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Research Article

SIM Count Person Uniqueness (SCPU) System to Enumerate Mobile SIM

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Abstract — The mobile number (one of the Telecommunication Identifiers (TI)) is normally associated with every Subscriber Identity Module (SIM), wherein the SIM may be a physical or virtual (e-SIM). In India, after redefining old acts and notifying the new Indian Telecom Act 2023, there is specific mention of enforcement against possessing more than notified SIMs along with applicable civil penalties if crossed the limit. Steps in this direction have been initiated by concerned authorities, but few gaps have been identified to strengthen the processes and requirements of the "Person Uniqueness System" across various telecom service providers, on every SIM activity. This paper attempts to explore the present procedures and shortcomings and formulate a new system namely the "SIM Count–Person Uniqueness (SCPU)" system for strict implementation of this clause of the Act. [1]

Keywords — Subscriber Identity Module (SIM) limitation, Mobile Numbers per person, SCPU: SIM Count Person uniqueness, TSP: Telecom Service Provider, POI: Proof of Identity, POA: Proof of Address, CAF: Customer Acquisition Form, KYC- Know Your Customer, LSA: Licensed Service Area, UIDAI: Unique Identification Authority of India, POS: Point of Sales, MNP: Mobile Number Portability, SC: SIM Count, GA: Geographical Area.

1. Introduction

In India, out of the working mobile connections, more than 90% are pre-paid & less than 10% are postpaid connections. Out of the working connections, most of the connections work for Individuals (compared to business purposes). In the present system, whenever the national authorities like to know about the number of connections/SIMs each person has across various telcos, it is possible, but not simple. Over that, if, National authorities would like to implement a condition saying that a person should be provided a maximum of a certain number of SIMs across all TSPs in the Nation; this is also possible, but it is a little more complicated. The importance and significance of this paper is to provide a solution/system to implement such provisions in a Nation by introducing a "uniqueness platform" to identify individuals/persons across Telcos. Also, another importance of this paper is once it was adopted in India the same procedure can be implemented in other countries based on the existing procedures that are presently prevailing.[2]

2. Related Work

2.1. Background of Customer documentation for mobile SIM

Evaluation of the process of Customer Acquisition Form (CAF) revised on par with the circumstances & technology development from time to time. Starting from Manual paper-based documentation (Proof of Identity (POI), Proof of Address (POA) and their original verification and attaching their copies along with pasting a photograph on the form), later scanning customer documents for easy accessing, next to that introduction of Know Your Customer (KYC). In contrast, the re-verification of customers' KYC, on the start of the utilization of Unique Identity to today's Digital KYC/E-KYC, passed many transitions by Telcos during the past few decades in the area of customer acquisition form procedures and their verification.

In the recent past, in India, after notification of the New Telecom Act 2023, it was decided to implement/enforce the condition of maximum SIMs that a person can hold.

2.2. Limit of SIMs per person and present practice of implementation/enforcement

In India, the maximum number of SIM cards a person can own is nine Nationwide, and six in Jammu & Kashmir, Assam, and the Northeast Licensed Service Areas (LSAs).

To implement this limitation, the concerned unit runs a program periodically across the customer data of all Telecom Service Providers (TSPs) to get the details of persons who have crossed the limit and inform the TSP/s of necessary action for disconnection of SIMs/connections acquired over

and above the prescribed limit. The subscriber data was further analyzed using advanced Data Analytics and AI to identify fraudulent mobile connections.

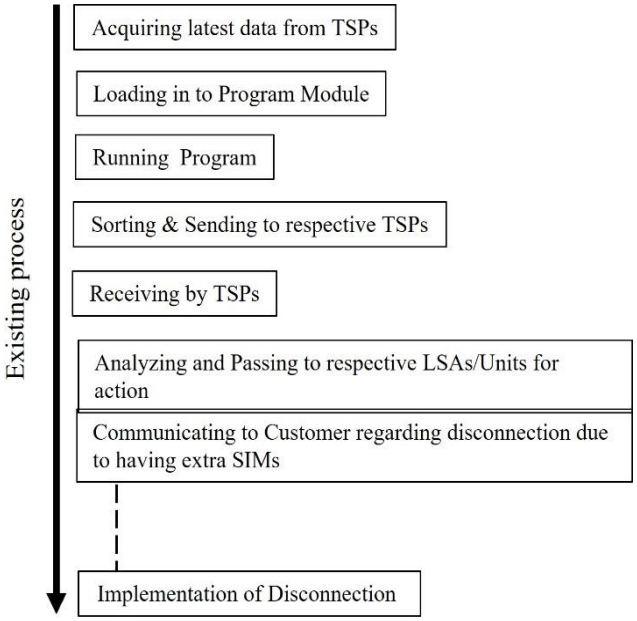

Fig.1. One Cycle of Implementation

While acquiring new customers, TSP (Point Of Sales i.e. POS) needs to get the details from the persons about the number of SIMs already existing with them, if already crossed the limit, not to provide connections to that person. [3]

2.3. Monitoring Mechanism by Individual Customer:

Authorities have a Digital Intelligent Unit (DIU) / Telecom Analytics for Fraud Management and Consumer Protect system (TAFCOP) which will enable a subscriber to get information about the number of mobile connections (SIMs) issued to him/her across all the TSPs. Individuals, themselves can check their usage of the limit through an online portal (Sanchar Saathi) by providing any one of their existing mobile numbers as input to get the list of all SIMs/Mobile numbers owned by that person. If any of them are not in use, or provided without their knowledge by misutilization of their IDs can be identified and can choose for disconnection of such SIMs by following a prescribed procedure. Authorities enabled a facility for verification of the number of Mobile connections an individual can do the following steps:

- Go to the Sanchar Saathi portal.
- Enter your mobile number and a captcha
- Click Validate Captcha and enter the OTP
- Click Login
- Enter any one of the existing mobile number
- TAFCOP System displays all mobile numbers with that person
- Among those mobile numbers, any/few of them identified that did not belong to them or are not in use, they can simply "tick" so that those numbers will be blocked/disconnected as per the prescribed process.

2.4. Mobile number is a National Asset

Every SIM is linked with a Mobile Number. The restriction of the number of SIMs, means, it is a restriction on the number of "mobile numbers" that a person can hold.

A mobile number is not simply a number, it is a National Asset. In India, this asset is being provided free of cost to the end user. This facility is being exploited by a considerable part of users by taking/discarding multiple mobile connections. Such practice is one of the main reasons for the draining/locking of mobile numbering resources.

In India, about 19% (about 219 million numbers) of the mobile connections/numbers are under "service suspended pending disconnection" status, creating a scarcity of numbering resources in the Nation. So, there is a need to discourage such practices.

In the present society, the contact number is everything about a person. Once, they discard that number, the whereabouts of that person cannot be easily tracked. So, there is a need to discourage such practices of frequently discarding SIMs.

2.5. Gaps in the present system

- The person who wants to take a new SIM/mobile connection, the customer always may not reveal the SIMs they already have on his / her name knowingly or unknowingly. This leads provision of new connection/SIM at POS, without knowing the number of SIMs they have at that moment.
- TSPs/POS does not have any tool/system that enables them instantly to know about the number of SIMs that a person has across the counter at the time of provisioning a new SIM/new mobile connection/new mobile number to that person.
- To meet their sales target, the TSP's POS may bypass/ignore the details provided by the customer who approached them to provide a new connection.
- All the persons/individuals may not be able to use the portal to know the SIMs already they have, so they are unable to know the SIMs taken on their name without their concern.
- The cumbersome process (ref: Fig-1) of intimating TSPs to withdraw connections who had more SIMs over the limit and later TSPs following all the prescribed procedures to disconnect the 10^{th} (or 7^{th}) SIM onwards, certainly takes a long time. Fraudulent persons normally use SIMs within a short period and discard them immediately. Thus, the existing process is "still" away from the prime objective of controlling online frauds, cyber crimes, unlawful activities, etc.
- The scarce resources, i.e. the major Telecom Identifier i.e. Mobile Number are provided free of cost seems to be another weakness in the present system. Not only one or two, that too, providing up to 9 (or 6) SIMs i.e. such many mobile numbers per person free of cost, is another weakness in the present system.
- Based on past judgments, still allowing "impossible to instantly authenticated/verifiable" POI or POA documents for customer acquisition is another challenge

in the present system, which became advantageous to fraudulent person POSs who misuse SIMs for anti-social/anti-national activities and online/cybercrimes.

2.6. SIM limitation in Other Countries

Different Nations have similar restrictions on holding maximum SIMs per person as follows:

Table 1: Status in Various Nations

Nation Name	A maximum number of SIMs can be held by a Person
China	5
Pakistan	5
Bangladesh	20
Sri Lankan	5
Bhutan	2
Nepal	3
Iran	2
Saudi Arabia	4
Ukraine	5
South Korea	5
Indonesia	3
Singapore	5
Malaysia	5
Rusia, USA, Japan, UK, Germany, France, Italy, Magnolia, Izrail, Australia, New Zealand, South Africa	No limit defined

In the countries, where SIM restriction on individual persons is in place, as per the initial study, it is noticed that operators in such Nations are working on collaboration to implement such conditions through their SIMs centralized database.

3. Objectives

To overcome the gaps found and to evolve a methodology/system that is fit for all the stakeholders in this system as follows:

3.1. To TSPs

To equip TSP (POS) and enable them to stick to the SIM limit prescribed at the time of providing SIM. Before providing SIM, TSP/POS needs to know the number of SIMs already had by that person.

3.2. To Individual Customers

Able to follow the limitations of SIMs as prescribed.

3.3. To Authorities

Ease of implementation of the limitation of SIMs that a person can hold, judiciously utilization of numbering resources, and monitoring the accountability of the allotted numbering resources.

To achieve this, across Telcos (i.e. TSPs, VNOs, etc.) it is necessary to have the uniqueness of a customer (individual/person). The purpose of such requirement is as follows:

1. To limit a person to have a maximum of 9 or 6 SIMs (physical SIMs & E-SIMs both including) across all TSPs.
2. Among the allowed SIM limitation per person, if, the first few SIMs are to be provided at normal cost/free and to collect extra charges for remaining. (Example: first 3 SIMs will be provided at normal charges and additional SIMs may be charged extra from the 4th SIM onwards).
3. Provide periodical reports to support administration.

4. Method/Procedure/Design

Utilizing available identity cards (for POA, POI) are Aadhar, Passport, Voter ID, Driving License, PAN card & Ration Card while issuing SIM/acquiring customers. To get the number of SIMs having a person across various Telcos/TSPs, there is a need for identification of a single ID (U-ID) that can be instantly authenticated across the SIM provisioning counter. [4]

Among all IDs that are presently used for POA or POI, the Aadhar ID has such capability in India, to authenticate the person through an online system by matching their Aadhar number with its associated bio-metric information. Here worth noting that, this authenticating system does not maintain the data of the number of SIMs held by a person. So, there should be a separate system in place to keep the directory of U-ID & SIM count on each U-ID. This system may be named as **SIM Count–Person Uniqueness (SCPU**) system. Whenever a new SIM is to be issued, Telcos need to update this system as well to check whether that new SIM provided to a person is not exceeding the allowed limit. [5]

4.1. The Architecture of the Proposed SCPU System

The block functioning of the SCPU system is as follows:

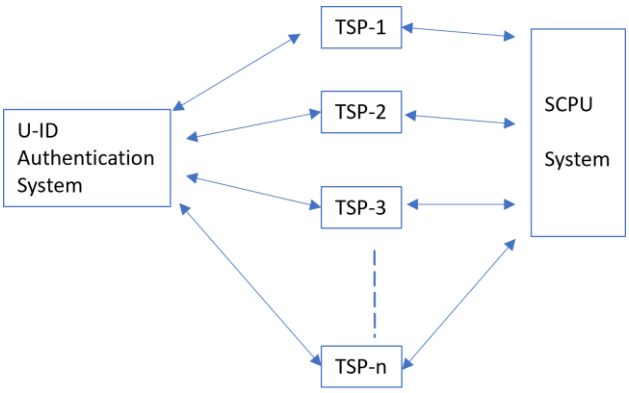

Fig.2. SCPU system connectivity

4.2. Existing set-up with TSPs

POSs/sales channels connect to their TSP API / App., system to provide customer services. As a part of the e-verification/e-KYC of customers, this system is already integrated with the U-ID authentication system to capture that person's details from UIDAI.

4.3. SCPU System

This is a centralized system that keeps U-ID-wise SIM count data and the capability to connect various TSPs for advising on every SIM activity, to implement the maximum allowed SIMs per person.

4.4. SCPU System Process

On each SIM activity at the Telco end, there is a need to access that SCPU System:

- At the time of the new mobile connection (Physical SIM / e-SIM).
- At the time of disconnection of a number (Post Paid) / GP2 Validity completed Pre-paid numbers.
- On MNP.
- Voluntary Disconnection of Mobile Connection (Post / Pre-paid).

4.5. Each SIM activity at the SCPU System needs to do

4.5.1. Issuing new SIM/Mobile number

Here there will be two cases, viz.,

a. A person who already has a certain number of SIM/s on their name is now acquiring one more SIM i.e. new mobile connection.
   - Advice POS "Not to issue new SIM" as the person already crossed the limit
   - Advice POS "Can issue new SIM" as the person is within the maximum prescribed limit.
   - *Advice POS "This person has "n" number SIMs" accordingly, if any to be charged extra as per rules about extra chargeable SIMs or Free SIMs or SIMs against normal charges.

b. A person, first time acquiring a new mobile connection (SIM) on their name (for example young persons who got eligibility age say 18 years, first time have their mobile connection on their name). Then that U-ID needs to be added to the SCPU system with count 0, and then provide advice to POS.

4.5.2. Disconnecting SIM/Mobile number

Reducing the SIM count against that person's U-ID for each disconnection received from Telco. Similar action for voluntary closure of SIM.

4.5.3. On MNP-Port out:

Putting a flag on the Telco name against that SIM (keep that flag for a period that porting code validity)

4.5.4. On MNP- Port in

a. Advices Telco as per above (1-a)
b. If, issued based on the above, then reduce one SIM count and Add one SIM count against that person.
c. Changing the Telco name in the database against that SIM and removing the flag on the Telco name.

4.6. Reports to be generated at the SCPU system

1. Periodic statements – Telco wise.
2. Verification for a period ending of total SIMs provided/disconnected/MNPs & Total SIMs count.
3. Count of chargeable SIMs.
4. Report on persons (U-IDs) who frequently acquire new SIMs and disconnect the existing SIMs.

4.7. SCPU system on-boarding

4.7.1. Guidelines for seeding of U-ID (say **Aadhar number) for every mobile number**:

1. The concerned authority is to issue guidelines to all Telcos/general public to update U-ID numbers against each SIM/Mobile number they issued/have.
2. Fixing a cut-of date/s for related all activities.
3. Checking the access with the Telcos system with the SCPU system.
4. Put a target date to do an internal arrangement in Telcos API / Apps, to enable all their out-lets in tune with the SCPU system for all their SIM issuing /disconnecting / MNP activities.

4.7.2. TSPs onboarding SCPU System:

1. Providing access to every Telco to this system.
2. Every Telco needs to upload the initial data as per the cut-off date.

4.7.3. Start using the SCPU system:

- After the cut-off date, every telco needs to do SIM activities such as new provision, disconnection, and MNP based on the advice of the SCPU system.
- Based on the initial SCPU system report, a notice SMS will be sent to all persons who have SIMs count more than the maximum limit. Accordingly, those persons need to voluntarily disconnect their extra SIMs, by fixing a target date. The procedure for this **Voluntary Disconnection** is to be defined. Even after the target date, if the persons do not respond, the procedures will be arrived by concerned authorities to withdraw extra SIMs from such persons.

4.7.4. Load of initial data at SCPU:

Receive the bulk data (as per the data template) from registered TSPs.
Prepare U-ID-wise data as per the data template.
Provide reports to authorities as per business rules.

4.7.5. Activity at TSP (POS) end:

- Enter the U-ID number.
- Authenticate with OTP through UIDAI.
- Send U-ID Number to SCPU system.
- Get Advice from the SCPU system.
- If activity is allowed, perform the activity.
- If activity is not allowed, terminate the process.
- Based on the allowed activity – Update the SCPU system.

While starting a process at one POS, the SCPU system will not advise other POSs, till the on-going process is completed on the U-ID number for which activity is required.

4.7.6. Activity at SCPU end:

Receive the U-ID from the POS and send advice as per the business rules to that POS.

Update data against the U-ID at the end of each process at POS.
Once a query is generated from one POS on a particular U-ID, no other query is accepted for that U-ID from other POSs.

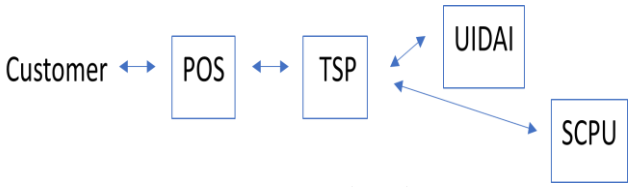

Fig.3. Work / Process flow of SCPU

4.8. Outcome of usage of the SCPU system:

- Maintains U-ID-wise SIM count
- Advise TSPs for SIM activities
- Provides periodic reports
- Arrives practical value of teledensity
- TSP wise Reports
- Budget the tele-identifiers
- Support investigation agencies

4.9. Business rules & SCPU system data templates:

To interchange information and at the same time protect the privacy of a person's data across systems can be exchanged in pre-defined data templates based on certain business rules:

Table 2. Business Rules & Advice

Business Rules	Advice
Restriction SIM count (SC) on a U-ID:	
If SC > 9 for GA Lot 1	Crossed the limit. Not to allow new connection SIM
If SC > 6 for GA Lot 2	Crossed the limit. Not to allow new connection SIM
If SC is <=9 for GA lot 1 and If SC <=6 for GA lot 2, for provision of a new SIM for a new connection	+1 for SC value
If SC is <=9 for GA lot 1 and If SC <=6 for GA lot 2, for disconnection/ voluntary closure of existing connection	-1 for SC value
MNP after port-in	Change of Telco name
If SC>2 and <9 for GA lot 1, If SC>2 and <6 for GA lot 2 for new connection provisioning of SIM	The present count is "n". Applies additional charges for new SIM.
If SC<2 for GA lot 1 and GA lot 2 for new connection provisioning of SIM	The new Number is Free as the present count is <2

Table 3. Geographical Area (GA)/LSA

GA Lot Number	GA Name (LSA)
1	GA name 1
1	GA name 2
1	.
1	GA name n
2	GA Name 1
2	GA Name 2
2	.
2	GA Name m

Table 4. Extra SIM Tariff Table

SIM Count	GA Lot	Tariff for new Mobile Number/SIM
0	1,2	free
1	1, 2	free
2	1, 2	Additional Charge
3	1, 2	Additional Charge
4	1, 2	Additional Charge
5	1, 2	Additional Charge
6	1, 2	Additional Charge
7	1	Additional Charge
8	1	Additional Charge
9	1	Additional Charge

Table 5. SIM Activity Codes

SIM Activity (SA)	SA Code
SIM for New Connection	NS
SIM for Replacement of faulty SIM	RSFS
SIM issue for technology upgradation	RSTU
Closure of post-paid connection	CPPC
Disconnection of pre-paid connection after grace periods	DPCAGP
MNP	MNP
Voluntary closure of pre-paid connection	VCPC
Add any other SIM activity…..	

Table 6. Data Template - TSP Initial Bulk Data Dumping to SCPU

			(LSA Name)	Activated date		
Telco Name	Mobile Number	U-ID No.	GA Name	DD	MM	YY YY

Table 7. Data-Template - TSP/POS before each SIM activity

Telco Name	U-ID No.	GA Name	SIM Activity (SA)

Table 8. Data Template - At SCPU end – Before SIM activity

Telco Name	U-ID No.	GA Name	SIM Activity	Advice to Telco	Query Reference Number with Date & Time

Table 9. Action table at SCPU end

SA Code	Purpose	ID Found	Count	Advise
NS	A New Mobile Number is to be allotted by Telco for that U-ID	Yes	Increment 1	As per business rules
--do--	--do--	No	Add a new record with this U-ID with a starting count of '0'	
RSFS / RSTU	On the existing Mobile Number of a U-ID	Yes	No change	

CPPC	The mobile number will be withdrawn from U-ID	Yes	Decrement 1
DPCAGP	The mobile number will be withdrawn from U-ID	Yes	Decrement 1
MNP	1. Mobile number with existing customer. 2. Change of Telco Name	Yes	No change
VCPC	The mobile number will be withdrawn from U-ID	Yes	Decrement 1

Table 10. Data Template - At TSP- after SIM activity – Updating SCPU

Telco Name	Mobile Number	U-ID No.	GA Name	SIM Action or No Action	Activated date & time						Query Reference Number with Date & Time
					Day (DD)	Month (MM)	Year (YYYY)	Hours (HH)	Minutes (MM)	Seconds (SS)	

Table 11. Data Template - At SCPU- after SIM activity

Telco Name	U-ID No.	GA Name	SIM Activity	SIM Count before activity	SIM Count after activity

Table 12. Initial Reports after Bulk Data Dump by TSPs

SIM Count (SC)	Number of U-IDs with this SC
1	
2	
.	
.	
n	
	**Total number of Persons/ U-IDs

** This figure can be used for calculating tele-density (mobile).

Table 13: TSP-wise Periodical Report

SIM Count:-->	1	2	3	4	5	.	.	.	n	**Total U-IDs (i.e. total number of Persons)**
Telco Name	**Number of U-IDs**									
Telco Short Name1										
Telco Short Name2										
.										
Telco Short Name n										

5. Results & Discussion

On implementation of the SCPU system it is possible to enforce the condition of holding of prescribed limit of SIMs by an individual can be achieved in the Nation.
In addition to the above, the National authorities are able to utilize their Telecom Identifiers (Mobile Numbers) judiciously as well as have overall control of TSPs while monitoring the utilization of their allotted Numbering resources effectively. [5]

Reports/data available on the SCPU system can help the National administration to have dynamic information to ascertain certain parameters like National Tele-Density, etc.
Instant SIM Count information from the SCPU system enhances the capability of POS of TSPs for smooth handling of every SIM activity.

The solution proposed in this paper can be utilized in other such Nations, where, a single/same ID is used for the issue of SIMs to individual persons across all Telecom Operators in that Nation.

There are certain limitations as follows:
1. Implementation of "maximum SIMs limitation" in case of an “individual” is dealt with in this paper. Business connections/bulk connections/SIMs issued to various entities are not under the purview of this paper.
2. Further if this SCPU system is implemented, as the biometric authentication is available for only Aadhar card, this Aadhar will become a single proof of ID to get a SIM for any Individual mobile connection, which was against the prevailing SC judgment to make it mandatory proof of ID as Aadhar for issue of SIM/Mobile connection.
3. Due to the 4G / 5G rollout in India bulk connections for the industry 4.0 applications will increase enormously the authentication for these types of connections is a challenging part, for this also adopting Aadhar number as mandatory of the respective signing authority from the organization which was requesting the bulk connections for specific applications as mentioned above otherwise to adopt other practice with the remaining identity proofs.[6]

6. Conclusion and Future Scope

Implementation and enforcement of prescribed rules/regulations are of utmost crucial in any Nation. This paper discusses the case of India, one of the biggest Telecom echo systems in the world. Through SCPU solution, the major difficulty of sales channels of all TSPs can be addressed and able to handle the smooth implementation of the major clause under the New Telecom Act 2023, i.e. maximum allowed SIMs per person. In addition to this, this solution can support the National administration with reports/ data for judiciously managing the mobile numbering asset of the Nation. The proposed SCPU system can be adopted in the future in other countries also based on the digital proof of ID that respective countries take into consideration for customer acquisition. Integrating this SCPU system with National / International investigating agencies will be taken as a future scope of study

to adopt the existing methodologies in the respective countries globally by improving the existing API modifications / adopting new API methodologies with the support of recent AI tools for data analytics.[7]

Data Availability
Data is available on the respective websites viz., https://dot.gov.in,https://trai.gov.in**,**and https://sancharsaathi. gov. in**.**

Conflict of Interest
It is declared that do not have any conflict of interest.

Funding Source
None.

Authors' Contributions
Author 1: Identified the Gap and designed the SCPU process & system. Author 2: Illustrated existing practice and helped in designing of SCPU system with relevant references and periodical reviews.

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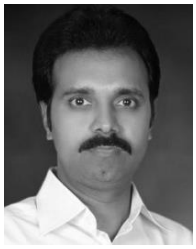
K.S. Srinivas earned his Master of Sciences in Physics from Andhra University and Master of Business Administration from SKD University, India. About 27 years in the Telecom Sector (DOT & BSNL) Voluntary Retired from BSNL Corporate Office, New Delhi in 2017. Had vast experience in Telecom Technical Maintenance, operations, Installations, acceptance testing of various internal & external plants /systems & Telecom Software tools /application system development, and its implementations. Customer-centric activities viz., General Customer interface, Corporate Clients, Marketing, Business Development, Sales, and National level to manage Telecom Training Centres spread across India and development of HR through training. He is currently an Independent Researcher. Presently developing various innovative solutions. Published five research papers on Technical & Management and registered one Patent also.



Dr.M.Satyaprasad graduated in Electronics & Communication also graduated in Education, Master of Business Administration with a specialization in Marketing; HRM, and also a Doctorate in Management from the School of Commerce & Management, Andhra University, Visakhapatnam in 2022. He is currently working as Deputy General Manager at BSNL. He has been a member of ITU-APT Foundation of India since 2022. Vast experience of nearly 30 years in the field of Telecommunications and worked in various specialized fields like Analog / Digital / IP Switching, Installation, operational activities of Optical Fibre Communication, Radio Communication, Mobile Communication, Data Communication, and Latest access technology with different applications for providing single window Enterprise Business solutions through MPLS-VPN over L2/ L3 layers, Leased Line, Point to Point, PRI, SIP Trunking, VSAT solutions, Multi & Uni cast solutions, security surveillance, IoT, AI, M2M, and Black Chain Technologies to provide smart comprehensive total solutions with end-user devices. He had vast experience in Marketing, Human Resource Management, and Enterprise business in comprehensively providing total solutions with the latest emerging & convergent Access Technologies. Had vast experience in Academics in signing MOUs with Educational Institutions to impart Skill development for Technical & Management students and experience in establishing Research & Incubation Centres in Universities / Engineering Colleges and delivered a good number of Technical & Management Industrial guest lectures on the recent Next Generation Technologies in Educational Institutions, Defence, Government and Public sector departments' seminars. Had vast experience in organizing Faculty Development Programmes (FDP) for the faculties. Nominated as a Board of Studies (BOS) member for Universities and Colleges. One Patent is also registered. Published four Technical & five Management papers in different International Journals.

