



Mobile Communications Development in 2008-2023



August, 2025

I . Data Pre-Processing

Project Snapshot

- The Project pre-processes csv mobile voice data from ITU website and automates making charts, slides and presentations
- The Project menu launched from ITU_Main, supporting files include ITU_Utils , Create_Charts

Menu:
0. Load dataframe
1. Create new charts
2. Read charts
3. Prepare slides
4. Print slides
5. Delete charts and slides
6. Exit
Choose action:
! Not an option! Try again.

Menu:
0. Load dataframe
1. Create new charts
2. Read charts
3. Prepare slides
4. Print slides
5. Delete charts and slides
6. Exit

Choose action: 0
 DataFrame loaded and formatted.

Choose action: 1

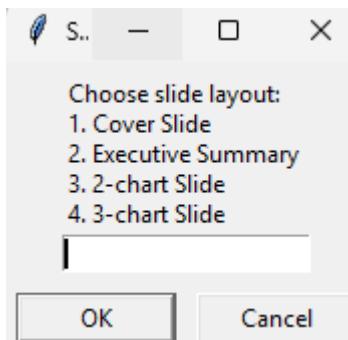
Available Indicators:

1. ARPU
2. Population
3. Subscribers
4. Market Size
5. Penetration Rate

Select indicator(s) (e.g., '1,3-4'):

Choose action: 2
Select files (e.g., 1,3,5-7):

Choose action: 3



Choose action: 4

Select an option:

1. Create a new presentation from selected slides.

2. Insert slide(s) into an existing presentation.

Enter option number (1 or 2):

1. Available Slide Files:

Enter slide numbers in desired order (e.g., 1,2,4-5):

2. Available Presentations:

Select a presentation number to insert into:

Available Slide Files:

Enter slide numbers to insert (e.g., 1,3-4):

Presentation has 13 slides.

Insert after which slide number(s)? (e.g., 2,4):

Presentation saved as Presentation5.pptx in 'Presentations' folder.

Choose action: 5

Which folder would you like to manage?

1. Charts
2. Slides
3. Presentations

Enter your choice: 1

Enter file numbers to delete (e.g., 1,3-4):

Enter your choice: 2

Enter file numbers to delete (e.g., 1,3-4):

Enter your choice: 3

Files in Presentations:

1. ITU Mobile Telecoms by Pandas Presentation.pptx
2. ITU Mobile Telecoms by Pandas Presentation2.pptx
3. Presentation1.pptx
4. Presentation4.pptx
5. Presentation_1.pptx

Presentation management options:

1. Delete Slides from Presentation

2. Delete Entire Presentation

Enter your choice (1-3):

Data Pre-Processing Overview

- Data was obtained in *.zip from the public website of **International Telecommunications Union**, <https://datahub.itu.int/> except for summary table with country classification - <https://datahub.itu.int/dashboards/idi/?e=ISR&y=2025>
- Zip files are saved and unpacked locally because downloading them from the website is inefficient and slower
- Data includes **3 dataframes** – mobile voice indicators, population and subscribers and country income and regional classification
- The dataframes were merged, data for 2003-2008 was deleted due to data unavailability for some indicators, countries with more than one zero except the last year were dropped. The remaining data for 137 countries is incomplete but is quite representative for the objective
- Data for 2004 is mainly missing, so further analysis shows comparable data analysis for **2008-2023**
- New indicators were calculated further in ITU_Utils – 1. **Market Size** (ARPU * Subscribers *12) and 2. **Penetration Rate** (Subscribers / Population)
- ITU_Utils also calculates **means for country aggregates classified by income, region and World** ARPU and Penetration Rates and also includes the **totals** for the other country-aggregate indicators
- The resulting dataframe for further manipulations in ITU_Main, ITU_Utils and Create_Charts files is available in the file ‘ITU_Mobile_Telecoms’, was called ‘**formatted_for_sbrn**’ and is saved in *.xlsx
- The analysis on the following slides is **based only on mobile voice data**, for shortcut the missing conclusions are provided by the author, because the focus of this is python-based data processing capacity rather than full-scale financial statistics analysis

II. Data Analysis

Global Mobile Voice Data Market Overview

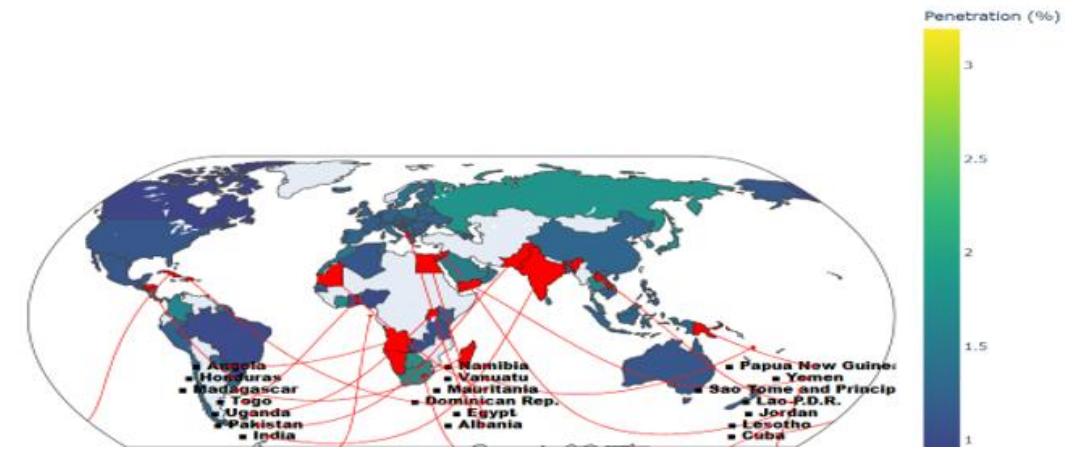
- The golden era of mobile voice market was mainly completed growth till 2012 shifting to data and messengers from 2013 and on
- Despite the common expectation for the analyzed market phase the growth of subscribers leads to the decline of mobile voice market, however, it means that revenues shift to data and media market segments
- Part of revenues was also lost to social media and mobile apps driving EBITDA margins from the peaks of 52%-58% (higher than FAANGS) down to 32%-38% range
- Mobile operators are seeking for new content- and service- based growth models to avoid becoming a data traffic pipeline with quite varying but still limited success (from negative to within 10% EBITDA margin effect)
- Mobile penetration rates exceeded 100% in most countries due to business voice communications, where businesses and employees have additional SIM cards
- Less developed emerging markets started the shift towards data before the market saturation due to apparent cost savings
- For the future of mobile communications market data, media and value chain segments have to be taken into the analysis but they were not in the scope of this presentation

Adjust Title

Despite the market maturity mobile communications market provides strong investment and development potential

- By 2023 the cost of mobile and internet access has become acceptable globally
- The remaining digital divide still provides opportunities for strategic investment
- Funding from development organizations, private investments and government support improve infrastructure, expand coverage, and accelerate the digitalization
- Increasing access to mobile communications provides opportunities for residents to study, work, business, and receipt of services
- Communications provide multiplication effect for economic growth for both individuals and countries
- Market capitalization growth potential still provides strong investment potential in some less developed parts of the world

Lowest 20 Mobile Penetration Countries, 2023



Cost of Internet Access (% GNI), 2023



Cost of Mobile Access (% GNI), 2023

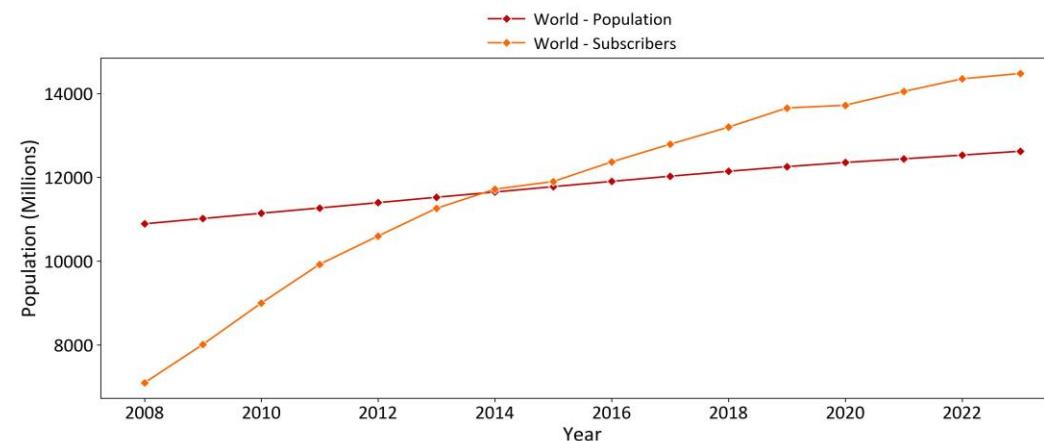


Source: ITU

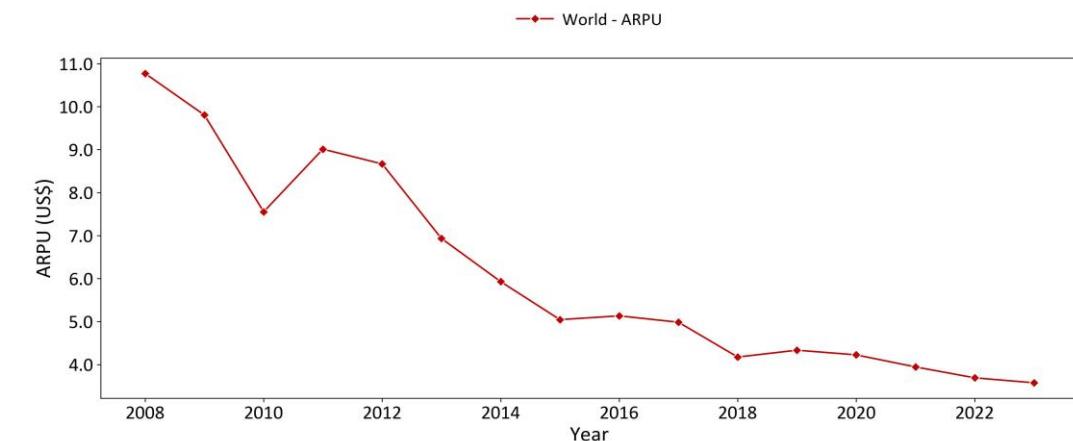
Mobile Telecommunications Market Overview

- Mobile voice data market was the fastest growing industry in the world ever
- By 2014 the global penetration rate exceeded the global population due to several numbers for voice data. Other factors, not related to voice services, also include wireless data modems, data only services and Internet of things (IOT) with individual additional SIM cards
- Average Global ARPU enabled the market growth driven both by the economies scale, technological improvements, competition, pay-as-you-go tariffs, transition from voice to lower cost data traffic in voice over LTE/Internet (VOLTE/VOIP) in mobile networks and data in messengers
- Those changes were different for individual countries and regions

Global Population and Subscribers Development



Global Mobile Voice Average Revenue per User (ARPU) Development

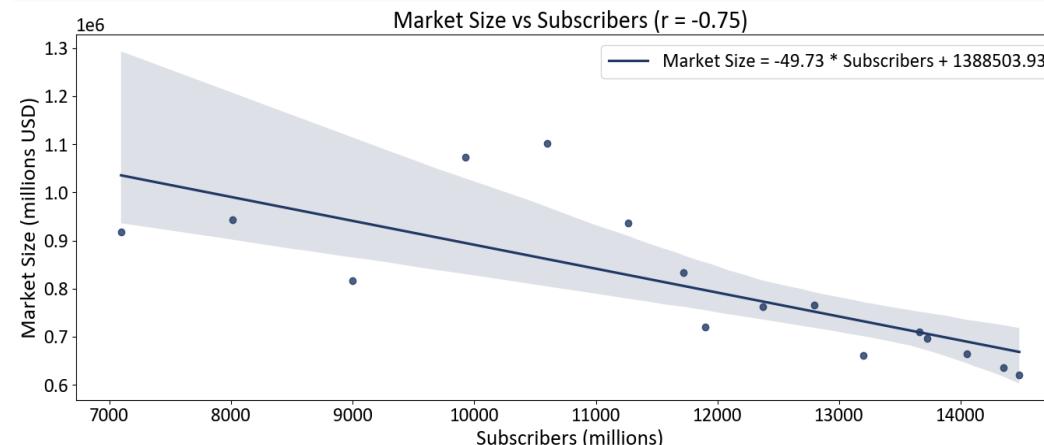


Source: ITU

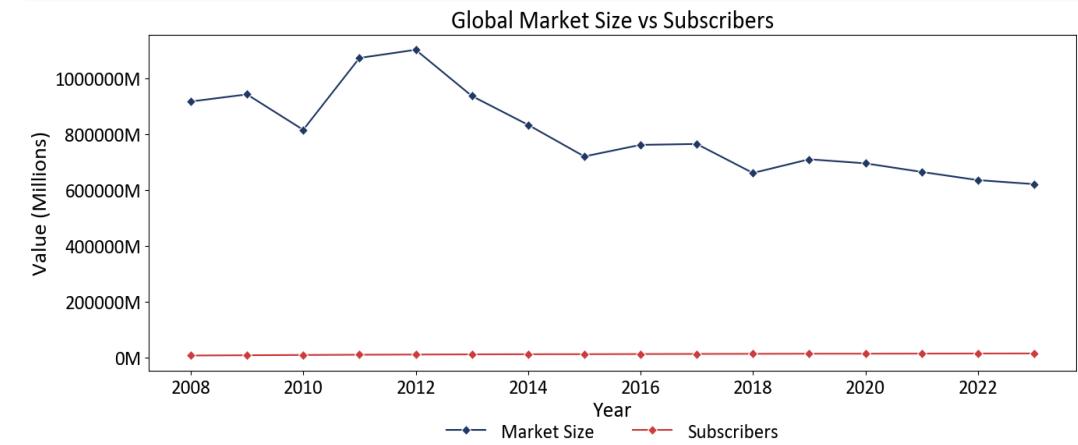
Growth Drivers: Subscribers

- The growth in the number of subscribers was the key driver for the global mobile voice market since the start of the market in 1990s
- However, the correlation for 2008 – 2023 was negative (0.75) with the key reasons being:
 - Most of the market growth happened in late 1990s -2008, which we don't see in the available data
 - The mobile voice market was falling after 2012 explained by the shift to data and messengers with cheaper package-pricing for data traffic and no interconnection and landing fees
 - General preference to interact in writing compared to making voice calls
- Mobile operators are seeking for new business models including the provision of more content and building of eco-systems, some still suggest taxing social network and messenger companies a traffic charge for consumer access to social media content

Global Mobile Voice Subscribers and Market Size Regression



Global Mobile Market Size and Subscriber Base Development



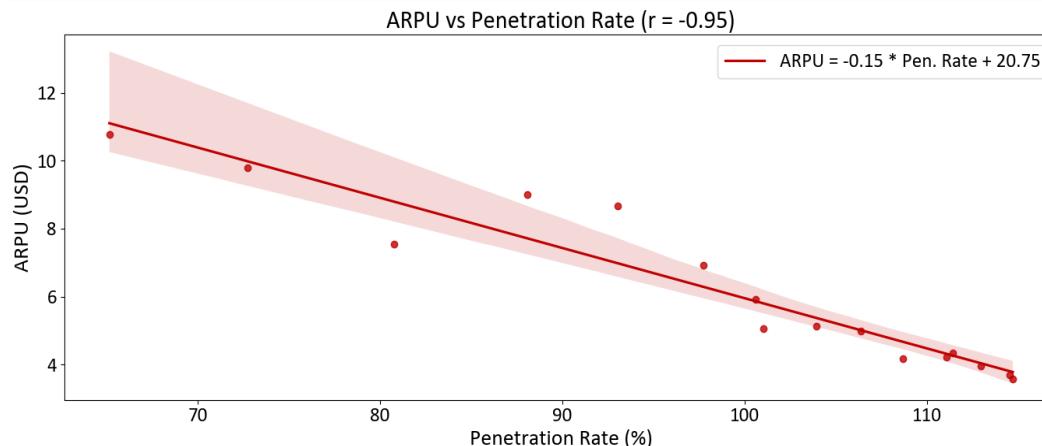
Note: correlation charts were produced manually in the preprocessing file because of their non-standard format

Source: ITU

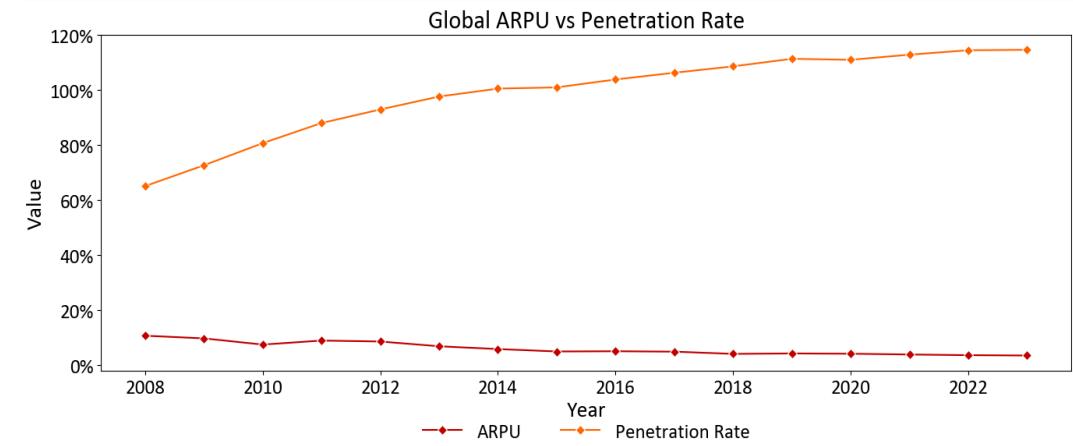
Growth Drivers: ARPU

- Mobile voice ARPU decline over 2008-2023 was, unlike subscriber growth, the continuation of the trend
- ARPU was falling as the technology was becoming cheaper (Moore's law), economies of scale, transition to data traffic (VOLTE/VOIP) also in the emerging markets around 2008-2012, competition, and almost no government regulation, which is a strong advantage
- One should note that penetration rate growth well beyond 100% accounts for the users having several numbers, e.g., private and business and a share of business mobile numbers
- Correlation of ARPU decline and penetration rate growth was almost perfect - minus (0.95%)

Global Mobile Voice Penetration and ARPU



Global Mobile ARPU and Penetration Rate Development



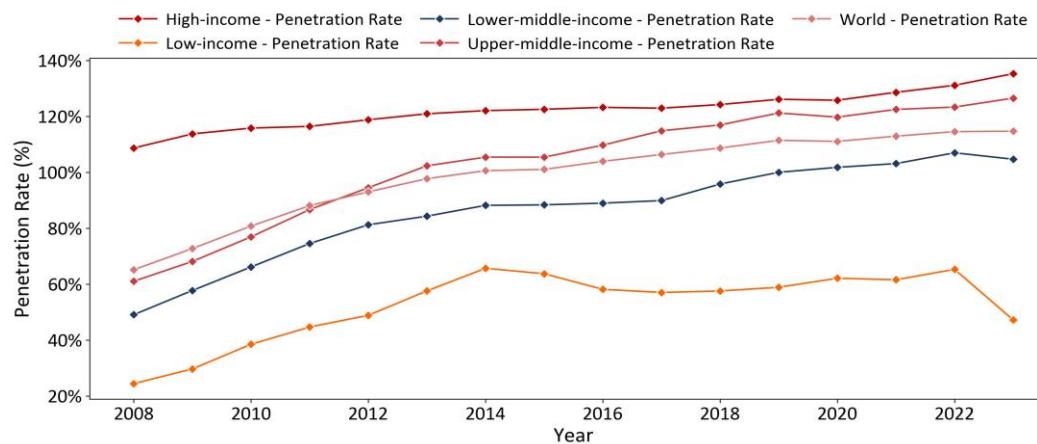
Note: correlation charts were produced manually in the preprocessing file because of their non-standard format

Source: ITU

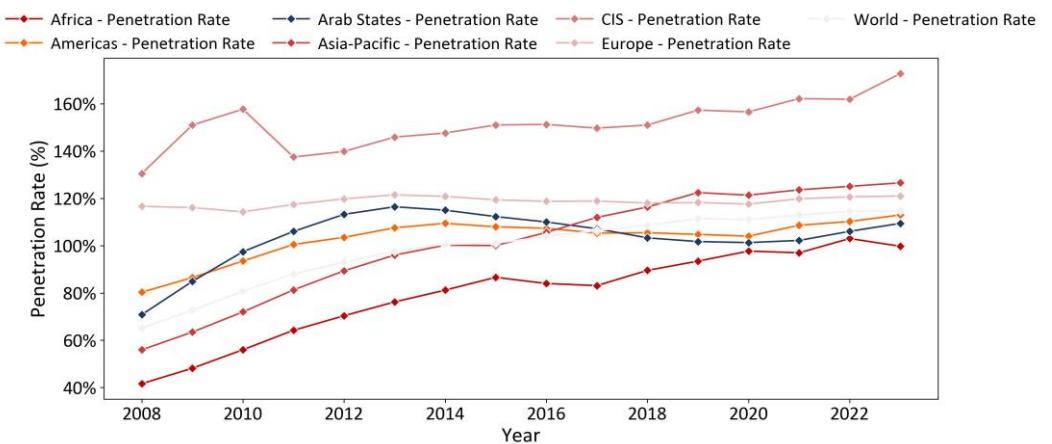
Mobile Voice Communications Penetration Rates Development

- Mobile voice penetration rates in higher income regions were above the world average drive by business segment and IOT, while this is still a less significant factor in lower income economies
- While the highest penetration rates in 2008-2023 in mobile voice market was in the CIS region the highest growth was in Asia and Africa
- High CIS penetration rates are explained by low ARPU, popularity of corporate phones and frequent change of tariffs and operators

Mobile Voice Penetration Rates in Key Economies by Income Split



Mobile Voice Penetration Rates in Key Economies by Regional Split

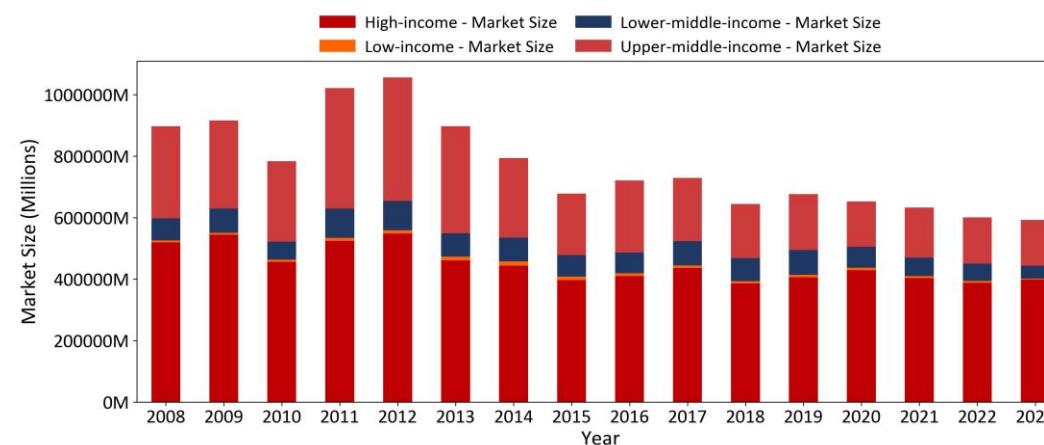


Source: ITU

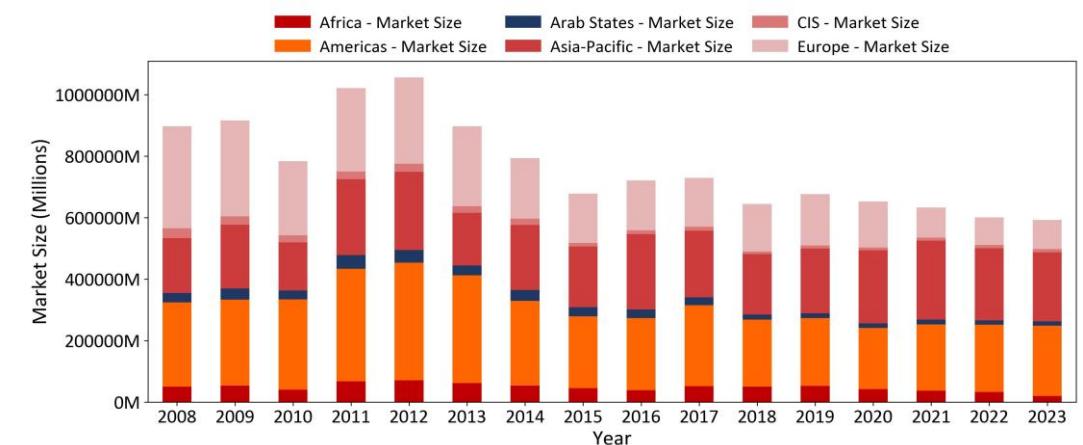
Mobile Voice Market Size Overview

- Consistent with the global slide regional charts reflect a decline in mobile voice market since 2013
- The decline was stronger in the higher income economies due to the shift to data and messengers
- Asia was the only region, where mobile voice market still continued growing, which is partly explained by network coverage, catch up growth but also cultural preferences
- Since 2012 mobile operators were actively changing their business models to retain revenues and margins with very different success, the overall EBITDA margins erosion was roughly 15%-20% on average (not the focus of this presentation)

Mobile Voice Market Size in Key Economies by Income Split



Mobile Voice Market Size in Key Economies by Regional Split



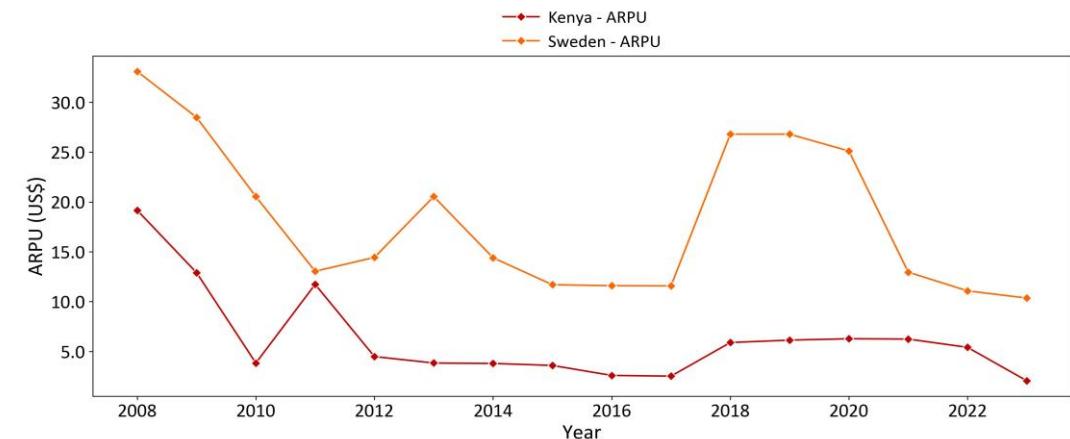
Source: ITU

Selected Developed vs. Emerging Comparison – Kenya : Sweden

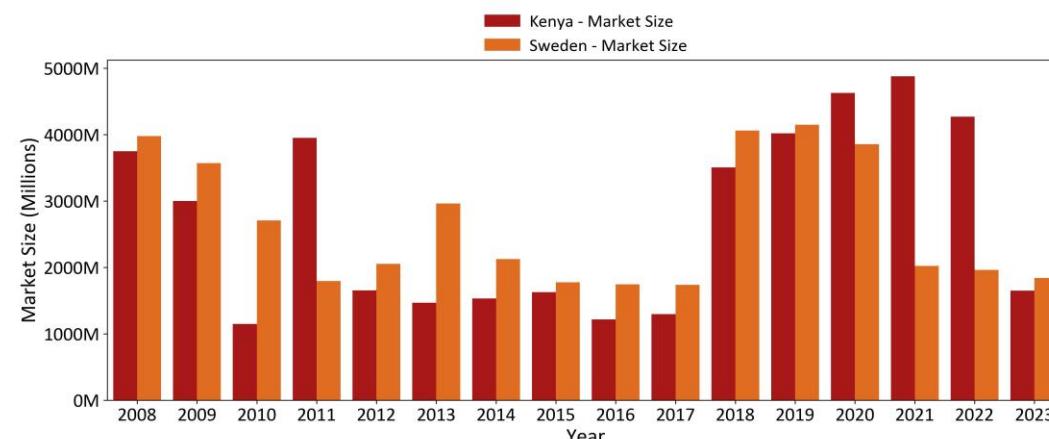
Except for high/low income divide and earlier market saturation Kenya and Sweden are consistent with the global mobile voice trends

- Despite a ~5.x difference in population the mobile voice market size in Kenya and Sweden is almost the same
- ARPU reflects a reducing gap between a developed and an emerging market
- Mobile voice market continued falling except around covid-time in Kenya (there was no strict lockdown in Sweden)
- The shift to data started around 2008 or even earlier for both Kenya and Sweden
- Penetration rate in Kenya reached 100% only in 2019, Sweden's ARPU was stagnant over the period

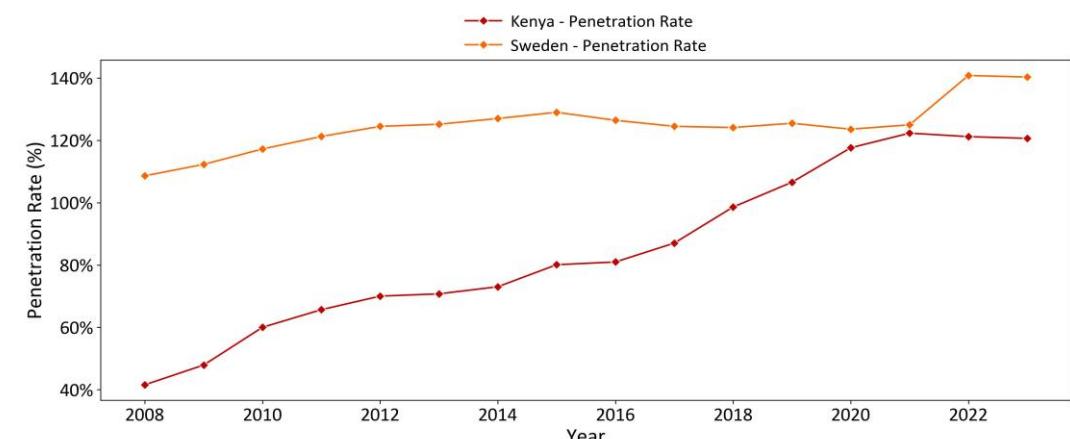
ARPU Development



Market Size Development



Penetration Rate



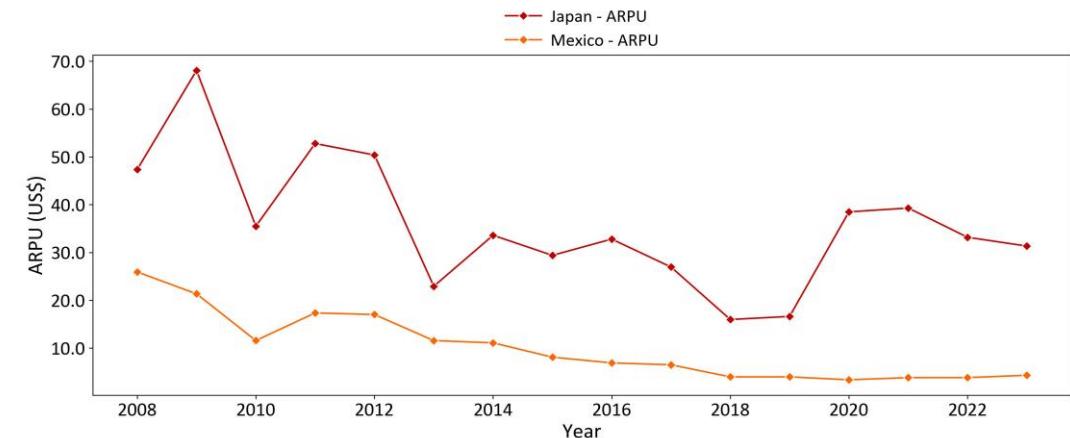
Source: ITU

Selected Developed vs. Emerging Comparison – Japan : Mexico

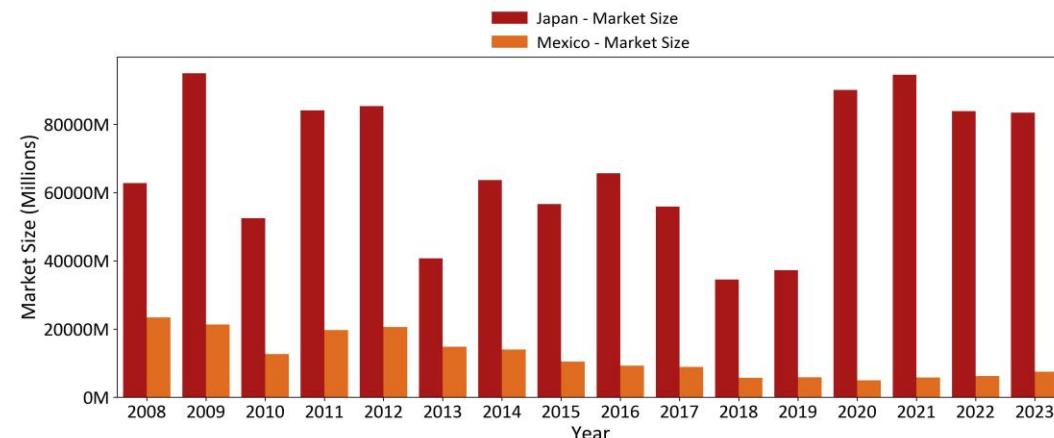
Mexico fits into the general mobile voice pattern, while Japan reflects stronger cultural preference for voice communication

- Japans market is larger than Mexico's by both population and market but the decline in mobile voice after 2012 is still visible (except covid)
- ARPU development in Japan appears less consistent, the drop in 2008-2010 was probably due to subprime crisis and lower business activities but otherwise it is probably a cultural feature of Japan to have more voice communication
- Penetration rate growth in Japan is outstanding even for a developed market and may be an indicator of the future for the rest of the world
- Penetration rate in Japan reflect the culture of separate profile for business and private purposes, which seems both reasonable and ethical

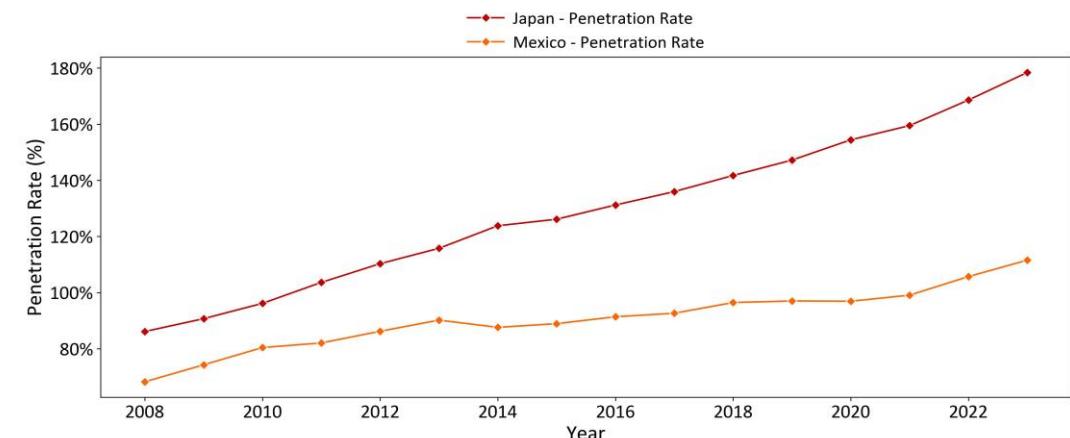
ARPU Development



Market Size Development



Penetration Rate



Source: ITU

Key Findings & Recommendations

Key Findings

- Peak of mobile voice services — 2012, decline in all regions except Asia (due to cultural)
- Subscriber growth no longer drives revenue growth (negative correlation with market size)
- ARPU drop due to cheaper technology, competition, and shift to messengers ($r \approx -0.95$ with penetration rate)
- High penetration (>100%) in many countries driven by multiple SIM cards and corporate contracts
- Developed markets reached saturation earlier and lost revenue faster; emerging markets followed the same trend later



Recommendations

- Targeted tariffs in high-penetration countries to grow revenue without increasing SIM count
- Expansion of paid digital services and ecosystems
- Launch and promotion of streaming video, music, cloud storage, and gaming services. This allows increasing ARPU without a significant increase in infrastructure costs
- Development of premium segments and IoT solutions
- Focus on corporate clients, M2M communications, smart devices, eSIM, and industry IoT platforms (logistics, agritech, energy)
- Personalized pricing and upsell in countries with high saturation
- Using big data analytics to create personalized offers and sell additional packages (speed, content, services) without increasing the number of SIM cards
- Development of infrastructure and accessibility of communications in countries with low penetration (40-50%) together with states and international organizations. This creates a new market and a long-term base for profit