that people touch in their day to day lives including (payment cards, point of saleterminals, and mobile phones), the act of frequent hand washing is likely to be more important than restricting what surfaces people touch.

According to experts, It is unlikely but may be possible for a person to get COVID-19 by touching a surface or object that has the virus on it and then touching their mouth, nose, or possibly their eyes. This is not thought to be the main way the virus spreads.[5] "The risk of banknotes spreading the coronavirus is small "unless someone is using a banknote to sneeze in," said Dr. Christine Tait-Burkard, an expert in infection and immunity at the Roslin Institute at the University of Edinburgh.[6] Others were a bit more cautious near to the start of the pandemic; "We don't know if you can pick up COVID-19 from contaminated surfaces or inanimate objects at this point. That's the bottom line," says Marilyn Roberts, a microbiologist at the University of Washington School of Public Health.[7] The medical journal, "The Lancet" updated its guidelines in May 2020 and reiterated that person to person contact and respiratory droplets are the primary and most important mode of transmission for COVID-19.[8]

However, Gary McLean, a professor of molecular immunology at London Metropolitan University, says: "The virus will not survive on cash for the length of time certain bacteria can, and will still require hand-to-face contact, minimizing the transmission chances. No scientific studies are demonstrating the coronavirus on cash, nor if it can be transmitted in that way".[9]

1.https://www.marketwatch.com/story/who-we-did-not-say-that-cash-was-transmitting-coronavirus-2020-03-06

2.https://www.bundesbank.de/en/tasks/topics/cash-poses-no-particular-risk-of-infection-for-public-828762

3.https://newsroom.mastercard.com/press-releases/cash-is-a-dirty-habit/

4.https://www.newindianexpress.com/cities/delhi/2020/apr/06/65-out-of-100-indians-dont-use-soap-to-wash-hands-before-meal-survey-2126342.html

5.Centers for Disease Control and Prevention Website. https://www.cdc.gov/coronavirus/2019-ncov/prepare/transmission.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fabout%2Ftransmission.html

6.Speaking to the Guardian, 3rd March 2020

7.https://www.technologyreview.com/2020/03/12/905341/coronavirus-contaminated-cash-quarantine/

8.https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30607-3/fulltext

9.https://www.londonmet.ac.uk/about/coronavirus/community-response/

1.2 How long does the COVID-19 virus live on banknotes?

COVID-19 is currently classified as a hazard and so it not available for commercial or general testing. This means that there is no data available specifically evidencing how long COVID-19 lasts for on banknotes. Conclusions are extrapolated from the behavior of similar viruses, such as the feline coronavirus, tested by banknote producers.

Some experts believe the question 'how long does the virus last for' misses the point. They say that it does not matter how long the COVID-19 virus lasts on a banknote and they emphasize that what matters is whether banknotes can pass on the virus or not. “In principle, it is entirely irrelevant how long pathogens can survive on surfaces. What is decisive is whether it is an infection channel” says, Dr. René Gottschalk,[10] who does not consider there to be any risk of transmitting coronavirus via banknotes. The head of Robert Koch Institute agrees and says “(Virus) transmission through banknotes has no particular significance.”

However, attempts have still been made to answer this question, with articles providing a range of results that depend on the temperature, humidity, type of virus, concentration of virus, methodology, and substrates selected. The examples that follow suggest coronavirus variants typically last less than a week. A 2014 review of scientific articles on viruses and bacteria on banknotes couldn't find any evidence of viruses on previously circulated banknotes.[11]

Stephanie Brickman from the WHO says that “We do not know [how long the virus lasts on banknotes,] but we estimate not longer than two hours. The virus will not survive for very long on surfaces, particularly on a dry surface like a banknote."[12]

Other coronavirus varieties can live on inanimate surfaces including metal, paper, and plastic for between hours to days, depending on initial concentration and conditions such as temperature and humidity, with viruses lasting longer at lower temperatures. In April 2020 the Lancet reported a study on a coronavirus variant where it lasted for four days on banknotes.[13] In the Journal of Hospital Infection review, where the virus, strain/isolate, inoculum (viral titer), and temperature were the same, a coronavirus variant lasted four to five days and up to approximately 25% longer on non-banknote paper than non-banknote polymer.[14] Another report suggests 3 days on plastic according to Vincent Munster and a team at the National Institutes of Health virology laboratory in Hamilton, Montana.[15]

In the July 2020 edition of the Lancet, these studies were criticized for using unrealistically strong concentrations of the virus.[16] Emanuel Goldman, a microbiology professor at Rutgers New Jersey Medical School suggested “as 100 people would need to sneeze on the same area of a table to mimic some of their experimental conditions” and the studies “stacked the deck to get a result that bears no resemblance to the real world,"[17] At 'real world' concentrations of the virus the implications are that the virus would last no-where near as long on a surface.

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10. https://www.bundesbank.de/en/tasks/topics/cash-poses-no-particular-risk-of-infection-for-public-828762
11. https://www.researchgate.net/publication/260398093_Paper_money_and_coins_as_potential_vectors_of_transmissible_disease
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14. G. Kampf, D. Todt, S. Pfaender, E. Steinmann, Journal of Hospital Infection, 104, (2020), 246-251
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2. Central Bank and industry position on Cash during COVID-19

2.1 1 Reassuring the public and putting risks into perspective

While several central banks have encouraged their customers to use digital banking facilities as far as possible, they have also taken steps to ensure continued and safe access to cash. Many central banks have now stated that banknotes pose no particular risk in spreading COVID-19. Many have cited the same message as experts: the risk of spreading COVID-19 by banknotes is lower than person-to-person contact and comparable to other the risk associated with touching any physical object.

- A Bank of England source, speaking to The Telegraph in March said there were no plans to quarantine or disinfect banknotes in the UK and that "the risk posed by handling a polymer note is no greater than touching any other common surface, such as handrails, doorknobs or credit cards."[18]
- Johannes Beermann, Executive Board Member of the Bundesbank stated that "So far there is no evidence of the coronavirus having been spread via euro banknotes. The probability of contagion with a virus via a banknote is very low in comparison with other surfaces."[19]
- The European Central Bank has said that Euro banknotes are safe to touch. "Overall, banknotes do not represent a particularly significant risk of infection compared with other kinds of surface that people come into contact within daily life," said ECB executive board member Fabio Panetta.[20]
- The South African Reserve Bank has stated "there is currently no evidence that the coronavirus is transmitted through the use of banknotes and coins."[21]
- The Reserve Bank of New Zealand put the risk into perspective compared to other objects and payment methods: "Cash is just one of many frequently touched surfaces we encounter. The same is true for any other payment device whether it's a card, phone or watch. This reinforces the need for good hand hygiene regardless of the way you pay or accept payment."[22]
- The Bank of Canada asked retailers to continue accepting cash: "The risks posed from handling Canadian banknotes are no greater than those posed by touching other common surfaces such as doorknobs, kitchen counters, and handrails. Canadians handling cash should follow the public health guidelines on COVID-19 and wash their hands as they would do for other activities.[23]

This sentiment has been echoed across the cash industry. Groups representing the currency ATM, transportation, and security sectors issued a paper "calling on governments, central banks, media, business, and society to stand up for cash to protect the resilience of existing payment ecosystem and ensure vulnerable groups are not deprived of the only means of payment that is available." It concludes with a call to action: "cash is safe: we should stop stigmatizing its users."[24]

Other activities from central banks have included encouragement of mobile ATM facilities to minimize travel and removal of fees associated with all types of payments. Many recognize that it is the face-to-face contact associated with any physical transaction and not a specific payment mechanism that represents the greatest risk, leading to an increased encouragement to stay home and shop online where possible whilst lockdown continues. Others recognize that some necessary activities require some element of physical interaction with multiple surfaces and simply highlight social distancing and the WHO advice on regular handwashing.

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19 https://www.bloomberg.com/news/articles/2020-02-28/bundesbank-says-euro-banknotes-have-low-risk-of-virus-contagion

20 https://www.rte.ie/news/business/2020/0428/1135340-euro-bank-notes/?utm_content=128904444&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944

21 https://www.iol.co.za/business-report/economy/we-are-not-recalling-cash-because-of-covid-19-says-sa-reserve-bank-45047774

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23. https://www.bankofcanada.ca/2020/05/bank-canada-asks-retailers-continue-accepting-cash/

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2.2 Clean Note Policy, Cash Quarantines, and Disinfection

Some central banks have sought to reassure the public and/or take steps that may reduce the already low risk of banknotes spreading COVID-19 by introducing disinfection procedures, quarantine procedures, or general steps to raise the quality of their circulating banknotes. Other central banks, some of whom have stated that banknotes pose no particular risk compared to other surfaces frequently encountered, have continued without quarantines or disinfection. This list that follows is not exhaustive but demonstrates full the range of responses observed.

- Fan Yifei, a deputy governor at the People's Bank of China, said efforts had been made to improve "the level of cleanliness" of cash in circulation,[25] with reports of new notes being printed, notes from badly impacted areas being destroyed, quarantine periods of seven to 14 days and disinfection techniques being used.
- The Bank of Thailand has suggested on Twitter that people could wash their banknotes with water and mild detergent if they were concerned.[26]
- A Bank of England source, speaking to The Telegraph in March said there were no plans to quarantine or disinfect banknotes in the UK and that "the risk posed by handling a polymer note is no greater than touching any other common surface, such as handrails, doorknobs or credit cards."[27]
- The Bank of Korea is reported to be superheating previously circulating banknotes to 150ºC for two to three seconds before they re-enter the economy.[28]
- The Central Bank of Hungary is quarantining banknotes for 14 days before sending them through a tunnel heated up to 170ºC.[29]
- In Hong Kong, the focus is on maintaining their clean note policy as opposed to specific treatments or quarantine procedures. "All banknotes returned to the vaults of the note-issuing banks will be sorted by machines automatically under a stringent standard, with filthy or unfit notes destroyed immediately," said a spokesperson from the Hong Kong Monetary Authority.[30]
- Some central banks are reported to be printing additional new banknotes to raise the quality of notes in circulation.[31]
- Some central banks, with circulating banknotes overseas or who circulate banknotes issued by another country, have adopted policies to quarantine incoming banknotes.[32]

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25. https://www.scmp.com/economy/china-economy/article/3079818/coronavirus-china-tries-bolster-confidence-banknotes-fears

26. https://www.centralbanking.com/central-banks/currency/banknotes/7522076/bank-of-thailand-advocates-washing-banknotes

27. https://www.telegraph.co.uk/news/2020/03/02/exclusive-dirty-banknotes-may-spreading-coronavirus-world-health/?mod=article_inline

28. https://www.reuters.com/article/health-coronavirus-southkorea-money/skoreas-central-bank-burns-quarantines-cash-in-coronavirus-precaution-idUSL4N2AZ1TL

29. https://hungarytoday.hu/coronavirus-hungarys-central-bank-quarantines-and-cleans-banknotes/

30. https://www.centralbanking.com/central-banks/currency/7509046/will-cash-survive-covid-19

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32. https://www.bullionstar.com/blogs/jp-koning/banknotes-and-coronavirus/

2.3 The Moral, Societal and Economic Impacts of Cash Related Policies

There are a growing number of calls to ensure that people can pay for essential goods and services. Digital and mobile payments play a role here but for billions of people around the world, this means ensuring continued access to cash. In some instances, this had led to commentary that refusing to accept cash is a form of discrimination.[33] The International Currency Association points out that cash is essential for social inclusion, it cannot be hacked and that it protects the privacy and anonymity of its users.[34]

For Central banks that operate a seignorage model then the act of issuing banknotes is profit-generating, with banknotes often paying for themselves. Furthermore, it provides the public with a free way to pay and a centrally-controlled source of payment that can act as competition to private companies and card/mobile payment fees. Central Banks have put out statements, policies have been considered and various initiatives are underway.

- According to a study by the Reserve Bank of India (RBI), India continues to have a strong bias for cash payments. Demonetization and active growth in GDP brought down the cash in circulation as a percentage of GDP to 8.70 *percent* in 2016-17. This increased to 10.70 *percent* in 2017-18 and 11.2 *percent* in 2018-19 which, however, is less than the pre-demonetization level of 12.1 *percent* in 2015-16.[35]
- The Bank of Canada has emphasized the importance of cash and accepting cash: "During this time of heightened public health measures intended to limit the transmission of COVID-19, some consumers and businesses are choosing not to use cash to limit potential exposure. Refusing cash could put an undue burden on people who depend on cash as a means of payment. The Bank strongly advocates that retailers continue to accept cash to ensure Canadians can have access to the goods and services they need."[37]
- The Canadian Association of Secured Transportation echoes the Bank of Canada: "the continued availability of the option to pay with cash is also of crucial importance to Canadians who depend upon using currency each day. We are not aware of any reliable scientific evidence indicating that practicing good hygiene, or safeguarding the public's health, requires consumers and businesses to give up the convenience, security, or privacy protections that cash transactions offer."[37]
- The Bank of Finland has put the relative risks into perspective to emphasize why it is important that cash continues: "Cash is the

Table: Cash Propensity and Growth in Cash

Country	Population (mn)	GDP (USD bn)	Cash propensity (%)	Total Cash Growth (%)
Australia	24.4	1282.0	11.2	-0.7
China	1382.7	10365.4	35.9	9.2
India	1299.8	2939.5	49.3	10.5
Japan	127.0	5049.4	3.4	-8.5
Korea	51.2	1458.9	4.1	2.1
Singapore	5.6	276.3	16.7	1.6

Source: Payments Global Cash Index for the Asia Pacific published in June 2018[36]

preferred form of payment for about 10 *percent* of Finns. For these people, cash may be the only possible payment method and they must get their purchase done. Cash can be used as usual during a coronary pandemic. However, the most important thing is careful hand hygiene, regardless of the payment method," Päivi Heikkinen, Head of the Payment Systems Department, Bank of Finland.[38]

Globally there is a significant activity designed to ensure continued access to cash, including mobile ATMs,[39,40] extensions to schemes allowing others to support vulnerable people in obtaining their cash,[41] reducing commissions and raising the limits on cash withdrawals[42,43] as well as putting appropriate social distancing measures in place to ensure that cash payments can continue.

Image: Maldives new 5 Rufiyaa banknote

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33. https://sf.eater.com/2020/3/25/21194256/restaurants-cash-san-francisco-coronavirus?utm_content=124742606&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944

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3. Recommendations

3.1 Advice for those handling cash frequently

Cash handlers will touch banknotes more frequently than the average person and so the advice around frequent hand washing and not touching your face is particularly important for this group of people. The risk of contracting the coronavirus through normal banknote handling processes remains low. There are however some sensible precautions for cash handlers to take:

- Wash hands frequently – ideally with soap and water, but an alcohol-based hand rub can also be used;
- Avoid touching banknotes and then touching your eyes, nose, or mouth;
- Avoid licking your thumb or fingers to aid manual banknote sorting;
- Where possible minimize the unnecessary transfer of banknotes between people;
- Where possible minimize the number of users per piece of cash handling equipment and wipe down the equipment at the end of the shift;
- Avoid sneezing or coughing onto a banknote – ideally, carry tissues that can be used to cover your nose and mouth before being disposed of.

3.2 Disinfecting or quarantining banknotes

There is a range of behaviors taken by central banks in this area, including the decision to continue as normal, disinfecting (typically by UV light or heat, although supercritical CO_2 will also work) or quarantining banknotes. Some central banks, including the Bank of England, have said that they are not disinfecting or quarantining banknotes.

For central banks wanting to do something (either "just in case" or because of a desire to be seen to be doing something) then quarantine will be the simplest and cheapest route forward if vault space permits. Those who are opting to quarantine their banknotes are typically doing so for between seven and fourteen days, which seems sensible given the literature review typically indicates the virus will typically last on a surface for less than a week. As per news sourcesone central bank hold notes in quarantine for four weeks.[44]

If considering storage at a higher temperature (e.g. prolonged periods at 60 or 70ºC or short periods at 150ºC) then paper notes will become drier, and more brittle particularly at the higher temperatures, but will recollect moisture once exposed to normal temperatures and humidity, then return to normal. There is no evidence that varnish will yellow over time if exposed to higher temperatures. Polymer banknotes are OK at the lower temperatures and exposure to higher temperatures for a few seconds should not give major issues. However, 150ºC is within the melting point range of the base polymer. At 150ºC the notes may stick together more if under pressure and increased temperature. Our limited testing at a higher temperature shows notes are more likely to distort particularly if handled/pulled and a few minutes at a high temperature can lead to shrinking.

If considering prolonged exposure to UV light, then please be aware that this can lead to the fading of some inks. The UV inks, blues, and reds are most susceptible. Overall central banks considering disinfection or quarantine of banknotes need to balance the cost and disruption to the cash cycle with the overall risk associated with handling banknotes and the impact that any quarantine or disinfection initiatives will have on the spread of COVID-19, given the other surfaces people touch and the higher risk associated with face-to-face contact.

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44. https://english.alarabiya.net/en/News/gulf/2020/03/12/Coronavirus-Kuwait-Central-Bank-quarantines-banknotes-for-four-weeks.html

3.3 Should I varnish my banknotes or move to polymer?

Given the relatively low risks associated with banknotes, discussed earlier, it is highly unlikely that transitioning from paper to polymer banknotes (or vice-versa) will have any significant impact on the spread of COVID-19. If a central bank has a concern about the perception of banknotes in circulation, then a review of the central bank's clean note policy may be sensible.

Evaluation of technologies with anti-viral properties is underway at organizations. Please be aware that no product will have been tested on COVID-19 as COVID-19 is currently classified as a hazard and not available commercially for testing purposes. Please also consider that banknotes are passed between people in a matter of seconds. If laboratory results indicate a product can kill coronavirus variants in e.g. 24 hours, it does not necessarily mean that it reduces the risk of coronavirus passing between people when the notes are exchanged in a matter of seconds. The WHO advises about frequently washing hands when touching physical surfaces will still apply, even for banknotes that are treated with some type of anti-viral treatment.

Both varnish and polymer may offer reassurance to the public as the banknotes will look cleaner in circulation for longer. Polymer in particular does not pick up dirt or soil as it ages.

4. Is Polymer an alternative of Paper?

4.1 Brief overview of polymer banknotes

Globally, the first non-paper notes were produced on a polyethylene material called Tyvek® and issued in Costa Rica and Haiti. The Isle of Man issued one denomination on Tyvek®, marketed by its printer, Bradbury Wilkinson as "Bradvek". These early banknote issues were not successful due to poor adhesion of the print to the plastic substrate, so the technology was improved.[45]

"Polymer"in the context of banknotes refers to a biaxially oriented polypropylene substrate (BOPP). The polymer has been established as a substrate for banknotes for almost 30 years. Extensive research by central banks has concluded that polymer offers new and unique security features that reduce the risk of counterfeiting.

Polymer was originally developed as a banknote substrate by the Reserve Bank of Australia (RBA) in conjunction with the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The RBA initiated this development in response to a counterfeiting incident in December 1966 when several high-quality counterfeits of the country's newly issued paper banknote series, which was regarded at the time as state of the art, began to circulate within one year of the introduction of the new series. A plastic-based substrate was proposed by CSIRO as a platform for a new generation of radically different security features and the first polymer banknote was an Australian commemorative issued in 1982. In 1992 the RBA started issuing the first family of banknotes printed on polymer. Since that time, over 40 Issuing Authorities have chosen polymer for commemorative and circulating banknotes.[46]

Image: the first banknote in the world to be printed on a non-fibrous polymer substrate with Diffractive Optically Variable Device (DOVD). Source: Reserve Bank of Australia, Museum

Until recently the only polymer banknote substrate available was Guardian® supplied by CCL (earlier Innovia which was formally known Securency International). In 2012 De La Rue ended this monopoly by launching a polymer substrate, which is now called Safeguard®. This has ensured central banks have a choice of suppliers and polymer substrates.[47]

Polymer substrate is a quite different material to paper. For example, being made in a continuous extrusion process from complex petrochemical, polymer substrates have no porosity, the porosity tests found in a paper specification do not apply to a polymer specification. It is the "zero" porosity of a polymer banknote that gives it its much greater resistance to soiling as the dirt cannot penetrate the substrate structure.

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45. http://www.polymernotes.com/costa-rica.html
46. https://museum.rba.gov.au/exhibitions/displays/polymer-banknotes/
47. https://www.theguardian.com/business/2013/dec/17/plastic-banknotes-security-dealers-magicians

4.2 Why Central Banks have transitioned to Polymer

One of the reasons given by Central Banks for switching to a Polymer substrate is that it raises the technological hurdle for counterfeiters in that they must learn to reliably print on plastic material to produce effective counterfeits (reference documents published by Australia, Canada, and Bank of England). This claim has been proven by changes in the counterfeit detection rates that are published.

Extracts from The Bank of England:48

- The new polymer notes allow for enhanced security features, such as the see-through window and holograms. This makes them harder to counterfeit than paper notes.
- They're stronger, too: a polymer fiver is expected to last two-and-a-half times longer than the old paper £5 note. Although, while our notes are stronger, they are not indestructible – so you should still take care of them.
- The life expectancy of polymer notes also makes them more environmentally friendly. The Carbon Trust has certified that the carbon footprint of a polymer fiver is 16% lower than its paper predecessor.
- Finally, polymer notes are cleaner since their smoother surfaces are resistant to dirt and moisture."

Extracts from the Reserve Bank of Australia include the following:[49]

- "The Reserve Bank moved to polymer to make Australia's banknotes more secure against counterfeiting, which had been on the increase as modern reprographic equipment became more readily available.
- Polymer banknotes are also more durable than paper banknotes, are cleaner and more hygienic, and can be recycled at the end of their useful life into a range of plastic products."

Extracts from the Reserve Bank of New Zealand include the fllowing:[50]

- "The average polymer note lasts about four times as long as a paper note. This keeps the cost of producing money down.
- Polymer notes are stronger and non-porous, so they do not get as dirty as paper. The unique texture of polymer banknotes makes them harder to counterfeit. Disposal of polymer notes is more environmentally friendly.
- Polymer notes are destroyed by being shredded. The shredded notes can be recycled into other plastic products instead of being buried or burnt."

48.https://www.bankofengland.co.uk/knowledgebank/why-are-new-banknotes-made-of-polymer#:~:text=Our%20new%20banknotes%20are%20made,safer%20and%20stronger%20than%20paper.&text=When%20did%20the%20Bank%20of%20England%20start%20printing%20banknotes%3F

49. History of Banknotes: https://banknotes.rba.gov.au/australias-banknotes/history/

50. About Polymer https://www.rbnz.govt.nz/notes-and-coins/notes/banknotes-in-circulation/about-polymer

4.3 The benefits of having moved to Polymer

The benefit of polymer banknotes to a central bank is divided between two key components, improved cost & improved quality in circulation, the exact ratio (divide) between these two components is determined principally by the central bank's clean note policy. Denominations that have a higher circulation velocity tend to exhibit lower note life and remain cleaner in circulation due to a higher sorting frequency, therefore polymer introduction for these denominations will provide a greater emphasis on cost-benefit through increased note life. Whereas denominations which have a low circulation velocity but high transactional velocity tend to exhibit longer note life but have lower quality (more heavily soiled) in circulation, introducing polymer on these denominations will provide a greater emphasis on improved quality in circulation by providing greater mechanical durability and soil resistance. The central bank can, of course, adjust its fitness standards up or down to balance the benefits in cost-savings and quality of banknotes in circulation.

Where data is available, those banks issuing polymer banknotes have reported an overall reduction in counterfeit levels. Counterfeits are often made on paper because of the difficulty of printing on plastic films or counterfeiters will target the previous series of paper banknotes.[51]

There have been some incidents of high-quality counterfeits of polymer banknotes but they have been older designs with fewer security features, using slow techniques. This has highlighted the importance of protecting lower denominations with security features that will deter counterfeiters.

Cost-effectiveness

Polymer is most cost-effective when used for denominations that have a high circulating velocity. The durability of the polymer increases the life of banknotes by 3-4x that of paper banknotes, this results in a significant cost benefit particularly where banknotes are regularly circulated through the cash sorting process. The increased life of polymer banknotes means that annual banknote issues can be significantly reduced and over a while, this can offset the initial higher cost associated with buying polymer.[52]

Durability

The durability of the polymer provides central banks with a quantifiable increase to the lifetime of a banknote and because they are highly resistant to moisture and soiling the notes remain cleaner. Consequentially there is reduced spend on banknote production, storage, and transportation. Banknote designs have also changed, the polymer enables the incorporation of clear windows which have high visual impact and, due to the range of counterfeit resistant security features, the substrate is highly secure It is often cited that polymer has environmental benefits compared to paper. This is based on a longer lifetime and reduced production and transportation costs amongst other factors. Suppliers of a substrate can now offer a bespoke service that assesses the environmental impact of a customer's selectedsubstrate in their geographical region.

Image: Bank of Ireland £5 (2019) with window backlit detail

The polymer is proven to be the most durable banknote substrate available with the increased life of a polymer banknote being well documented and evidenced. Over 40 Issuing Authorities are currently circulating polymer notes for all or some of their denominations. Denominations that have a high transactional velocity are physically handled more and suffer higher levels of wear and soiling. The polymer will extend the lifetime of these notes and unlike paper, they won't soil. The failure modes that cause banknotes to be withdrawn from the market differ between paper and polymer. The primary reasons for paper banknotes failing are corner folds, edge tears, and soiling, all caused through general handling and processing. For polymer banknotes, the primary failure mode is ink wear/fading. This occurs when the banknote has been circulating longer than recommended for its environment.

Security

Keeping one step ahead of the counterfeiter is critical for central banks. Polymer has proven to be a more challenging substrate for counterfeiters to master as they initially lack the skills to reproduce the substrate and the new specialist security features developed for polymer. One of the key reasons why the Reserve Bank of Australia, the Bank of England, and the Bank of Canada decided to adopt polymer was to enhance counterfeit resilience. Whilst no banknote is, or ever will be, entirely counterfeit-proof, research suggests that techniques required to produce a high-quality counterfeit polymer banknote are slow, expensive, and require a high level of effort and technical expertise. The machinery and techniques needed are also different, for example, standard desktop printers are designed to print on paper, but not on plastic film. These things combined, present a significant barrier to digital desktop counterfeiting.

Polymer banknotes can include many of the security features already familiar to the public including the tactility created by intaglio inks, specialist colour changing inks, and holographic foils. Polymer provides a good platform for incorporating sophisticated security features not available on paper banknotes. For example, intricate and complex clear windows are security features in their own right. In addition, the window can host other printed or applied features, and because they use this clear area the can be seen from both the front and back of the banknote. Whilst windows can be used in principle on paper banknotes, the scope of their use is more limited

Few key features on the new £20 note issued on 20 February 2020, include

- A large see-through window with a blue and gold foil on the front depicting Margate lighthouse and Turner Contemporary. The foil is silver on the back.
- A smaller see-through window in the bottom corner of the note, inspired by Tintern Abbey.
- A metallic hologram which changes between the word 'Twenty' and 'Pounds' when the note is tilted.
- The Queen's portrait in the see-through window with '£20 Bank of England' printed twice around the edge.
- A silver foil patch with a 3D image of the coronation crown.
- A purple foil patch containing the letter 'T' and based on the staircase at the Tate Britain.

Source: Bank of England, https://www.bankofengland.co.uk/

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51. https://www.rba.gov.au/publications/bulletin/2014/mar/1.html
52.https://www.rba.gov.au/publications/bulletin/2019/dec/a-cost-benefit-analysis-of-polymer-banknotes.html

Cleanliness

Polymer notes are not porous and so do not absorb moisture or dirt like their paper counterparts. This means they have excellent anti-soiling properties. They can easily be cleaned with a damp cloth or hand sanitizing solution, which means that in parallel with their increased lifetime the notes will also remain cleaner for a longer period than paper notes. In certain environments such as produce markets, the benefits of polymer over paper have been realized. The impermeable nature of the notes means they do not absorb the moisture from the wet produce e.g. fish or the general environment, and the cash handlers have reported back positively that polymer notes are cleaner and remain in better condition than paper notes. A fish market is an extreme setting but demonstrates the improvement in cleanliness offered by the polymer.

Environment friendliness

Although polymer banknotes the base material of polymer is a non-renewable resource, due to its recyclability, it has more than one life. For example, The Reserve Bank of India engaged the services of The Energy and Resources Institute (TERI) to conduct a study on the carbon footprint of cotton-based banknote paper substrate vis-vis plastic-based substrate and to estimate their overall environmental impact, taking into account their complete lifecycles.[53] The Life Cycle Impact Assessment results for the two types of notes indicate that replacing cotton-based notes with plastic-based notes would have significant environmental benefits.

Polymer/plastic banknotes (and the waste from production) can be granulated and recycled into useful plastic products such as compost bins, plumbing fittings, and other household and industrial products. Comparison to polymer, most of the paper-based banknotes are 75% cotton – which takes large amounts of pesticides and water to produce.[54]

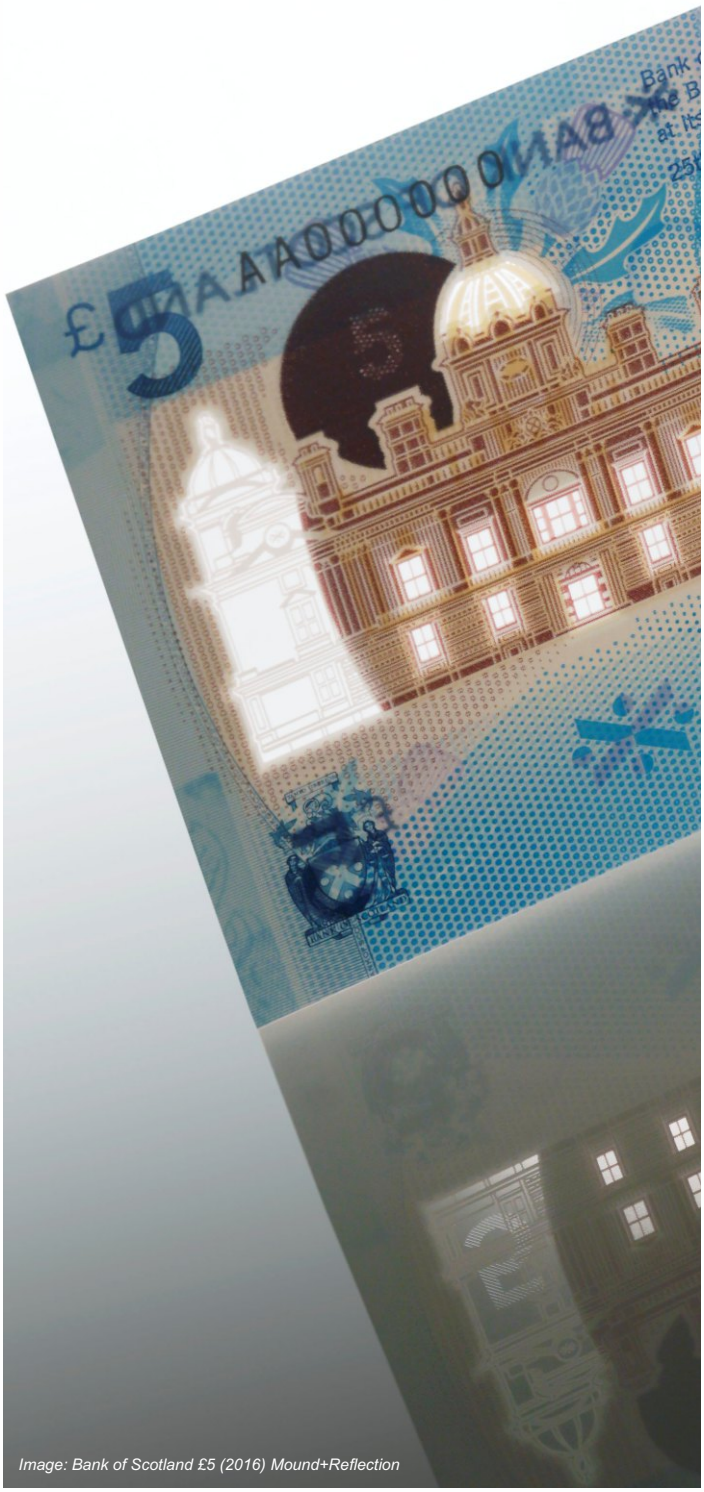

Image: Bank of Scotland £5 (2016) Mound+Reflection

53. https://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/P2_08CUM220813.pdf
54. https://www.bbc.com/news/magazine-15782723

4.4 Issuing Authority Studies and Circulation Trials

Several studies have been conducted which demonstrate the benefit of polymer substrates in circulation.

As with any study, these can be used to illustrate that these durability solutions provide benefit in real-life situations, however, the absolute amount of benefit will be exclusive to the circulating environment in which the study was undertaken and may have been affected by factors external to the trial.

	Source	Trial Information	Study Conclusion
Reserve Bank of Fiji	The Polymer Fiji $5 Story So Far. Banknote Conference 2016.	The trial was undertaken to assess the benefits of changing from paper to polymer Circulation data from the introduction in 2013 including: • Re-issue vs. New Note issues • Banknote life performance • Circulation velocities	3.6-time higher note life than paper notes 47% lower order requirement than paper notes.
Reserve Bank of Australia	The Life of Australian Banknotes. Alexandra Rush RDP 2015-10.	This paper proposes an alternative way of studying banknote life by estimating survival models, which are commonly used in studying life expectancies in medicine or the duration of events in economics. These models can produce estimates of central tendency that are much less volatile over time and provide information on the probability that banknotes survive over time. The models' predictions of banknote survival are intuitive and the results are consistent with samples of circulating and unfit banknotes.	Study shows that the proposed methods of assessing banknote life correlate well with sampling performed on circulating notes. Performance of $5 given as 6 months for paper and 3.5 years for polymer equivalent.
Reserve Bank of Australia	Cost-Effectiveness of Polymer Currency Notes – Australia's Experience Les Coventry November 2001 – XV Pacific Rim Banknote Printers Conference	Report outlining the benefits seen since the introduction of polymer banknotes including: • Impact on counterfeiting • Increased durability	The presentation concludes and presents data showing that the switch to polymer resulted in a drop in counterfeit rates and an increase in note life.
Reserve Bank of Australia	Life of Polymer Currency Notes – A Study Les Coventry November 2001 – XV Pacific Rim Banknote Printers Conference	The paper addresses the subject of banknote life and how the Australian experience can be a guide for the adoption of polymer in other countries.	The Australian data on life shows a significant (at least fivefold) increase in the life of notes with the move from paper to polymer.

4.5 Conclusion

It is almost 20 years since the first polymer banknotes were introduced by Australia. In the future banknotes will be much used by automats like ATMs and banknote acceptors. From this perspective, polymer banknotes seem to behave better than cotton-based banknotes. Feeding polymer notes into an automat are easier because such notes are less affected by tears, missing parts, and clipped corners.[55] Also, from 'green' perspective polymer banknotes seems to have better performance when it comes to environmental and sustainability aspects.

Although polymer banknote cost more they can be economical in the long run. The Bank of England estimates that printing the £5 and £10 notes on plastic, rather than paper, will cut production costs by a quarter, or £100m, over the next ten years.[56] The Reserve Bank of Australia reports that it has saved nearly 1 billion Australian dollars in the 25 years it has been on polymer.[57]

Overall the central banks and banknote issuing authorities have evidenced numerous benefits over time. The transition of paper banknotes to polymer banknotes continues globally.

Image: Trinidad & Tobago $50 Safeguard (Specimen) banknote. Clear window with image of bird: the Red-capped Cardinal.

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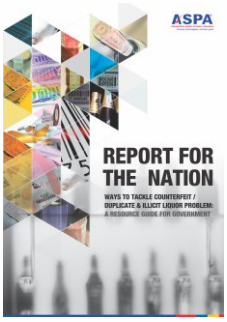
55. https://www.dnb.nl/en/binaries/20121100%20Banknote%20of%20the%20future_tcm47-282189.pdf
56. http://www.bankofengland.co.uk/banknotes/polymer/Pages/default.aspx
57.https://www.rba.gov.au/publications/bulletin/2019/dec/a-cost-benefit-analysis-of-polymer-banknotes.html

ASPA Publications



Ways to tackle Counterfeit, Spurious & Illicit Liquor problem

Publication: 2019

Language: English

Price: Complimentary after registration as PDF

https://www.aspaglobal.com/report-for-nation

Instructions for the stakeholders to understand the illicit liquor problem, gaps in current systems and ways to tackle it.

Confronting illicit Tobacco trade in India for Economic & Socio Development

Publication: 2019

Language: English

Price: Complimentary after registration as PDF

https://www.aspaglobal.com/report-for-nation

Providing a resource guide to the Government of India on the issue of illicit tobacco trade and usage of Tax Stamp as solution.

Importance of Authentication and Traceability in Indian Food value chain

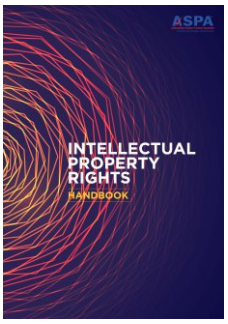
Publication: 2020

Language: English

Price: Complimentary after registration as PDF

https://www.aspaglobal.com/report-for-nation

Providing a resource guide to the Government of India on the issue of illicit tobacco trade and usage of Tax Stamp as solution.



Intellectual Property Rights Handbook

Publication: 2020

Language: English

Price: Complimentary after registration as PDF (For members only)

The handbook aims to help ASPA members set strategies to optimize the benefits from the intellectual assets created by their personnel.

The State of Counterfeiting in India

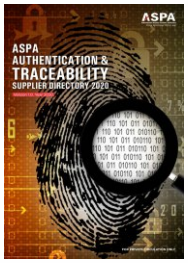
Publication: 2020

Language: English

Price: Complimentary after registration as PDF

The report is first of its kind document prepared by ASPA to analyse news items and understand the nature of counterfeiting activity in India, Industries and regions which are most affected by counterfeiting.

Upcoming Reports



Authentication Supplier Directory

Release Date: Upcoming November 2020

Language: English

Price: Complimentary hard copies for Government officials / Brand owners only.

For more information, visit https://www.aspaglobal.com/report-for-nation

Notes

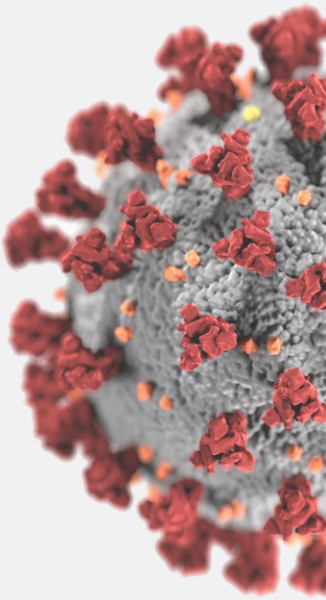
Notes

"As a nation, we now face a serious threat and challenge from the illicit economy.

Illegal activities slowed industrial growth, thus affecting producers, and stunted revenue, hitting job growth. Consumers were the ultimate victims of counterfeiting, smuggling, and piracy as they paid excessive prices for substandard products that also increased exposure to health and safety risks.

To fight the crime of the 21st Century, the involvement of all stakeholders is important and therefore, we must maintain all that we can do to prevent it. A hand is what is required to come out of the and this is where we prove our responsibility".

JOIN US IN FIGHT AGAINST FAKES!



About

ASPA®
Authentication Solution Providers' Association
Diverse technologies, common goal.

The Authentication Solution Providers' Association (ASPA) is a self-regulated, non-profit organization of authentication solution providers.

Formed in 1998 with the objective to curb counterfeit products in various sectors, it is the only association of its type in the world primarily focused on the adoption and advancement of authentication technology and solutions for brand, revenue, and document protection. As an industry body of authentication solutions providers, ASPA encourages its members to adopt best practices, standards, and usage of advanced technology in providing cost-effective anti-counterfeiting solutions against counterfeiting. ASPA members protect over 15,000 brands worldwide through the identification of genuine products and documents. ASPA works closely with global authorities such as International Hologram Manufacturers Association (IHMA), Counterfeit Intelligence Bureau (CIB), FICCI-CASCADE, CSIR-NIIST, ACMA, CII & other industry bodies in India.

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