FUTURE COMMUNICATIONS TRANSLATION LAB @ SIT
Request for Proposals (RFP)

	FUTURE COMMUNICATIONS TRANSLATION LAB @ SIT (FCTLab @ SIT) SETUP Open Call for Proposals on 20 Jan 2022
RFP Number	FCTLab @ SIT RFP 1
Open Date for Proposals	**20 Jan 2022**
Closing Date for Proposals	Soft copy of the proposal to be submitted. The grant call will close on 28 Feb 2022, or when the funds are exhausted. The submitted proposals will be evaluated on a first-come-first-evaluate (or earlier if the funding is committed) basis. Softcopy submission Proposals and all accompanying attachments **MUST** be submitted in **PDF format to** FCTranslab@ SingaporeTech.edu.sg. Please refer to Annex A for application template
Other Instructions	For more information, please refer to: https://www.singaporetech.edu.sg/research/grant-call-fctlab If you have any queries, please send them to the FCTLab @ SIT Programme Office at FCTranslab@SingaporeTech.edu.sg.

REQUEST FOR PROPOSALS: FCTLab @ SIT SETUP

Background

1. The Future Communications Translation Lab @ SIT situated at Singapore Institute of Technology (FCTLab @ SIT) will help to foster collaboration and capability development for 5G applications and services, helping to facilitate innovation, translation, and acceleration of the 5G ecosystem growth.

2. The grant call aims to equip the FCTLab @ SIT with the required infrastructure and equipment to encourage collaborations with Research Institutes (RIs), Institutes of Higher Learning (IHLs), technology companies and other government agencies to advance applied research and development (Applied R&D) in industry-relevant areas, which would enhance the adoption, exploitation and translational efforts of 5G technology in Singapore.

3. The key objectives of the FCTLab @ SIT are:

   a. Developing and trialling new and innovative 5G solutions and products;
   b. Driving demand-led research/ translate industry applications;
   c. Fostering experimentation and innovative mindset;
   d. Testing and validating applications and solutions;
   e. Acquiring knowledge and technology insights from open standard 5G technologies from various technology partners; and
   f. Developing technical capabilities in 5G technologies.

Scope of Grant Call

4. The FCTLab @ SIT Programme Office invites submission of proposals that meet the objectives of the grant call and shall adhere to the following requirements:
   a. Host Organisations (i.e. applicants) shall propose the 5G standalone systems that will serve as an open platform for carrying out simultaneous 5G innovation and validating of use cases which can include but not limited to technology areas in 5G Systems, Network Management & Optimisation, Cybersecurity and Communications. Please refer to Annex B for details on technical requirements;
   b. Host Organisations shall identify and secure technology industry partners to leverage the 5G standalone systems and develop use cases, products and services to build up the 5G ecosystem;
   c. Training of engineers to operate and manage the 5G standalone systems. The proposed 5G standalone systems should also be supported by a robust operation and maintenance plan during the project qualifying period;
   d. Proposals should propose an outreach programme for the 5G ecosystem to share on 5G technologies, use cases and technical learnings gathered from this project, as well as have discussions and activities on the same; and
   e. Host Organisations shall remain the owners of their 5G standalone systems at all times. However, they must be prepared for their 5G standalone systems to remain at SIT's current Dover campus until 31 March 2025, and thereafter, to

relocate the 5G standalone systems to SIT's new campus in Punggol. Proposals should include quotations for the following tranches:

Awarded in this grant call

(i) set-up/installation, operation and maintenance of the 5G standalone systems at SIT's current Dover campus, from the award of the RFP until 30 September 2024 (i.e. project completion by 30 Sep 2024);

Not awarded and to be discussed later

(ii) operation and maintenance of the 5G standalone systems at SIT's current Dover campus from 1 October 2024 until 31 March 2025;

(iii) relocation and set-up/installation of the 5G standalone systems to SIT's new campus in Punggol after 31 March 2025; and

(iv) operation and maintenance of the 5G standalone systems on a yearly basis for another five (5) years upon completion of installation at SIT's new campus in Punggol.

f. If the Host Organisation is the original equipment manufacturer of the hardware and software for the 5G standalone systems, the Host Organisation shall produce the necessary supporting document(s) to show that its claims in respect of the hardware and software are based on prevailing market rates.

Eligibility, Funding Support and Other Important Information

5. In line with 5G's focus on near-to-market and industry-focused innovations, this grant call is open to locally registered companies (i.e. majority local shareholder equity) with businesses in 5G and/or related areas.

6. Host Organisations should be prepared to work with Singapore's research community, or form consortia comprising Institute of Higher Learnings (IHLs) and Research Institutes (RIs) such as Singapore Institute of Technology, in developing their proposals or developing use cases, products and services with industry partners. IHLs and RIs are not eligible for funding. The terms of such collaborations, including rights, title to and interest in any intellectual property created, shall be separately agreed upon between the Host Organisation and the respective IHL or RI.

7. Proposals by Host Organisations shall not be funded or be currently considered for funding by other agencies.

8. Funding awarded to Host Organisations cannot be used to support overseas projects and on-going research activities. All funding awarded must be used to carry out the **project activities in Singapore (i.e.** for the required infrastructure and equipment to set up/install, operate and maintain the 5G standalone systems at FCTLab@SIT), and is strictly not to be used for normal business operations.

9. Budget for the entire project shall be broken down into the following broad categories, mainly: (a) manpower; (b) equipment and (c) others. Please refer to Annex C for the list of fundable and non-fundable costs when proposing the project budget.

10. FCTlab @ SIT Programme Grant will co-fund up to 50% of the qualifying costs. The Host Organisation shall bear the rest of the costs and also shall contribute in-kind services. In-kind services can include manpower, materials and other services. In-kind contributions demonstrate the participation and commitment of the Host Organisations and their collaborators to the project.

11. The project duration, including completion of the final report and all miscellaneous project activities, shall not exceed **three (3) years (i.e. project completion by 30 Sep 2024)**. The proposed project schedule must be realistic, allowing sufficient time for the preparation of final report and for the review of project results.

12. Proposals will be evaluated against the following criteria:

a. Clear demonstration of the proposed 5G infrastructure and equipment to be deployed, and how the deployed systems can support technology industry partners to develop use cases, products and services;

b. Significant ecosystem development that benefits Singapore in terms of capabilities and manpower development, as well as adoption of 5G applications/ solutions;

c. Strong and clear demonstration of outreach avenues to share technical learnings and use cases that will benefit the 5G ecosystem;

d. Excellent execution by an experienced project team with a good track record and whose members have the relevant and complementary expertise.

e. Reasonableness of the proposed budget.

f. Level of support (eg software upgrade, advanced technical support) and maintenance of 5G infrastructure and equipment deployed in the project.

Application and Evaluation Process

13. This Request for Proposal (RFP) is a one stage process.

Submission

14. The Host Organisation should fill up the proposal's details in accordance with the stipulated application template. The proposal and the supporting documents **MUST** be sent in PDF format to FCTranslab@SingaporeTech.edu.sg**.**

15. Full Proposal must be endorsed by the Chief Executive Officer / Chief Technology Officer (or equivalent) of the Host Organisation.

Result

16. Host Organisations with successful Full Proposals which are accepted and approved would be notified. Awarded projects will commence thereafter.

End

Annex A

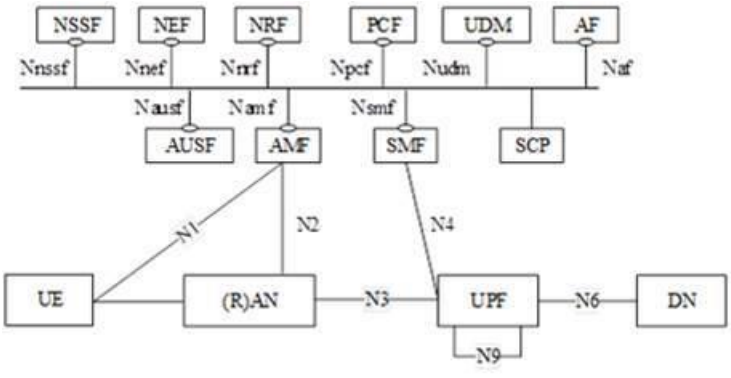
Application Template

Please see attachment.

Annex B

Technical Requirements

A. Infrastructure requirements		
A.1	Base requirements	○ End to end 5G connectivity infrastructure, with the following supported features: • full development environment and necessary tools for applications development. • provision for UE hardware and software. • wide-range of UEs, including non-proprietary UE inserted by user(1). ○ Support end-to-end network slicing including • core network slicing • RAN slicing • Multiple, configurable network slices with different slice supporting similar or different services types (SST) beyond eMBB • Multiple QoS Flows per slice. ○ System shall provide configurable API (1) Non-proprietary means that we can use equipment made by other OEM, while proprietary means that we can only use UE manufactured by the Host Organisation. We do not want the 5G infra to be restricted to only equipment produced by Host Organisation. So with this statement, Host Organisation should provide UE produced by them (or model and made information of UEs); in addition, they should also recommend UE of other brands that are compatible with the 5G infra. To include non-proprietary UE also means that Host Organisation will need to make known the user interface (UI) and other information required to use the 5G signal.
A.2	5G Coverage	○ 99.9% indoor coverage for FCTLab (approximately 500sqm). ○ 120m outdoor coverage from FCTLab and within the SIT@Dover campus, for applications such as autonomous vehicle, robots, drones, etc. Please refer to page A5 for site map of coverage. ○ The network coverage is preferred to be achieved with multiple cells so as to support related performance testing including mobility and handover, uses cases for robotics, AV, drones, etc ○ 4 or more than 4 unique cells (for localization experiments) ○ The topology of cells proposed should take into considerations of *coverage, transmit power, localization performance, interference.* ○ Support flexible configuration of commissioning/de-commissioning of mobile gNB, e.g., gNB mounted vehicles/cell on wheels(COW), gNB mounted on a UAV/drone.
A.3	Frequency Spectrum for Use	○ Operate within the n78 band, with selectable channel bandwidth (minimally 50 MHz and 100 MHz). ○ Support (benchmarked to 100 MHz channel bandwidth)

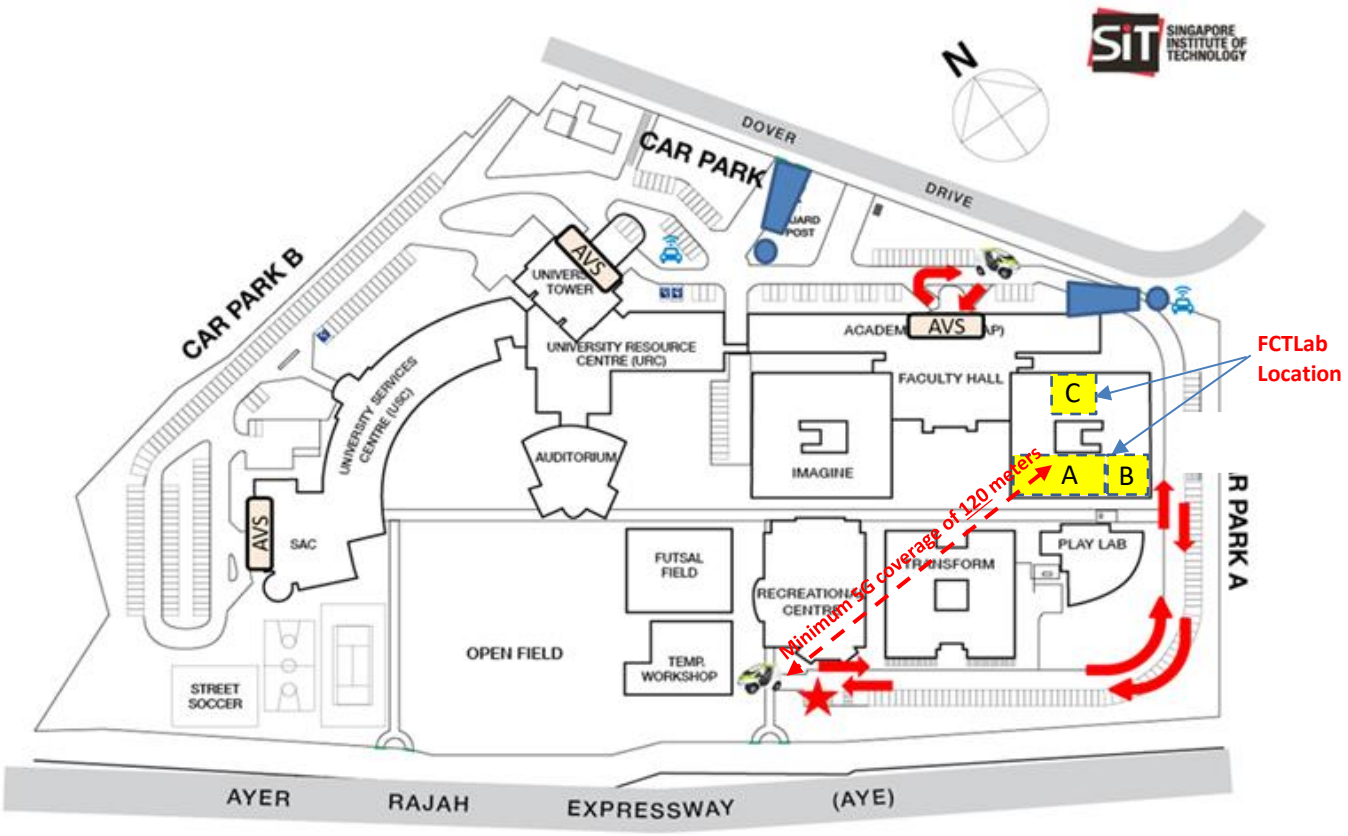
		• Typical peak downlink data rate: 1Gbps • Typical peak uplink data rate: 100 Mbps • Typical round-trip latency : 10ms or less • Configurable frame configuration (eg. 4:1 DDDSU, 7:3 DDDDDDSUUU) • Subcarrier spacing of 15KHz, 30 KHz, 60KHz, and optional 120 KHz ○ Support NR-U Sub-6GHz, or Sub-7GHz ○ To provide UE device(s) to demonstrate the infrastructure capabilities. Preferred to have open source software running on the UE device for benchmarking. Alternatively, Host Organisation should provide list of compatible UE models that have been tested with the 5G system.
A.4	Upgrades and bug fixes	○ Timely upgrades as and when bug fixes / patches, new capabilities (including implementation of capabilities in 3GPP Release 16, Release 17) are made available. ○ System should be upgradable to FR2.
B. Technical Information Required (this can be current capabilities, on roadmap, etc.), or clearly state that they will not be included (including considerations of why they are not included).		
B.1	○ Compliance info to 3GPP specifications (Release 15, 16, 17). ○ Supported and verified use cases such as C-V2X, Industrial IoT, Augmented Reality/Virtual Reality/Extended Reality, UAV (remote control, positioning, data analysis), wearables, emergency services (calls, medical equipment), first responder. Use cases supportable but not fully validated should be included in the shared information pack. ○ System capabilities such as URLLC, NR-based access to unlicensed spectrum (NR-U), eCAPIF, bandwidth parts, etc.	
B.2	Deployment Architecture (e.g. Option 2 Standalone for sub6GHz/mmWave, supported spectrum ranges in FR1/FR2, channel bandwidth, etc.)	
B.3	Core network functions provided (or not) minimally including information on the following:  System is able to provide log of N1, N2, N3, N4, N6, N9.	
B.4	Core system capabilities and architecture (e.g. capabilities of underlying networking/compute/storage/virtualisation to support core service-based architecture, management and orchestration capabilities, features to manage and re-configure Core NFs.	
B.5	APIs for third party access (e.g. capabilities exposed through NEF, NWDAF).	

B.6	○ Multi-access Edge Computing (MEC) capabilities (including lifecycle management of third party applications hosted by MEC). ○ Development environment documentation of MEC
B.7	○ RAN Architecture (e.g. "traditional" RAN, Distributed-RAN, O-RAN Alliance specifications-based) and RF / Antenna capabilities (e.g. m/MIMO, beamforming, subcarrier spacings supported, frame/slot configurations supported). ○ RAN/O-RAN interface and RAN API, and procedures to obtain log files of RAN/O-RAN interfaces. ○ Documentation on procedures to configure the RAN system setups, e.g., subcarrier spacing reconfiguration, resource allocation manipulation for different users/RAN slices, etc ○ Documentation on accessing and saving the RAN KPI logs, interface logs
B.8	Operations, Administration and Management capabilities (OAM) such as performance monitoring, configuration management, fault management, etc.
B.9	Cybersecurity related capabilities (e.g. system hardening, IDS).
B.10	Network slicing and QoS support (e.g. RAN slicing capabilities and max number of slices per gNB, access/core slicing capabilities, 5QIs supported, SSTs supported) as well as network slice management capabilities (e.g. GUI for end-to-end network slice template creation, slice lifecycle management).
B.11	Mobility functionalities (e.g. for handover testing).
B.12	○ Overall expected network capacity and performance metrics (e.g. data rates, user and control plane latencies, user concurrency). ○ Bandwidth monitoring through Netflow/sFlow.
B.13	uSIM provisioning capabilities.
B.14	Other capabilities (e.g. network analytics tools).
C. Capabilities. **Note: As the testbed aims to evolve as the capabilities of 5G are made available, proposals should include plans to deploy capabilities that are not currently generally available / have limited availability (e.g. in 12 months, 18 months, 24 months etc). There should be *at least 4* such capabilities proposed, and can include areas such as (other relevant areas are also possible):**	
C.1	Domain related capabilities referenced in 3GPP specs, e.g. 5G NR V2X-sidelink, GBR 5QI 3, Industrial IOT, Augmented Reality, UAV (remote control, positioning, data analysis), robotics, distributed renewable energy monitoring and management**.**
C.2	Third party integration capabilities such as NEF.
C.3	URLLC related capabilities such as configured grants, mini-slots, retransmission schemes to increase link reliability, improved control channel monitoring, etc.
C.4	Radio enhancements such as Bandwidth Parts.
C.5	Non-connectivity capabilities such as 5G Positioning - we strongly encourage applicant to develop positioning/localisation capability as part of the proposal. The **5G localization** capabilities should support the following two main technical goals: 1. Localization of UE for end-user, for use cases including robotics, navigation, transportation, and augmented reality. 2. Localization of UE for the authority, for use cases such as first responder and emergency call services where the location of the caller and first responder is needed to by the authority to provide quick reaction. The following capabilities and corresponding log information should be made available:

	a. E-CID: This will include cell-ID, timing advance (TA), round trip time, and angle of arrival (AOA). This is necessary for goal 1. b. OTDOA: Observed Time Difference of Arrival at UE and provision of positioning subframe in orthogonal frequency-division multiple access (OFDMA) for UE to report its reference signal time difference (RSTD) measurements. This is required for goal 2. c. UTDOA: Uplink time difference of arrival, this is for base stations to collect TDOA measurements of a UE in order to localize it. This is a complementary solution to (b) for goal 2. The difference is that all computation is done by the network and no functionality need to be implemented on the UE. d. RFPM (radio frequency pattern matching): This will require radio propagation prediction software and associated surveying solution. This is a complementary solution for goal 1. If only some of the above features are supported, or the features will be enabled at different phases, we request the information on what is supported and corresponding performances, at what timelines. Host Organisation should also provide information on alternative localization technologies supported in the system, if applicable.
C.6	Non-3GPP access (e.g. with IEEE 802.11-based networks, using capabilities such as N3IWF, ATSSS, etc.), NR-based access to unlicensed spectrum (NR-U), etc.

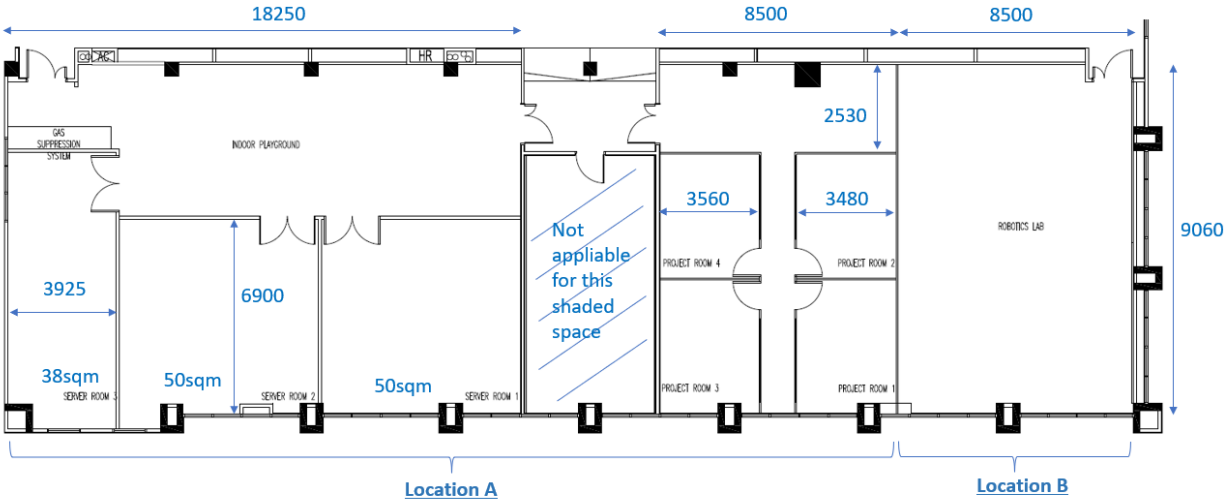
Site Map for Indoor and Outdoor 5G Coverage from FCTLab

- Please refer to diagrams below for indoor coverage of FCTLab, as well as 120 metres outdoor 5G coverage from FCTLab and within the SIT@Dover campus, for applications such as autonomous vehicle, robots, drones, etc.



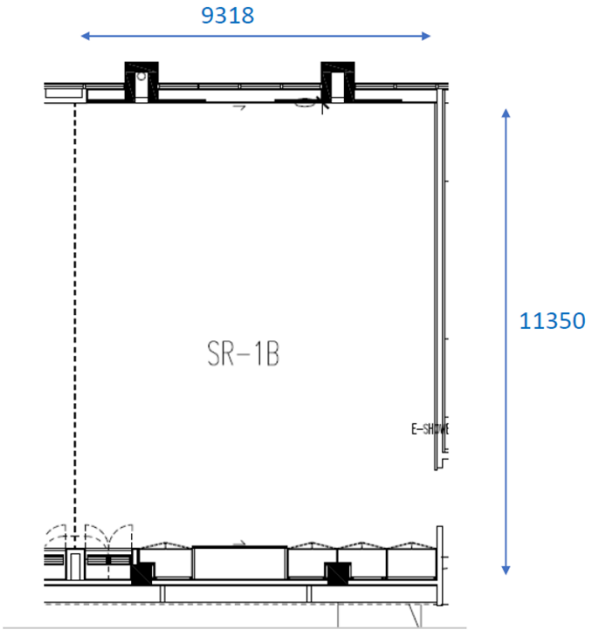
Floorplan for Location A & B of FCTLab

- 5G Standalone System(s) will be placed in the Server Rooms. Coverage of 5G is required for Location A, Location B and corridor area.



Dimensions (approximate) in mm

- **Floorplan for Location C of FCTLab**Coverage of 5G is required for Location C and corridor area. Location C is situated at Level 1 and directly facing Location A on the same Level 1.



Dimensions (approximate) in mm

Annex C

FUNDABLE ITEMS

Type of Expenses	Description
Manpower	
General policy	The general principle is that grants should support salary costs (inclusive of employer's CPF but exclude AWS, bonuses, and other allowances). Fractional charging for staff costs based on time commitment to the project must be practiced.

Type of Expenses	Description
Equipment (Hardware & Software)	
General policy	Applicant shall provide the basis and justification for the purchase of any equipment for the consideration of funding: • the purpose of the equipment, • how it would be applied to the Project, and • formal established and consistently applied policies of the Applicant on equipment purchase. Applicant shall declare whether similar equipment currently exists within the organisation for each piece of equipment that is proposed to be purchased. No purchase of equipment is allowed unless specifically provided for in the Grant and approved by SIT. The procurement of such equipment must be made according to the formal established and consistently applied policies of the Applicant. The invoices for all claims must be dated before the end of the qualifying period. Related party transactions (e.g. company internal costs, subsidiary company costs) item(s) must be based on prevailing market rates. For purchased equipment (hardware)= (Allowable cost x qualifying period) ÷ 36 months Leased equipment (hardware)= Cost of lease during the qualifying period Purchased equipment (software) = (Allowable cost x qualifying period) ÷ 24 months Shortlisted applicants are expected to provide quotations as per their proposed budget.
Cost of capital works, general infrastructure, general purpose IT and communication equipment, office equipment, and furniture and fittings	Not allowable under indirect costs, unless specifically provided for in the Grant and approved by SIT. Examples of such costs are computers, office productivity softwares, PDAs, mobile phones, photocopier machines, workstations, printers, etc. Generic Software (incurred for the normal business operation purpose) such as Microsoft Windows, Microsoft Office, Norton Anti-Virus, etc are not allowable.

Type of Expenses	Description
Others	
Materials, Consumables and ICT services	Types of Materials, Consumables and Infocomm Services (ICT) Costs supportable should be duly considered and justified in the context of the project undertaken. "Materials and consumables" refer to physical goods used in the production of prototype for the Project, purchased from third parties. "Infocomm services ICT" refers to infocomm services charges, such as fee-based charges, like data-centre charges, hosting and internet connectivity costs, necessary for carrying out the Project. Types of Materials, Consumables and Infocomm Services ICT Costs incurred for normal operational business purposes of the Applicant are not allowable.
Marketing and Publicity Expenses	Support for such item should be duly considered and justified in the context of the project undertaken.
Professional services	Include local and professional services. Consultants and subcontractors shall not be staff of the Company, and foreign professional services must be specifically indicated.
Others	Uniqueness of the cost to be supported should be explained and support to be duly considered and justified in the context of the project undertaken.

NON-FUNDABLE ITEMS

Type of Expenses	Description
General policy	Not allowable for expenses that are not directly related to the project. All procurement of such items must be made according to the formal established and consistently applied policies of the Host Organisation.
Audit fees	Not allowable. This includes both internal and external audit fees.
Entertainment & Refreshment	Not allowable.
Fines and Penalties	Not allowable.
Legal Fees	Not allowable.
Patent Application	Not allowable. This includes patent application filing, maintenance and other related cost.
Professional Membership Fees	Not allowable.
Staff retreat	Not allowable.