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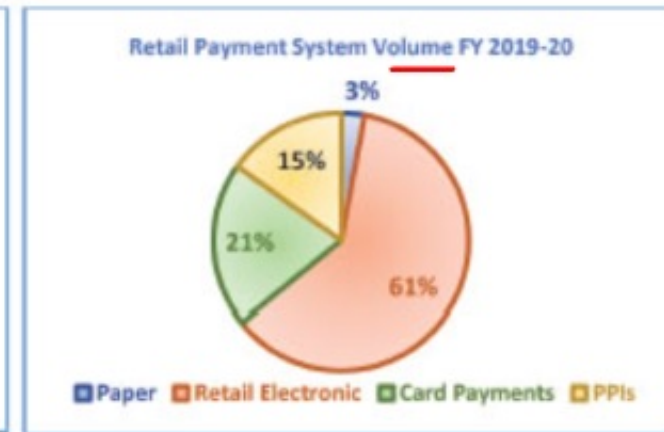
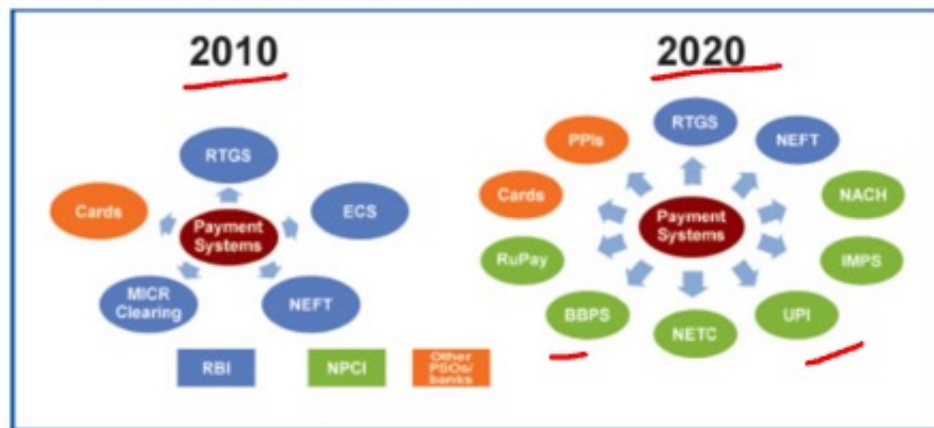
Payment Technologies

Atul Kedia

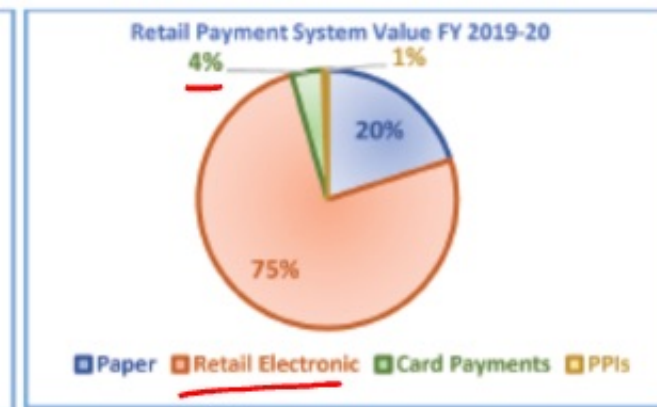
Managing Partner, Light Hill Capital

atul.kedia@iiml.org

India's payment systems DO NOT COPY OR POST



Source: RBI Data

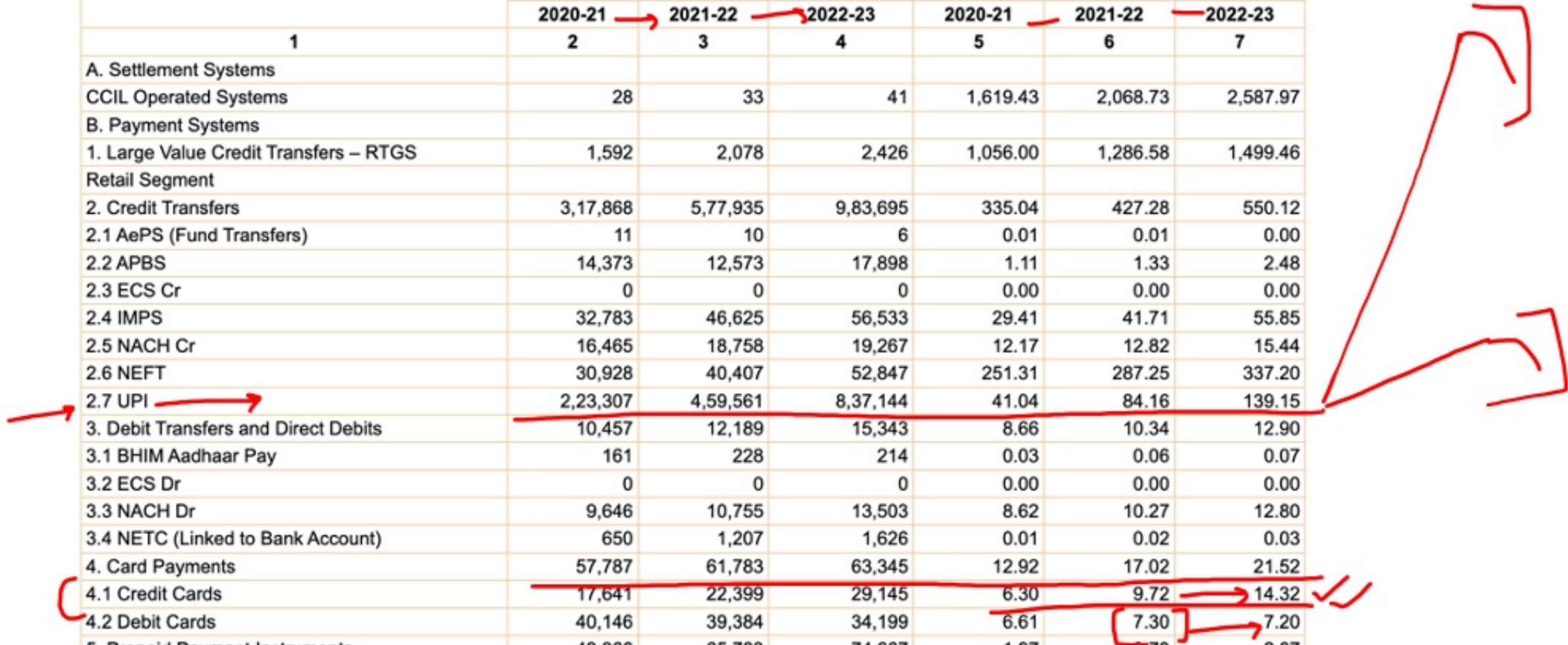


Source: RBI Data

Payment System Indicators - RBI data

Table IX.1: Payment System Indicators - Annual Turnover (April-March)

Item	Volume (lakh)			Value (₹ lakh crore)		
	2020-21	2021-22	2022-23	2020-21	2021-22	2022-23
1	2	3	4	5	6	7
A. Settlement Systems						
CCIL Operated Systems	28	33	41	1,619.43	2,068.73	2,587.97
B. Payment Systems						
1. Large Value Credit Transfers – RTGS	1,592	2,078	2,426	1,056.00	1,286.58	1,499.46
Retail Segment						
2. Credit Transfers	3,17,868	5,77,935	9,83,695	335.04	427.28	550.12
2.1 AePS (Fund Transfers)	11	10	6	0.01	0.01	0.00
2.2 APBS	14,373	12,573	17,898	1.11	1.33	2.48
2.3 ECS Cr	0	0	0	0.00	0.00	0.00
2.4 IMPS	32,783	46,625	56,533	29.41	41.71	55.85
2.5 NACH Cr	16,465	18,758	19,267	12.17	12.82	15.44
2.6 NEFT	30,928	40,407	52,847	251.31	287.25	337.20
2.7 UPI	2,23,307	4,59,561	8,37,144	41.04	84.16	139.15
3. Debit Transfers and Direct Debits	10,457	12,189	15,343	8.66	10.34	12.90
3.1 BHIM Aadhaar Pay	161	228	214	0.03	0.06	0.07
3.2 ECS Dr	0	0	0	0.00	0.00	0.00
3.3 NACH Dr	9,646	10,755	13,503	8.62	10.27	12.80
3.4 NETC (Linked to Bank Account)	650	1,207	1,626	0.01	0.02	0.03
4. Card Payments	57,787	61,783	63,345	12.92	17.02	21.52
4.1 Credit Cards	17,641	22,399	29,145	6.30	9.72	14.32
4.2 Debit Cards	40,146	39,384	34,199	6.61	7.30	7.20
5. Prepaid Payment Instruments	49,366	65,783	74,667	1.97	2.79	2.87
6. Paper-based Instruments	6,704	6,999	7,088	56.27	66.50	71.63
Total - Retail Payments (2+3+4+5+6)	4,42,180	7,24,689	11,44,138	414.86	523.94	659.04
Total Payments (1+2+3+4+5+6)	4,43,772	7,26,767	11,46,563	1,470.86	1,810.52	2,158.50
Total Digital Payments (1+2+3+4+5)	4,37,068	7,19,768	11,39,476	1,414.58	1,744.01	2,086.87



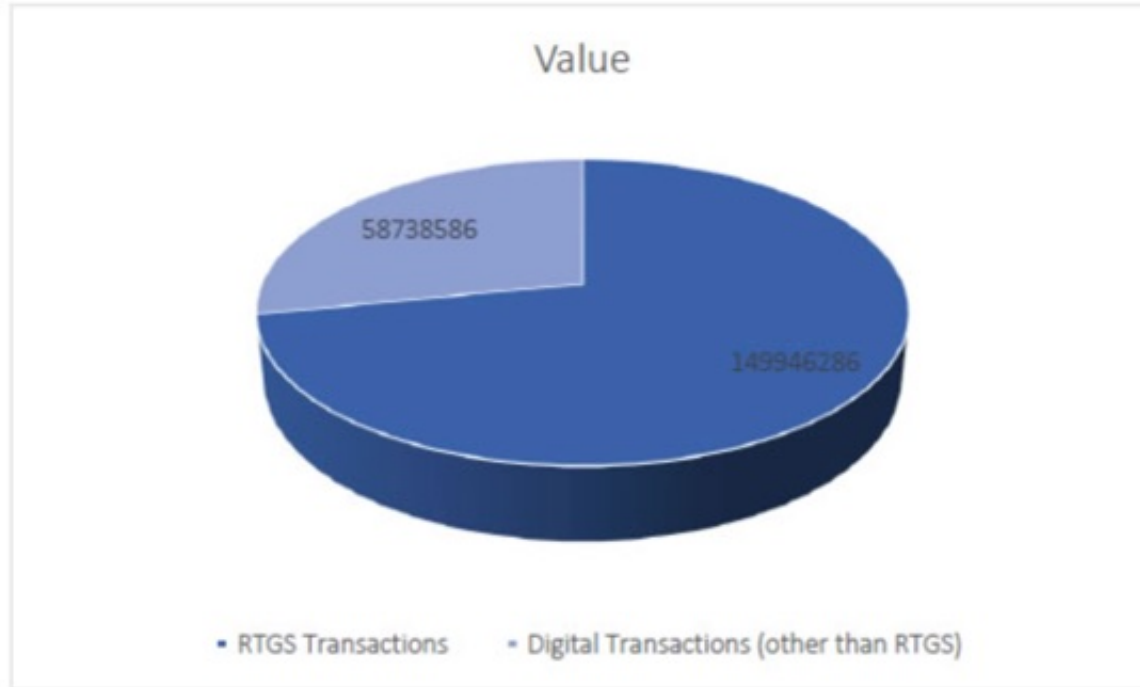
Payment Infrastructure - RBI data

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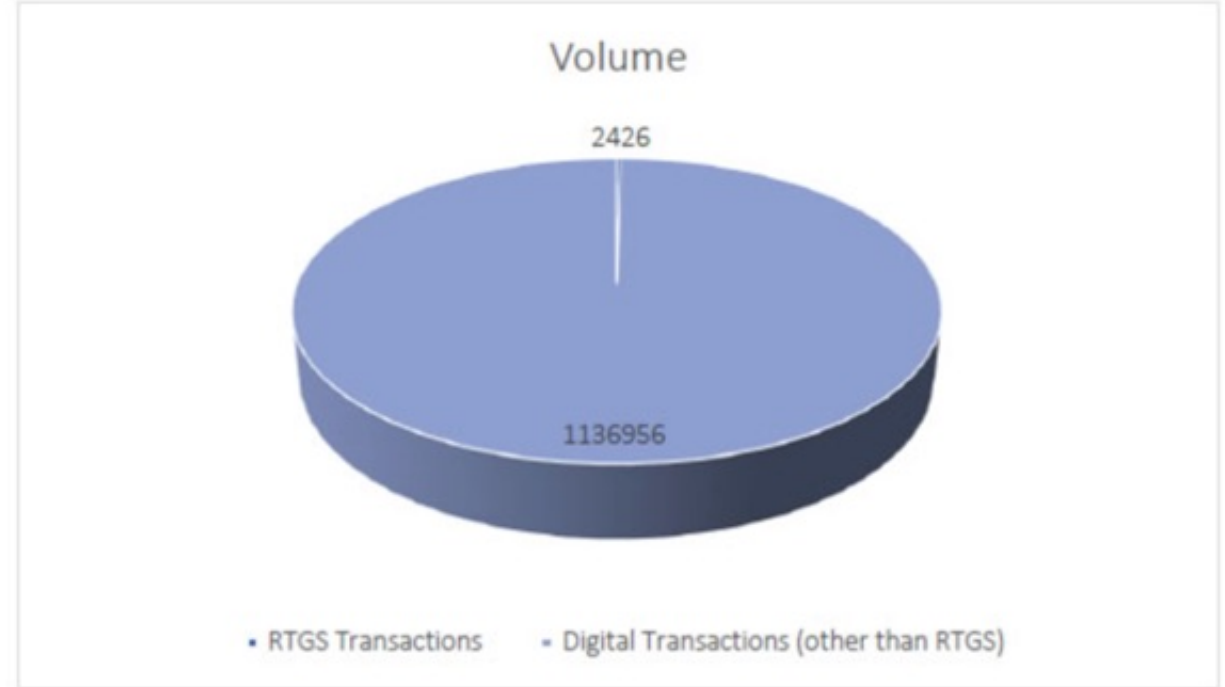
PART III - Payment Infrastructures (Lakh)				
System	As on March	2022	2023	
	2023	Oct.	Sep.	Oct.
	1	2	3	4
Payment System Infrastructures				
1 Number of Cards (1.1 to 1.2)	10465.62	10235.99	10713.04	10748.82
1.1 Credit Cards	853.03	793.68	930.17	947.11
1.2 Debit Cards	9612.59	9442.32	9782.86	9801.71
2 Number of PPIs @ (2.1 to 2.2)	16185.22	15985.59	16718.09	16830.87
2.1 Wallets @	13384.65	13195.92	13437.06	13576.88
2.2 Cards @	2800.57	2789.67	3281.03	3253.99
3 Number of ATMs (3.1 to 3.2)	2.59	2.55	2.58	2.58
3.1 Bank owned ATMs \$	2.23	2.20	2.23	2.23
3.2 White Label ATMs \$	0.36	0.35	0.35	0.35
4 Number of Micro ATMs @	16.11	12.91	14.87	15.30
5 Number of PoS Terminals	77.90	72.11	83.03	83.48
6 Bharat QR @	53.82	47.19	59.82	59.75
7 UPI QR *	2563.77	2253.23	2950.06	3017.20

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RTGS vs. others - RBI data



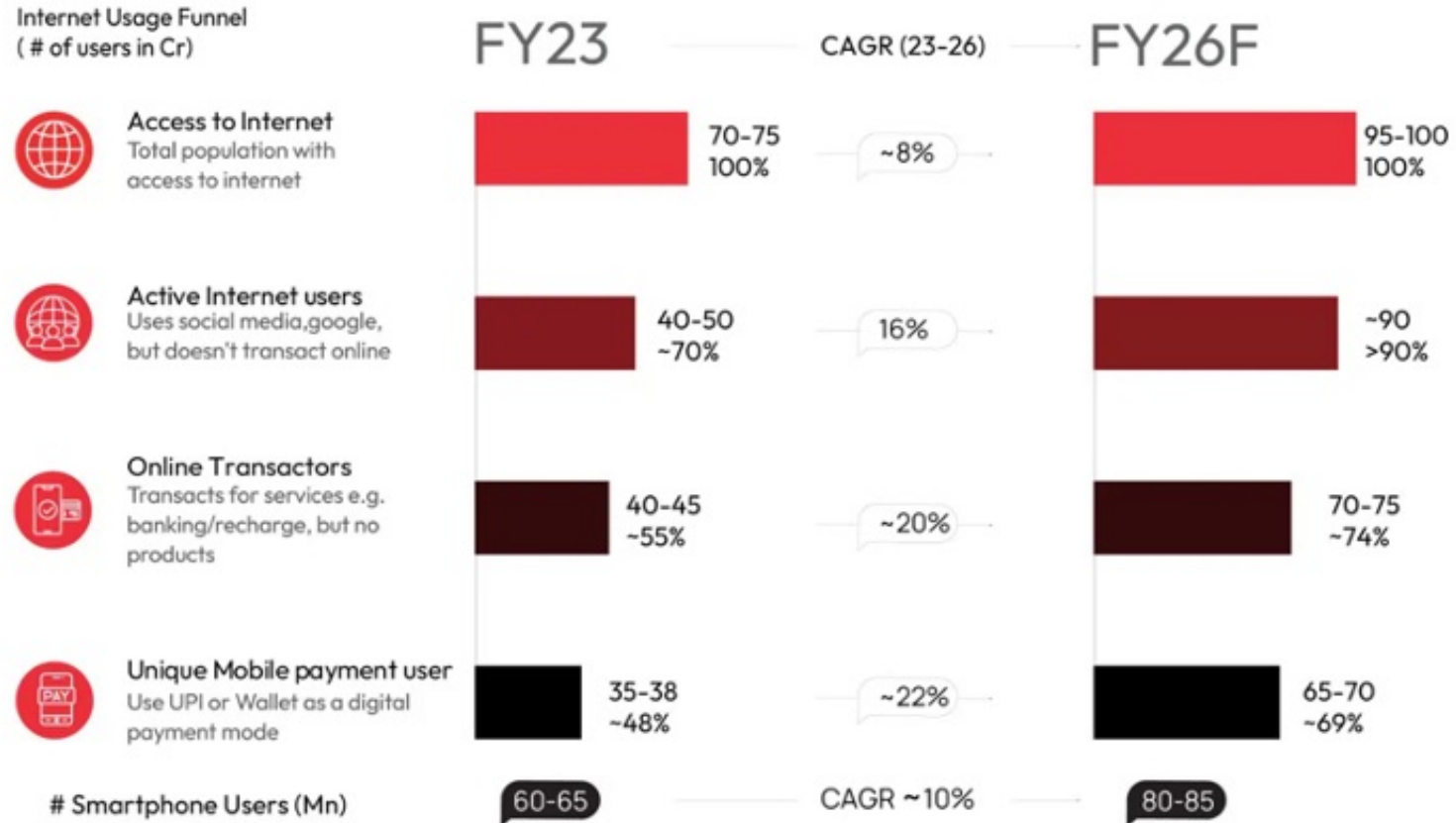
RTGS Value as % of Digital Transactions (2022-23)



RTGS Volume as % Digital Transactions (2022-23)

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India is on a fast-track path to becoming a digital economy

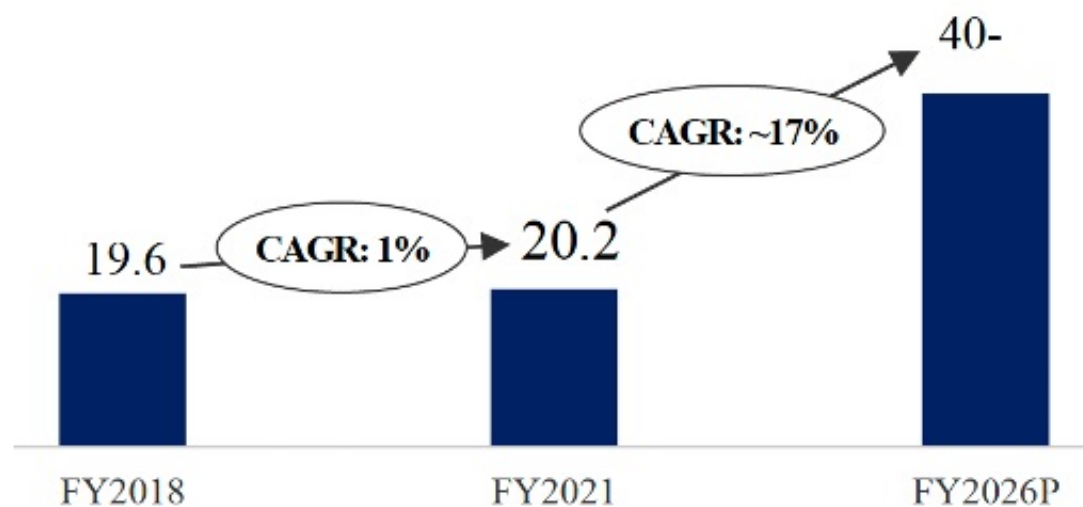


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Digital payments

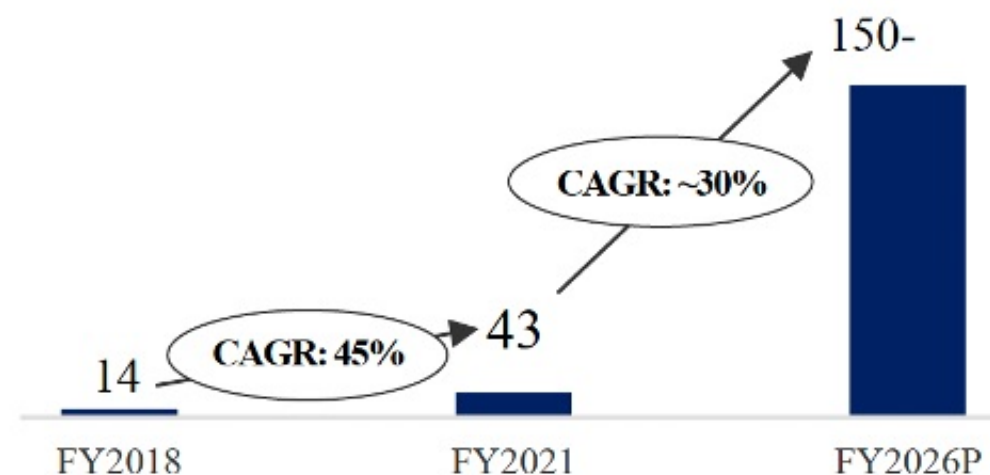
Total digital payments by value

US\$ trillion



Total digital payments by volume

Billion

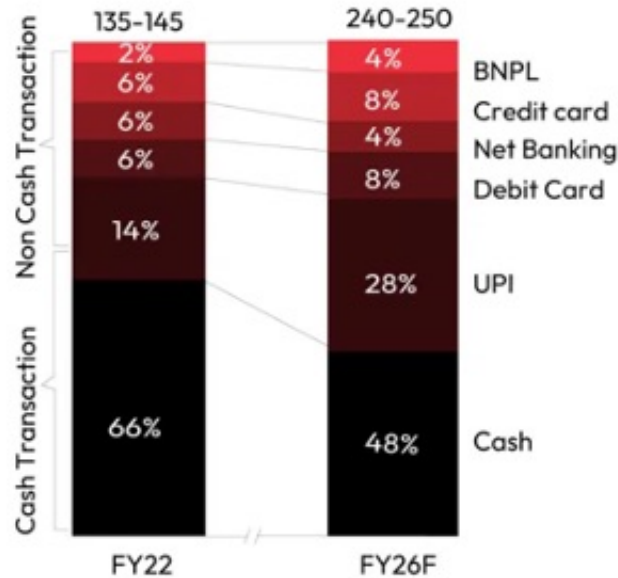


Source: Paytm offer document

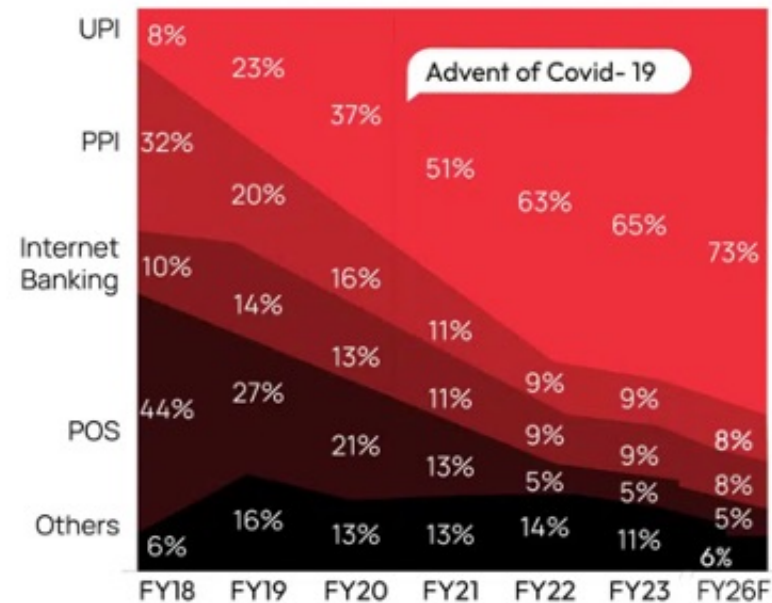
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Indian households which already make ~35% digital transactions are expected to cross ~50% by FY 26

Indian Household Consumption -By Payment Type
In INR Lakh Cr



Non-Cash Transactions in India -By volume
%, FY18-26F

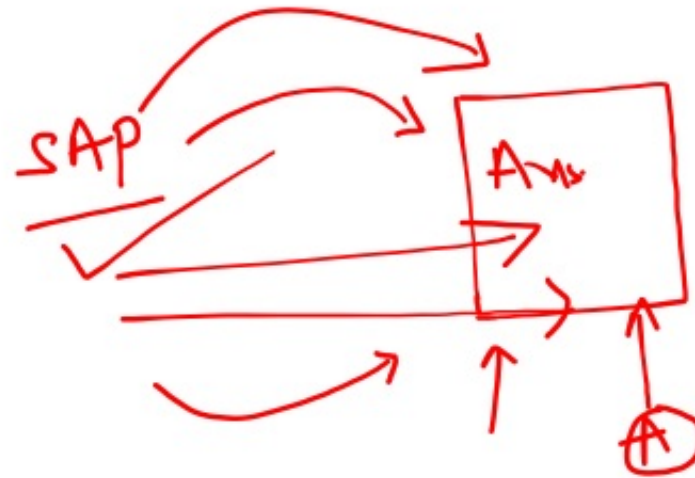


Source(s): Redseer Analysis
Non-cash transactions do not include cash transactions at branches.
Internet transactions include RTGS, AePS, ABPS, NETC, and IMPS financial transactions.

redseer

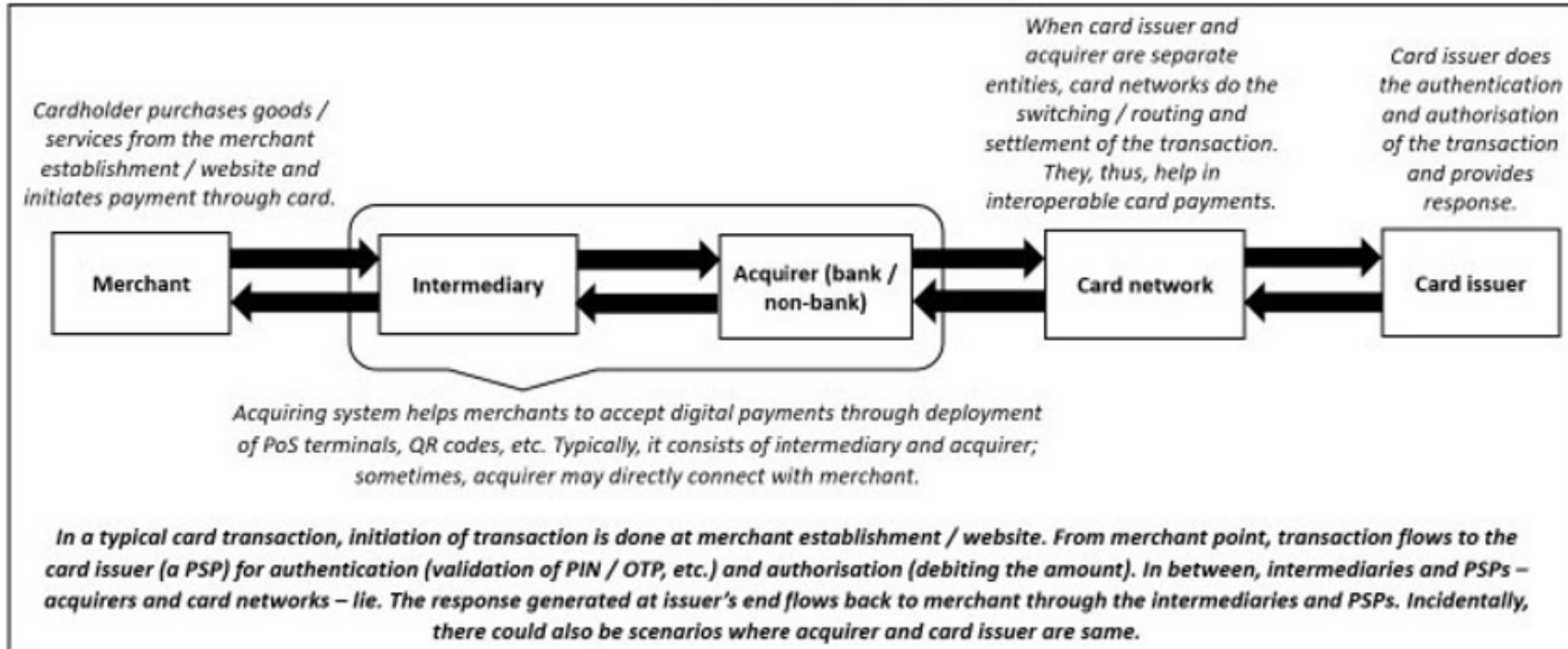
Digital Payments / Advancements

- ▶ Open APIs - the backbone of payment ecosystem
 - ▶ Straight through process ✓
 - ▶ Versus proprietary standards ✓
- ▶ Merchant payments - POS machines to payment gateway to QR code
 - ▶ 80-100 mln merchants have access to internet
- ▶ Virtual accounts



How do they make money?!

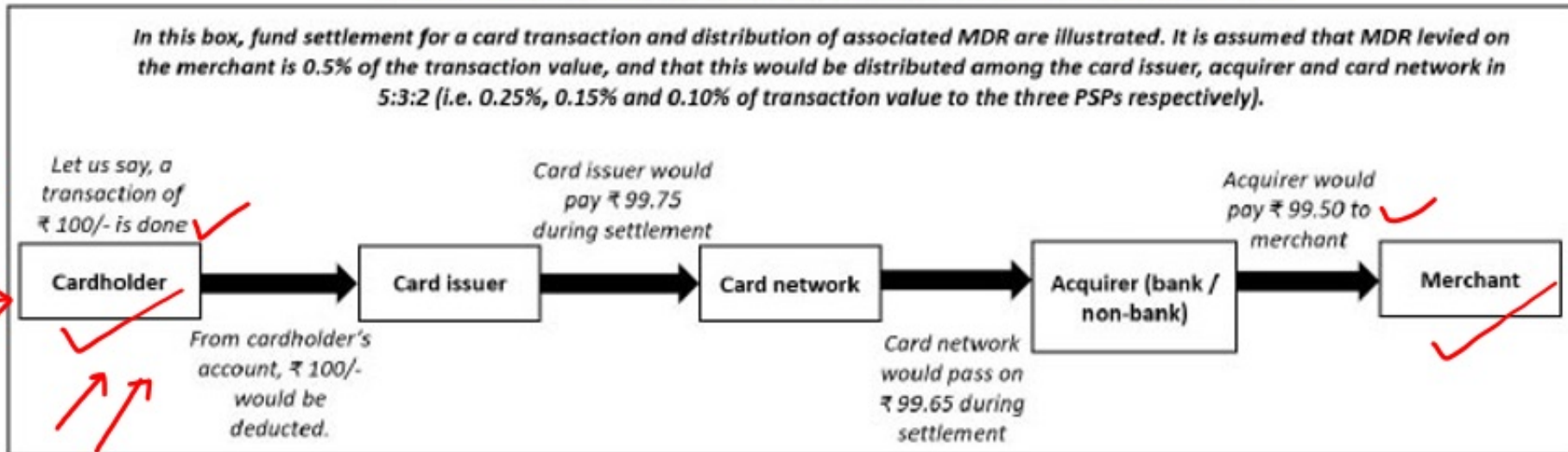
Box 1: Card transaction flow



Source: RBI

How do they make money?!

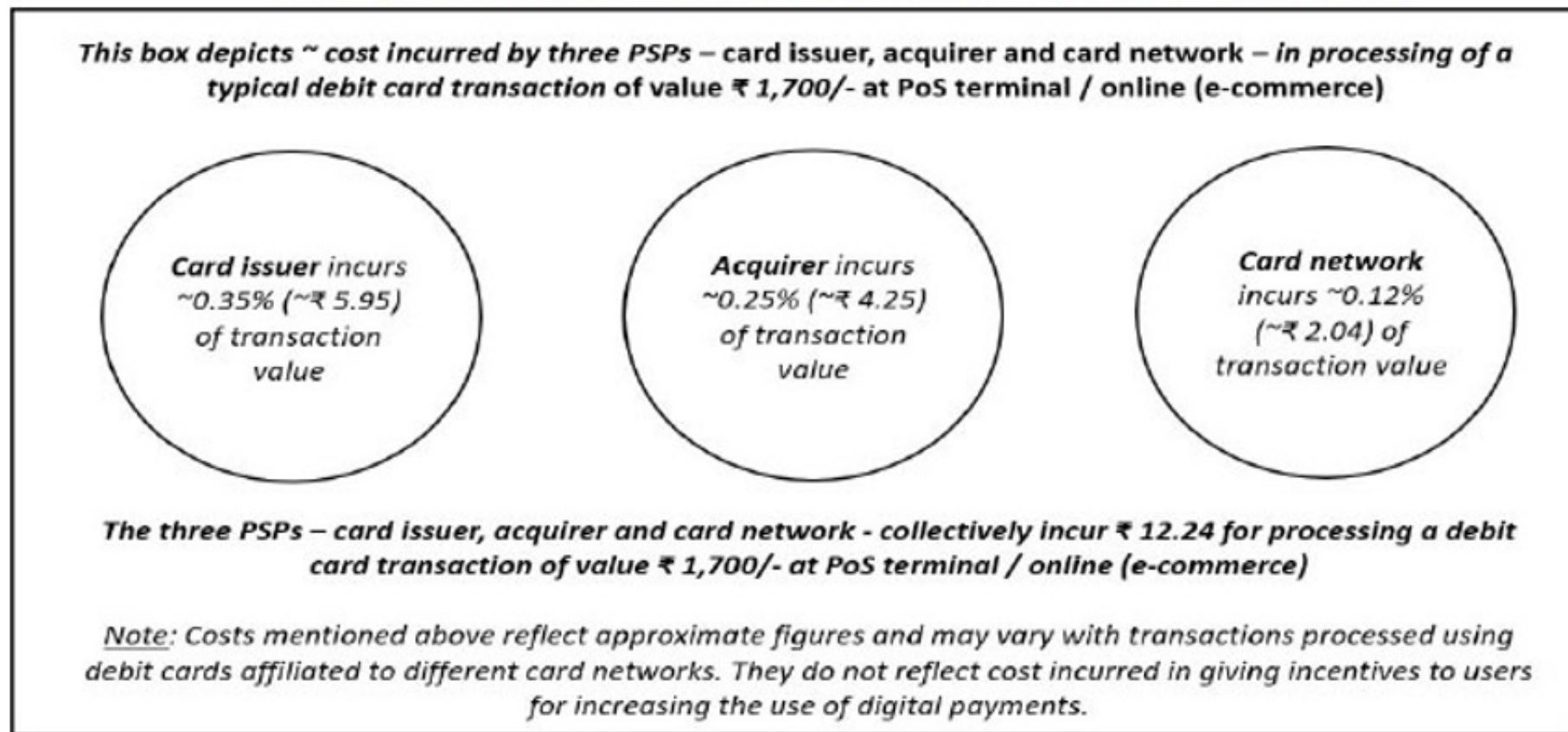
Box 2: Settlement of card transaction and distribution of associated MDR



Source: RBI

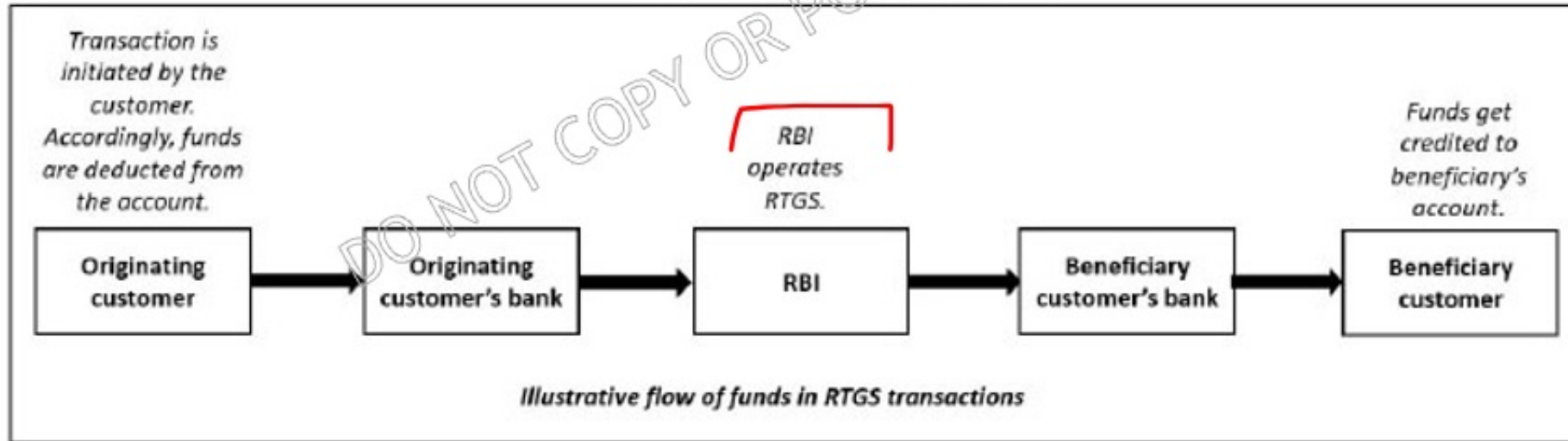
How do they make money?!

Box 3: Approximate cost incurred by PSPs in processing of a typical debit card transaction



How do they make money?!

Box 4: Transaction flow in RTGS

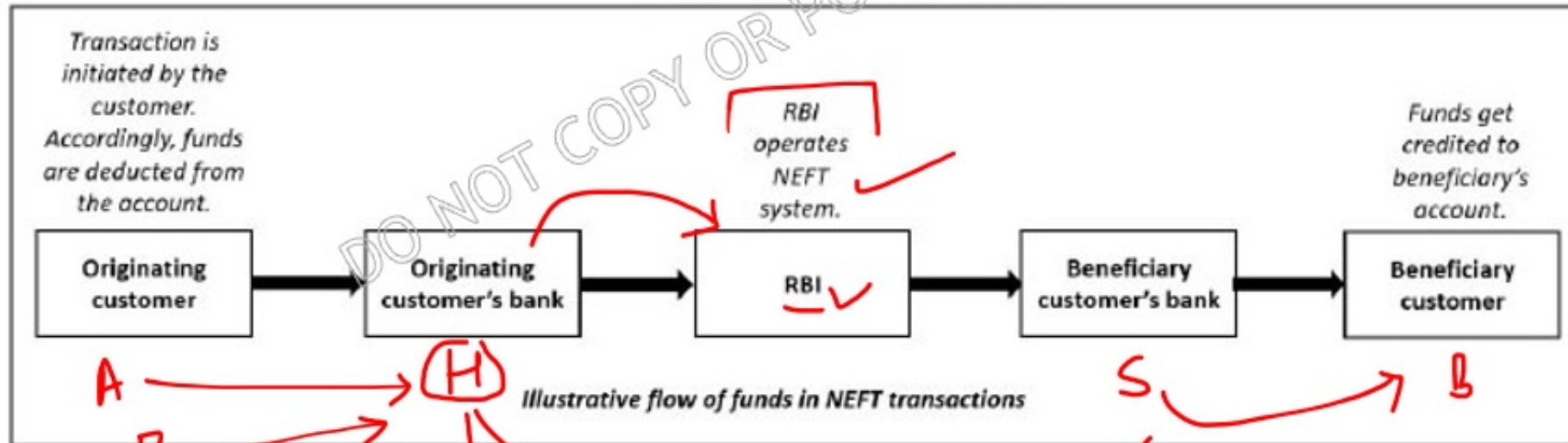


Source: RBI

How do they make money?!

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 $\frac{A}{RBI}$ +10

Box 5: Transaction flow in NEFT

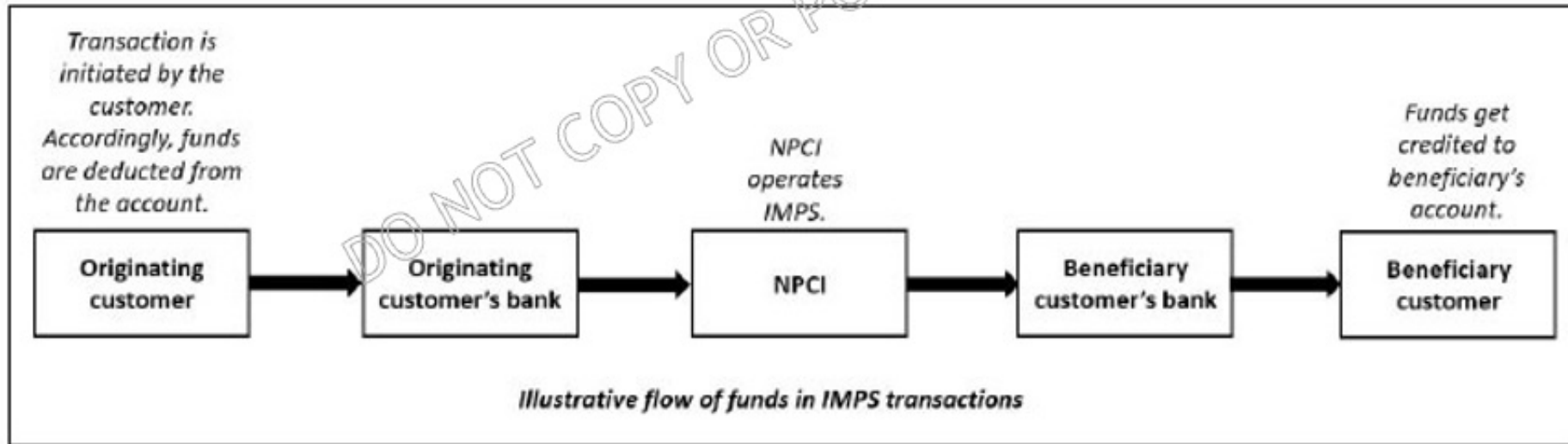


Source: RBI

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How do they make money?!

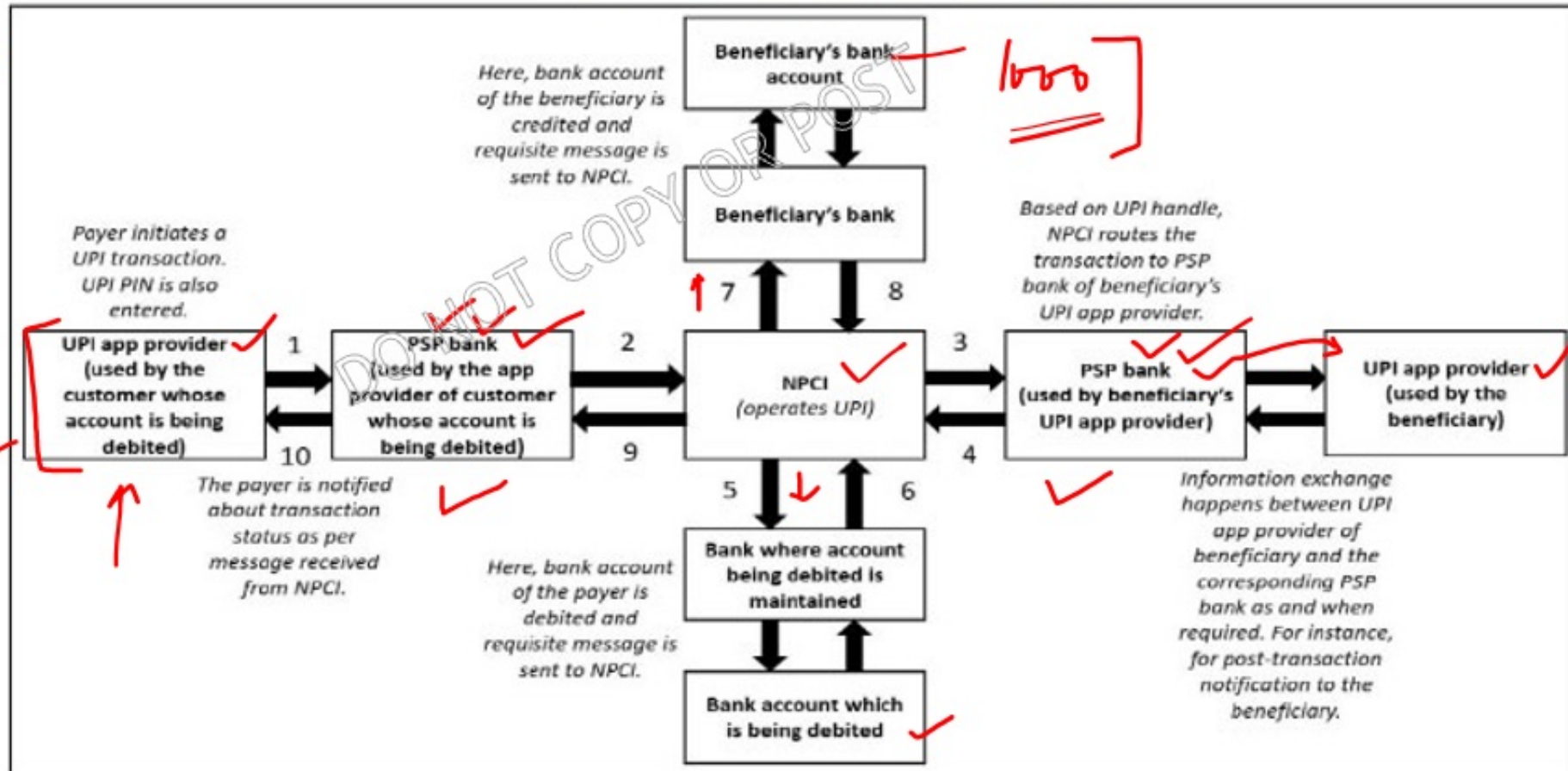
Box 6: Transaction flow in IMPS



Source: RBI

How do they make money?!

Box 8: Transaction flow in UPI (payer initiated)

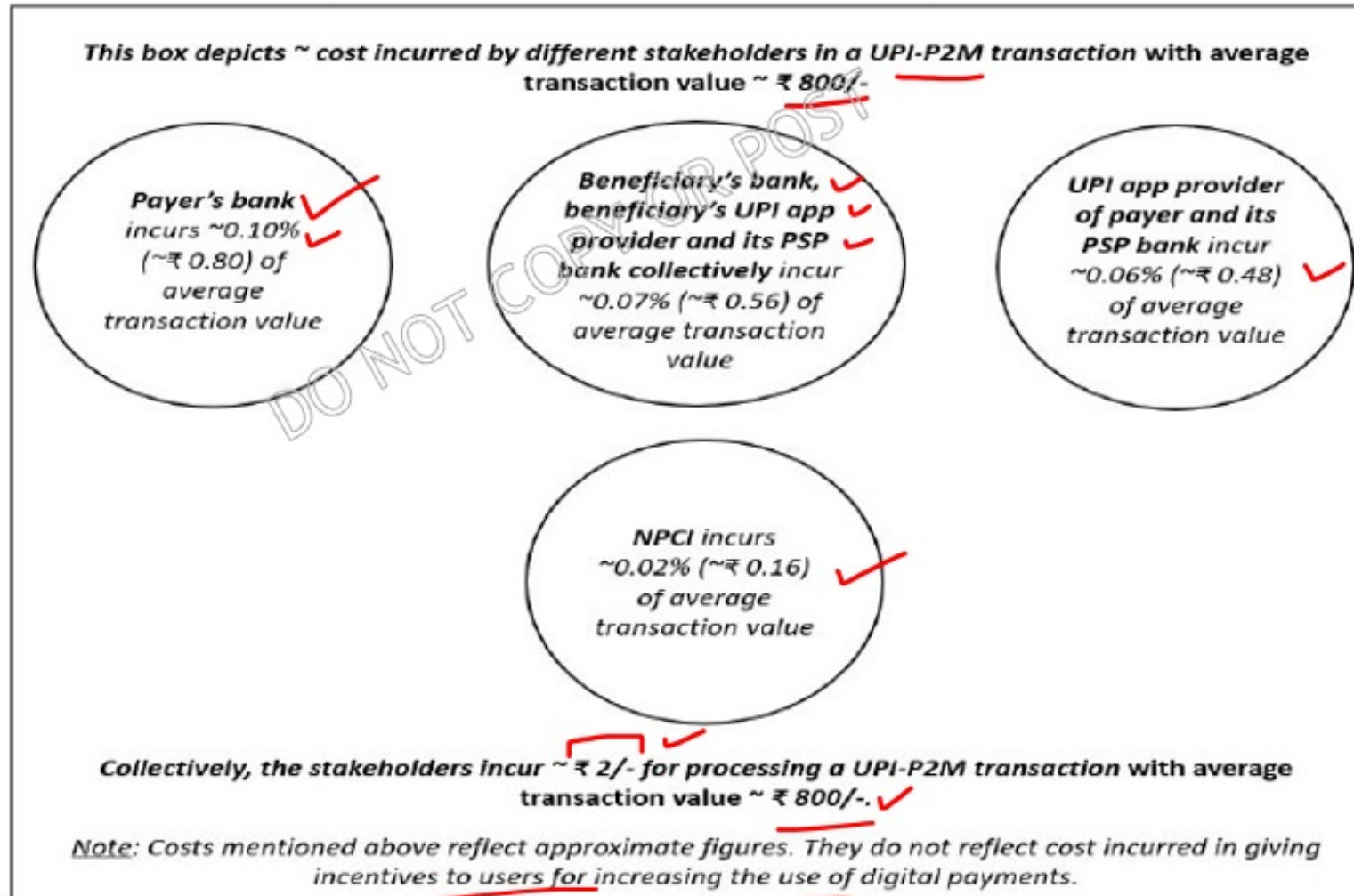


Source: RBI

Authorized for use only in Atul Kedia's sessions at the FRMBFS programme (IIM Visakhapatnam) - 2024

How do they make money?!

Box 9: Approximate cost incurred by stakeholders in processing a UPI P2M transaction



Source: RBI

Roles & Responsibilities of NPCI

1. NPCI owns and operates the Unified Payments Interface (UPI) platform
2. NPCI prescribes rules, regulations, guidelines, and the respective roles, responsibilities and liabilities of the participants, with respect to UPI. This also includes transaction processing and settlement, dispute management and clearing cut-offs for settlement
3. NPCI approves the participation of Issuer Banks, PSP Banks, Third Party Application Providers (TPAP) and Prepaid Payment Instrument issuers (PPIs) in UPI
4. NPCI provides a safe, secure and efficient UPI system and network
5. NPCI provides online transaction routing, processing and settlement services to members participating in UPI
6. NPCI can, either directly or through a third party, conduct audit on UPI participants and call for data, information and records, in relation to their participation in UPI
7. NPCI provides the banks participating in UPI access to system where they can download reports, raise chargebacks, update the status of UPI transactions etc.

Roles & responsibilities of PSP Bank

1. PSP Bank is a member of UPI and connects to the UPI platform for availing UPI payment facility and providing the same to the TPAP which in turn enables the end-user customers / merchants to make and accept UPI payments
2. PSP Bank, either through its own app or TPAP's app, on-boards and registers the end-user customers on UPI and links their bank accounts to their respective UPI ID.
3. PSP Bank is responsible for authentication of the end-user customer at the time of registration of such customer, either through its own app or TPAP's app
4. PSP Bank engages and on-boards the TPAPs to make the TPAP's UPI app available to the end-user customers
5. PSP Bank has to ensure that TPAP and its systems are adequately secure to function on UPI platform
6. PSP Bank is responsible to ensure that UPI app and systems of TPAP are audited to safeguard security and integrity of the data and information of the end-user customer including UPI transaction data as well as UPI app security
7. PSP Bank has to store all the payments data including UPI Transaction Data collected for the purpose of facilitating UPI transactions, only in India
8. PSP Bank is responsible to give all UPI customers an option to choose any bank account from the list of Banks available on UPI platform for linking with the customer's UPI ID.
9. PSP Bank is responsible to put in place a grievance redressal mechanism for resolving complaints and disputes raised by the end-user customer

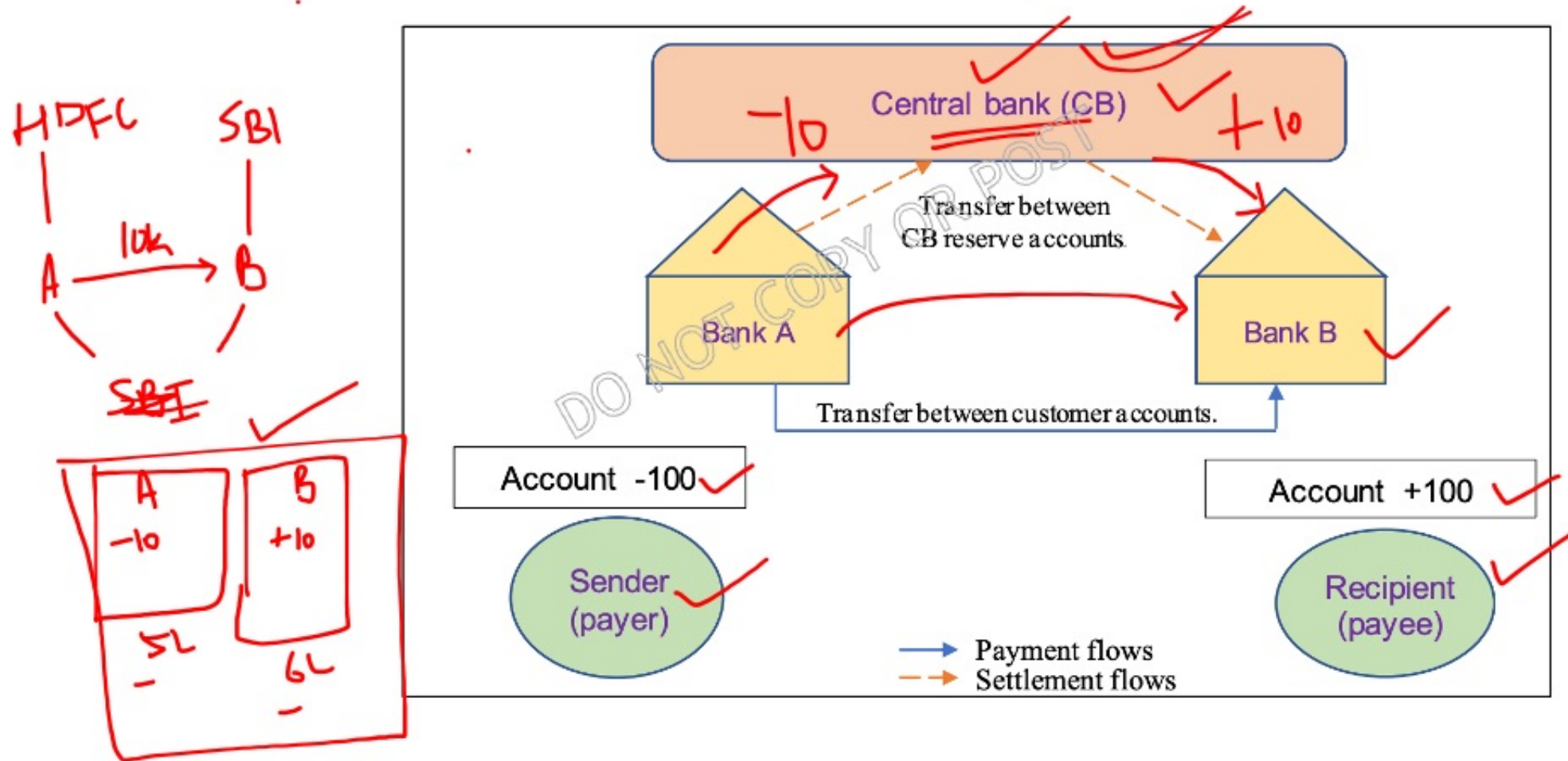
Roles & responsibilities of TPAP

1. TPAP is a service provider and participates in UPI through PSP Bank
2. TPAP is responsible to comply with all the requirements prescribed by PSP Bank and NPCI in relation to TPAP's participation in UPI
3. TPAP is responsible to ensure that its systems are adequately secure to function on the UPI platform
4. TPAP is responsible to comply with all applicable laws, rules, regulations and guidelines etc. prescribed by any statutory or regulatory authority in relation to UPI and TPAP's participation on the UPI platform including all circulars and guidelines issued by NPCI in this regard
5. TPAP has to store all the payments data including UPI Transaction Data collected by TPAP for the purpose of facilitating UPI transactions, only in India
6. TPAP is responsible to facilitate RBI, NPCI and other agencies nominated by RBI/ NPCI, to access the data, information, systems of TPAP related to UPI and carry out audits of TPAP, as and when required by RBI and NPCI
7. TPAP shall facilitate the end-user customer with an option to raise grievance through the TPAP's grievance redressal facility made available through TPAP's UPI app or website and such other channels as may be deemed appropriate by the TPAP like email, messaging platform, IVR etc.

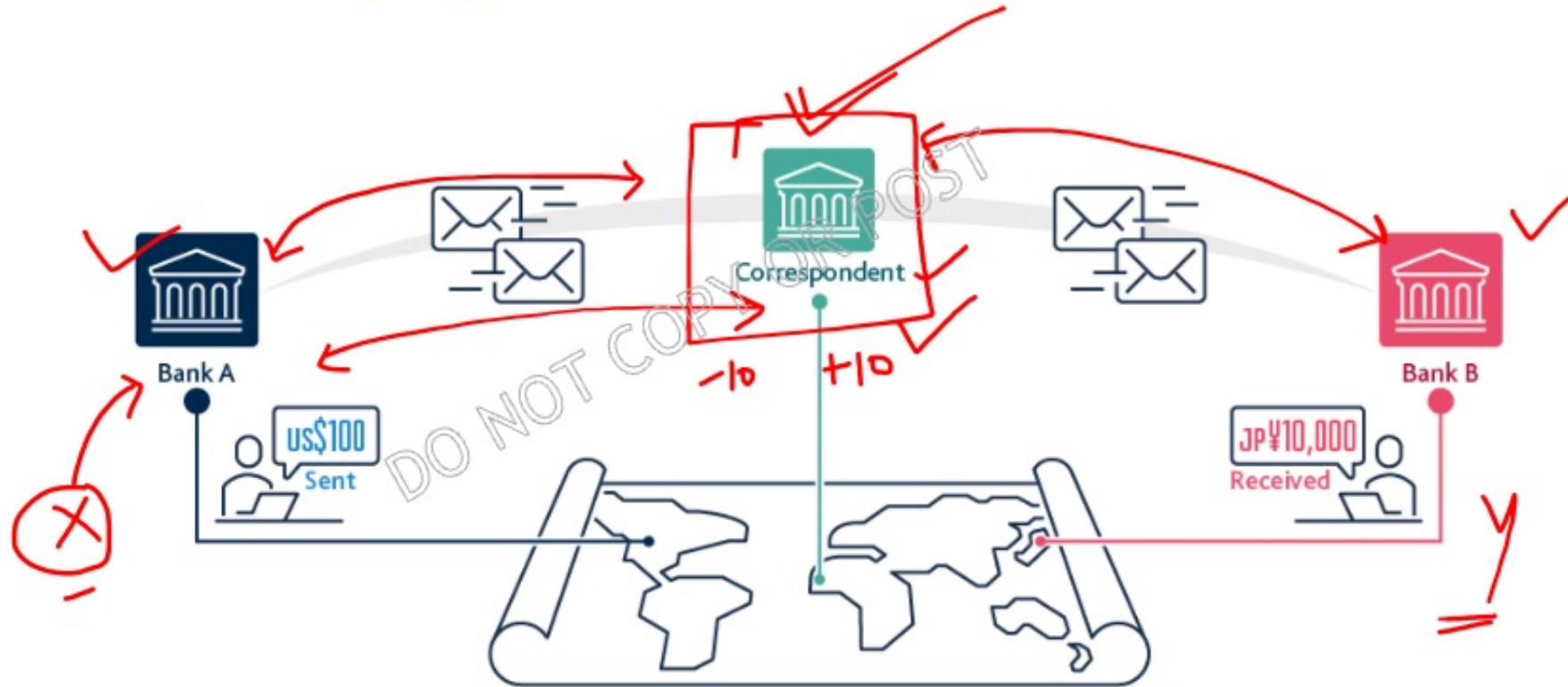
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Cross-border payments

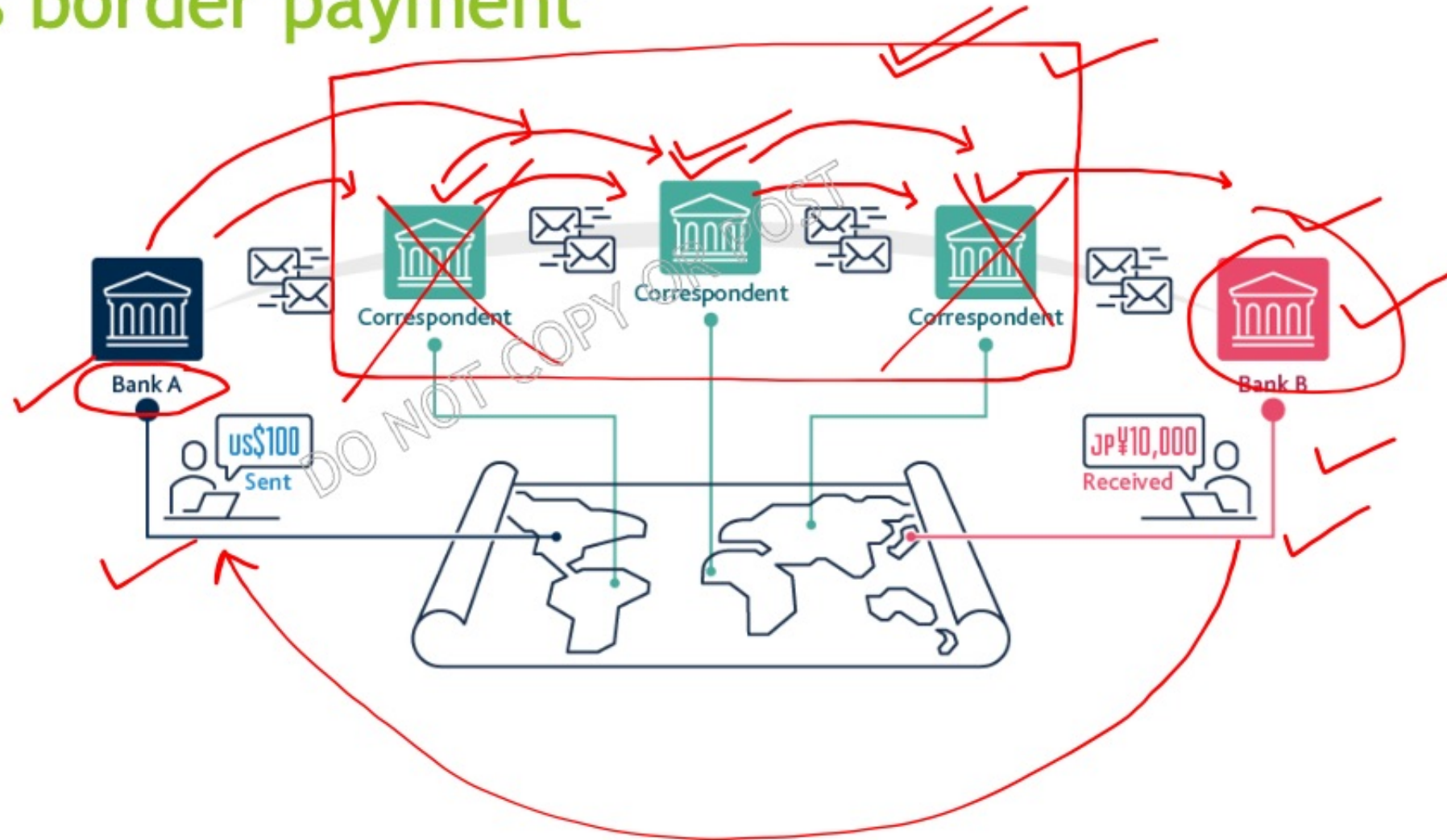
Execution of a Domestic Payment



Cross border payment



Cross border payment

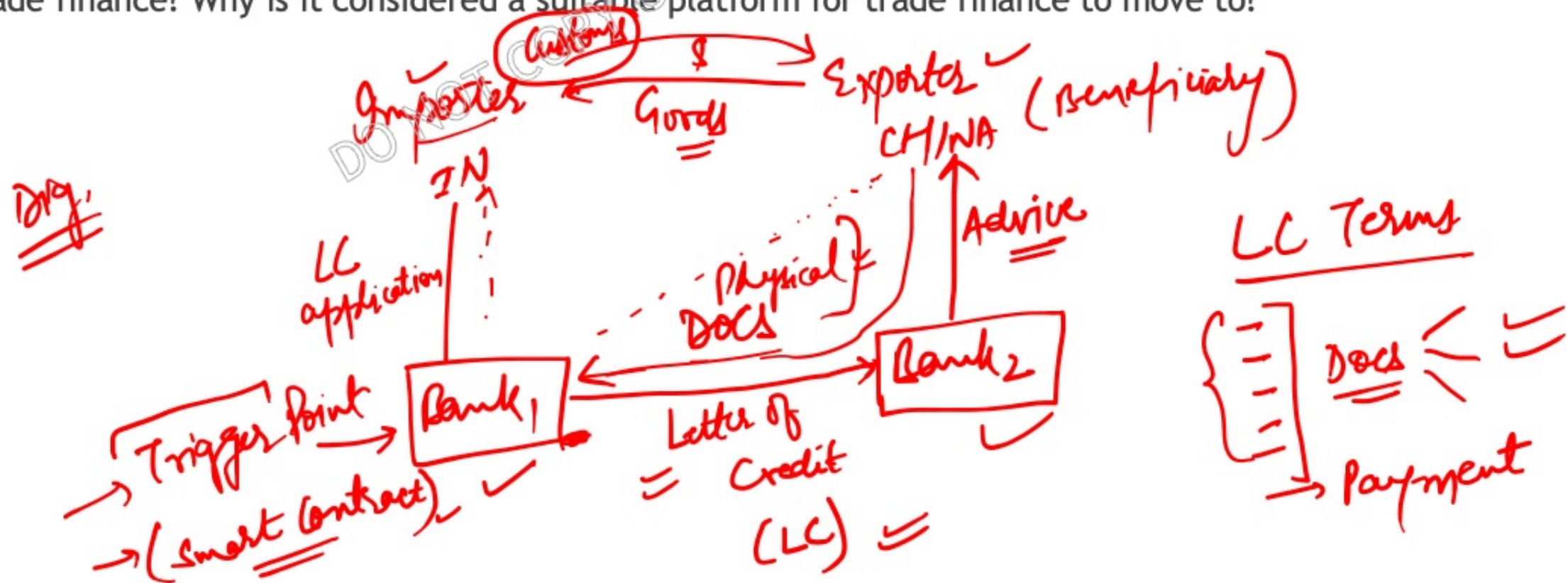


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Trade Finance vs. Blockchain

Trade Finance through Blockchain

- ▶ What are the key steps in the trade finance process? What is the role of banks in the trade finance process? How is risk apportioned?
- ▶ What are its strengths and weaknesses of blockchain when compared with the traditional process of trade finance? Why is it considered a suitable platform for trade finance to move to?



Bottlenecks in the Traditional Trade Finance Process

- ▶ In the traditional trade finance process, considerable paperwork is required. This documentation process takes at least 5 to 10 days, which in turn leads to a delay in financing and delivery of goods.
 - ▶ Shipment of goods can be delayed until multiple checks are performed by various intermediaries.
- ▶ All of the parties involved in the process are required to maintain their own database of documents related to the transaction.
- ▶ The possibility of fraud is high, as the same batch of goods could be financed multiple times by multiple banks.

Blockchain in TF

- ▶ Public blockchain
- ▶ Private blockchain
- ▶ Consortium Blockchain

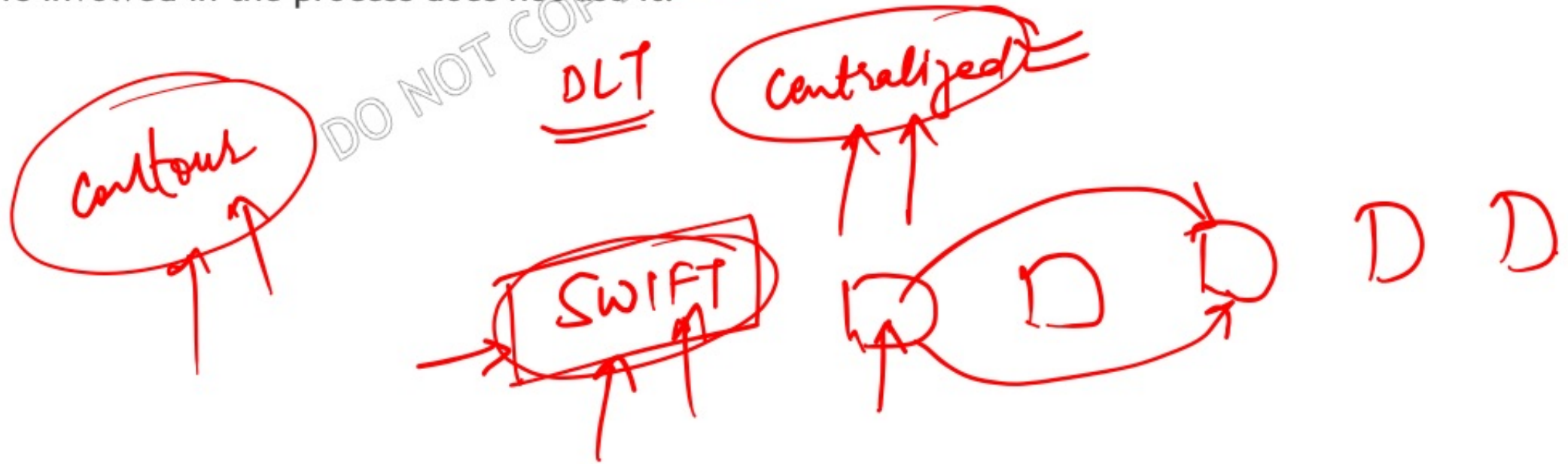
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Strengths of blockchain-based trade finance process

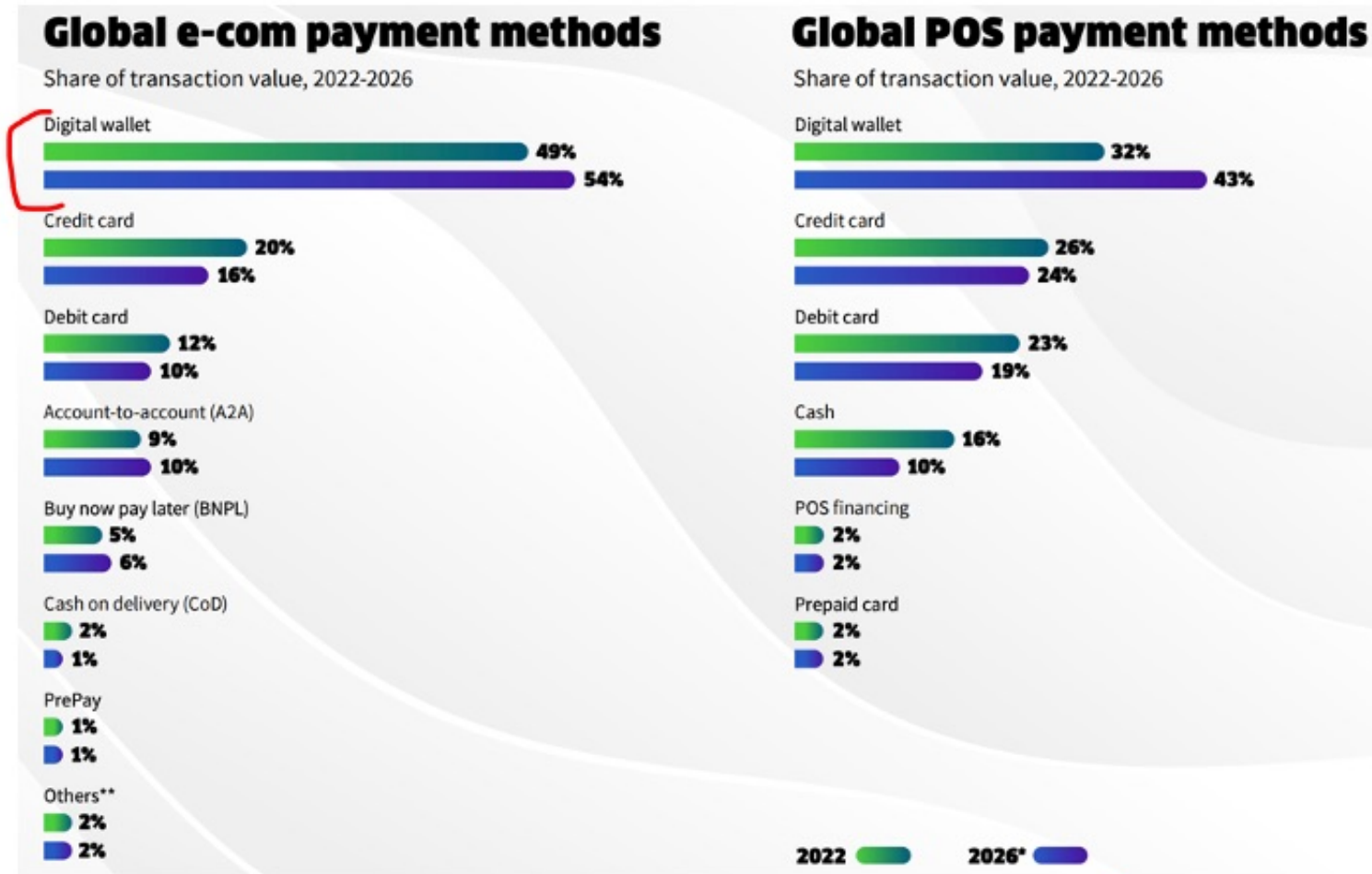
- ▶ Transactions are processed quickly (less than 24 hours) and overheads are reduced.
- ▶ Through a smart contract, the transaction is automatically implemented (see subsection “The blockchain-based trade financing process” in the case).
- ▶ Tracking can be done in real time by all of the actors involved in the process.
- ▶ The possibility of double spending/fraud is eliminated.
- ▶ The need for intermediaries is eliminated.

Weaknesses of blockchain-based trade finance process

- ▶ The initial set-up cost is high.
- ▶ Regulatory issues arise in different countries.
- ▶ All of the trading partners must use the same ledger, i.e., blockchain cannot be used if any of the actors involved in the process does not use it.



Consumer payment methods - global share



Source: https://www.fisglobal.com/en/-/media/fisglobal/files/campaigns/global-payments-report/FIS_TheGlobalPaymentsReport2023_May_2023.pdf

Prepaid Payment Instruments (PPIs)

- ▶ **Small PPIs** can be used only for purchase of goods and services at a group of clearly identified merchant locations / establishments, which have a specific contract with the issuer (or contract through a payment aggregator / payment gateway) to accept the PPIs as payment instruments.
- ▶ **Full KYC-PPIs** can be used for purchase of goods and services, funds transfer or cash withdrawal.
- ▶ These cards can be issued by both banks and non-banks.
- ▶ **Closed System PPIs** are issued by an entity for facilitating the purchase of goods and services from that entity only. Cash withdrawals are not permitted. These instruments cannot be used for payment or settlement for third party services. The issuance or operation of such instruments is not classified as a payment system requiring approval / authorisation by RBI and are, therefore, not regulated or supervised by RBI.

Small PPIs

- ▶ PPIs upto ₹10,000/- (with cash loading facility):
 - ▶ The amount loaded during any month shall not exceed ₹10,000/-;
 - ▶ The total amount loaded during the financial year shall not exceed ₹1,20,000/-;
 - ▶ The amount outstanding at any point of time shall not exceed ₹10,000/-;
 - ▶ The total amount debited during any given month shall not exceed ₹10,000/-;
 - ▶ These PPIs shall be converted into full-KYC PPIs within 24 months.
- ▶ PPIs upto ₹10,000/- (with no cash loading facility):
 - ▶ Same limits as above:
 - ▶ Loading / Reloading shall be from a bank account / credit card / full-KYC PPI; and
 - ▶ The Small PPIs (with cash loading facility) existing as on December 24, 2019 can be converted to this PPI, if desired by the PPI holder.

'Full-KYC' PPI

- ▶ Reloadable in nature;
- ▶ The amount outstanding shall not exceed ₹2,00,000/- at any point of time;
- ▶ There are no limits prescribed for total credits or debits during a month; and
- ▶ They can be used for purchase of goods and services, cash withdrawal and funds transfer.

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Other PPIs



▶ Gift PPIs

- ▶ Maximum value of each such prepaid gift instrument shall not exceed ₹10,000/-;
- ▶ Are not reloadable;
- ▶ Cash-out or fund transfer is not permitted ('back to source account' permissible);
- ▶ Shall be revalidated (including through issuance of new instrument) as and when requested by the PPI holder; and

▶ Mass Transit Systems (PPI-MTS)

- ▶ These PPIs are issued by MTS operators;
- ▶ May also be used only at merchants whose activities are allied / related to / are carried on within the premises of the transit system;
- ▶ Reloadable in nature;
- ▶ Maximum outstanding cannot exceed ₹3,000/- at any point of time;
- ▶ Cash-out or refund or fund transfer is not permitted;
- ▶ Shall be revalidated (including through issuance of new instrument) as and when requested by the PPI holder.

PPI - deployment of funds by non-banks

- ▶ Escrow account with scheduled commercial bank(s)
- ▶ The balance in the escrow account shall not, at the end of the day, be lower than the value of outstanding PPIs and payments due to merchants.
- ▶ Non-bank PPI issuer can enter into an agreement with the bank maintaining the escrow account, to transfer "core portion" of the amount, in the escrow account to a separate account on which interest is payable.
- ▶ "Core Portion" shall be computed as under:-
 - ▶ Step 1: Compute lowest daily outstanding balance (LB) on a fortnightly (FN) basis, for one year (26 fortnights) from the preceding month.
 - ▶ Step 2: Calculate the average of the lowest fortnightly outstanding balances [(LB1 of FN1+ LB2 of FN2++ LB26 of FN26) divided by 26].
 - ▶ Step 3: The average balance so computed represents the "Core Portion" eligible to earn interest.

PPI examples

- ▶ Paytm wallet ✓
- ▶ Payzapp wallet ✓
- ▶ Ola wallet ✓
- ▶ Amazon ✓
- ▶ Starbucks ✓
- ▶ Gyftr vouchers ✓
↑ ↑

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RBI and CBDC

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Managing Partner, Light Hill Capital

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RBI - Balance Sheet

RESERVE BANK OF INDIA							
BALANCE SHEET AS ON MARCH 31, 2023							
(Amount in ₹ crore)							
Liabilities	Schedule	2021-22	2022-23	Assets	Schedule	2021-22	2022-23
Capital		5.00	5.00	Assets of Banking Department (BD)			
Reserve Fund		6,500.00	6,500.00	Notes, Rupee Coin, Small Coin	6	17.13	9.50
Other Reserves	1	236.00	238.00	Gold-BD	7	1,96,864.38	2,30,733.95
Deposits	2	17,33,787.56	13,54,217.22	Investments-Foreign-BD	8	11,41,127.75	10,08,993.26
Risk Provisions				Investments-Domestic-BD	9	14,88,815.96	14,06,422.89
Contingency Fund		3,10,986.94	3,51,205.69	Bills Purchased and Discounted		0.00	0.00
Asset Development Fund		22,974.68	22,974.68	Loans and Advances	10	2,08,792.85	2,88,813.53
Revaluation Accounts	3	9,34,544.00	11,26,088.12	Investment in Subsidiaries	11	2,063.60	2,063.60
Other Liabilities	4	75,547.53	1,35,282.86	Other Assets	12	46,900.04	59,474.84
Liabilities of Issue Department				Assets of Issue Department (ID) (As backing for Notes Issued)			
Notes Issued	5	31,05,720.56	33,48,244.67	Gold-ID	7	1,25,348.98	1,40,765.60
				Rupee Coin		508.29	277.29
				Investments-Foreign-ID	8	29,79,863.29	32,07,201.78
				Investments-Domestic-ID	9	0.00	0.00
				Domestic Bills of Exchange and other Commercial Papers		0.00	0.00
						31,05,720.56	33,48,244.67
Total Liabilities		61,90,302.27	63,44,756.24	Total Assets		61,90,302.27	63,44,756.24

Source: RBI

RBI - Balance Sheet

Schedule 5:	(Amount in ₹ crore)	
	2021-22	2022-23
Notes Issued ✓		
(i) Notes held in the Banking Department	17.07	9.43
(ii) Notes in circulation ✓	31,05,703.49	33,48,218.85
(iii) CBDC-W	0	10.69
(iv) CBDC-R	0	5.7
Total	31,05,720.56	33,48,244.67

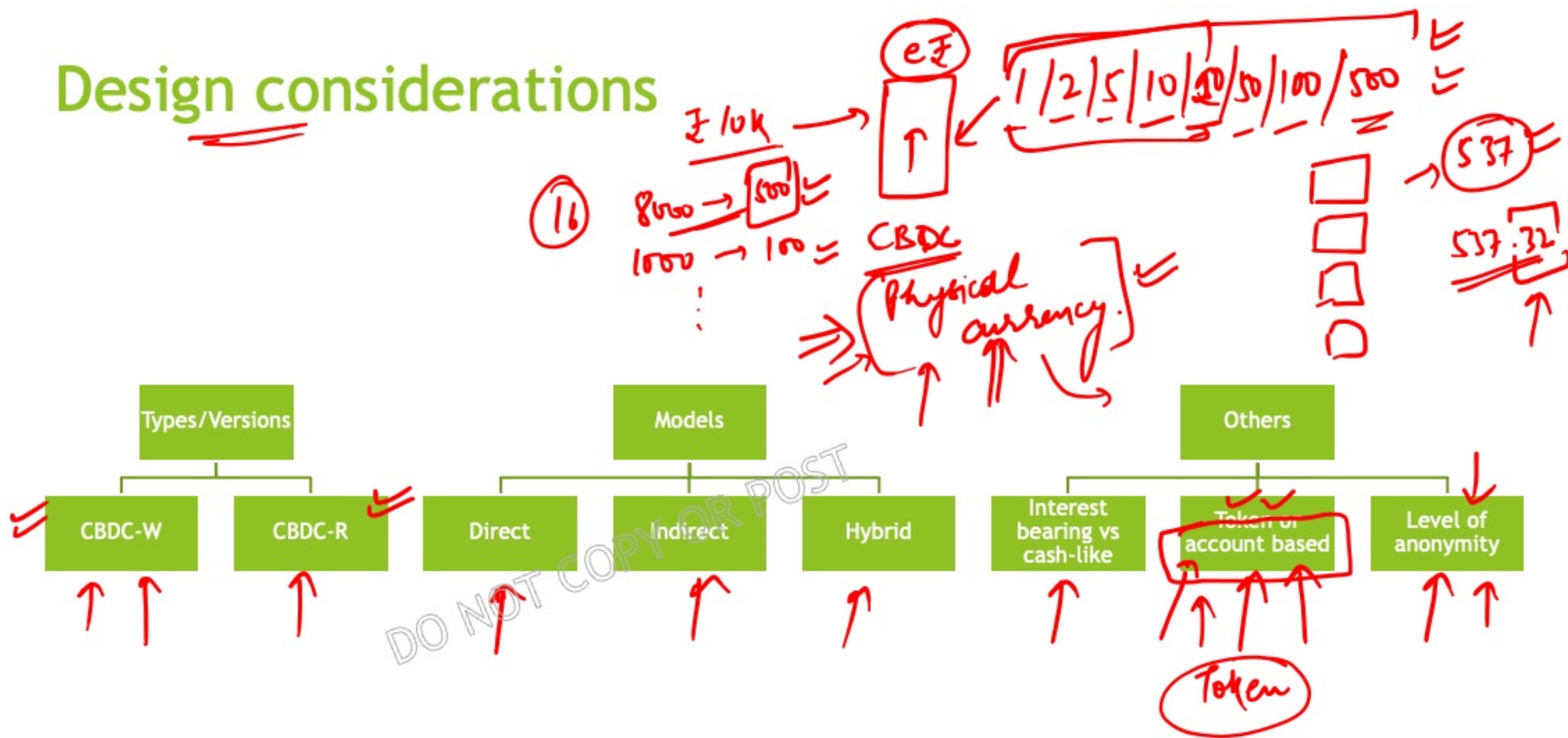
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CBDC

- ▶ CBDC may be defined as a widely held electronically recorded central bank liability available for transfer, whether on a distributed ledger or a more conventional database.
- ▶ CBDC vs. widening of access to accounts in central bank reserve money beyond domestic commercial banks
- ▶ What about maintenance of retail accounts?
- ▶ Central bank's liability vs. third party

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Design considerations

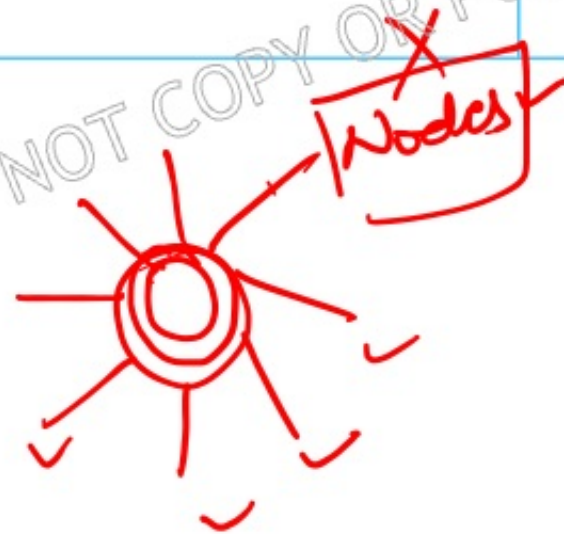


Centralized Databases versus DLT

Blockchain
crypto

Advantages of Centralized Databases	Advantages of DLT (if implemented properly)
<ul style="list-style-type: none">Competencies more readily available for technology, security, and vendor relationshipBetter control of privacyEasier to scaleEasier to upgradeLarge available product base built on top	<ul style="list-style-type: none">More resilient by design if no single point of failure is introduced.Offers new governance optionsCentral bank does not have to hold any private dataCould increase compatibility with DLT-based tokenized financial assetsInnovative domain, with new solutions emerging from decentralized finance

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Motivation

- ▶ Do we need another form of payment? - NEFT, RTGS, IMPS, UPI etc.
 - ▶ Minimise the use of cash and cash management expenses - annual Rs. 5k cr
 - ▶ Promoting financial inclusion
 - ▶ Supporting competition, efficiency and innovation in payments
 - ▶ Cross border transactions
 - ▶ Rapid rise of virtual private currencies - can undermine the monetary policy transmission and the stability of domestic currency through creating a parallel economy.
- Handwritten notes: "57." and "250 cr" are written next to the "annual Rs. 5k cr" point. A bracket groups the last three points, with an arrow pointing to the right. A large bracket groups the first two points, with an arrow pointing to the right. A large bracket groups the last two points, with an arrow pointing to the right. A diagonal watermark "DO NOT COPY OR POST" is visible across the bottom half of the slide.

Policy implications

- ▶ Balance Sheet impact
 - ▶ Switching from cash to CBDC
 - ▶ Switching from deposits to CBDC
- ▶ AML/CFT Perspective
- ▶ Privacy and data protection considerations

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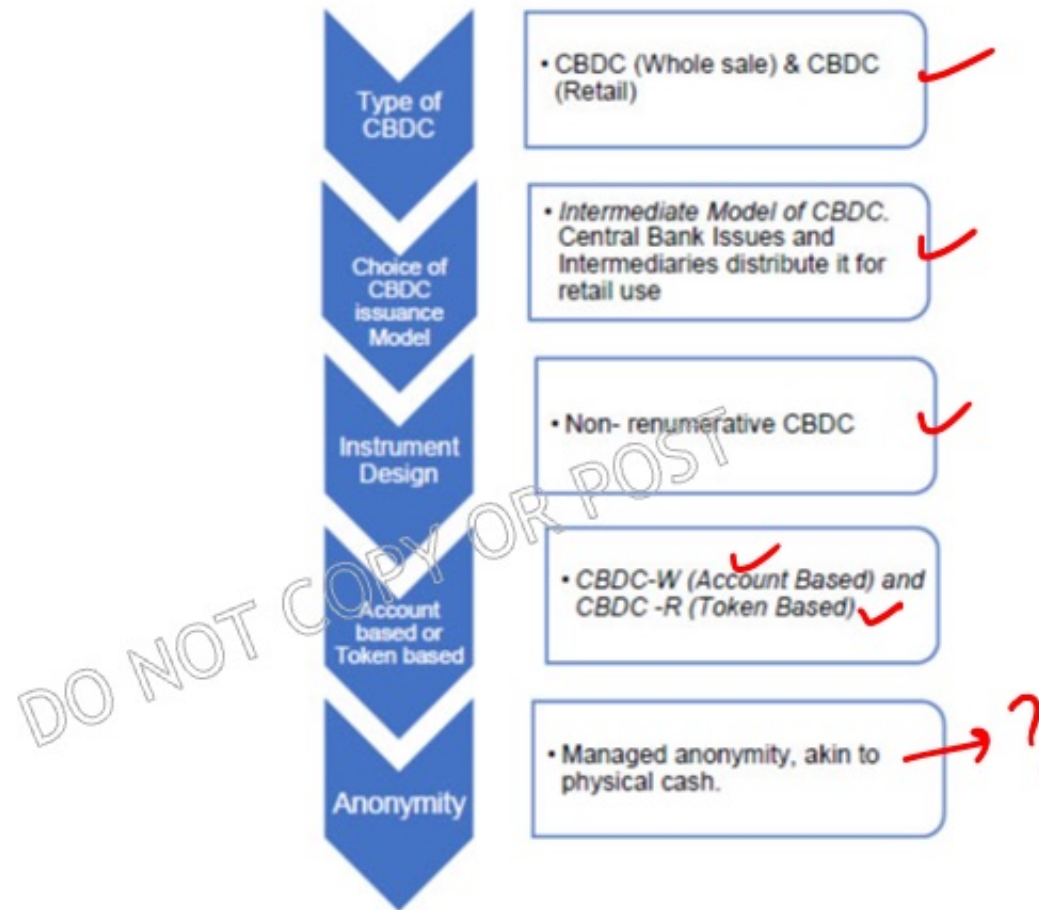
Banks X

Other considerations

- ▶ User friendliness and impact on existing payment infrastructure
- ▶ Resource intensiveness
- ▶ Consumer protection and Grievance Handling
- ▶ Anonymity of transactions
- ▶ Impact on financial statement audits
- ▶ Public awareness

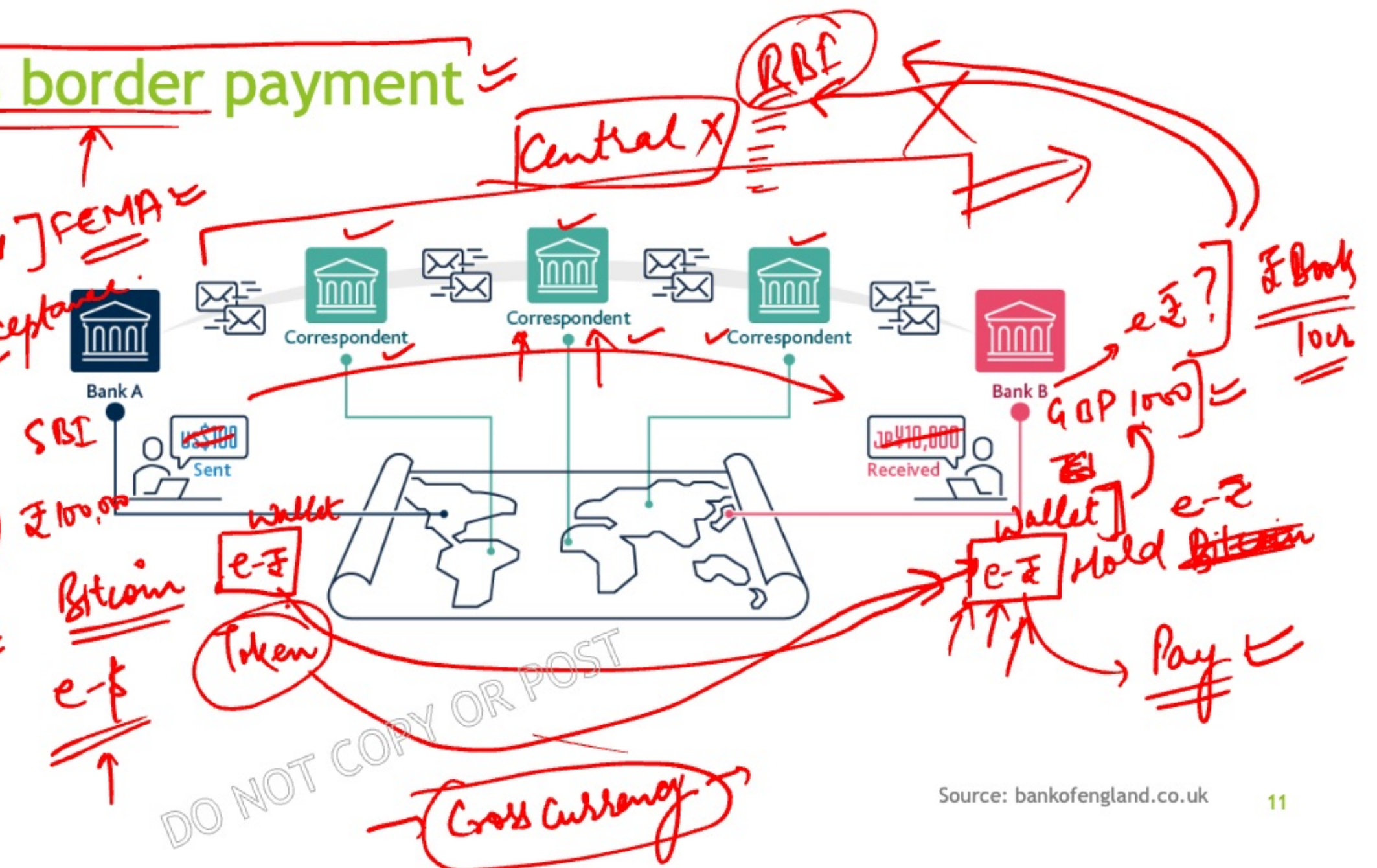
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Preferred design choices



Cross border payment

- Regulation] FEMA
- e-₹ acceptance
- Settlement



- Invoice ₹ INR