The Role of Refurbished **Mobile Phones** in **Digital Inclusion** and **Sustainable Development**

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1. Introduction





Problem 1 : Persistent Digital Divide due to Unaffordable Smartphones

Quarter ending	Subscriber Base (million)		Tele-density (%)	
	Rural	Urban	Rural	Urban
Mar-23	518.63	653.71	57.71	133.81
Jun-23	520.19	653.70	57.83	133.19
Sep-23	522.66	658.46	58.05	133.54
Dec-23	527.77	662.56	58.56	133.76
Mar-24	533.90	665.88	59.19	133.72

 Table 1: Subscriber Base & Tele-density - Rural &

 Urban

 Source: TRAI

As per World bank survey conducted across 22 countries across Africa, Latin America, and Asia, reasons for not owning a smartphone include affordability (39%), Lack of Electricity (18%) and Lack of mobile coverage (16%)

Source: "Strategies Towards Universal Smartphone Access," Broadband Commission for Sustainable Access, ITU and UNESCO, pp. 25, Sep 2022.

Smart phone possession among rural population is a challenge majorly due to affordability issues.

Problem 2 : E-Waste Management

Market Statistics in India



Phasing out 2G feature phones from the market will generate significant e-waste, which must be managed responsibly.



Source: TRAI

Phone Market Segmentation

- ▶ India shipped in 146 million smartphones in 2023.
- \blacktriangleright 25% of 146 million = 36.5 million.
- More than 25 million smartphones have a potential to be available in the second-hand market in 2026-2027.
- ➤ Assuming, average life of a smartphone is 3 years.
- Selling price after one year of use 60-65%
- Depreciation Another 15-20% after every subsequent year of use.

Source: icea.org.in/blog/wp-content/uploads/2022/02/ICEA-IDC-Re-commerce-Report.pdf

> Conclusion:

The price of such phones in the second-hand market can be as low as Rs. 3,000 which can come under the affordable category for Below Poverty Line people with further government incentives.

Smartphone Shipments in 2023 price segment wise



Source: IDC, 2023 India's Smartphone Market Grew by 1% YoY in 2023 to 146 Million Units, says IDC

About Refurbishment



Definition –

- The process of restoring a used product to a likenew condition or even improving its functionality.
- This process involves inspecting, repairing, and replacing any faulty components, as well as cleaning and testing the item to ensure it meets quality standards.

Refurbishment Process







Social



- Wider access to technology enhances access to information, communication, economic opportunities, education, and civic engagement, helping to bridge the digital divide and empower marginalized communities. This promotes a more inclusive society and supports the achievement of SDG 10 - Reduced Inequalities.
- The refurbishment industry creates jobs in collection, repair, and sales, supporting SDG 9 - Industry, Innovation, and Infrastructure by promoting sustainable industrial practices and strengthening infrastructure development.









- Refurbishing a phone reduces 87% of the climate impact compared to producing a new one by extending its lifespan and lowering the volume of electronic waste sent to landfills or improperly disposed of. This supports Sustainable Development Goal 12 (SDG12) -Responsible Consumption and Production, by promoting resource efficiency, waste reduction, and sustainable consumption patterns.
- Refurbished electronics require less energy and have a smaller carbon footprint.



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Refurbishment Benefits (contd..)

Financial



- Provides affordable access to technology for a broader audience, promoting mobile broadband adoption. A 10% increase in mobile internet penetration can boost GDP by 2.5% to 2.8% in developing countries like India.
- Enables companies to profit from returned products due to cosmetic, performance, or reliability issues. Profit margins on remanufactured products can reach up to 40%.









Challenges in Existing Market

01 Infrastructure Issues

Insufficient infrastructure in rural and Tier-3 cities.

03 Data Security

Concerns over personal data deletion.

02 Ownership Transfer

Legal and Procedural Uncertainties due to undefined ownership transfer procedures.

04 Pricing Transparency

Lack of Standardised pricing and fair competition.

05 Unregulated Market

Unregulated Sector and low recycling awareness.









- The target smartphones in the proposed model : Under Rs. 17,000.
- The target buyers: Individuals from low-income groups, those living below the poverty line.
- The proposed cost model is simpler and does not explicitly show factors such as transportation charges, value-added charges, and data deletion charges, as these are considered part of other cost variables.
- In case of no refurbishment required, the performance factor and cost of refurbishment are ideally assumed as 1 and 0.
- The cost of a smartphone depreciates by 35-40% after one year of use and by further 20-25% after every subsequent year.





Stakeholders



Aggregator

Terms and Conditions











Aggregator



Refurbishment Process





15TH ITU ACADEMIC CONFERENCE **Distribution Of Refurbished** Phones Point Of Sale Point Of Sale Refurbisher Point Of Sale



Buying Process



pricing

Buying Process





Centralised Software



Parameters for Price Calculation

Physical parameters

•IMEI number

- Purchase receipt
- Scratches and dents
- •Original accessories (Charger, cable, box)
- •Battery performance test
- •Repair History receipts
- Physical button test
- •Charging port test
- Speakers
- Microphone
- Touch screen
- Vibration Mode
- Fingerprint sensor
- Wireless connectivity (wifi/ hotspot/ Bluetooth/NFC)
- •Cameras
- •Brightness slider
- •All physically verifiable sensor test

Internal components and software

- All sensor performance
- •RAM and secondary memory check
- Service History for genuine parts
- •CPU (Single and multicore performance)
- GPU performance
- Battery condition test
- Display (dead pixels)
- CPU throttling test

Existing Benchmark tools

Geekbench

- •PC Mark and 3D Mark
- •AnTuTu etc.

- \blacktriangleright Ca = price of new product at launch year
- Cd = price of the product after depreciation for y years
- Ci = cost of input phone paid to seller after benchmark testing
- \blacktriangleright Cr = cost of refurbishment process
- > Pm = Profit Margin of aggregator
- \succ Co = output cost of product = Ci + Cr
- \succ Cs = cost after subsidy = Co Sb
- \blacktriangleright Ps = selling price of product = Cs + Pm
- Df = Depreciation factor as function of years y
- Pf = Performance factor as function of parameters
- Sb = Subsidy for a phone from government
 - > Target : Ps<Cd



Economic Viability

Case 1 : No Refurbishment required



Case 2 : Refurbishment required



• Inspect & Charge

Ensure functionality, charge fully, enable 'Airplane Mode'.

• Data Wipe

Use NIST-approved software(eg: Bitraiser), generate erasure certificates.

• Verify Wipe

Restart, check for remaining data, perform secondary wipe if needed.

• Deactivate & Encrypt

Deactivate accounts, turn off activation lock, encrypt data.

• Reset & Update

Factory reset, update OS, final inspection for complete data erasure.

SOP For Data Deletion

Benefits of the Model

Challenges in Existing Market	How the Model Overcomes It
1. Infrastructure Issues	The model addresses infrastructure challenges by having POS systems at each block level, ensuring greater accessibility and coverage, even in rural and Tier-3 cities.
2. Ownership Transfer	Ownership transfer issues are resolved by recording ownership transfer at each level in a centralized software, ensuring transparency and clear procedures during ownership handover.
3. Data Security	Concerns over data security are overcome by following stringent data deletion SOPs (Standard Operating Procedures), ensuring all personal or sensitive data is deleted safely and in compliance with regulations.
4. Pricing Transparency	Pricing transparency is improved with a centralized software where prices are estimated, recorded and accessible to all stakeholders through an online portal, ensuring fair pricing and easy access to historical pricing data.
5. Unregulated Market	The unregulated market issue is addressed by involving government certification, which enhances trust and expands market access. The model also provides eco-certification, promoting environmental sustainability.

Challenges



Proposed Solutions

• We can find out the models of smartphones having difficult disassembly and **Technical Challenges** they will not then be considered in the domain of the project. (component sub-assembly) **Challenges in Assessing** • By comparing the performance report of a number of smartphones from the benchmarking tools, we can predict the useful life of a smartphone. **Refurbished Products** • We can provide refurbished smartphones preloaded with applications designed to teach users how to operate smartphones and navigate key **Barriers beyond Cost** government apps such as Ayushman Bharat, agriculture services, and Direct Benefit Transfer (DBT)-related platforms

- Enhancing Digital Inclusion by providing Affordable Access:
 - Provides technology to underprivileged sections of society.
 - Supports social and economic participation as global connectivity grows.

> Environmental Impact:

- Extends device lifespan, reducing e-waste.
- Aligns with Sustainable Development Goals on responsible consumption and production.

- ✓ Way Forward:
- Several policies initiated by the Government will help reduce cost of repair/refurbishment for the aggregators and improve competitiveness.



2.





Unlocking Access...



Thank youk