

Terms of Reference

Feasibility Study for Government Network (GovNet) and Myanmar Research and Education Network (mmREN) System Design

Partnership between the Ministry of Transport and Communication and Ministry of Education

1.0 Introduction

The Government of the Republic of the Union of Myanmar is currently implementing the Telecommunication Sector Reform (TSR) project, with support from the World Bank. The project development objectives are to:

- (i) improve the enabling environment for the telecommunications sector and extend coverage in selected remote pilot locations; and
- (ii) establish priority e-Government technological foundations and institutional capacity for government to embark on its public sector reform program

The TSR project takes an integrated approach to the development of the ICT sector in Myanmar. It has four substantive and interrelated components. Creating an enabling policy, regulatory and legal environment will facilitate the establishment of a competitive telecommunications market. This will lead to an expansion of good quality and affordable communications in Myanmar. Institutional reform of the Government-owned incumbent, Myanmar Post and Telecommunications (MPT), will enable appropriate separation of the policy and operational functions of the Government, facilitating the establishment of a level playing field in the sector. The development of a universal service strategy and implementation of pilots will ensure the expansion of services to extremely remote communities. Finally, the establishment of key priority e-Government foundations will allow for common technical horizontals/shared services that government agencies will have access to in order to facilitate the use of ICT for governance reforms and public sector modernization.

1.1 Government Network (GovNet) in Myanmar

For efficient and effective governance, it is necessary that various government ministries, departments and other institutions should be connected among themselves both a central government and regions/state government levels. This will improve the communication between various government organisations and will also avoid duplication of various databases and IT platforms. Government officials should also have access to high speed, sustainable and affordable internet services for efficient public service delivery system. The proposed feasibility study will focus on Local Area Network (LAN) and Wide Area Network (WAN) between central and regions/state government organisations.

1.2 Ministry of Education National Research and Education Network

The Ministry of Education (MoE) is currently implementing the third year of the National Education Strategic Plan (NESP) 2016-21. In the NESP the MOE commits to achieving the following Transformational Shift for higher education by 2021: *Students have equitable access to a world-*

class higher education system, leading to better opportunities for employment and significant contributions to a knowledge-based economy.

To support the achievement of this Transformational Shift the MoE is proposing to partner with the Ministry of Transport and Communication (MoTC) to establish a Myanmar national research and education network (mmREN) that will link all 173 Universities across the country. Myanmar is one of the few countries in the Asia-Pacific Region that has yet to establish a National Research and Education Network (NREN). See Annex 1 for a list of the 21 Asia-Pacific countries with NRENs operating in their education sectors.

In recent years many countries have invested in expanding Internet access and connectivity to University faculty and students through establishing dedicated and centralized organisations called National Research and Education Networks (NRENs). NRENs manage connectivity services and software and systems for members and they support global scientific collaboration through providing access to digital educational resources. NRENs create formal linkages between higher education institutions within a country and with international networks that connect universities, research centers and digital resources in over 120 countries around the world².

mmREN will enable the Government of the Republic of the Union of Myanmar to establish an international-standard, national research and education network that will directly benefit all University faculty and students. Additional beneficiaries will be Myanmar non-governmental organisations and private sector companies that will partner with Universities to collaborate on socio-economic development initiatives and industrial technical research.

mmREN will provide an accessible digital platform for all University faculty and students to collaborate, share information and improve the quality of teaching, learning and research in all Universities. mmREN will enable high speed dedicated connectivity to the education sector while expanding research capability in Myanmar. mmREN will make a direct and substantial contribution to Myanmar's inclusive economic growth in the coming years.

As an example, mmREN may be used to the establishment of a national online library containing electronic copies of all books, journals, research papers, articles, course materials, reference books and other materials in Myanmar and English languages currently in use at all 173 Universities. All students and faculty will have 24 hour access to the online library. Materials listed in the online library will be downloadable so that students and faculty can study these materials offline. The mmREN online library will enable Myanmar to leapfrog the traditional library model and this will dramatically reduce the cost of expanding these facilities for the government.

mmREN will help to establish a 21st Century learning platform that will improve the quality of degree programs benefiting both full-time and distance-learning students. mmREN will establish formal links with important international learning and research networks, such as:

- (i) Asia Pacific Advanced Network (APAN)³;
- (ii) ASEAN Science and Technology Research and Education Network Alliance (ASTRENA)⁴;

² See Foley, M. 2016. The Role and Status of National Research and Education Networks (NRENs) in Africa. World Bank Education, Technology & Innovation: SABER-ICT Technical Paper Series (#05). Washington, DC: The World Bank.

³ APAN refers to both the organisation representing its members, and to the backbone network that connects the research and education networks of its member countries/economies to each other and to other research networks around the world. APAN is a key driver in promoting and facilitating network-enabled research and education activities. These include research collaboration, knowledge discovery and sharing, tele-health and natural disaster mitigation. See <https://apan.net/about>

- (iii) Trans-Eurasia Information Network (TEIN)⁵;
- (iv) GÉANT -- a pan-European data network linking 50 million users in over 10,000 institutions⁶;
- (v) ASEAN Fisheries Education Network (ASEAN-FEN)⁷;
- (vi) ASEAN Teacher Education Network (AsTEN)⁸;
- (vii) South East Asia Research Network (SEARN) -- based at the London School of Hygiene & Tropical Medicine⁹; and,
- (viii) Asia-Pacific Network for Global Change Research (APN)¹⁰ and many others.
- (ix) ASEAN Universities Network (AUN)

mmREN will enable students, faculty, researchers and administrators to access an extensive national online library and to work together locally, nationally and internationally using 21st Century networking and computing facilities. For example:

- Students and staff would be able to bring their own devices and connect anywhere on campus or at different Universities easily and efficiently;
- Education could be supported by e-Learning facilities that would enable faculty to work together to deliver courses based on internationally available content;
- Researchers would be able to collaborate easily with national and international colleagues;
- Faculty and students will be able to access streaming video portals for self-directed learning;
- Video-and web-conferencing facilities will enable research and teaching collaborations and information sharing between Universities in Myanmar and internationally;
- mmREN will provide access to many different software services, data services and high performance computing (grid/cloud) and access to international science gateways.

In Myanmar today there are a number of key conditions in place that will directly support the achievement of establishment and effective use of mmREN. For example, Myanmar has a high adult literacy rate (91%), there are more than 15 million active internet and social media users (28% penetration) and there are more than 50.5 million mobile subscriptions (95% vs population).

⁴ TEIN uses the ICT technologies to increase regional cooperation with Asian countries and to bridge the digital divide of less developed regions. It connects universities and research institutions with high capacity Internet network to increase the exchanges of knowledge among them and make big international research projects real. It connects Asian researchers to each other and with their counterparts in Europe via direct links to Europe's GÉANT network, providing the Asia-Pacific countries with a gateway for global research collaboration.

⁵ ASTRENA is inked to APAN.

⁶ GÉANT interconnects research, education and innovation communities worldwide, with secure, high-capacity networks, enabling collaboration on projects ranging from biological science, to earth observation, to arts and culture.

⁷ ASEAN-FEN consists a team of university-based consortia representing the fisheries and aquaculture oriented institutions within the Southeast Asia region. ASEAN-FEN was established by agreement of its principal University members for the purpose of supporting and enhancing the fisheries and aquaculture sector through education, research, and public outreach in the region. The ASEAN-FEN supports and facilitates activities of educators, scientists, and agencies responding to local, regional, national, and international issues on fisheries and aquaculture.

⁸ AsTEN works to address issues, challenges and concerns relevant to Teacher Education programs and policies in ASEAN region.

⁹ SEARN is a platform to facilitate research collaboration. It provides a forum to support the communication and dissemination of research findings, highlight research areas and a network connecting people in LSHTM and collaborators outside with an interest in South East Asia. SEARN includes all ASEAN countries: Thailand, Vietnam, Laos, Myanmar (Burma), Cambodia, Malaysia, Indonesia, Brunei, Singapore, Timor-Leste (East Timor) and the Philippines.

¹⁰ APN is an intergovernmental network that promotes policy-oriented research and capacity-building activities related to global change in the region. APN receives financial contribution from the governments of the United States, Japan, Republic of Korea and New Zealand, with in-kind contribution from all it 22 member countries.

In addition, Myanmar has 60 technology and computer universities located across the country that are providing technology training and research¹¹.

mmREN will have a major impact on research, teaching and learning that will create a strong, well-educated population and this will have a major positive impact on a Myanmar's economy. mmREN will be an asset for the country and a key component to support national socio-economic development.

1.2.1 ICT situation in Myanmar's education sector

The higher education sector in Myanmar needs quality communication infrastructure to enable universities, institutions of higher learning and research organisations to meet their networking and internet requirements. Reforming and redeveloping the universities and the wider higher education sector of Myanmar is going to be one of the greatest challenges that will require insight, vision, competence, integrity and goodwill, and a tremendous amount of material resources. Thus, the establishment of NREN in Myanmar will play an important role.

ICT infrastructure is very important and a driving force to reduce the digital divide. And it is a prerequisite for e-Government, e-Commerce, e-Education and other fields. Currently, there are 173 universities in Myanmar and their ICT usage is very diverse. Internet connectivity ranges from the lowest (2Mbps) to the highest (350 Mbps). See Annex 2 for a list of universities that are currently using MPT fibre internet.

To overcome the current problems, such as the digital divide gap and the scarcity of educated and talented human resources in Myanmar, the government needs to boost access to high-quality Internet and revolutionize the education system to include greater focus on the skills required in a modern business environment and to have creative ideas. After establishing a NREN in Myanmar, many e-education, telemedicine and similar applications will be initiated.

1.2.2 Existing 2013 Feasibility study to establish mmREN – Myanmar Research and Education Network

A two-year feasibility study for connecting Myanmar to the Trans-Eurasia Information Network (TEIN4)¹² was commissioned by European Commission (EC) at the beginning of 2013¹³. The aim was to explore the feasibility of deploying a regional backbone connecting a dedicated National Research and Education Network (NREN) in Myanmar. The study was carried out by University of Computer Studies, Yangon (UCSY), as a main contractor, and Trans-Eurasian Information Network Corporation Center (TEINCC). The research undertaken before announcement of the findings involved via physical visits, workshops, video conferencing and email discussions with technical experts from neighboring NRENs, the Network Startup Resource Center (NSRC), Ministry of Transport and Communication (MoTC) (as the service provider), as well as faculty members and the universities which will participate in the establishment of Myanmar Research and Education Network (mmREN).

1.2.4 Partnership between MoTC and MoE

¹¹ Evidence of the quality of training provided by some of these Universities can be found in the success of graduate students who placed 6th, out of 163 competing countries, at the 2017 World Robotic Olympics in the USA, see <http://www.moi.gov.mm/moi:eng/?q=news/29/07/2017/id-11192>

¹² Trans-Eurasia Information Network (TEIN4) provides a large-scale research and education data-communications network for the Asia-Pacific region. It connects Asian researchers to each other and with their counterparts in Europe via direct links to Europe's GEANT network, providing the Asia-Pacific countries with a gateway for global research collaboration. Operating at speeds of up to 10 Gbps it currently connects eighteen countries in the Asian and South Asia region.

¹³ The final report from this study is available upon request.

In recent months the Rector's Committee Chairman, National Education Policy Commission, with support from the Director General, Department of Higher Education (DHE), MoE have held a series of consultative meetings with senior officials from the MoTC – Deputy Minister, Director General, Post and Telecommunications Department among others – to discuss the mmREN initiative. At this time there is strong consensus among senior MoTC and MoE to move forward with a comprehensive system design study for the mmREN project.

2.0 Overall Scope of the Terms of Reference and Approach

Based on the findings presented in the above introduction section the MoTC is proposing to undertake a Feasibility Study for GovNet and mmREN with technical support from a team of international and national consultants.

Part 1 of the Terms of Reference will cover a Feasibility Study for GovNet (at Federal and State/Region levels only) and Part 2 the mmREN System Design Study. There are logical and strong synergies for undertaking these two main parts under one assignment. For example, it is clearly cost-effective to document the infrastructure connectivity situation and needs across the country for both GovNet and mmREN at the same time. In addition, documentation of the current infrastructure connectivity within and between government organisations (GovNet) will provide opportunities to systemically link government Ministries, Departments and Agencies (MDAs) to mmREN once it is in place. This will enable mmREN to be used across government as opposed to limiting access just to higher education institutions.

In addition, following documentation of connectivity infrastructure under GovNet at Federal and State/Region levels, and connectivity and related capacities in universities, the government will be able to consider more formal linkages between GovNet and universities, ideally starting in the major towns and cities across the country. GovNet and mmREN may also be used for capacity building of government institutions.

In summary, the systematic documentation of GovNet and mmREN connectivity in government MDAs and HEIs (including Technical, Vocational Education and Training (TVET) institutions, such as Government Technical Institutes (GTIs) and Government Technical High Schools (GTHSs)) will provide an essential foundation for the successful establishment, operation and use of the e-Government system.

2.1 Proposed approach

The MoTC is proposing an approach that involves the following three stages: Stage 1: Formulation of the study methodology and design, piloting and finalisation of data collection tools, submission and approval of an Inception Report; Stage 2: Data collection by universities and government organisations and submission to the expert team for preliminary data analysis; and, Stage 3: Data analysis, report drafting, consultations with key stakeholders (including review of the main data findings), report finalisation and approval. Each stage is further discussed below.

Stage 1: Proposed period – 3 weeks

Under Stage 1 the contracted team will deploy to Naypyitaw to meet with MoTC officials and start their assignment. During Stage 1 the team will review all available data, including secondary literature, associated with GovNet and mmREN. The team will conduct interviews with key stakeholders involved in this project in both NPT and Yangon. MoTC will organise visits for one or more team members to a representative large city (e.g. Yangon) and a smaller town supporting a rural State/Region. Additional visits to towns in other States/Regions can be arranged if needed.

The overall focus of Stage 1 will be on drafting and submission of a detailed Inception Report, which will explain how the team will undertake all aspects of the study, i.e. study methodology, research methods, sampling frame, data analysis approach, detailed workplan, etc. The Inception Report will include tested and final draft data collection tools that will be used during Stage 2. If needed the team will undertake training of identified university data collection supervisors who will coordinate data collection under Stage 2. The MOE will translate all data collection tools listed in the approved Inception Report. At the end of Stage 1 international expert team members will return to their home countries and their work assignment will continue again at Stage 3.

Stage 2: Proposed period – 6 weeks

Under Stage 2, the MoTC with support from the MOE, will coordinate data collection from all universities and identified government organisations/MDAs using the tools listed in the approved Inception Report. Identified MoTC/MOE officers and/or University faculty will coordinate data collection from all identified organisations. Completed data collection forms will be collected, checked through a quality assurance process and translated. At the end of Stage 2 all submitted and checked data will be submitted to the study team for analysis.

Stage 3: Proposed period – 4 weeks

Under Stage 3 the contracted team will deploy to Naypyitaw to work with MoTC officials and other stakeholders to review the main findings from the data collection undertaken during Stage 2. During this period the study team will work on other aspects of the study, such as those outlined in the Scope of Works Part 1 and 2 below. The focus of this stage will be on drafting final reports for GovNet and mmREN.

The proposed timing for Stages 1-3 are outlined below.

Steps	Tentative timing	Comments
Award of contract	1 st week of March	Following publication of the TOR in early February, the tender process and selection should take 5-6 weeks.
Stage 1	March and April	As outlined above
Inception Report presentation and review meeting	4 th week of April	A one-day meeting will be held to consult with all key stakeholders on the draft Inception Report. Following comments from stakeholders the Inception Report will be revised, submitted and approved by the MoTC. Contract Deliverable 1 = 20% contract payment on delivery and approval of the final draft Inception Report.
Stage 2	May/June	As outlined above.
Stage 3	June/July	As outlined above. Report writing will be undertaken as outlined in the detailed Inception Report. Deliverable 2 and 3 = 40% payment on delivery of 1 st draft of two final reports.

		Deliverable 2 and 3 = 40% payment on delivery of final draft of two reports, following the end of the assignment.
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2.1.1 Scope of Work -- Part 1: GovNet

The main objective of the GovNet feasibility study is to establish a comprehensive picture of existing infrastructure connectivity and needs in 41 cities and towns in 15 States/Regions in order to enable establishment of the first phase of an international-standard, nation-wide e-Government system. For a list of the 41 cities and towns see Annex 3.

The consultant team will be required to develop practical data collection tools for government organisations in all 41 cities and towns to provide information on their existing infrastructure connectivity. Based on a rigorous assessment of this data, combined with a review of data collected to date on the connectivity status of 173 Universities across the country, the expert team will recommend cost-effective, sustainable and 21st Century technology relevant solutions to establish a national network called GovNet. GovNet will mainly include telecommunication connectivity infrastructure for both at WAN and LAN levels. In making their recommendations the expert team will be required to identify and share any relevant best-practice lessons from within the Asia region, or internationally, that Myanmar can adapt and build upon to establish GovNet and mmREN.

The expert team will be required to propose business models for the long-term sustainable connectivity of the GovNet network and also for promoting public private partnerships. All of the 41 cities and towns in 15 States/Regions host one or more Universities (see Annex 3). The expert team should explore leveraging existing infrastructure and HR capacities in these Universities, especially in the 60 Computer and Technological Universities, to support, sustain and mainstream GovNet both locally, e.g. through local GovNet “hubs” and nationally. In addition, a prominent CU or TU based in Yangon (or another city) could be selected to host a government-funded, possibly independently governed and managed non-profit organisation that would be established to manage all aspects of both GovNet and mmREN networks, including network/system maintenance, on-demand support for users, network upgrades, etc. This organisation is also outlined in Scope of Work Part 2, No. 2 below.

The expert team will be required to provide a costed investment program (i.e. budget) to upgrade the existing connectivity infrastructure to establish GovNet nationally and in the proposed 41 cities and towns or through a phased approach initially involving a smaller number of cities and towns. Therefore, the final GovNet report will include both a detailed budget to establish, grow and sustain the network and a well-defined road map to establish GovNet over a specified time period.

2.2.2 Scope of Work -- Part 2: mmREN

The main objective of the mmREN System Design Study is to establish a dedicated high-speed connection for research and education sector development and expansion in Myanmar and to promote international R&E collaboration with Asian and European countries. This project will also provide new opportunities for HR development, it will significantly improve education quality in Myanmar that is aligned with international standards, and it will support the growth of national ICT infrastructure and services to support education, research and training.

The mmREN System Design Study Scope of Work will cover the following areas:

1. National broadband connectivity network infrastructure requirements including technical specifications, and detailed budget/costing, to physically connect all 173 Universities under one robust, quality national network;
2. Institutional design for mmREN – possibly as an independent, specialised internet service provider to provide advanced ICT services to 173 Universities, i.e. manage, maintain and grow mmREN;
3. Economic cost-benefit analysis of establishing mmREN;
4. Business models for long-term sustainable connectivity network and also for promoting public private partnerships;
5. Comprehensive system design specifications and budget for a national, integrated E-library system.

Each of these five areas are expanded upon in the following section.

1. Infrastructure and system requirements/specifications and detailed budget

mmREN will be an inter-institutional network connecting academicians, researchers, and scientists nationwide via high-speed backbone network. This network will link all users for data exchange, communication and related collaboration activities. mmREN will be a single network infrastructure connecting all public universities, TVET institutions and Education Colleges, etc.

In recent months the DHE, MoE, with support from experts from selected Universities, have developed a database of all existing broadband network infrastructure and systems in place across the 173 universities. The mmREN System Design Study team will review this information and collect any additional data needed to determine the infrastructure and system requirements and specifications to physically connect all 173 Universities under a dedicated national broadband network. As the MoE already has a very good understanding of these needs and anticipated costs the role of the design team will be to verify this information, expand upon it where needed, and then complete the detailed infrastructure and system requirements and specifications. Upon completion of these requirements and specifications the design team will draft a detailed budget outlining the estimated costs to establish the national broadband network.

2. Institutional design for mmREN

The Rector's Committee and MoE are proposing to establish an independent, specialised internet service provider to provide advanced ICT services to all 173 Universities. mmREN is expected to be a fully government financed organisation under a relevant body under the MoE's organisational structure. mmREN will be responsible for managing, maintaining and growing the national broadband network and links with international NRENs. The MoE will need to consider using different names for the national network and the NREN, which is a common approach taken in other countries. For example, New Zealand's NREN is called REANNZ (Research and Education Advanced Network New Zealand Ltd.) and the national network is called Kiwi Advanced Research and Education Network (KAREN). mmREN will be established based upon

best practice lessons from countries around the world as well as the laws, regulations and institutional structures in the education sector in Myanmar¹⁵.

3. Economic cost-benefit analysis from establishing mmREN

The mmREN System Design Study will include an economic cost-benefit analysis from establishing mmREN. It will be very useful for a strategic cost-benefit analysis assessment to be undertaken to demonstrate the potential economic benefits for Myanmar through having the mmREN in place. This analysis will be used by the Union Ministers from the MoE and MoTC to secure funding support for the mmREN initiative from senior government officials.

For example, a recent independent economic analysis study undertaken in New Zealand found that the Kiwi Advanced Research and Education Network (KAREN) had delivered at least NZ\$150 million in incremental annual returns to New Zealand's economy by 2015, principally through increased GDP growth deriving from accelerated ICT uptake.

4. Business models for long-term sustainable connectivity network and also for promoting public private partnerships

The mmREN System Design Study will include cost-effective business models for long-term sustainable connectivity network and also for promoting public private partnerships. This will also include Indefeasible Right of Use (IRU) business models for GovNet and mmREN.

5. Comprehensive system design specifications and budget for a national, integrated E-library system

In recent years a number of universities in Myanmar have implemented projects with national and international organisations to establish E-libraries. The Rector's Committee and MoE are proposing to build upon these achievements through establishment of an integrated, national E-library system that is accessible to all 173 universities.

The mmREN System Design team will study international best-practice lessons and innovations from around the world in successfully establishing national E-libraries linking a large number of

¹⁵ For example, the Singapore Advanced Research and Education Network (SingAREN) is Singapore's national research and education network (REN). SingAREN serves Singapore's Research and Education community through facilitating efficient exchanges of local traffic and providing international connectivity through peering arrangements with overseas RENs. The networks are dedicated for Research and Education (R&E) activities, such as E-Learning, video-conferences and research data management across international boundaries. SingAREN is a non-profit society that serves the user community with these key objectives: Advocate and champion advanced network applications and technology in Singapore. Be the platform of collective representation of the community of research and education networks (REN) in Singapore. Facilitate cost-competitive adoption of advanced Internet technologies for Singapore RENs. SingAREN maintains close working relationships with the Next Generation Internet community, such as APAN (Asia Pacific Advanced Network), Internet2 and TEIN (Trans-Eurasia Information Network). REANNZ (Research and Education Advanced Network New Zealand Ltd), a Crown-owned not-for-profit company in New Zealand that owns and operates the Kiwi Advanced Research and Education Network (KAREN). The REANNZ Network is a high-capacity, ultra-high-speed national research and education network connecting New Zealand's tertiary institutions, research organisations, libraries, schools and museums, and the rest of the world. REANNZ is a full service internet provider, connecting our members to national and international internet. New Zealand researchers and educators can use KAREN to participate in e-research. KAREN aims: to enable leading-edge e-research; to facilitate universal connectivity throughout the New Zealand and international research and education communities; to encourage broad participation by the research and education sector in New Zealand through accessible technology and reasonable pricing; to connect the research and education sector to the broader innovation community for pre-commercial research and development based collaboration; and, to facilitate participation by multiple telecommunications-sector partners to ensure the greatest possible flexibility for ongoing evolution.

higher education institutions. The study team will undertake a comprehensive review of existing lessons and systems in Myanmar to determine what is working well and why. Then the study team will prepare the comprehensive system design specifications and budget for an integrated, national E-library system.

3.0 Deliverables

- (1) Inception Report
- (2) 1st draft and final draft GovNet Report and Annexes

This report should cover all three levels of connectivity

- 1) International connectivity required for high speed internet;
 - 2) Domestic backbone connectivity using national optical fibre system. wherever possible, spare capacity of optical fiber owned by Myanmar electricity transmission network, Railways and gas pipelines (if any) should be used to minimise the connectivity cost; and,
 - 3) Local area WiFi network.
- (3) 1st draft and final draft mmREN System Design Study Report and Annexes, covering all five areas of the Scope of Work.

Deliverables (Reports/Documents/Trainings)	Number of Copies		Date of Submission	Review Period by the Client from the date of submission
	English	Myanmar		
Inception Report	1	???	xx days from the effectiveness date of Contract	7 days???
1 st draft and final draft GovNet Report and Annexes This report should cover all three levels of connectivity 4) International connectivity required for high speed internet; 5) Domestic backbone connectivity using national optical fibre system. wherever possible, spare capacity of optical fiber owned by Myanmar electricity transmission network, Railways and gas pipelines (if any) should be used to minimise the connectivity cost; and, 6) Local area WiFi network.	1	???	Xxxx weeks after approval date of inception report???	6 weeks???
1 st draft and final draft mmREN System Design Study Report and Annexes, covering all five areas of the Scope of Work.	1	,	Xx weeks after first draft report???	4 weeks???

4.0 Consultants qualifications and experience requirements

Firm's qualifications and experience requirements:

The consultants must have at least 8 years of experience in conducting similar tasks and the consultants should have done similar work in at least 3 developing countries.

The consultants should be able to field a team with financial, economic, technical and legal experience in the telecommunications sector, with at least one member with 10 years and another with 5 years of international experience in similar projects, such as broadband access programs in rural areas and/or within indigenous communities, particularly in the South East Asia region and other developing countries. The consultant team must also have a local resource/ associate in Myanmar to support it with sector related and logistical issues. The consultants should be familiar with World Bank procurement practices and procedures and will be selected based on experience and capacity in carrying out this type of work.

Proposed key staff's qualifications and experience requirements:

1. Team Leader:
 - a. General Education: At least a Master's degree in Engineering or Economics or Law or Finance or Business.
 - b. Adequacy for the Assignment: Demonstrated experience in similar projects. At least 10 years of work experience in the telecommunications sector. Deep knowledge and experience in similar assignments in at least 3 countries. He/She should have a good understanding of World Bank procurement processes and procedures and should be familiar with universal service projects that have been implemented under World Bank projects.
 - c. The team leader should have relevant experience working in the Asian region and should be familiar with Myanmar's telecommunications sector.

2. Telecommunications Expert

- a. General Education: At least a Master's degree in Engineering or Business
- b. Adequacy for the Assignment: Should have at least 10 years of working in the telecommunications sector. Should have deep knowledge of telecommunications technology and should have worked on at least 3 similar projects. Should have a good understanding of technology landscape and the future of broadband.
- c. The telecommunications expert should have relevant experience working in the Asian region.

3. Economics and Financial Expert

- a. General Education: At least a Master's degree in economics, business or finance.
- b. Adequacy for the Assignment: S/he should have at least 10 years of working on similar projects in developing countries. Experience should include working on at least 3 similar projects in developing countries. S/he should also have experience in financial modelling and conducting rural telecommunications demand studies.
- c. The Economics and Financial expert should have relevant experience working in the Asian region.

4. Local Expert:

- a. Have at least 5 years of experience in the ICT sector and should be made available to PTD throughout the period of the assignment to assist in different activities.
- b. He/she should have at least a Bachelor's degree and good English spoken and writing.

Expert	Months
Team leader	xx
Telecommunication Expert	xx
Economics and Financial Expert	xx
Local expert	xx
TOTAL	xx

Since this is just an indicative value, the Consultants shall estimate and propose the number of key professional staff months, non-key professional staff and support staff months that are necessary for the assignment to fulfil all the requirements for the execution of the Services.

Annex 1: List of Asia-Pacific National Research and Education Networks (NRENs)

Name of Country	Name of National Research and Education Network (NREN)
1. Australia	<u>AARNet</u>
2. Bangladesh	BdREN
3. Cambodia	CamREN
4. China	CERNET
5. Hong Kong	HARNET
6. India	NKN
7. Indonesia	INHERENT/ITB
8. Japan	JGN2plus/NICT
9. Japan	MAFFIN
10. Japan	SINET3/NII
11. Korea	KOREN/NIA
12. Laos	<u>LERNET</u>
13. Malaysia	MYREN
14. Nepal	NREN
15. New Zealand	<u>REANNZ</u>
16. Pakistan	PERN2
17. Philippines	PREGINET
18. Singapore	SingAREN
19. Sri Lanka	LEARN
20. Thailand	ThaiREN
21. Vietnam	VINAREN

Annex 2: List of for a list of universities that are currently using MPT fibre internet

No.	Name	Township	Region	Commercial Bandwidth	CSR Bandwidth	Bandwidth promotion	Total Bandwidth	Account Code
1	East Yangon University Thanlyin	Thanlyin	Yangon	20M			20M	IK4-EYU-002 / OINT-006088-YGN-BB
2	Higher Education Department	Kamaryut	Yangon	2 M	2M	1 M	5 M	IK5-HED-001
3	Higher Education Department	Kamaryut	Yangon	10 M	2M	1 M	13 M	IK5-HED-002
4	International Theravada Buddhist, Missionary University	Mayangone	Yangon	4M			4M	IK5-ITB-005
5	Myanmar Maritime University	Thanlyin	Yangon	10M			10M	IK5 MMU 059 OINT-003677-YGN-BB
6	National University of Arts, Ministry of Religious Affairs	Dagon Myothit (South)	Yangon	4M			4M	OINT-007274-YGN-BB(FIC-2)-2yr
7	State Pariyatti Sasana University	Mayangone	Yangon	2M			2M	OINT-003775-YGN-BB
8	State Pariyatti Sasana University	Mayangone	Yangon	2M			2M	OINT-006359-YGN-BB(FIC-2)-2yr
9	Technological University (Thanlyin)	Thanlyin	Yangon	50M			50M	OINT-00345-D07-BB
10	Technological University (Yangon)	Insein	Yangon	100M	10M	5M	115M	IK5-FBR-009
11	Technology University (Hmawbi)	Hmawbi	Yangon	100M			100M	IK5-MST-034
12	Universities' Central Library	Kamaryut	Yangon	10M			10M	OINT-006842-YGN-BB(FIC-2)-2yr
13	University of Computer Science (ICTTI)	Hlaing	Yangon	50M	4M	10 M	64 M	IK4-MOS-002
14	University of Computer Studies (Yangon)	Shwepyithar	Yangon	100M			100M	IK4-YCU-001
15	University of Informaion Technology	Hlaing	Yangon	100M			100M	OINT-006342-YGN-BB
16	University of Dagon	Dagon Myothit(East)	Yangon	50M			50M	IK5-DGU-006
17	University of Dental Medicine (Yangon)	Thingangyun	Yangon	20M			20M	OINT-005651-YGN-BB
18	University of Distance Education	Kamaryut	Yangon	4M	26M	2 M	32 M	IK5-FBR-011
19	University of Distance Education	Kamaryut	Yangon	4M			4M	OINT-007356-YGN-BB
20	University of Medicine 1 (Yangon)	Kamaryut	Yangon	10M			10M	OINT-006121-YGN-BB
21	University of Medicine 1 (Yangon)	Lanmadaw	Yangon	20M	2M	5M	27M	IK5-UOM-002
22	University of Medicine 2 (Yangon)	North Okkalapa	Yangon	10M			10M	OINT-01354-D07-BB IK5 UOM 003
23	University of Nursing	Lanmadaw	Yangon	8M			8M	IES-UON-020 / OINT-003169-YGN-BB
24	University of Pharmacy Yangon	North Okkalapa	Yangon	4M			4M	OINT-003927-YGN-BB
25	University of Public Health	Latha	Yangon	10M			10M	OINT-01341-D07-BB IES UPH 028
26	University of Yangon	Kamaryut	Yangon	350M			350M	IK5-UOY-001,
27	University of Yangon	Kamaryut	Yangon	4M			4M	IK5-MJL-018
28	University of Yangon	Kamaryut	Yangon	20M			20M	OINT-006472-YGN-BB
29	University of Yangon	Kamaryut	Yangon	20M			20M	OINT-006473-YGN-BB(FIC-2)-2yr
30	West Yangon Technological University	Hlaingtharyar	Yangon	10M			10M	IK5-WYT-002
31	West Yangon University	Htantabin	Yangon	10M			10M	IK5-WYU-001
32	Yangon University of Economic	Hlaing	Yangon	4M	16M	2 M	22 M	IK5-YUE-003
33	Yangon University of Economic	Kamaryut	Yangon	4M	16M	2 M	22 M	IK5-YUE-002
34	Yangon University of Economic (Ywar Thar Gyi)	Dagon Myothit(South)	Yangon	4 M	6M		10 M	OINT-003942-YGN-BB / IK5-YUE-004

No.	Name	Township	Region	Commercial Bandwidth	CSR Bandwidth	Bandwidth promotion	Total Bandwidth	Account Code
35	Yangon University of Education	Kamaryut	Yangon	10M			10M	IK5-YUE-006
36	Yangon University of Foreign	Kamaryut	Yangon	6M			6M	IK5-UFL-004
37	Mandalay Distance University	Chanayethazan	Mandalay	4M			4M	OINT-005986-MDY-BB(FIC-2)
38	Meiktila Institute of Economics	Meiktila	Mandalay	4 M			4 M	IK5-PMHLU0145MDY
39	Myanmar Aerospace Engineering University	Meikhtila	Mandalay	10M			10M	OINT-005803-MDY-BB
40	Technological University (Kyaukse)	Kyaukse	Mandalay	2M			2M	IK5-TUK-033MDY
41	Technological University (Mandalay)	Mandalay	Mandalay	50M			50M	IK5-FBR-004
42	Technological University (Mandalay)	Patheingyi	Mandalay	20M			20M	OINT-180107-MDY-BB
43	Technological University (Meiktila)	Meiktila	Mandalay	10M			10M	IK5-TU0188MDY
44	Technology University (Pyinoolwin)	Pyin Oo Lwin	Mandalay	20M			20M	IK4-UOT-001
45	University of Computer Studies (Kyaukse)	Kyaukse	Mandalay	10M			10M	IK4-UCS-002
46	University Of Computer Studies (Meiktilar)	Meiktila	Mandalay	4M			4M	IK5-CUM-011
47	University of Computer Studies (Patheingyi)	Patheingyi	Mandalay	50M			50M	IK5-FBR-003
48	University of Foreign Languages (Mandalay)	Mandalay	Mandalay	4M	6M		10 M	IK5-MUF-020
49	University of Kyaukse	Kyaukse	Mandalay	4M			4M	IK5-KSU-003
50	University of Mandalay	Mahar Aung Myae	Mandalay	10M	10M		20M	IK5-MDU-012
51	University of Mandalay	Mahar Aung Myae	Mandalay	4M			4M	IK4-MDU-007
52	University of Mandalay	Aungmyaythazan	Mandalay	4M			4M	IK5-MUF-020
53	University of Medical Technology (Patheingyi)	Patheingyi	Mandalay	4M			4M	OINT-180047-MDY-BB
54	University of Medicine (Mandalay)	Chanayethazan	Mandalay	10M	10M		20 M	IK5-UOM-006
55	University of Meiktila	Meiktila	Mandalay	10 M	4M		14M	
56	University of Nursing	Chanmyathazi	Mandalay	4M			4M	OINT-005650-MDY-BB
57	University of Tradional Medicine (Mandalay)	Aungmyaythazan	Mandalay	2M			2M	OINT-006278-MDY-BB
58	Yatanarpon University (Mandalay)	Amarapura	Mandalay	20M			20M	IK5-YUM-003
59	University of Agriculture (Research)	Pyinmana	Naypyitaw	2M			2M	OINT-006117-NPT-BB
60	University of Agriculture	Pyinmana	Naypyitaw	2M	2	18	20M	IK5-UA0084NPW
61	University of Forestry	Pyinmana	Naypyitaw	2M	2	18	20M	IK5-UF0085NPW
62	University of Veterianary Science	Yezin	Naypyitaw	2M	2	18	20M	IK5-UVS0127NPW
63	Technological University (Hinthada)	Hinthada	Ayeyarwady	10M			10M	OINT-006216-ADY-BB
64	University of Computer Studies (Pathein)	Pathein	Ayeyarwady	4M			4M	IK5 uvvy(c) 0017 AYY
65	University of Hinthada (Rector)	Hinthada	Ayeyarwady	8M			8M	IK5 HTU 002 AYY
66	University of Maubin	Maubin	Ayeyarwady	6M			6M	OINT-006840-ADY-BB
67	University of Pathein (Rector)	Pathein	Ayeyarwady	4M			4M	IK5 PTU 0010 AYY
68	Technological University (Taungoo)	Taungoo	Bago (East)	4M			4M	IK5-TTU001BGE

No.	Name	Township	Region	Commercial Bandwidth	CSR Bandwidth	Bandwidth promotion	Total Bandwidth	Account Code
69	Technology University (Pyay)	Pyay	Bago (West)	2M			2M	MOINT-00943
70	University of Bago	Bago	Bago (East)	4M			4M	No Account Code
71	University of Computer Studies (Pyay)	Pyay	Bago (West)	10M			10M	MOINT-00957
72	University of Computer Studies (Taungoo)	Taungoo	Bago (East)	10M			10M	IKS-TCU002BGE
73	University of Pyay	Pyay	Bago (West)	4M			4M	MOINT-00944
74	University of Taungoo (Rector)	Taungoo	Bago (East)	10M			10M	IKS-UT-006-BGE(TGO)
75	University of Bamaw	Bhamo	Kachin	4M			4M	OINT-007077-KAC-BB / IK5 BMU 001
76	University of Computer Studies (Bamaw)	Bamaw	Kachin	6M			6M	OINT-005816-KAC-BB
77	University of Computer Studies (Myitkyina), Principal	Myitkyina	Kachin	10M			10M	OINT-007078-KAC-BB / IK5-MCU 001 KC
79	University of Myitkyina	Myitkyina	Kachin	4M			4M	OINT-007076-KAC-BB / IK5 MNU 038
80	University of Computer Studies (Loikaw)	Loikaw	Kayah	4M			4M	No Account Code
81	University of HpaAn	Hpa-an	Kayin	1M	4M		5 M	IKS-HAU-003
82	University of Loikaw	Loikaw	Kayah	4M			4M	IK5-PLU 0144KYH
83	Technology University (Magway)	Magway	Magway	10M			10M	IKS-TU-011MGW
84	University of Community Health	Magway	Magway	2M			2M	No Account Code
85	University of Computer Studies (Magway)	Magway	Magway	10M			10M	IKS-CUM-009
86	University of Computer Studies (Pakokku)	Pakokku	Magway	8M			8M	OINT-006365-MAG-BB
87	University of Magway	Magway	Magway	10M			10M	IKS-PMU-0146-MGY
88	University of Medicine (Magway)	Magway	Magway	20M			20M	IKS-PUM-0185-MGY
89	University of Pakokku	Pakokku	Magway	8M			8M	IK4-PKU-001
90	Technology University (Mawlamyine)	Mawlamyine	Mon	10M			10M	IKS-UTM-001
91	University Of Computer Studies (Thaton)	Thaton	Mon	10M			10M	IKS-UCT-002
92	University of Mawlamyine	Mawlamyine	Mon	10M			10M	IKS-MLU-033
93	Monywa University of Economics	Monywa	Sagaing	4M			4M	IKS-MUE-024
94	Sagaing University of Education	Sagaing	Sagaing	4M			4M	IKS-SUE-003
95	Thi Ta Gu International Buddhist University	Sagaing	Sagaing	2M			2M	IES-TTG-002
96	University for the Development of National Races	Sagaing	Sagaing	10M			10M	IKS-NRU-001
97	University Of Computer Studies (Monywa)	Monywa	Sagaing	10M			10M	IKS-CPU-013
98	University of Monywa	Monywa	Sagaing	4M			4M	IKS-UOM-005
99	University of Sagaing	Sagaing	Sagaing	4M			4M	IKS-SGU-002
100	University of Shwebo	Shwebo	Sagaing	8M			8M	IK4-SBU-001
101	Medical University (Taunggyi)	Taunggyi	Shan (South)	8M			8M	MOINT-00965
102	Technological University (Taunggyi)	Taunggyi	Shan (South)	8M			8M	OINT-006261-SHS-BB
103	University Of Computer Studies (Keng Tung)	Kengtung	Shan (East)	6M			6M	No Account Code

No.	Name	Township	Region	Commercial Bandwidth	CSR Bandwidth	Bandwidth promotion	Total Bandwidth	Account Code
104	University Of Computer Studies (Lashio)	Lashio	Shan (North)	8M			8M	OINT-006034-SHN-BB
105	University Of Computer Studies (Taunggyi)	Taunggyi	Shan (South)	4M			4M	IK5-CUT-010
106	University of Kengtung	Kengtung	Shan (East)	4M			4M	IK5-PKTU0147SHE(East)
107	University of Lashio	Lashio	Shan (North)	1M	3		4M	OINT-006035-SHN-BB
108	University of Pinlon	Loilen	Shan (South)	4M			4M	MOINT-00960
109	University of Taunggyi	Taunggyi	Shan (South)	4M			4M	IK4-RTU-001
110	University Of Computer Studies (Myeik)	Myeik	Tanintharyi	10M			10M	OINT-005837-TAI-BB/IK5-UOC-002-TNY
111	University Of Computer Studies (Dawei)	Dawei	Tanintharyi	10M			10M	IK5-UOC-001-TNTY
112	University of Dawei	Dawei	Tanintharyi	10M			10M	IK5-DWU-012
113	University of Myeik	Myeik	Tanintharyi	10M	4		14M	IK5-MSU-035
114	University of Technical Institute	Dawei	Tanintharyi	10M			10M	OINT-006213-TAI-BB(FIC-2)-3yr

Colleges List

116	National Management College	Botahatung	Yangon	10M			10M	IK5-NMC-008
117	Cooperative College	Patheingyi	Mandalay	4 M	4M		8 M	IK4-CPC-008
118	Myingyan Degree College	Mingyan	Mandalay	10M	4M		14 M	IK4-MDC-021
119	Mandalar Degree College	Amarapura	Mandalay	10M			10M	IK5-MDC-014
120	Lacquerware Technology College	NyaungU	Mandalay	2M			2M	OINT-006684-MDY-BB
121	Co-operative College	Patheingyi	Mandalay	4M			4M	IK4-CPC-008
122	Government Technological College (Myingyan)	Myingyan	Mandalay	4M			4M	OINT-006336-MDY-BB
123	Moe Hnyin University/ Degree College	Mohnyin	Kachin	4M			4M	IK5-PMHU0152KCN
124	Yenangyaung Degree College	Yenangyaung	Magway	4M			4M	IK5-YDC-009

Government Technical Institute

125	Government Technical Institue (Magway)	Magway	Magway	4M			4M	OINT-006328-MAG-BB(FIC-2)
126	Government Technical Institue (Yenangyaung)	Yenangyaung	Magway	4M			4M	OINT-006743-MAG-BB
127	Government Technical Institute (Kanbalu)	Kanbalu	Sagaing	4M			4M	OINT-006171-SAG-BB(FIC-2)-2yr
128	Government Technical Institute (Shwe Pyi Thar)	Shwe Pyi Thar	Yangon	4M			4M	OINT-005523-YGN-BB
129	Government Technical Institute (Insein)	Insein	Yangon	4M			4M	OINT-006621-YGN-BB
130	Government Technical Institute (Mandalay)	Chanayetharzan	Mandalay	4M			4M	OINT-005542-MDY-BB

Annex 3: List of Townships, Towns and cities

Townships – Towns & Cities (No. of Universities)	State/Region (No. of Universities)
1. Yangon(28)	Yangon (28)
2. Mandalay (31)	Mandalay (31)
3. Meiktila (4)	
4. Kyaukse (2)	
5. Yamethinn	
6. Bagan	
7. Myingyan	
8. Kalay (3)	Sagaing,13
9. Monywa(5)	
10. Sagaing (4)	
11. Shwebo,(1)	
12. Magway (6)	Magway ,(11)
13. Pakokku(4)	
14. Yenanchaung	
15. Dawei,(4)	Taninthayi,(7)
16. Myeik (3)	
17. Bago(1)	Bago(9)
18. Taungoo(4)	
19. Pyay (4)	
20. Mawlamyine (3)	Mon (4)
21. Thahton(1)	
22. Sittway (3)	Rakhine(5)
23. Taung Goke	
24. Kyaukphyu (1)	
25. Myitkyina(4)	Kachin (9)
26. Mohnyin(1)	
27. Banmaw (3)	
28. Katha (1)	
29. Loikaw(4)	Kayar (4)
30. Hpa-An(4)	Kayin(4)
31. Taunggyi (5)	Shan (15)
32. Panglong (3)	
33. Kyaing Tong (3)	
34. Lashio(4)	
35. Pathein (4)	Ayeyarwaddy (11)
36. Myaungmya	
37. Hinthada (3)	
38. Maubin(3)	
39. Bogalay (1)	
40. Haka (2)	Chin (2)
41. Nyapyitaw (3)	Nyapyitaw (3)

Number of Universities, Degree Colleges and Colleges under respective Ministries (2013)

Sr	Ministry	University	Degree College & College	Total
1	Eudcation	41	27	68
2	Health	15		15
3	Science and Technology	58	3	61
4	Defence	5	1	6
5	Culture	2		2
6	Environmental Conservation and	1		1
7	Agriculture and Irrigation	1		1
8	Livestock and Fisheries	1		1
9	Co-operatives	2	3	5
10	Religious Affairs	3		3
11	Border Affairs	1	2	3
12	Transport	1	1	2
	Grand Total	131	37	168