GROWTH OF VALUE ADDED SERVICES IN INDIAN TELECOM INDUSTRY: A DIAGNOSTIC STUDY

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Certificate

This is to certify that the thesis entitled "GROWTH OF VALUE ADDED SERVICES IN INDIAN TELECOM INDUSTRY: A DIAGNOSTIC STUDY" being submitted by Mr. Bijoyananda Mishra to the Indian Institute of Technology Delhi for the award of the degree of Doctor of Philosophy (Ph.D.), is a record of bona fide original research work carried out by him. He has worked under our guidance and supervision and has fulfilled the requirements for the submission of the thesis, which has attained the standard required for a Ph.D. degree of the Institute. The results presented in this thesis have not been submitted elsewhere for the award of any degree or diploma.

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Dedicated to the sweet memory of

my loving parents

Late Sita Devi and late L B Mishra

and my beloved wife

Late Sanghamitra.

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Abstract

There are 1019.5 million active mobile connections as on May 2017 as per the report of TRAI. However, the revenue, as well as the average revenue per user (ARPU), are exhibiting slow growth for all the operators in India. This has happened due to the commoditization of voice as a product. There is an imperative need for the growth of revenue from nonvoice streams so as to ensure a proper return on the investment made by the telecom operators. Therefore it is considered appropriate to take up the study on the growth of value added services that would contribute towards the increase in revenue of Telecom operators in India. Based on various studies and the available data from the operators of developed nations it is established that the growth of value-added services would be beneficial for the Government and consumers too.

One of the focus areas in this study relates to the growth of VAS revenue of telecom operators in India. It is necessary to examine the impact of pricing and strategy changes on various segments of the revenue in the short term. Therefore adaptive non-linear models have been developed to study the revenue prediction for three segments of revenue for one to four months ahead. The segments studied are VAS, data, and voice.

The revenue from VAS could increase due to increased usage as well as by increasing the number of VAS users of a telecom operator. In view of this, the study focuses on identification and inter-relationship between the factors of growth of VAS business, a key segment of the telecom revenue. A study has also been made to explore the VAS growth in rural area through increased broadband access and adoption. The rollout of 3G/4G and LTE network has facilitated the roll-out of services needing high bandwidth in urban areas. However, the spread of such network is poor in the rural

areas and therefore a study has been made to analyze the factors of growth of broadband access in rural areas that could facilitate mobile data offloading and proliferation of the public WiFi network. This shall boost the usage of VAS in rural India.

The current investigation has employed simulation studies, focused group discussions, factor analysis, TISM, MICMAC analysis, Case study method, survey questionnaires, interviews, and the triangulation method as research tools and methods to facilitate the various sections of this study.

The revenue time series is nonlinear in characteristics and therefore adaptive nonlinear prediction model would perform better than the linear ones. The current study exhibits that the TENN model shows the best revenue prediction performance compared to other linear and nonlinear models employed for the same purpose. The factors for increasing the growth of VAS have been identified in this study. They are the business model, policy/regulation, smartphone penetration, revenue sharing, marketing strategy, dispute resolution mechanism, and Technology. It is observed that revenue sharing has the maximum driving power out of all these factors. The Government needs to support the adoption of rural bandwidth services by suitable policy intervention, subsidy, and encouraging public-private partnerships. The other factors that would be considered important are the reliability of services, timely delivery of services, cost and content in the local language besides digital literacy.

The findings of this study would be of help to all the stakeholders of the VAS and OTT services industry that includes the TSPs, VAS vendors, Content providers, licensor as well as the regulator. The results of this study would also assist other industry bodies in India like IAMAI, FICCI, COAI, and ASSOCHM etc. The telecom operators and VAS vendors can utilize the findings of this study in bringing

about a paradigm shift in revenue sharing too. The TSPs can utilize the non-linear predictive models for revenue prediction in the immediate time frame. These models could be of use in predicting the sales of various products of the operator too. The regulator can utilize the results of this study in bringing out a suitable framework in the needy areas.

Even though the study focuses on the Indian telecom sector but the same findings are equally applicable to the telecom sector of other countries facing similar situations. In essence, the study would be of immense help to academia too for carrying out further research work in the same or related field.

KEYWORDS: VAS, Nonlinear adaptive models, ANN, NOFN, Digital divide.

सार

ट्राई की रिपोर्ट के अनुसार मई 2017 तक 1019.5 मिलियन सक्रिय मोबाइल कनेक्शन हैं। हालांकि, राजस्व, साथ ही औसत राजस्व प्रति उपयोगकर्ता (एआरपीयू), भारत के सभी ऑपरेटरों के लिए धीमी वृद्धि का प्रदर्शन कर रहे हैं। यह एक उत्पाद के रूप में आवाज के कमोडिटीकरण के कारण हुआ है। गैर-प्रवाह धाराओं से राजस्व के विकास की अनिवार्य आवश्यकता है ताकि दूरसंचार ऑपरेटरों द्वारा किए गए निवेश पर उचित वापसी सुनिश्चित हो सके। इसलिए, मूल्य वर्धित सेवाओं के विकास पर अध्ययन करने के लिए उचित माना जाता है जो भारत में दूरसंचार ऑपरेटरों के राजस्व में वृद्धि के लिए योगदान देगा। विभिन्न अध्ययनों और विकसित देशों के ऑपरेटरों के उपलब्ध आंकड़ों के आधार पर यह स्थापित किया गया है कि मूल्यवर्धित सेवाओं की वृद्धि सरकार और उपभोक्ताओं के लिए भी फायदेमंद होगी।इस अध्ययन में फोकस क्षेत्रों में से एक भारत में दूरसंचार ऑपरेटरों के मूल्य वर्धित सेवा (वीएएस), राजस्व के विकास से संबंधित है। अल्प अवधि में राजस्व के विभिन्न हिस्सों पर मूल्य निर्धारण और रणनीति परिवर्तन के प्रभाव की जांच करना आवश्यक है। इसलिए एक से चार महीने आगे राजस्व के तीन हिस्सों के लिए राजस्व पूर्वानुमान का अध्ययन करने के लिए अनुकूली गैर-रैखिक मॉडल विकसित किए गए हैं। अध्ययन किए गए खंड वीएएस, डेटा और आवाज हैं।

मूल्य वर्धित सेवा (वीएएस), से राजस्व बढ़ते उपयोग के साथ-साथ दूरसंचार ऑपरेटर के वीएएस उपयोगकर्ताओं की संख्या में वृद्धि के कारण बढ़ सकता है। इसके संदर्भ में, अध्ययन दूरसंचार राजस्व का एक प्रमुख खंड, वीएएस व्यवसाय के विकास के कारकों के बीच पहचान और अंतर-संबंध पर केंद्रित है। ब्रॉडबैंड पहुंच और गोद लेने के माध्यम से ग्रामीण क्षेत्र में वीएएस विकास का पता लगाने के लिए एक अध्ययन भी किया गया है। 3 जी / 4 जी और एलटीई नेटवर्क के रोलआउट ने शहरी क्षेत्रों में उच्च बैंडविड्थ की जरूरत वाली सेवाओं के

रोल-आउट की सुविधा प्रदान की है। हालांकि, ग्रामीण क्षेत्रों में ऐसे नेटवर्क का प्रसार खराब है और इसलिए ग्रामीण क्षेत्रों में ब्रॉडबैंड पहुंच के विकास के कारकों का विश्लेषण करने के लिए एक अध्ययन किया गया है जो सार्वजनिक डेटा ऑफलोडिंग और सार्वजनिक वाईफाई नेटवर्क के प्रसार को सुविधाजनक बना सकता है। इससे ग्रामीण भारत में वीएएस के उपयोग को बढ़ावा मिलेगा।

वर्तमान जांच ने सिमुलेशन अध्ययन, केंद्रित समूह चर्चा, कारक विश्लेषण, टीआईएसएम, एमआईसीएमएसी विश्लेषण, केस स्टडी विधि, सर्वेक्षण प्रश्नावली, साक्षात्कार, और इस अध्ययन के विभिन्न वर्गों को सुविधाजनक बनाने के लिए शोध उपकरण और विधियों के रूप में त्रिकोण विधि को नियोजित किया है।

राजस्व समय श्रृंखला विशेषताओं में गैर रेखीय है । और इसलिए अनुकूली गैर रेखीय भविष्यवाणी मॉडल रैखिक लोगों से बेहतर प्रदर्शन करेगा। वर्तमान अध्ययन दर्शाता है कि टीएनएन मॉडल एक ही उद्देश्य के लिए नियोजित अन्य रैखिक और गैर रेखीय मॉडल की तुलना में सबसे अच्छा राजस्व भविष्यवाणी प्रदर्शन दिखाता है। इस अध्ययन में वीएएस के विकास में वृद्धि के कारकों की पहचान की गई है। वे व्यापार मॉडल, नीति / विनियमन, स्मार्टफोन प्रवेश, राजस्व साझाकरण, विपणन रणनीति, विवाद समाधान तंत्र और प्रौद्योगिकी हैं। यह देखा गया है कि इन सभी कारकों में राजस्व साझा करने की अधिकतम ड्राइविंग शक्ति है। सरकार को उपयुक्त नीति हस्तक्षेप, सब्सिडी, और सार्वजनिक-निजी साझेदारी को प्रोत्साहित करके ग्रामीण बैंडविड्थ सेवाओं को अपनाने का समर्थन करने की आवश्यकता है। अन्य कारकों को महत्वपूर्ण माना जाएगा जो डिजिटल साक्षरता के अलावा स्थानीय भाषा में सेवाओं की विश्वसनीयता, सेवाओं की समय पर वितरण, लागत और सामग्री की विश्वसनीयता हैं।

इस अध्ययन के निष्कर्ष वीएएस और ओटीटी सेवा उद्योग के सभी हितधारकों के लिए मदद करेंगे, जिनमें टीएसपी, वीएएस विक्रेता, सामग्री प्रदाता, लाइसेंसधारक और नियामक शामिल हैं। इस अध्ययन के परिणाम आईएएमएआई, फिक्की, सीओएआई और एसोचैम इत्यादि जैसे अन्य उद्योग निकायों की भी सहायता करेंगे। दूरसंचार ऑपरेटरों और वीएएस विक्रेता इस अध्ययन के निष्कर्षों का उपयोग राजस्व साझाकरण में भी एक आदर्श बदलाव लाने में कर सकते हैं। टीएसपी तत्काल समय सीमा में राजस्व भविष्यवाणी के लिए गैर-रैखिक भविष्यवाणियों के मॉडल का उपयोग कर सकते हैं। ये मॉडल ऑपरेटर के विभिन्न उत्पादों की बिक्री की भविष्यवाणी करने में भी उपयोग किए जा सकते हैं। नियामक जरूरतमंद क्षेत्रों में उपयुक्त ढांचे को लाने में इस अध्ययन के परिणामों का उपयोग कर सकते हैं।

भले ही अध्ययन भारतीय दूरसंचार क्षेत्र पर केंद्रित है लेकिन वही निष्कर्ष समान स्थितियों का सामना करने वाले अन्य देशों के दूरसंचार क्षेत्र पर समान रूप से लागू होते हैं। संक्षेप में, अध्ययन एक ही या संबंधित क्षेत्र में आगे अनुसंधान कार्य करने के लिए अकादमिक के लिए भी बहुत मददगार होगा।

कुंजीशब्द: मूल्य वर्धित सेवा (वीएएस), नॉनलाइनर अनुकूली मॉडल, एएनएन, एनओएफएन, डिजिटल विभाजन।

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Abbreviations

ALC- Adaptive linear combiner

ANFIS- Adaptive network based fuzzy inference system

ANN- Artificial neural network.

ARMA- Auto regressive moving average

ARPM- Average revenue per minute

ARPU- Average revenue per user.

ASSOCHM-Associated Chambers of Commerce of India

BBNL- Bharat broadband network limited

BRIC- Bsazil, Russia, India and China

BSNL- Bharat sanchar nigam limited

CAGR-Cumulative annual growth rate

CDN- Content delivery network

CMS- Call mangement services

COAI-Cellular operators association of India

CRBT- Caller ringback tone

CUG- Closed user group

Deity-Department of Electronics and Information Technology

DOT- Department of Telecommunications

DS- Data services

FICCI- Federation of Indian Chambers of Commerce and Industry

G2C- Government to citizen

G2G- Government to Government

GDP- Gross domestic product

GMPCS-Global Mobile Personal Communication System

GP- Gram (village) Panchayat

GPON- Gigabyte paasive optical network

GPRS- General packet radio service

HSPA-High speed packet access

IAMAI-Internet and mobile association of India

ICT-Information communication technology

ILD- International long distance

IMS-IP-based Multimedia Services

IoT- Internet of things

ISP- Internet service provider

ITU- International telecom union

IVR- Interactive voice response

LSA-Licensed service area

LTE- Long term evolution

MCA- Missed call alerts

MLP- Multilayer perceptron

MMS- Multi media service

MNO- Mobile network operator

MOU- Minutes of usage

MSO- Multi service operator

MVAS- Mobile value added service

MVNO- Mobile virtual network operator

NASDAQ- National Association of Securities Dealers Automated Quotations

NeGP-National eGovernance plan

NIC- Natinal informatics center

NOFN-National optical fiber network

NTP- National telecom policy

OFC- Optical fiber cable

Ofcom- Office of communication

OS- Operating system

OTT- Over the top

PEOU- Perceived ease of use

PSO- particle swarm optimisation

PSTN- Public switched telecom network

PU- Perceived usefulness

QoS- Quality of services

RBF- Radial basis function

RCS- Rich communication suite

RF- Radio frequency

SMS- Short message service

SPV- Special purpose vehicle

STK- Sim application tool kit

TAM- Technology acceptance model

TCIL-Telecommunication consultant India limited

TENN- Trigonometric expansion based neural network

TISM- Total interpretive structural modelling

TPB- Theory of planned behaviour

TRA- Theory of reasoned action

TRAI- Telecom regulatory authority of India

TSP- Telecom service provider

UASL-Unified access service license

UNESCO- United Nations Educational Scientific and Cultural Organization

USOF- Universal services obligation fund

USSD- Unstructured supplementary services data

UTAUT-Unified Theory of Acceptance and Use of Technology

VAS-Value added services

VOiP- Voice over internet protocol

VS- Voice services

WAP- Wireless access protocol

WCDMA-Wideband Code Division Multiple Access