Proceedings of

Spectrum Management Conference 2023

(May 17, 2023)

organized on the occasion of

World Telecommunications and Information Society Day 2023
(WTISD-23)

By

Nepal Telecommunications Authority

Kathmandu, Nepal

EXECUTIVE SUMMARY

SPECTRUM MANAGEMENT CONFERENCE, 2023

Nepal Telecommunications Authority celebrated the World Telecommunication and Information Society Day 2023 (WTISD-23) by organizing Spectrum Management Conference, 2023.

Topics such as Present Telecommunications Market of Nepal, Emerging Mobile Technologies, and Current Status and Future Demand of Spectrum were discussed.

More than 150 Dignitaries, Delegates, Experts and Guests from various national and international organizations actively participated in the program.

KEY TAKEAWAYS

- Connectivity is the key. Nepal should focus on expanding the current ICT networks to unconnected rural and remote areas. Integrated infrastructure development mechanism as well as use of Rural Telecommunication Development Fund can be helpful in building cost effective sustainable coverage. Accessibility, Affordability, Reliability, Digital Literacy, Privacy and Security Assurance etc. help in digital inclusion.
- Current bandwidth demand of most Nepali users can be met by high capacity 4G network. Main capacity enhancement options are either limiting the coverage and densifying the cells or availing more spectrum in the existing cells and equipment. First one is capex-intensive and time-consuming approach. So, assigning more spectrum is the best way to expand network capacity and ensuring service quality. Nepal should expand the 4G network by assigning more spectrum to the service providers.
- 5G is designed to change the paradigm from connecting people to the connecting society and is regarded as a driver for digital transformation and socio-economic development. For 5G readiness, both supply-side (regulatory fees and policies, taxation, ARPU and network economics) and demand-side (smartphone affordability, data usage, vertical readiness) factors need to be aligned. Nepal should gradually prepare for the deployment of 5G, starting from urban areas, to preserve and increase competitiveness, collaborate with verticals and create market.
- Nepal has vacant 700 MHz Band, 2300 MHz Band, 2600 MHz Band and C-Band (subject to coordination with Fixed Satellite and broadcasting services). So, the coverage and capacity demand of the industry will be met for short to medium-term. To maximize the benefits of ICTs to the society, these spectrum should be released timely and fairly.

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Celebration of World Telecommunication and Information Society Day (WTISD-23)

Link to the Session Video:
https://www.youtube.com/watch?v=Uztn5VB-uj0

SESSION 1:
WELCOME ADDRESS

Mr. DEEPESH ACHARYA
Director
Nepal Telecommunications Authority

EXCERPTS OF SPEECH

Good Morning and Happy World Telecommunication and Information Society Day 2023!

First, on behalf of Nepal Telecommunications Authority, I would like to welcome all the participants and distinguished guests in this conference organized on the auspicious occasion of World Telecommunication and Information Society Day. The theme for this year is set as "empowering the least developed countries through information and communication technologies.

Welcome to Spectrum Management Conference. The theme set by Ito itself highlights the importance of ICT in developing country like Nepal. Though the significant development of uses of ICT in the country is satisfactory, there are still lots of issues needed to be addressed and further enhancement of the sector which will help us to grow as a real digitized nation and announce our productivity. Today, in this conference, we will be focusing on the spectrum uses and way forward for better ICT services in the country. We have experts in our list of presenters and moderators who have extensive knowledge of the sector and who have worked decades in the ICT sector. We also have the participation from International Organizations who will share their experience and guide us for the efficient uses of scarce resources for the development of ICT in the country. Today, we have good conference program scheduled for the day to discuss various issues such as current Telecom market scenario, digital economy status, and uses of 4G as well as 5G and new technologies. We look forward to active participation from all the invitees and we believe the outcome of the event would be very fruitful for proper uses of the spectrum. We wish you all have a great day ahead.

Once again, I would like to welcome the Honorable Minister and Secretary of the Ministry of Communication and IT, Chairman and Board Members of Nepal Telecommunications Authority, and all distinguished guests and invitees in this conference.

Thank you all for your valuable time today.

Have a good day!

SESSION 1:
INAUGURATION

Ms. REKHA SHARMA
Minister
Ministry of Communication and Information Technology

SESSION 1:
VIDEO MESSAGE FROM INTERNATIONAL TELECOMMUNICATION UNION, SECRETARY GENERAL

Ms. DOREEN BOGDAN-MARTIN
Secretary General
International Telecommunication Union (ITU)

VIDEO TRANSCRIPTION

The internet's first message and World Telecommunication and Information Society Day happened the same year five decades ago. It changed the way that we think about telecommunication and human connection and today digital technology is redefining what it means to connect to one another to opportunity to knowledge to the world. But on this day, we remember that too many people are left behind that just one-third, one-third only of the population in Least Developed Countries is connected that it's our collective responsibility to support LDCs on their journey from potential to prosperity through technology. That's why ITU, the UN Agency for Digital Technologies dedicates this day this year to these countries. And that's why I call on you today to join our campaign to empower LDCs by making a pledge to partner to connect digital coalition. Together we can make 2023 a year of unprecedented digital development in Least Developed Countries and create a truly universally connected world where everyone everywhere shares in the benefits of technology.

SESSION 1:
MESSAGE FROM ASIA PACIFIC TELECOMMUNITY

Dr. JONGBONG PARK (on behalf of the SECRETARY GENERAL)
Director, Project Development
Asia-Pacific Telecommunity

EXCERPTS OF SPEECH

Namaste!

The Secretary General of APT would like to extend his appreciation to the Government of Nepal for the invitation and extend his congratulations to Nepal Telecommunications Authority (NTA) for organizing this event.

Today, we get together to discuss the betterment of the spectrum management in Nepal, which is essential for making people connected. Connectivity is a crucial issue for every and each one of us, and Nepal is no exception. In today's digital age, having access to the Internet is essential for social and economic development. The COVID-19 pandemic has highlighted its importance even further as many peoples had to work remotely and rely on online services to stay connected.

However, in 2022, as ITU Secretary General mentioned, only 36% of the LDCs are online whereas the global average is 66%. Mobile coverage in LDCs is also far behind: 83% versus global average of 95%. So, we need some collective efforts to bridge digital gap. In Nepal, mobile broadband users are more than 93 percent. However, there are still many areas with lack of adequate coverage, particularly in the rural and remote areas. This is why it is essential to continue investing in infrastructures and improving coverage across the country through fixed-line, mobile, Wi-Fi and satellite. With the betterment of connectivity and affordable services, more people will have access to the Internet and it's all benefits.

As an Intergovernmental organization and as part of the International Community, APT has work programs to assist the Government of Nepal. When it comes to the National Spectrum Roadmap and modernizing the National Licensing Mechanism, collective efforts are done by the SATRC members together. APT also provides tailormade training courses (APT local training), consultancy services (APT expert mission) and technical guidance (APT Reports and Recommendations). So, I'd like to encourage to reach out to APT to have more collaboration.

I'm confident that Nepal can successfully upgrade the technologies including 5G and reap the benefit of the exciting new technologies. I'd like to reassure that APT will be ready to work together in effective way. There is no doubt that the journey requires a lot of collaboration and coordination between the government, network operators, vendors and other stakeholders. But the outcomes will cause to grow and thrive all.

Thank you!

SESSION 1:

SPECIAL ADDRESS BY THE SECRETARY, MINISTRY OF COMMUNICATION AND INFORMATION TECHNOLOGY

Mr. KRISHNA BAHADUR RAUT

Secretary

Ministry of Communication and Information Technology

EXCERPTS OF SPEECH

Good Morning!

World Telecommunications and Information Society Day 2023 (WTISD-23), being observed with slogan dedicated to LDCs, is an opportunity to LDC like Nepal for digital transformation and development of telecommunication and IT sector, we should put our efforts accordingly.

Development of information and communication sector digitally and economically connected the world, where information exchange is possible within seconds. These technologies should be used for economy, social and overall prosperity of the country. We should make the technologies and services affordable, reliable, safe and secure.

ICT ecosystem and infrastructure development will benefit landlocked country like Nepal. Technology can provide us global exposure to goods and services as stated in Nepal Trade Integration Strategy (NTIS).

By utilizing rural telecommunication development fund, broadband connectivity should be expanded soon to yet-to-be covered rural and remote areas. We should also ensure the right and positive use of the technology.

ICT is a cross-cutting but major domain; it impacts all other sectors of the society. We are lagging in many ICT indicators. We should work together and build infrastructure to minimize digital divide and promote digital inclusion.

SDG goal no 9 (Industry Innovation and Infrastructure), target 9.8 (Universal Access to Information and Communications Technology) could not be met by 2020, now we should align our policies, plan and programs to meet this target by 2030. Achieving this target will help us in production, industry and public service delivery etc.

For safe, satisfying, enriching, productive and affordable use of ICTs, policies, legal and institutional reform are backbone. The ministry is working to revise the Telecommunication Act, IT Act, Cyber Security Act etc. to address the technological development.

May this day energize us to move forward for the development of this sector.

Thank you!

SESSION 1:
CHIEF GUEST ADDRESS BY THE MINISTER, MINISTRY OF COMMUNICATION AND INFORMATION TECHNOLOGY

Ms. REKHA SHARMA
Minister
Ministry of Communication and Information Technology

EXCERPTS OF SPEECH

Namaste!

May this World Telecommunications and Information Society Day 2023 (WTISD-23) inspire us to solve the problems in in the field of information and technology in our country. Today's slogan is more relevant to us.

Radio frequency, as a scarce resource, needs to be managed properly. Today's discussion among experts and stakeholders of this field is a plausible initiative by the Authority in this direction. The Ministry and the Council of Ministers ensure proper facilitation for the implementation of the suggestions and conclusions obtained from the conference.

Today, ICT is identified as an essential service by the Government of Nepal. On the one hand, we have started to prepare for 5G to be competitive in the international market. On the other hand, not even a basic telecommunication service is available in remote and rural areas.

We have to review our current status and activities, quantify the problems, and identify possible solutions in the field of telecommunication. We need to review what has been done in the past and what we are doing now to solve the problems this field is facing.

We have to analyze why the revenue is decreasing despite the expansion and widespread use of the ICTs and find out how a developing country like ours can generate more revenue from this sector.

We should all work together in collaborative but competitive environment to reduce the digital divide, to serve the remote areas, to improve the quality of services, and to make the service affordable and accessible to all.

Gaps related to technology, management and policy needs to be analyzed and all stakeholders should take responsibility to reduce the identified disparities. For effective outcome, we should move forward by setting goals and deadlines.

The Ministry will help and support the growth of the sector through policy and legal framework reform. The government will formulate policies and programs to attract internal and external investment in this sector and also ensure returns as well as level playing field.

Thank you.

SESSION 1:
ADDRESS BY THE CHAIRMAN

Mr. Purushottam Khanal
Chairman
Nepal Telecommunications Authority

EXCERPTS OF SPEECH

Good Morning!

We are here to celebrate World Telecommunication and Information Society Day, 2023. The theme of WTISD-23 for this year is "Empowering the least developed countries through information and communication technologies," and it is most relevant to our context. The ICT sector could act as a catalyst to achieve greater efficiency in other vertical sectors which will ultimately leads to the GDP growth. In addition, I believe it is important to evaluate the Digital Nepal Framework's current state of development critically and make the required amendments and preparations for the achievement of the Digital Nepal objective.

Currently, the Authority is working to develop a sustainable nationwide backbone infrastructure using Rural Telecommunication Development Fund and other funds. Now, it is time to work more quickly for universal connectivity and the digital transformation of the country in a collaborative way to promote digital innovation and the economy. We must go together with the world to leverage the benefits of the emerging technology for the betterment of public and the nation.

Today, we are here not only celebrating WTISD-23 but also having an in-depth discussion on the current telecom market, and disruptive innovation, 5G. The 5G provides a wide range of services and is considered a vital tool for digital transformation. The digital transformations will have a direct impact on the creation of wealth and economic development. However, we are in the early stages of 5G deployment, and the progress of the 5G trial is still not satisfactory.

We will also discuss the management of fundamental and crucial resource for communication, which is the spectrum. To provide a wide range of services, 5G and beyond technologies demand enough spectrum from unlicensed and license bands (low band, mid-band and high band). The effective and efficient management of spectrum is key to the sustainable development of the sector and the national economy.

I hope this occasion will be a good platform to discuss contemporary issues among and between international and national experts. Since we are in the process of revising the Telecommunication Act, ICT policies, and the spectrum policy, the outcome of the conference will be fruitful for policy formulation and implementation.

Thank you.

Session 2

Present Telecommunications Market of Nepal and Way Forward

Link to the Session Video:
https://www.youtube.com/watch?v=Uztn5VB-uj0

SESSION 2:
PRESENT TELECOMMUNICATIONS MARKET OF NEPAL AND WAY FORWARD

Mr. RABINDRA JHA
Member
Nepal Telecommunications Authority
(Moderator)

SESSION OUTLINE

Nepal's telecommunications market has witnessed significant growth and development in recent years. Because of the advances in mobile and broadband penetration, optical fiber network and rural connectivity, the sector has played a crucial role in connecting people, promoting digital inclusion, and contributing to the country's economic development. But the challenges of reliable infrastructure extending to the remote areas, broadband affordability, digital literacy and skills, cyber security and regulatory improvements are still there.

In such context, present status of telecommunication sector in LDCs and Nepal as well as the interconnection between ICT infrastructures and digital economy in Nepal were discussed in this session.

Speakers (in the order of presentation):

Dr. Siddhartha Raja, Senior Digital Development Specialist, World Bank

Mr. Gaurav Giri, Joint Secretory, Ministry of Communication and Information Technology

Mr. Guru Prasad Paudel, Executive Director, Nepal Rastra Bank

MODERATOR'S BIO

Mr. Jha completed Master Degree in Business Studies from Tribhuvan University, Nepal in 2007 and Bachelor of Electronics & Communications Engineering, from B.I.T. Sindri, Dhanwad, India, in 1986.

He has more than 30 years of experience in the field of telecommunications and served in executive levels of Nepal Telecom such as Project Manager, Chief Human Resource Officer and Deputy Managing Director. He has published numerous articles in the field of technology, economy, consumer, strategy related to mobile and telecommunications services.

SESSION 2 TALK 1:
TELECOM MARKET IN LDCS: CHALLENGES, OPPORTUNITY AND WAY FORWARD

Dr. SIDDHARTHA RAJA
Senior Digital Development Specialist
World Bank
(Speaker)

SYNOPSYS

- Nepal's enthusiasm and progress made in telecommunications and information society over the years requires recognition and appreciation.
- The importance of universal, inclusive, affordable, and reliable access to the internet and digital services can not be overstated, as highlighted by the COVID-19 pandemic. And without such provisions, there is going to be exclusion.
- The link between affordable access to high-speed internet and development is now not just very clear, but extremely starkly presented. At present, 61% of people around the world have access to fixed broadband at home.
- Nepal is doing well in terms of fixed broadband connections, now the focus should be to expand the access to rural, remote and hill areas so that all individuals, regardless of their location or background have access to the technologies and opportunities.
- Today, approximately 60 and 10 percent of global connections are 4G and 5G respectively. A progressive, technology-neutral and flexible approach to spectrum allocation, assignment, and monitoring is important for continuing innovation.
- Investment in the region of $1.8 billion dollars are going to be required for a country like Nepal to achieve universal access to good quality internet connectivity by 2030. It has to be joint effort between the public and private sectors, development partners, and financing institutions.
- Cost reduction measures, such as infrastructure sharing and easy access to sites, rights of way, passive infrastructures are necessary to make network rollout cheaper.
- Digital and informational literacy are important to build trust and maximize the benefits of the digital economy. Inclusion of marginalized groups and addressing cyber security risks are crucial aspects of the digital economy.
- Improvement and continuous capacity building of regulatory bodies and fostering trust among investors are essential for sustainable development and growth of the telecommunications and information society sector.

SPEAKER'S BIO

Siddhartha Raja is with the World Bank Group's Digital Development global practice. As a senior specialist, he assists governments to design and implement policies and programs that connect more people to information and opportunity through digital networks and services. Siddhartha's work in countries across Europe and Asia has led to the expansion of affordable broadband connectivity,to people developing their digital skills and working online, and to exponential improvements in international connectivity. Based in Kathmandu, Nepal as Regional Cluster Leader for South Asia for Digital Development, Siddhartha helps coordinate the design and implementation of policy reforms and investment programs to support digital economy development across the eight countries of the region.

SESSION 2 TALK 2:
CURRENT STATUS OF ICT MARKET IN NEPAL

Mr. GAURAV GIRI
Joint Secretary
Ministry of Communication and IT
(Speaker)

SYNOPSYS

- The information and communication market in Nepal is undergoing significant changes and the government has set long-term goal of achieving accessible modern infrastructure and intensive connectivity for prosperity. The Ministry of Communication and Information Technology is leading the development of the ICT sector in the country.
- There are regulatory complexities that need to be addressed. Quick action is required to safeguard the broadcasting industry while promoting internet-based technologies. OTT platforms, content regulation for OTT and television is difficult. But, the implementation of a clean feed policy has helped mitigate some of the problems faced in broadcasting content regulation. Pricing regulations for licenses and services also need to be updated to accommodate new technologies.
- The ICT sector in Nepal faces several challenges, including limited access to telecommunication, increasing abuse of social networks, cybersecurity, underutilization of allocated orbital slots, and insufficient use of information technology in public service delivery. Other challenges that need to be tackled include promoting competitive ICT-based industries, increasing investment in research and development, delivering services to scattered settlements, and facilitating telecom infrastructure sharing.
- ICT has got recognition as a driver of economic development, the government has already prepared Digital Nepal Framework which aims to increase the use of ICT in various aspects of the society. Investment and new jobs in ICT is increasing, youths are attracted to this sector, digital literacy is increasing, and public service delivery has been easier and less costly. Development and adoption of new technologies all contribute to the positive outlook for the ICT market.
- By addressing regulatory complexities, overcoming challenges, and leveraging opportunities, Nepal can further develop its ICT sector and contribute to socio-economic growth.

SPEAKER'S BIO

Mr. Gaurav Giri joined government service as an Electronics Engineer in the year 2004 at the Ministry of Communication and Information Technology (MoCIT) and worked at the ministry of Culture, Tourism and Civil Aviation during the year 2007-2008.

Promoted to Under Secretary in the year 2009, he served in the MoCIT, Department of Information and Broadcasting as well as Department of Hydrology and Meteorology.

In the year 2021, he had been promoted to Joint Secretary. Since then, he has been serving at the Frequency Management Division at MoCIT. He has worked for a long time in the radio spectrum management sector.

He has received Bachelor's degree in Electronics Engineering from the Institute of Engineering, Pulchowk Campus in the year 2002 and Master's degree in Sociology and Anthropology from Tribhuvan University in the year 2012.

SESSION 2 TALK 3:

ANALYSIS OF THE CURRENT TELECOM MARKET AND THE ROLE OF DIGITAL ECONOMY IN NEPAL

Mr. GURU PRASAD PAUDEL
Executive Director
Nepal Rastra Bank
(Speaker)

SYNOPSYS

- Digital infrastructure is an essential component of digital economy. Out of 80 initiatives identified by Digital Nepal Framework, 19 are related to Digital Foundation.
- Nepal has experienced a significant growth in broadband penetration, especially after the COVID-19 pandemic. 4G services have been extended to all 77 districts, including rural areas. Considering the low GDP per capita ($1,371.97), the data rate per GB is still relatively expensive.
- According to the Census 2021, around 73% of the Nepali population owns a smartphone. However, a study by the Nepal Rastra Bank reveals that only about 68% of people have a bank account. Branchless banking through smartphones can be more effective in bringing people into the banking system and improving financial inclusion.
- The Census data also indicates that more than 92% of people in Nepal use electricity for lighting. This means broadband internet access can be immediately extended to more than 92% of the population through proper planning and infrastructure development.
- Accessible, affordable, and high-quality connectivity is particularly crucial for the service delivery under digital payment system.
- Nepal has witnessed a rapid surge in electronic payments in terms of number of users and transaction volumes. These advancements have been made possible due to reliable advancements in ICTs.
- Lack of digital and biometric IDs raises concerns regarding the authenticity of SIM card registrations and digital wallets. Implementing such identification systems not only helps prevent fraudulent activities and unauthorized access, but also ensures that government subsidies and facilities reach the intended beneficiaries.
- Telecom operators and regulators in Nepal should prioritize the establishment of a strong digital foundation by implementing the initiatives outlined in the Digital Nepal Framework. By doing so, everyone can benefit from the opportunities provided by technology and digitalization.

SPEAKER'S BIO

Mr. Guru Prasad Paudel is Executive Director at Payment Systems Department of NEPAL RASTRA BANK. He has completed M. Phil. in Management. Central Banker for 21 years, he has served different departments: Bank supervision, Bank and Financial Institution Regulation, Foreign Exchange Management, Head of Province Office experiences.

SESSION 2 DISCUSSION:
PRESENT TELECOMMUNICATIONS MARKET OF NEPAL AND WAY FORWARD

SUMMARY OF DISCUSSION

- Dr. Raja suggested that leveraging public-private partnerships, such as the integrated infrastructure development mechanism, and improving business cases can effectively expand broadband coverage to rural and remote areas in Nepal. He also mentioned that the World Bank is implementing the Digital Nepal Acceleration program, which supports the deployment of broadband networks in rural regions and provides assistance with policy and regulatory matters.
- Mr. Giri emphasized the consideration of social media regulation, the issuance of infrastructure sharing regulations to reduce investment duplication, and the development of new acts and regulations for cyber security. These initiatives are expected to bring about transformative changes and address the challenges faced in the field of ICT.
- Mr. Paudel highlighted that slow adoption of digital technologies in Nepal can be attributed to the persistence of traditional mindsets that has not fully embraced the change. For successful digital transactions, certain prerequisites such as reliable equipment, adequate infrastructure, regulatory supervision, connectivity, and access to electricity are essential. Moreover, Mr. Paudel stated that financial institutions are open to accepting digital payments for taxes of any amount. While Nepal may not achieve an immediate transition to a cashless society, there is already a noticeable shift towards reduced cash reliance.
- Mr. Ananda Raj Khanal,a former Senior Director of the Authority, stressed the need for open discussions to identify and solve the existing problems in the telecommunications sector. Mr. Giri added that the current licensing regime could be a barrier for new operators. However, he mentioned that positive changes are underway. A new telecom act is being drafted, and the licensing regime is being revised to be based on revenue. Additionally, implementing spectrum auctions followed by obtaining a telecom license will have a positive impact on the sector.
- Mr. Paudel highlighted that it is mandated to have at least one branch of financial institutions per municipality for government transactions. However, the pace of branch expansion has been slow, and there is a growing preference for branchless banking. Ultimately, Mr. Paudel emphasized that what truly matters is access to banking services rather than the mere existence of traditional bank branches.
- A representative from the Civil Aviation Authority of Nepal acknowledged the difficulty in retaining human resources within the country, and the operation of new technologies is largely dependent on vendors. Meanwhile, a representative from the Nepal Academy of Science and Technology emphasized the importance of focusing on digital literacy and digital inclusion. They emphasized the need to make dedicated efforts in these areas to enhance people's skills and ensure equal access to digital resources for all.

- According to Mr. Suresh Pudasaini, a former Chairman of the Authority, taking initiatives in digital technologies always yields benefits. He pointed out that the renewal fee for basic telephone service is higher than the actual license fee, and he suggests that it should be reconsidered and revised. Mr. Giri replied that the fee is determined based on the license auction. However, he acknowledged that the collection of the renewal fee in installments from the first year is posing challenges to network rollout. Mr. Giri further indicated that efforts are being made to address the hindrance caused by the installment payment structure.
- Mr. Paudel highlighted the increasing interdependence of the telecom, ICT, and banking sectors. He proposed that introducing specific provisions for SMS and mobile data could enhance the secured and reliable use of technology in the financial industry. Additionally, he emphasized the need for regulators in the telecom and banking sectors to collaborate and exchange knowledge to create a more secure and efficient environment for financial services. The representative from the Internet Service Providers expressed the viewpoint that instead of solely relying on mobile data, the security features of WiFi can also be enhanced as per the requirement of fintech industry.
- A representative from the Nepal Police pointed out that although data is collected through the National ID system, it is not shared with any entities. He also highlighted a similar issue with passports and embossed number plates, where data is not effectively utilized.
- The representative from Ncell Axiata emphasized that there is no duopoly in the internet service industry in Nepal. They stated that the two main mobile operators should not be solely blamed for all the challenges encountered in the sector.
- Mr. Jha concluded that the regulator should play a facilitating role for the operators, while the operators should, in turn, prioritize facilitating the consumers. He emphasized the importance of ensuring equal access and benefits of ICTs for everyone.

Session 3

Emerging Mobile Technologies

Link to the Session Video:
https://www.youtube.com/watch?v=UMtr2GRimic

SESSION 3:
EMERGING MOBILE TECHNOLOGIES

Mr. C. MANI CHAULAGAIN
Expert
(Moderator)

SESSION OUTLINE

5G is creating a buzz in the region as well as globally. Our honorable Minister also emphasized that sooner or later Nepal has to go for 5G. With 4G already deployed in all 77 districts of Nepal and with Indian ICT Minister declaring that India would be 6G ready by 2028-29, this could be the right time for Nepal to be 5G ready.

From Global standpoint, as per GSA data, 519 operators in 156 countries have been investing in 5G in the form of trial, license acquisition, deployment, soft launches and launches. Today, we have over 1.3 billion 5G subscribers globally and annual growth is 86%.

5G unique feature of High data rate, ultra-reliable transmission and low latency makes it perfect solution to natively support emerging technologies such as artificial intelligence, augmented reality, virtual reality and so on. 5G has been used in many vertical sectors and has been the key enabler of fourth Industrial Revolution.

The Digital Nepal Initiative launched by the Government of Nepal has the objective of maximizing the use of ICT in multiple sectors like agriculture, tourism etc. in order to enhance productivity in production sector and efficiency in public service delivery. Therefore, 5G can be an enabler of digital economy in Nepal. Best practices of 5G deployment in developing countries and the way forward for Nepal were discussed in this session.

Speakers (in the order of presentation):

Dr. Jongbong Park, Director, Project Development, Asia-Pacific Telecommunity

Mr. Foong Chee Kheong, Chief Regulatory Officer, Axiata Group

Dr. Pradip Paudyal, Deputy Director, Nepal Telecommunications Authority

MODERATOR'S BIO

Mr. Chaulagain holds Engineering Degree & MPA from the Prestigious Universities. He possesses over 25 Years of international Expertise in the ICT domains. Formerly he has worked at Telecom multinationals (Equipment Vendors) in Europe, APAC & South Asia in different capacities for over 10 years. After returning to Nepal, he has worked as the CEO of one of the Telecom Operators from 2009 till 2012. Later he served as the Board Member of Nepal Telecommunications Authority for 5 years.

Mr. Chaulagain possesses a unique 360-degree knowledge in Telecom domain as he has worked for Vendors, Operators and Regulator. As a Member, he supported the Authority on the matter of policy formulations such as Frequency Policy (4G & 5G), Merger & Acquisition draft, Cross holding Policy, matters related to Licensing Framework of Independent Infrastructure Providers and other Regulatory Policies.

SESSION 3 TALK 1:
BEST PRACTICES OF 5G DEPLOYMENT IN DEVELOPING COUNTRIES

Dr. JONGBONG PARK
Director, Project Development
Asia-Pacific Telecommunity
(Speaker)

SYNOPSYS

- Asia-Pacific region was an early adopter of 5G and led the implementation of the technology, but is falling behind. Causes could be pandemic, lack of investment, lack of conducive policy and regulatory arrangements, reluctance of industry, issue of digital literacies etc.
- 5G itself is a tool for bridging the digital divide, but there is a notion that it has deepen due to 5G. Developed countries like Japan, Korea, Singapore etc. are well advanced in 5G deployment whereas developing countries are not ready to come up with 5G.
- For countries like Nepal where underground optical fibers deployment is very difficult, Fixed Wireless Access would be quite an efficient way to reach out the remote and rural areas in order to bridge the digital divide. There are many global cases of FWA focused on rural areas in Malaysia, Thailand, Philippines and Vietnam from A-P region.
- The regulator should set out transparent spectrum roadmap to the industry inviting investment from the operators.
- Nominal spectrum fee (Maldives, Bhutan, Philippines) and long-term license (Indonesia) at reasonable price can nurture the industry and society can take benefit from it.
- Infrastructure Sharing (Active: India, Passive: Malaysia) contribute to improve network coverage and reduce costs.
- Considerations for 5G: Government led conducive 5G ecosystem and regulatory environment, reasonable pricing of Spectrum, thorough plan for backhaul networks in urban and rural areas, 5G use cases (with verticals) in Nepali context,
- Public-private partnership, collaborative approach will contribute to the growth of 5G ecosystem.
- APT requests to update the APT Frequency Information System regularly.

SPEAKER'S BIO

Dr. Jongbong PARK joined the Secretariat of Asia-Pacific Telecommunity on 1st July 2015 as a Director, Project Development. Dr. PARK is responsible for management of all of Work Programs of APT, covering ICT policy and regulation, ICT development, technical groups, capacity building programs as well as preparatory meetings for internal conferences and assemblies. His international engagement was started in early 2000's through various joint projects with ITU and funding institutions, such as African Development Bank and Inter-American Development Bank. He also had served various chairmanships of APT and ITU. His academic background is ICT technology management. He holds a Doctor's degree on ICT standardization.

SESSION 3 TALK 2:

5G IN DEVELOPING COUNTRIES AND THE PROSPECTS IN NEPAL

Mr. FOONG CHEE KHEONG
Chief Regulatory Officer
Axiata Group
(Speaker)

SYNOPSYS

- Axiata is operating in 11 markets, many having similar demographics and customers like Nepal.
- Whenever a country increases adoption of broadband, a lot of other sectors get impacted, and there's a positive economic multiplication and correlation to the GDP.
- The benefits of 5G may not be noticeable when streaming videos in small screen. But it becomes obvious while using applications such as gaming which require low-latency.
- If done right, 5G will accelerate digitization of industries and verticals such as manufacturing, automotive, healthcare, agriculture etc.
- To address 5G readiness, both supply-side (spectrum, license fees, taxation, regulatory policies, decreasing ARPU, deteriorating network economics) and demand-side (smartphone affordability, higher data usage, vertical readiness) factors need to be aligned.
- Compared to emerging markets where Axiata operate, the mobile data in Europe and America are approximately 5 and 10 times more expensive.
- Top global vertical industries are retail logistics, transport, health, manufacturing, oil and gas, smart cities, smart agriculture, smart airports and ports.
- 5G use cases related to ports, airports, cities, manufacturing, oil and gas are offered by Axiata.
- Unlike 4G and 3G which require only network design and optimization, more important in 5G is to build a strong partnership and technology ecosystem to support digital transformation initiatives.
- Significant 5G cost accelerators are RAN and Energy, and the cost can be optimized by network ownership sharing, if allowed by the regulatory regime.
- Most developed markets have consolidated to a 2 or 3 MNO market through merger and acquisition. As 5G matures, further consolidation is expected.
- Releasing under-utilized bands, identification of new bands, 5G trial, infrastructure sharing, regulatory symmetry between ISP, OTT and MNOs are suggested.

SPEAKER'S BIO

Foong Chee Kheong is the Chief Regulatory Officer, Axiata Group Berhad. CK has about 27 years of experience in telecommunication, with roles in regulatory strategy and policy development with prior experience in network engineering and project management. CK holds a BSc in Electrical and Electronic Engineering (First Class) from Queen's University Belfast, United Kingdom and an MBA and LLM (IT and Telecoms Law) from the University of Strathclyde.

SESSION 3 TALK 3:
5G AND WAY FORWARD IN NEPAL

Dr. PRADIP PAUDYAL
Deputy Director
Nepal Telecommunications Authority
(Speaker)

SYNOPSYS

- Subscription of 3G and 4G combined is approximately 93% and 4G only subscription is around 65%, but the geographic coverage is poor in the mountains and hilly region.
- Previous generations of mobile communications were focused to enhance the mobile data rate. 5G is beyond that, it is designed to change the paradigm from connecting people to the connecting society (machines, objects, devices).
- 5G is regarded as a driver for digital transformation and socio-economic development, contributing to the key areas of the SDGs and improve the Quality of Life.
- 5G adoption rate is quite high and it is expected to overtake 4G by the end of this decade.
- Challenges: the current telecommunications market has become increasingly saturated, and revenues are in decline, but the spectrum and license fees are not declining; the 4G capacity in developing countries are under-utilized; investment requirements for 5G are about three times higher than for 4G; poor coordination with industry verticals; power supply problem, cost of network infrastructure and consumer devices, lack of flexible policy and sustainable business policy.
- Balanced solutions: focus on 4G deployment and start with 5G use cases, incentivize investment, allocate favorable spectrum, promote digital transformation & innovation, collaborate with verticals, ensure security & trust.
- 5G strategy and digital innovation policies are essential.
- Nepal has 700 MHz band vacant, 2300 MHz and 2600 MHz are also available. So, the coverage and capacity demand of the industry will be met comfortably.
- Spectrum in C-band will be available after coordinating with satellite services. MmWave bands are also considered.
- Readiness: technology neutrality and contiguous spectrum, preparing frequency auction in 700 MHz and 2600 MHz/3500MHz for new entrant, identification of new licensed and unlicensed bands, spectrum policies are being revised, national information highway, exploring 5G use cases, 5G trial.

SPEAKER'S BIO

Dr. Pradip Paudyal received a PhD degree (European Level) in Telecommunications Engineering from Roma Tre University, Italy. He also holds an executive MBA from Pokhara University. He has been working at the NTA since 2011 and is currently a Deputy Director of the Regulation Department. He is also a part-time faculty member at different universities in Nepal. He has published more than a dozen research papers in international journals and conferences and serves as a reviewer for prestigious international journals and conferences. His current research interests include telecommunications technologies and policies.

SESSION 3 DISCUSSION:
EMERGING MOBILE TECHNOLOGIES

SUMMARY OF DISCUSSION

- On question, whether 5G should be deployed on immediate basis or wait until 4G LTE networks are exploited appropriately, Dr. Park told that he observed the similar dilemma in other parts of the world because of their own constraints. Dr. Park and Mr. Chaulagain agreed that the difficulty and cost of deploying and the return on investment are hindrances in adopting 5G in mmWave frequencies, such as the 26 GHz band.
- Dr. Park suggested that the 2.6 GHz band in urban and downtown areas and the 600/700 MHz bands in rural, unserved, and underserved areas are appropriate for 5G deployment in Nepal. He also recommended a mixture of both for Fixed Wireless Access.
- Regarding the plans of Axiata Group's plan for 5G deployment in Nepal, Mr. CK acknowledged that the transition from 4G to 5G will not happen overnight and requires time. He suggested addressing the pressing issue of improving 4G coverage first and gradually preparing the ground for 5G, including verticals and the ecosystem.
- Mr. CK emphasizes the importance of improving 4G coverage in Nepal to enhance digital inclusion and reduce the digital divide. He suggested assigning more spectrum for existing technologies in existing bands to extend 4G coverage. He also mentioned the economic benefits of utilizing idle spectrum blocks.
- Mr. CK expressed the need for 5G trials to verify and align with the technology, and to prepare verticals for adoption. He requested the allocation of spectrum for 5G trials to ensure successful deployment. He also stated that Axiata Group will launch 5G service in Nepal within 2 years.
- Dr. Paudyal mentioned that the current focus should be on expanding 4G coverage throughout the nation. He also stated that 5G impacts the economy directly and indirectly. Therefore, 5G deployment in key cities should be started to preserve and increase our competitiveness. The priority is to connect every individual, especially in rural areas.
- Regarding 6G, Dr. Park mentioned that countries like Nepal should prioritize connectivity rather than aiming to be leaders in adopting newer technologies. It was suggested to focus on deploying and fully utilizing 4G and 5G before considering 6G. Dr. Paudyal agreed that it is quite too early to think about 6G in Nepal.
- Mr. Ananda Raj Khanal, a former Senior Director of the Authority, opinioned that Nepal may not need to commercially deploy 5G for the next three to five years. Dr. Paudyal said that nationwide 5G networks may not yield immediate return on investment, but the regulator should act proactively so that the positive benefits of this disruptive technology reaches all type of customers appropriately. The testing and deployment of 5G in feasible areas should start. Similarly, development

of new use cases, promotion of innovation and localized business applications should be prioritized.

- Mr. Bhesh Raj Kanel, a former Chairman of the Authority, said that he is observing network coverage shrinkage from legacy 2G to current 4G network. He also believed that 5G trial opportunity to all network operators may create impetus for earlier commercial deployment of 5G. He also told that at least 5G experimental network should be deployed, as pilot project, to collaborate with verticals, to create market.
- Dr. Paudyal informed the gathering that the Authority is determined for creating enabling environment through activities such as ongoing act amendment process, frequency policy changes, and the entry of a new operator for competition.
- Overall, the opinions expressed highlight the importance of improving 4G coverage while gradually preparing for the deployment of 5G in Nepal. The focus is on addressing the connectivity needs of the population and developing suitable use cases and business applications for 5G.

Session 4

Spectrum for IMT: Current Status and Future Demand

Link to the Session Video:
https://www.youtube.com/watch?v=8TMmjE208xQ

SESSION 4:
SPECTRUM FOR IMT: CURRENT STATUS AND FUTURE DEMAND

Mr. AMBAR STHAPIT
Director
Nepal Telecommunications Authority
(Moderator)

SESSION OUTLINE

With the emergence of new services in the field of wireless technology, the spectrum demand is always increasing. And the adequate access to spectrum is key for the development and coverage expansion of telecommunication network. Spectrum, as a scarce resource, requires proper management to ensure equitable access and interference free environment among different users as well as services, and for addressing the ever-increasing demand created by existing and new technologies as well. Enough spectrum in the timely manner is very important to ensure accessible, affordable and quality service for consumers. Some contemporary issues such as status of cellular network deployment, spectrum utilization, spectrum demand in the country as well as international best practices of spectrum management were discussed in this session.

Speakers (in the order of presentation):

Mr. Adeel Israr, Chief Technology & Enterprise Business Officer, Ncell Axiata Limited

Mr. Sujit Ananda Malla, Deputy Manager, Nepal Telecom

Mr. Ashish Garg, Senior Manager Spectrum & Policy, South Asia, GSMA

MODERATOR'S BIO

Mr. Ambar Sthapit has Master degree in Engineering. He has 25 years of experience in the Telecom Regulatory field. During that period, he has been involved in formulating Policies and other Regulatory Frameworks to develop the Telecom Sector of Nepal. Currently he is working as Director at Nepal Telecommunication Authority. He is head of Regulation Division

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SESSION 4 TALK 1:
STATUS OF 4G DEPLOYMENT, SPECTRUM UTILIZATION AND DEMAND

Mr. ADEEL ISRAR
Chief Technology & Enterprise Business Officer
Ncell Axiata Limited
(Speaker)

SYNOPSYS

- Ncell has spectrum in 900 MHz, 1800 MHz and 2100 MHz, and is operating 2G, 3G and 4G including VoLTE mobile services hand in hand with industry growth and evolution.
- Ncell has consistent user base of 13.45 million, but 25% of the handsets support 2G only.
- 4G handset penetration is 72%, population penetration is 90% and number of physical sites is more than 4000.
- 4G coverage is approaching traditional 2G coverage, and the voice-centric market is shifting gradually towards data-centric.
- More than 50% of the data usage is attributed to streaming services (Youtube, Tiktok, Facebook).
- Around 98% of MBB access is happening on small screen, and 720p resolution in small screen requires maximum of 3 Mbps.
- Spectrum utilization of Ncell has exceeded 80% of its total capacity.
- 95% of global 5G deployment are for eMBB and FWA, but Nepal has abundant fiber penetration as well as less investment per CPE (1/5 times).
- Current data usage per user per month is around 4GB. Many operators have started to migrate to 5G when this usage reaches 15 GB. Nepal's usage will reach that region in 2 to 2.5 years.
- Additional spectrum is needed in existing portfolio to support 4G utilization for next 1 to 2 years support applications for digital inclusivity and digital Nepal framework.
- 700 MHz spectrum (for coverage) as well as spectrum below 6 GHz are most relevant for next few years.
- 2600 MHz could be more suitable for Nepal, because this can be used simultaneously for 4G and 5G, so the gradual shift towards 5G is possible.
- Site acquisition process should be made easier, spectrum caps should be relaxed, and equal opportunities should be given to all operators.

SPEAKER'S BIO

Muhammad Adeel Israr is currently serving as the Chief Technology & Enterprise Business Officer of Ncell Axiata Limited which is a part of Axiata Group Berhad, one of the leading telecommunications groups in Asia in pursuit of a vision to be the Next Generation Digital Champion by 2024.

As the CTEO of Ncell, Adeel is responsible for managing and overseeing Technology strategy, operations, planning, deployment, and enablement of digital technologies for Ncell. Adeel has over 2 decades of experience working in telecommunication industry and has witnessed the telecommunication evolution from voice to data and beyond. His previous stints include various senior leadership roles managing technology strategy, operations, deployments and digital transformations in green and brownfields operations encompassing South Asia and South East Asia Regions.

SESSION 4 TALK 2:
STATUS OF 4G AND 5G DEPLOYMENT, SPECTRUM UTILIZATION AND DEMAND

Mr. SUJIT ANANDA MALLA
Deputy Manager
Nepal Telecom
(Speaker)

SYNOPSYS

- Nepal Telecom (NT) operates 4G LTE Advanced (including VoLTE) with 15 MHz spectrum in 1800 MHz and 10 MHz bandwidth in 800 MHz band. NT also provides 3G, 2G and CDMA cellular services.
- NT's 4G service is available through more than 4100 physical spots and has reached 740 out of 753 local bodies all over Nepal. With features like carrier aggregation, it has theoretical peak download and upload speed of 391.6 Mbps and 93.75 Mbps.
- Small cell deployment for better throughput as well as improving highway coverage, tourist route coverage etc. are also planned.
- NT is performing 5G trial (the talk of the town) in 2600 MHz band with 60 MHz bandwidth. Filed testing and handset onboarding works are underway and the peak download speed of 1 Gbps has been tested.
- Non-standalone 5G has been adopted. NR radio cells are combined with LTE radio cells using dual connectivity to provide radio access. The core network is the existing 4G evolved packet core.
- Wireless networks in Nepal are ushering towards data services and there is a declining trend in voice, so new approach in network design and spectrum management is required for catering the data and voice services with optimal balance.
- As the radio resources are getting congested, short-term solution could be upgradation of channel bandwidth but the long-term solution is to adopt newer technology that are more spectrally efficient.
- Timely allocation of spectrum in coverage and capacity bands is required for the adoption of existing and new technologies.
- User Devices ecosystem is pivotal for faster adoption of any technologies.
- Regional spectrum harmonization is beneficial for managing unwanted cross-border interference.

SPEAKER'S BIO

Mr. Malla graduated as Electronics & Communications Engineer from Mapua Institute of Technology, Manila, Philippines and acquired Master's degree in information system engineering from Himalayan Institute of Science & Technology, Kathmandu.

He has been engaged in Telecommunication Sector since 1998 and is associated to Nepal Telecom for Planning, Implementing, O&M of Satellite Transmission System (Standard A, B, F1 Earth Stations) as well as Cellular Communication Network (2G, 3G & 4G).

He has wide experiences in Planning, Operation & Maintenance, and Project Roll Out of Satellite Transmission System and Cellular Network (2G, 3G & 4G).

SESSION 4 TALK 3:
INTERNATIONAL BEST PRACTICES FOR SPECTRUM MANAGEMENT FOR 4G, 5G AND BEYOND

Mr. ASHISH GARG
Senior Manager Spectrum & Policy
GSMA South Asia
(Speaker)

SYNOPSYS

- By the end of 2022, 5G Services were launched in 91 markets by 237 operators around the world.
- Asia-Pacific Region is expected to lead the next phase of 5G growth and the number of 5G connections will be more than 50% of world's total 5G connection by 2030. But the adoption will be less compared to developed market.
- Even with adoption of 5G, 4G will remain a dominant technology until 2030.
- Bhutan, India and Maldives have rolled out 5G network in South Asia. Total of 15 countries (51 operators) have live 5G network.
- GSMA Intelligence suggests that 5G will overtake 4G by 2028. Contrary to this, less than 10 percent of connections in Nepal will be in 5G in 2030. But the launch of 5G may accelerate the growth because the adoption of 5G is faster than previous technologies.
- Low bands (below 1 GHz) provide deep indoor and rural coverage. These are also considered driver of digital equality, reducing urban and rural divide and delivering affordable connectivity.
- Mid-band spectrum is at the heart of 5G. 3.5 GHz band accounts for the majority of 5G network launches, followed by 2100 MHz and 2600 MHz mid-bands. Contiguous bandwidths of 100 MHz per operator optimal for initial 5G rollout.
- Nepal should release additional blocks of spectrum in existing bands, as well as assign 700 MHz and 2600 MHz immediately. Spectrum caps should be revised too.
- Key enablers of successful 5G/IMT auctions in 2022 in India can be taken as a practical regulatory approach.
- Nepal administration should support the identification of new IMT bands through contribution in APG and WRC meetings.
- Right spectrum at right time, right price and right conditions are key policy recommendations from GSMA.

SPEAKER'S BIO

Mr. Garg is the Senior Manager, Spectrum and Policy, South Asia for the GSMA. Prior to joining the GSMA, he held various positions in the ICT sector including with Reliance, Etisalat, Samsung Networks and industry associations including telecom infrastructure providers. In these roles, he was responsible for delivering projects in spectrum management, digital Infrastructure, broadband penetration, sectoral taxation, etc.

Ashish specializes in the field of spectrum management and has a wealth of experience in managing and resolving complex issues such as spectrum re-farming, harmonization, auctions including active participation with Government for review of NFAP and implementation of WRC decisions at Regional and National levels.

SESSION 4 DISCUSSION:
SPECTRUM FOR IMT: CURRENT STATUS AND FUTURE DEMAND

SUMMARY OF DISCUSSION

- Mr. Sthapit informed that the Authority has already initiated the process to revise the capping in 900 MHz and 2100 MHz bands.
- Mr. Israr said that Ncell Axiata is experiencing congestion in 900 MHz LTE even after radio balancing to push subscribers to 1800 and 2100 MHz bands whenever possible. He reminded that Ncell has only 9.6 MHz in sub-1 GHz band but is operating 2G, 3G and 4G mobile services. Ncell expects more spectrum in sub-1 GHz band in equitable basis, preferably in 900 MHz.
- Mr. Malla pointed out that Nepal Telecom (NT)'s customers' profile is different, is serving users in very remote areas whose handsets mostly support 2G voice only. So, 2G is given high priority by NT and has dedicated total 9.6 MHz of 900 MHz band for 2G service. Another sub-1 GHz band, 800 MHz had poor device ecosystem at the time of rollout, but the ecosystem is improving these days.
- Representatives from both operators emphasized that there are two options to augment the capacity of the network. One approach is to limit the coverage and densification of cells. This process is capex intensive, foreign currency is consumed to import equipment, and the process is time consuming. Another approach, making more spectrum available, enables more capacity with same cells and equipment. So, assigning more spectrum is best way to expand network capacity.
- Mr. Malla mentioned that the mobile network is shifting from voice to data, and the capacity of some bands are wearing out. As a result, more spectrum is needed to serve the customers.
- Mr. Israr estimated that there is roughly 30 percent traffic increase per year, and the operators will require more spectrum in sub-1 GHz as well as mid bands in months to come. More bandwidth in existing bands is favorable to minimize the equipment import and to enable immediate rollout.
- Mr. Garg stated that 4G will continue to be a dominant technology for some time and will remain a significant one even after introduction of 5G. As same frequency band can be used for multiple technologies, he said that the discussion on spectrum requirement for each technology may be irrelevant. He cited that 5 GHz spectrum in mmWave band and 2 GHz spectrum in mid bands are estimated to be required for IMT services by 2030. In low bands, there is no definite figure identified, but more spectrum is always helpful to cater the demand.
- Mr. Israr said that the current statistics, traffic and usage adoption data indicates that significantly more spectrum is needed in 1.5 years. When the operators have to invest to meet the demand, 5G, which has double the spectral efficiency, would be more practical option at that time instead of investing in 4G. But the energy sector should be ready (5G consumes 3 to 3.5 times more power), handset price has to go down and data usage per user should increase as well.

- Mr. Israr claimed that the vendors won't leave behind the late adopters of 5G technology. As every market has its own dynamics, support for existing and new technologies will be available reasonably, without squeezing the juice out of late adopters. He also pointed that the early adopters of 5G paid the higher prices, and the costs are going down now.
- Mr. Malla stated that NT is currently doing 5G trial in 2600 MHz band. He also mentioned that NT will participate in the spectrum auction to acquire bandwidth required for commercial 5G operation.
- Mr. Garg stated that Artificial Intelligence (AI) can be used to better manage spectrum and other resources in telecom network. It can be used to analyze where to shift and allocate more resources. Mr. Israr mentioned that self-optimization network algorithm and mechanism is being used for last three years. He also said that the effectiveness of AI models can be limited by the handset ecosystem as well as the terrain which affect the radio propagation.

CLOSING:
SUMMARY OF THE CONFERENCE AND CLOSING REMARKS

Mr. PURUSHOTTAM KHANAL
Chairman
Nepal Telecommunications Authority

EXCERPTS OF SPEECH

Thank you for the wonderful conference.

On behalf of the Authority, I'd like to thank the Ministry of Communication and Information Technology, Nepal Rastra Bank, Asia-Pacific Telecommunity, GSMA, Axiata Group, Nepal Telecom, Ncell Axiata and other stakeholders for their participation. Of course, immense thanks must go to our experts and moderators who worked so hard to get prepared and made the discussion so lively and insightful.

Here in Nepal, 4G is still in its expansion phase. During 5G policy or strategy formulation, the readiness of vertical sectors, operators' obligations including spectrum and license fees and declining revenue will also be considered. Meanwhile we cannot ignore the benefits as expected to be provided by the 5G and we are not allowed to lose our competitiveness. So, looking back to the last couple of hours, the most complex issue of spectrum management has been dealt with from different perspectives considering national, regional and international practices and our context.

On behalf of NTA I would like to assure you that your incredible inputs, which have also been noted by the reporters, will be considered in the decision-making process. We have made good efforts for the development of the sector, but we still have a long way to go. So now I believe that we are entering a new era with lots of Hope on the horizon. We are very clear that collaboration, interactions and discussions are needed for the better management of the sector and to leverage the benefit of the technologies for the Nepalese people. Therefore, similar discussion will be continued in the future as well.

Finally, I would like to thank the program organizing committee, Authority staffs, hotel management team and technical staff for the support and assistance. Thank you all. Enjoy the dinner. And I would like to request that the international experts visit the beautiful places and don't miss the chance to feel the beauty of Nepal.

Thank you!

Organizing Committee

Mr. Ambar Sthapit,	Director
Mr. Hiranya Prasad Bastakoti,	Deputy Director
Mr. Sandip Adhikari,	Deputy Director
Dr. Pradip Paudyal,	Deputy Director
Mr. Surendra Khatri,	Assistant Director

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