D3.4 COMMON FRAMEWORK REPORT FOR THE ESTABLISHMENT OF “APPLY LABS"

WP3 Academic staff training and preparation for delivery

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Project Information

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Executive Summary

This document summarizes the common framework report for the establishment of “Apply Labs”. It has been developed by the APPLY partners and formulates the requirements for setting up of Equipment and Establishment of “APPLY Labs" in Partner Countries. Establishment of an “APPLY lab” in each partner institution to run MSc programmes and vocational training courses on “Applied Computational Fluid Dynamics”. The acquired equipment will be installed in these laboratories ready to be used for the delivery of the programme in WP4 and for research and networking purposes during and after the project. Each Asian partner university will allocate the appropriate physical space to host the equipment while it is projected to serve as a secretariat of “APPLY lab”.

The aim of the first deliverable of Work Package 3.4 is to study requirements of laboratory equipment and devices/systems/software for delivering the Apply CFD curriculum in Asia. This required the (i) identification of the desired equipments/softwares/systems, (ii) Identification of the space to host the facility/ to install these devices, (iii) map the procurement policy of the respective Asian Partners in compliance with Erasmus guidelines and define the timeline for the procurement after approval from the respective partner institution governing body.

The Manipal Academy of Higher Education, India and Manipal University Jaipur could not use the funds allocated to buy any of the decided Lab facilities/equipments or software due to FCRA restrictions. Both the Universities made use of the internal funds from their respective Universities to deploy the program/course.

The first activity that was undertaken for the purposes of the 3rd work package, was to establish a common framework for establishing “APPLY Labs” in partner countries. The establishment of these Labs are important to compliment the Master’s program/ course that are developed in respective partner Universities. In order to identify the necessary lab equipment’s/ software’s that are required for execution of the developed curriculum it was necessary to develop a framework towards identification and procurement of these lab assets. Once the framework was established, the set-up of “Apply Labs” was mandated.

This activity will result in one fully-equipped “APPLY Lab” in each of Asian partner HEIs.

1. Framework deliverables

There are three areas of deliverables expected from each of Asian HEIs geared towards enabling the course delivery in the APPLY curriculum design of the program is summarised as follows;

The budget and technical specifications of the labs with the list of the purchased equipment was drafted by each Asian HEIs under the guidance of the EU HEIs, so that labs are tailored to course content established in previous work packages.

In order to identify and develop the “APPLY Lab” in Asian Partner countries for delivering the Computational Fluid Dynamics program/courses the following actions (processes) were conducted by the Asian partner HEIs, as described in the following Actions.

(i) identification of the desired equipment/software/systems,

(ii) Identification of the space to host the facility/ to install these devices,

(iii) map the procurement policy of the respective Asian Partners in compliance with Erasmus guidelines and define the timeline for the procurement after approval from the respective partner institution governing body

The first action taken was to list all the universities of institutes of interest in Asia and divide them into the ones that offer postgraduate programs related to CFD and the ones that do not. A wide range of universities were surveyed, and numerous programs were listed from different faculties and individual departments. The initial list proposed included:

i. Workstations for resource intensive CFD simulations
ii. mutlicore CPUs, over 8;
iii. sufficient memory over 32GB & DDR4-2666
iv. graphic cards with ability to to execute GPU computing (CUDA cores > 128)
v. License commercial for commercial CFD packages including Ansys Fluent or COMSOL
vi. Complementary software CAD software, grid generation, post-processing modules

The second action conducted was to gather detailed information regarding the existing Master’s courses related to Computational Fluid Dynamics, offered by the identified Thai universities in the first action. The aim was to collect general information about each Master’s program and its courses, such as the ECTS credits of each course, the duration of the programs, the number and type of courses, the duration of the master thesis in semesters etc.

In this stage the procurement policy of the respective Asian Partners was mapped in compliance with Erasmus guidelines. A timeline was established for the procurement after approval from the respective partner institution governing body.

Secondly, Asian Universities or HEIs will then follow their respective procurement procedure as mandated by their Universities or HEI’s, in accordance with project budget and EACEA procurement rules.

Thirdly, the Asian HEIs will report the actual list of equipment finally purchased by the HEIs

Each Lab will be delivered with the corresponding manual addressed to students and guiding them on how to make use of the infrastructure in coherence with curricula syllabi and material developed in previous work packages. The acquired equipment will be installed in these laboratories ready to be used for the delivery of the program and for research and networking purposes during and after the project.

This activity involved in all Asian Universities allocated with fund to provide the list of equipment, in accordance with the project budget of 223,020€.

The list of equipment suggested by the approved project for the Apply Lab consisted of the followings.

I. High-end PCs
II. High-end Laptops
III. printer/Scanner
IV. commercial CFD packages
V. Computer-Aided Design (CAD)
VI. Post processing software
VII. 3D printer.

As some of the equipment may already be available in the HEIs, the proposed equipment to be purchased in each HEIs would address the lacking or add value to their lab to support the MSc course and the VET courses. The list of all equipment deemed required by each Asian Partner should be within the given allocated budget and to be evaluated as relevant provided with justification. The HEIs are also required to provide the official documents from the University management with assurance that the original equipment or software has been purchased and accessible for the teaching of the programs. The process adopted was as follows:

i. The equipment list required by the partner universities were finalized
ii. The equipment list was reviewed to match to the budgetary allocation and the terms decided in the APPLY proposal
iii. Discussion with software providers/suppliers for providing the quotations
iv. On approval from the respective HEI's raise Purchase Orders
v. Introduce the equipment/software into the APPLY lab

All the Asian HEI's successfully procured the required APPLY lab equipment's except for P5-Manipal University Jaipur, India which could not spend the funds to procure the equipment due to late confirmation of FCRA from Government of India. P6-Manipal Academy of Higher Education, India was unable to receive any funds, so did not procure any Lab resources. But P6 successfully started the Master's program in Applied Computational Fluid Dynamics the Lab development was supported using the Universities own funding.

2. Budget and Specification of Asian HEIs' for APPLY Lab

The following Table 3.2A describes the total allocated budget in Euro (**€**) for Equipment of Asian HEIs' APPLY Lab. The overall total budget spent for equipment was 206.476,17€ distributed among 7 Asian HEIs. Table 3.3.1B provides the list of equipment proposed by each of Asian partners in the initial proposal based on their discussion with their respective stakeholders and evaluating their requirements as per their course plan. It was providing a initial list of their specifications, and justifications on why the equipment are needed.

Partner	Partner Name	Country	Budget in Euro
P1	Chiang Mai University	Thailand	31,860.00
P2	Naresuan University	Thailand	31,860.00
P3	Universiti Technology Mara	Malaysia	31,860.00
P4	Universiti Malaya	Malaysia	31,860.00
P5	Manipal University Jaipur	India	31,860.00
P6	Manipal Academy of Higher Education	India	31,860.00
P7	Vellore Institute of Technology	India	31,860.00

Table 1 Initial Budget allocation

3. Setup of Equipment and Establishment of “APPLY Labs” Partner HEI’s

3.1. Setup of Equipment and Establishment of “APPLY Labs" in CMU

The APPLY Lab at CMU is divided into two main components, each with distinct objectives. The first is dedicated to supporting local students who attend the course in person. The second aims to establish cloud-based servers, enabling both CMU students and external partners to remotely access and perform computation-intensive simulations, eliminating the need for direct access to high-performance computers. Due to the Indian government’s Foreign Contribution (Regulation) Act (2010), two of our partners (MAHE and MUJ) were unable to purchase the equipment to serve their local student. Per the consortium agreement, parts of equipment budget originally planned for MAHE and MUJ were redirected to CMU. This fund is used to set up remote computer service and APPLY cluster that all Partner’s countries can use.

Figure 1 APPLY CFD Lab at CMU

3.1.1.APPLY CFD physical Lab

The Computer Laboratory for onsite learning consists of seven mid-level workstation-class PCs and one high-level PC. The HPC provided by the grant has been used in four programs taught at CMU: 1. the master’s program in Advanced Computational Engineering and design, 2. the master’s program in Mechanical Engineering, 3. the master’s program in Energy engineering, and 4.Bachelor’s program in Mechanical Engineering. Examples of courses are Computational Fluid Dynamics, Finite Element Method, Computational Aerodynamics, Advanced Fluid and Heat Transfer, Numerical Method for PDEs, and Numerical Method for Navier-Stokes equations. In addition, they have been used in the final year thesis in the graduate and undergraduate levels. More than 30 students have been using this facility to complete their thesis.

Figure 2 The four Cloud servers. Three on the left are dual-socket Intel Xeon with a number total core of 36-48 cores. The server on the right is a dual-socket 48-core AMD EPYC. The servers are accessed remotely by several users.

3.1.2.APPLY CFD Lab on a cloud

The physical laboratory above is run on Microsoft’s Windows operating system, which allows the students to adapt to the program rapidly. However, MS Windows does not cost-effectively support concurrent users; one computer can only serve one user at a time. A Linux OS and a more powerful computer are required to enable concurrent usage of the machines and serve more students. To this end, we set up 4 HPC servers (dual-socket with high memory). Each server can serve 10-15 students simultaneously. Allowing all of our partner to run the course at the same time. This flexibility enables the possibility of a joint teaching session that one professor and setup an online course for all the partners. Each student can log on to these machines and work with Graphical User Interface (GUI) of industry-standard software such as SolidWorks, Inventor, or ANSYS simulation suite. Theses servers allow the user to share the resources and they can solve daily-level tasks. *To save cost, we assemble most of the computer and the workstation ourselves. The overall computing power of these machines is roughly two to three times more than we purchase the pre-built servers from usual supplier such as DELL or HP, at the same budget. This leads to a long list of equipment bills.*

3.1.3. The APPLY Cluster

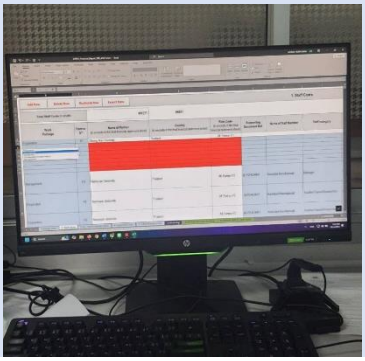
CFD researchers and students are expected to carry out intensive research. This requires substantial computing power going beyond normal computer power and resources. To serve the APPLY consortium as a whole and **enable MUJ and MAHE to access their original fund**, the APPLY consortium established the **Memorandum of Agreement on APPLY cluster**. This cluster serve as a mini-supercomputer found in advanced computational center in the developed country around the world such as the Frontier Supercomputer at Oakridge National Laboratory in USA or the LUMI supercomputer at the European High-Performance Computing in Finland. The APPLY cluster runs on Ubuntu Linux with Slurm job scheduling with more than 308

TB of redundant storage. This cluster allows the APPLY’s students and/or researchers to conduct cutting-edge research in the area of CFD and other computational sciences.

Figure 3 The three computing nodes of APPLY Cluster

Figure 4 Disk storage server of the APPLY cluster with 308 TB total capacity.

Item No	Equipment description &Technical Specification	Quantity	Justification of Needs	Estimated Price (€)	Photo of the equipment/ lab where the equipment is located

1.	**LOGITECH C922 Pro Stream Webcam** Max Resolution: 1080p/30 fps - 720p/ 60 fps Camera mega pixel: 3 Focus type: Autofocus Lens type: Glass Built-in mic: Stereo Mic range: Up to 3 ft (1 m) Diagonal field of view (dFoV): 78° Digital zoom: 1.2x	1	This equipment is used for teaching and learning, research or thesis work.	84.88	
2.	**Lenovo thinkstation P62** Processor: AMD Ryzen Threadripper PRO 3945WX 12-Cores 4.00 GHz RAM: 144 GB GPU: NVIDIA RTX A4000	1	This equipment is used for research purposes such as conducting high-performance computing tasks.	1900.10	
3.	**HP Monitor 24.5"** LED Backlight 1920 x 1080 (144 Hz) 557 x 492 x 206 mm	6	This equipment is used as a workstation display.	809.19	

4.	**Dell monitor 27”** LED-backlit LCD monitor / TFT active matrix 2560 x 1440 (DisplayPort: 165 Hz, HDMI: 144 Hz) 24.1 in x 7.9 in x 20.6 in	1	This equipment is used as a workstation display.	348.38	 
	Workstations	5	This equipment is used for research purposes.		
5.	**Workstation No. 1**			1,800.65	
	CPU-Intel Core i9-10900X 3.7GHz	1			
	Mainboard MSI MEG X299	1			
	RAM KINGSTON HyperX FURY BLACK 32 GB DDR4/3200	2			
	WD BLUE SN550 1TB NVMe M.2 2280	1			
	HDD 6 TB WD Black 7200rpm Sata3	3			
	SATA-III 2 TB Seagate Barracuda(256MB)	1			
	CPU air cooler BE QUIET Shadow Rock	1			
	PSU Corsair RM750 - 750 W 80+ GOLD	1			

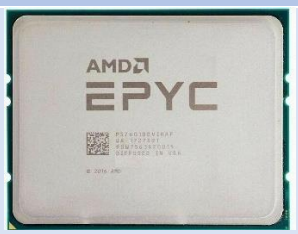
	Case Lian li Lancool	1			
	Logitech Mouse and Keyboard MK200	1			
	Cooler master WR530 Size XL	1			
	Patch cord cable	1			
	Power Bar 3M SYNDOME	1			
	VGA ASUS TUF GTX1650 4GB GDDR6	1			
6.	**Workstation No. 2**			2699.91	
	CPU-Intel Core i9-10900X 3.7GHz	1			
	Mainboard MSI MEGX299	1			
	RAM Apacer(Panther/Golden) 32GB DDR4/3200	2			
	WD BLACK SN750 1TB NVMe M.2 2280	4			
	FLASH DRIVE SANDISK CRUZER BLADE 16GB	3			
	NVIDIA QUADRO RTX A4000 16GB GDDR6	1			
	CPU air cooler BE QUIET Shadow Rock	1			
	PSU Corsair RM750 - 750 W 80+ GOLD	1			
	Case Lian li Lancool	1			
	Logitech Mouse and Keyboard MK200	1			
	Patch cord cable	1			
7.	**Workstation No. 3**			1894.78	
	CPU-Intel Core i9-10900X 3.7GHz	1			
	Mainboard MSI MEGX299	1			

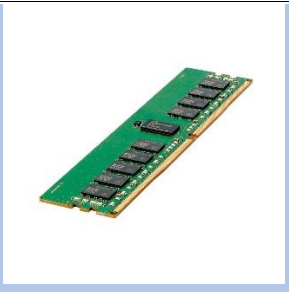
	RAM Kingston HyperX Predator 16GB DDR4/3200	4			
	WD BLUE SN550 1TB NVMe M.2 2280	3			
	WD BLUE SN550 1TB NVMe M.2 2280	3			
	VGA ASUS TUF GTX1650 4GB GDDR6	1			
	CPU air cooler BE QUIET Shadow Rock	1			
	PSU Corsair RM750 - 750 W 80+ GOLD	1			
	Case Lian li Lancool	1			
	Logitech Mouse and Keyboard MK200	1			
	Patch cord cable	1			
8.	**Workstation No. 4**			2,027.65	
	CPU-Intel Core i9-10900X 3.7GHz	1			
	Mainboard MSI MEG X299	1			
	RAM Samsung 16GB DDR4/3200	7			
	WD BLUE SN550 1TB NVMe M.2 2280	1			
	WD BLACK SN750 1TB NVMe M.2 2280	2			
	Micro SD card 128GB SAMSUNG EVU PLUS	1			
	CPU air cooler BE QUIET Shadow Rock	1			
	PSU Corsair RM750 - 750 W 80+ GOLD	1			
	Case Lian-li Lancool li White	1			
	Logitech Mouse and Keyboard MK200	1			

	VGA ASUS TUF GTX1650 4GB GDDR6	1			
9.	**Workstation No. 5**			1016.74	
	Mainboard 1151 MSI MAG Z390	1			
	RAM KINGSTON HyperX FURY BLACK 32 GB DDR4/3200	2			
	WD BLUE SN550 1TB NVMe M.2 2280	1			
	WD BLUE SN550 1TB NVMe M.2 2280	3			
	Micro SD card 256GB SANDISK EXTREME PRO	1			
	CPU air cooler BE QUIET Shadow Rock	1			
	PSU Thermaltake TR2 650W 80+WHITE	1			
	Logictech Wireless Mouse and Keyboard	1			
	VGA ASUS TUF GTX1650 4GB GDDR6	1			
	High-Performance Computing (HPC) server	4	This equipment is used for research purposes such as conducting high-performance computing tasks.		
10.	**HPC No. 1**			2,713.76	
	Intel CPU Xeon Platinum 8124M SRD1Y 8124 3.0GHx 18 Cores	2			

	Mainboard AsRock Rack Dual socket LGA 3647 Intel C621	1			
	RAM Samsung 16 GB DDR4-2666	12			
	RAM Samsung 16 GB DDR4-3200	7			
	Logictech Wireless Mouse and Keyboard	1			
11.	**HPC No. 2**			2,208.28	
	Intel CPU Xeon Platinum 8124M SRD1Y 8124 3.0GHx 18 Cores	2			
	Mainboard AsRock Rack Dual socket LGA 3647 Intel C621	1			
	RAM 16GB DDR4-2666	12			
	Mouse Bungee Signo	1			
12.	**HPC No. 3**			1,862.83	
	CPU EPYC 7451 2.3 GHz 24 Cores 64MB Socket SP3	2			
	Mainboard H11DSI-NT Supermicro Server Neu	1			
	HPE RAM 16GB DDR4 PC4-2666V	4			
	RAM Samsung 16GB 1RX4 PC4-2666V PC4-21300R DDR4	4			
	RAM Samsung 16GB 1RX4 PC4-2666V PC4-21300R DDR4	2			
13.	**HPC No. 4**			1,695.11	

	CPU Intel Xeon 8175M SR3FU 2.5GHz 24 Core LGA3647	2			
	Mainboard AsRock Rack EP2C621D16-4LP	1			
	RAM Samsung 8GB DDR4 PC4-21300 2666MHz 1.2V	5			
	RAM Micron 16GB 2Rx4 PC4-2666MHz DDR4-21300R RDIMM 288Pin 1.2V ECC REG	6			
14.	Nvidia Tesla K80	1	This equipment is used for additional upgrade on high-performance computing machines.	218.96	
15.	Nvidia tesla P100 Passive HBM2 16 GB PCI-Express 1600Mhz Display Graphic card	1	This equipment is used for additional upgrade on high-performance computing machines.	535.14	
16.	Nvidia tesla P100 16 GB GPU accelerator Graphic card	4	This equipment is used for additional upgrade on high-performance computing machines.	874.05	

17.	**Highspeed Network Systems**		This equipment is used for establishing a rapid data transfer system.	732.31	
	Cisco 10Gbe Nexus 2348TQ Up to 240 Gbps of switching capacity in each direction (480 Gbps full duplex) Hardware forwarding at 1440 Gbps or 2160 million packets per second (mpps) Oversubscription ratio of 2:1 32-MB buffer	1			
	Intel Omni-Path Card Pcle 3.0x16 Date rate 100Gbps	8			
18.	AMD EPYC 7401 core 2.0 GHz 64MB 155W	1	This equipment is used for additional upgrade on high-performance computing machines.	715.68	

19.	HPE 16GB 1RX4 DDR4 PC4-2666V ECC Memory	4	This equipment is used for additional upgrade on high-performance computing machines.	410.27	
	Lenovo Legion sation		This equipment is used for research purposes.		
20.	**Lenovo Legion T5 26AMR5** 512GB SSD M.2 2280 NVMe TLC WLAN 2x2ax+BT MoW RTX3060Ti 8GB G6 256b H+3DP Ryzen 7 5800 3.4 8C 64GB DDR4/3200 Armor U	1	This equipment is used for research purposes.	1,432.16	
21.	**Lenovo Legion T5 26AMR5** 512GB SSD M.2 2280 NVMe TLC WLAN 2x2ax+BT MoW RTX3060 12GB G6 192b H+3DP Ryzen 7 5800 3.4 8C 64GB DDR4/3200 Armor U	1	This equipment is used for teaching and research purposes.	1,367.30	

2 2.	**APPLY cluster** CPU 64-bit 64-core 2 units 2.1-3.4 GHz 128 cores Memory 512 GB 1 SSD 4TB 2 units Mainboard memory 32 slots NVMe 8 slots	3	This equipment is used for academic research and final year thesis project .	22,801.21	
2 3.	**Disk storage server** Cpu 64-bit 48-core 2 units 2.25 GHz 256 cores Memory 256 GB SSD 18TB 6 units, 20TB 10 units Mainboard memory 16 slots	1	This is used for storing research data and hold big data for data science, machine learning, AI and data-driven modelling.	13,572.15	

Table 2 Equipment Specifications, Quantity, Justifications, and Estimated Price

3.1.4.Procurement procedure

The equipment bought with APPLY fund are governed by two regulations. The first is the EACEA regulations and the second is the

Chiang Mai University Regulations on Procurement and Asset Management for Research and Development by Researchers, B.E. 2562 (2019 A.D.). Under these regulations, the PI to purchase equipment with a value of less than 25,000 EUR by himself. The value higher than this must be purchased through the committee with tender procedure. If the tender process fails, then the committee can purchase it directly from the vendor. All the equipment bought in the APPLY project has a value of less than 25,000 EUR.

3.1.5.Actual Equipment ordering, price and delivery date

Name of Institutions: Chiang Mai University (CMU)

Location of APPLY lab: 30th Anniversary building, Faculty of Engineering, Chiang Mai University, 239 Huaykaew Rd., Suteph, Muang, Chiang Mai, Thailand

No	Equipment	Unit	Doc. Ref.	Total price in (€)	Date of Receipt

			Number		Date of Delivery /Invoice	
1	**LOGITECH C922 Pro Stream Webcam** Max Resolution: 1080p/30 fps - 720p/ 60 fps Camera mega pixel: 3 Focus type: Autofocus Lens type: Glass Built-in mic: Stereo Mic range: Up to 3 ft (1 m) Diagonal field of view (dFoV): 78° **Digital zoom: 1.2x**	1	P1-EC-031	84.88	14/08/2020	14/08/2020
2	**Lenovo thinkstation P62** Processor: AMD Ryzen Threadripper PRO 3945WX 12-Cores 4.00 GHz RAM: 144 GB GPU: NVIDIA RTX A4000	1	P1-EC-021	1,900.10	07/05/2021	07/05/2021
3	**HP Monitor 24.5"** LED Backlight 1920 x 1080 (144 Hz) 557 x 492 x 206 mm	6	P1-EC-027	797.33	31/05/2021	31/05/2021
4	**Dell monitor 27”** LED-backlit LCD monitor / TFT active matrix 2560 x 1440 (DisplayPort: 165 Hz, HDMI: 144 Hz) 24.1 in x 7.9 in x 20.6 in	1	P1-EC-025	327.00	27/05/2021	27/05/2021
5	**Workstation No. 1**					

	CPU-Intel Core i9-10900X 3.7GHz	1	P1-EC-011	446.49	09/01/2021	09/01/2021
	Mainboard MSI MEG X299	1	P1-EC-009	248.36	09/01/2021	09/01/2021
	RAM KINGSTON HyperX FURY BLACK 32 GB DDR4/3200	2	P1-EC-012	237.96	09/01/2021	09/01/2021
	WD BLUE SN550 1TB NVMe M.2 2280	1	P1-EC-004	75.85	13/11/2020	13/11/2020
	SATA-III 2 TB Seagate Barracuda(256MB)	1	P1-EC-014	41.86	11/01/2021	11/01/2021
	HDD 6 TB WD Black 7200rpm Sata3	3	P1-EC-033	265.36	07/08/2021	07/08/2021
	CPU air cooler BE QUIET Shadow Rock	1	P1-EC-007	51.30	09/01/2021	09/01/2021
	PSU Corsair RM750 - 750 W 80+ GOLD	1	P1-EC-007	102.88	09/01/2021	09/01/2021
	Case Lian li Lancool	1	P1-EC-012	70.02	09/01/2021	09/01/2021
	Logitech Mouse and Keyboard MK200	1	P1-EC-026	14.18	31/05/2021	31/05/2021
	Cooler master WR530 Size XL	1	P1-EC-002	10.12	09/09/2020	09/09/2020
	Patch cord cable	1	P1-EC-017	4.57	14/01/2021	14/01/2021
	Power Bar 3M SYNDOME	1	P1-EC-017	12.43	14/01/2021	14/01/2021
	VGA ASUS TUF GTX1650 4GB GDDR6	1	P1-EC-015	131.66	12/01/2021	12/01/2021
6	**Workstation No. 2**					
	CPU-Intel Core i9-10900X 3.7GHz	1	P1-EC-011	446.49	09/01/2021	09/01/2021
	Mainboard MSI MEGX299	1	P1-EC-010	241.00	09/01/2021	09/01/2021
	RAM Apacer(Panther/Golden) 32GB DDR4/3200	2	P1-EC-006	205.23	09/01/2021	09/01/2021
	WD BLACK SN750 1TB NVMe M.2 2280	4	P1-EC-019	374.44	06/04/2021	06/04/2021
	FLASH DRIVE SANDISK CRUZER BLADE 16GB	3	P1-EC-003	8.75	11/11/2020	11/11/2020

	NVIDIA QUADRO RTX A4000 16GB GDDR6	1	P1-EC-029	1,089.20	13/07/2021	13/07/2021
	CPU air cooler BE QUIET Shadow Rock	1	P1-EC-007	51.30	09/01/2021	09/01/2021
	PSU Corsair RM750 - 750 W 80+ GOLD	1	P1-EC-007	102.88	09/01/2021	09/01/2021
	Case Lian li Lancool	1	P1-EC-012	70.02	09/01/2021	09/01/2021
	Logitech Mouse and Keyboard MK200	1	P1-EC-026	14.18	31/05/2021	31/05/2021
	Patch cord cable	1	P1-EC-017	1.14	14/01/2021	14/01/2021
7	**Workstation No. 3**					
	CPU-Intel Core i9-10900X 3.7GHz	1	P1-EC-011	446.49	09/01/2021	09/01/2021
	Mainboard MSI MEGX299	1	P1-EC-010	241.00	09/01/2021	09/01/2021
	RAM Kingston HyperX Predator 16GB DDR4/3200	4	P1-EC-024	282.07	24/05/2021	24/05/2021
	WD BLUE SN550 1TB NVMe M.2 2280	3	P1-EC-020	228.29	07/05/2021	07/05/2021
	WD BLUE SN550 1TB NVMe M.2 2280	3	P1-EC-005	235.17	09/01/2021	09/01/2021
	VGA ASUS TUF GTX1650 4GB GDDR6	1	P1-EC-015	131.66	12/01/2021	12/01/2021
	CPU air cooler BE QUIET Shadow Rock	1	P1-EC-007	54.02	09/01/2021	09/01/2021
	PSU Corsair RM750 - 750 W 80+ GOLD	1	P1-EC-007	102.88	09/01/2021	09/01/2021
	Case Lian li Lancool	1	P1-EC-012	70.02	09/01/2021	09/01/2021
	Logitech Mouse and Keyboard MK200	1	P1-EC-026	14.18	31/05/2021	31/05/2021
	Patch cord cable	1	P1-EC-017	1.01	14/01/2021	14/01/2021
8	**Workstation No. 4**					
	CPU-Intel Core i9-10900X 3.7GHz	1	P1-EC-013	454.10	09/01/2021	09/01/2021

	Mainboard MSI MEG X299	1	P1-EC-013	245.82	09/01/2021	09/01/2021
	RAM Samsung 16GB DDR4/3200	7	P1-EC-022	551.21	18/05/2021	18/05/2021
	WD BLUE SN550 1TB NVMe M.2 2280	1	P1-EC-016	78.39	13/01/2021	13/01/2021
	WD BLACK SN750 1TB NVMe M.2 2280	2	P1-EC-030	213.40	09/07/2021	09/07/2021
	Micro SD card 128GB SAMSUNG EVU PLUS	1	P1-EC-003	11.92	11/11/2020	11/11/2020
	CPU air cooler BE QUIET Shadow Rock	1	P1-EC-007	54.02	09/01/2021	09/01/2021
	PSU Corsair RM750 - 750 W 80+ GOLD	1	P1-EC-007	102.88	09/01/2021	09/01/2021
	Case Lian-li Lancool Ii White	1	P1-EC-032	75.73	06/08/2021	06/08/2021
	Logitech Mouse and Keyboard MK200	1	P1-EC-026	14.18	31/05/2021	31/05/2021
	VGA ASUS TUF GTX1650 4GB GDDR6	1	P1-EC-015	131.66	12/01/2021	12/01/2021
9	**Workstation No. 5**					
	Mainboard 1151 MSI MAG Z390	1	P1-EC-003	139.27	11/11/2020	11/11/2020
	RAM KINGSTON HyperX FURY BLACK 32 GB DDR4/3200	2	P1-EC-012	237.96	09/01/2021	09/01/2021
	WD BLUE SN550 1TB NVMe M.2 2280	1	P1-EC-031	89.47	07/06/2021	07/06/2021
	WD BLUE SN550 1TB NVMe M.2 2280	3	P1-EC-018	213.07	04/02/2021	04/02/2021
	Micro SD card 256GB SANDISK EXTREME PRO	1	P1-EC-008	40.34	09/01/2021	09/01/2021
	CPU air cooler BE QUIET Shadow Rock	1	P1-EC-007	54.02	09/01/2021	09/01/2021
	PSU Thermaltake TR2 650W 80+WHITE	1	P1-EC-001	45.41	14/08/2020	14/08/2020
	Logictech Wireless Mouse and Keyboard	1	P1-EC-026	27.65	31/05/2021	31/05/2021
	VGA ASUS TUF GTX1650 4GB GDDR6	1	P1-EC-015	131.66	12/01/2021	12/01/2021

10.	**HPC No. 1**					
	Intel CPU Xeon Platinum 8124M SRD1Y 8124 3.0GHx 18 Cores	2	P1-EC-038-1	715.28	31/07/2021	31/07/2021
	Mainboard AsRock Rack Dual socket LGA 3647 Intel C621	1	P1-EC-038-2	502.36	31/07/2021	31/07/2021
	RAM Samsung 16 GB DDR4-2666	12	P1-EC-038-3	882.00	16/08/2021	16/08/2021
	RAM Samsung 16 GB DDR4-3200	7	P1-EC-038-4	589.80	18/05/2021	18/05/2021
	Logictech Wireless Mouse and Keyboard	1	P1-EC-026	27.65	31/05/2021	31/05/2021
11.	**HPC No. 2**					
	Intel CPU Xeon Platinum 8124M SRD1Y 8124 3.0GHx 18 Cores	2	P1-EC-039-1	697.36	16/08/2021	16/08/2021
	Mainboard AsRock Rack Dual socket LGA 3647 Intel C621	1	P1-EC-039-2	518.48	13/08/2021	13/08/2021
	RAM 16GB DDR4-2666	12	P1-EC-039-3	918.14	26/03/2022	26/03/2022
	Mouse Bungee Signo	1	P1-EC-003	6.09	11/11/2020	11/11/2020
12.	**HPC No. 3**					
	CPU EPYC 7451 2.3 GHz 24 Cores 64MB Socket SP3	2	P1-EC-040-1	437.55	25/07/2020	25/07/2020
	Mainboard H11DSI-NT Supermicro Server Neu	1	P1-EC-040-2	412.32	25/08/2020	25/08/2020
	HPE RAM 16GB DDR4 PC4-2666V	4	P1-EC-040-3	681.22	25/09/2020	25/09/2020
	RAM Samsung 16GB 1RX4 PC4-2666V PC4-21300R DDR4	4	P1-EC-040-4	246.03	16/09/2020	16/09/2020
	RAM Samsung 16GB 1RX4 PC4-2666V PC4-21300R DDR4	2	P1-EC-040-5	130.94	07/10/2020	07/10/2020

13.	**HPC No. 4**					
	CPU Intel Xeon 8175M SR3FU 2.5GHz 24 Core LGA3647	2	P1-EC-041-1	492.99	06/10/2022	06/10/2022
	Mainboard AsRock Rack EP2C621D16-4LP	1	P1-EC-041-2	584.42	14/08/2022	14/08/2022
	RAM Samsung 8GB DDR4 PC4-21300 2666MHz 1.2V	5	P1-EC-041-3	223.32	20/05/2020	20/05/2020
	RAM Micron 16GB 2Rx4 PC4-2666MHz DDR4-21300R RDIMM 288Pin 1.2V ECC REG	6	P1-EC-041-4	358.99	19/06/2020	19/06/2020
14	**Nvidia Tesla K80**	1	P1-EC-046	219.60	26/07/2020	26/07/2020
15	**Nvidia tesla P100 Passive HBM2 16 GB PCI-Express 1600Mhz Display Graphic card**	1	P1-EC-047	537.81	02/04/2022	02/04/2022
16	**Nvidia tesla P100 16 GB GPU accelerator Graphic card**	4	P1-EC-048	878.42	30/09/2022	30/09/2022
17	**Highspeed Network Systems**					
	Cisco 10Gbe Nexus 2348TQ	1	P1-EC-044	295.79	01/12/2022	01/12/2022
	Up to 240 Gbps of switching capacity in each direction (480 Gbps full duplex)					
	Hardware forwarding at 1440 Gbps or 2160 million packets per second (mpps)					
	Oversubscription ratio of 2:1					
	32-MB buffer					
	Intel Omni-Path Card Pcle 3.0x16	8	P1-EC-045	400.00	07/07/2020	07/07/2020
	Date rate 100Gbps					

18	**AMD EPYC 7401 core 2.0 GHz 64MB 155W**	1	P1-EC-042	763.07	21/04/2020	21/04/2020
19	**HPE 16GB 1RX4 DDR4 PC4-2666V ECC Memory**	4	P1-EC-043	412.32	26/04/2020	26/04/2020
20	**Lenovo Legion T5 26AMR5** 512GB SSD M.2 2280 NVMe TLC WLAN 2x2ax+BT MoW RTX3060Ti 8GB G6 256b H+3DP Ryzen 7 5800 3.4 8C 64GB DDR4/3200 Armor U	1	P1-EC-034	1,283.41	16/08/2021	16/08/2021
21	**Lenovo Legion T5 26AMR5** 512GB SSD M.2 2280 NVMe TLC WLAN 2x2ax+BT MoW RTX3060 12GB G6 192b H+3DP Ryzen 7 5800 3.4 8C 64GB DDR4/3200 Armor U	1	P1-EC-035	1,232.80	17/08/2021	17/08/2021
22	**APPLY cluster** CPU 64-bit 64-core 2 units 2.1 GHz 128 cores Memory 512 GB 1 SSD 4TB 2 units Mainboard memory 32 slots NVMe 8 slots	3	P1-EC-036	22,801.21	31/08/2022	31/08/2022
23	**Disk storage server** CPU 64-bit 64-core 2 units 2.25 GHz 256 cores Memory 256 GB SSD 18TB 6 units, 20TB 10 units Mainboard memory 16 slots	1	P1-EC-037	13,572.15	31/08/2022	31/08/2022

No	Equipment	Unit	Doc. Ref. Number	Total price in (€)	Date of Delivery /Invoice	Date of Receipt
1.	Dell Precession M3561 K L p	4 1 2 3	EQ-P3-INV08675	5826.09	7/12/2021	24/12/2021
2.	Dell Optiplex 5090 Tower XCTO I7-11700 and Dell E2422H 24" Monitor	3	EQ-P3-INV08675	4173.91	7/12/2021	24/12/2021
3.	Dell Optiplex 7090 Tower Desktop and Dell S2421HN 23.8" FHD IPS LCD Monitor (HDMI Port)	3	EQ-P3-INV09844	4564.57	7/6/2022	22/6/2022
4.	Proteus maker 3D printer	1	EQ-P3-INV09844	1043.48	7/6/2022	22/6/2022
5.	Epson EB-FH52 Projector	1	EQ-P3-INV10559	836.96	27/9/2022	14/10/2022
6.	Magnetic Glass Whiteboard - 2400mm x 1200mmx 4mm	1	EQ-P3-INV10559	510.87	27/9/2022	14/10/2022
7.	Ace Smartone Multi-Touch	1	EQ-P3-INV10559	5147.83	27/9/2022	14/10/2022
8.	Mobile Rack	1	EQ-P3-INV10559	565.22	27/9/2022	14/10/2022
9.	HP Color Laserjet Pro MFP M183FW	1	EQ-P3-INV10559	536.96	27/9/2022	14/10/2022
10.	Kandao Meeting Pro 360 All in One Conferencing Camera	2	EQ-P3-INV10560	2086.52	27/9/2022	14/10/2022
11.	LQ UQ75 65" Series 4K Smart UHD TV With AI Thin Serial No. 206INPT4F432	1	EQ-P3-INV10560	978.26	27/9/2022	14/10/2022

12.	LQ UQ75 65" Series 4K Smart UHD TV With AI Thin Serial No: 206INTX4F201, 206INZY4f389	2	EQ-P3-INV10560	1956.52	27/9/2022	14/10/2022
13.	Apple Ipad Mini 6th Gen/Wifi/256GB/8.3"	2	EQ-P3-INV10560	1282.17	27/9/2022	14/10/2022
14.	Aten 30M True 4K HDMI Active Optical Cable (True 4K@30m)	2	EQ-P3-INV11014	543.48	12/12/2022	19/12/2022
15.	PEPPER JOBS (TCH-11) Ultra USB C Multiport & Network HUB	2	EQ-P3-INV11014	182.17	12/12/2022	19/12/2022
16.	32"-65" Portable TV Display Stand with Wheels (50kg)	2	EQ-P3-INV11014	295.65	12/12/2022	19/12/2022
17.	Laptop bag	2	EQ-P3-INV11014	282.61	12/12/2022	19/12/2022
18.	Leather Sleeve For 13.3 Inch Macbook	1	EQ-P3-INV11014	147.61	12/12/2022	19/12/2022
19.	Commscope CAT6 UTP 24AWG Cable	1	EQ-P3-INV11014	141.30	12/12/2022	19/12/2022
20.	32"-70" Double Arms 4 Way Adjustable Wall TV Bracket	1	EQ-P3-INV11014	54.35	12/12/2022	19/12/2022
21.	PICO 4 ALL IN ONE Vr HEADSET 256.G	1	EQ-P3-CS151868	521.52	10/11/2022	10/11/2022
22.	TARGUS TSB96001GL-70 GEOLITE 15.6" BACKPACK	4	EQ-P3-CS151203	282.61	4/10/2022	4/10/2022
	Total			**31960.66**		
	Actual Allocation			**31860.00**		

Table 3 Actual Equipment ordering, price and delivery date

3.2. Setup of Equipment and Establishment of "APPLY Labs" in Naresuan University

APPLY Lab named " Advanced Computational Mechanical Engineering Lab, ACME Lab" was established and located at Floor 6th Mechanical – industrial Engineering Building, Department of Mechanical Engineering,

Faculty of Engineering, Naresuan University. All equipment supported from APPLY project was installed and operated though the class of CFD module including research project and master thesis.

Figure 5 APPLY Lab in NU

Table: Equipment Specifications, Quantity, Justifications And Estimated Price					
	Name of Institutions: Naresuan University (NU) Location of APPLY lab: Department of Mechanical Engineering, Faculty of Engineering, Naresuan University, Phitsanulok, Thailand				
Item No	Equipment description &Technical Specification	Quantity	Justification of Needs	Estimated Price (€)	PHOTO OF THE EQUIPMENT/ LAB WHERE THE EQUIPMENT IS LOCATED
1.	**Lenovo Workstation PS T620** CPU : Processor AMD Ryzen™ Threadripper™ PRO 3995WX 64 Core, 2.7 to 4.2 GHz Cache Memory (Level) L1 4 MB, L2 32 MB, L3 Cache 256 MB RAM : 128 GB ECC DDR4-3200MHz, RDIMM RAM HDD : 1 TB Solid State Drive M.2 2280 Gen 4 PCIe + 3.5 inch 1TB 7200rpm Hard Disk Drive VGA : NVIDIA Quadro P1000 GDDR5 NIC : LAN 10/100/1000 CHASSIS : Tower	1	This equipment is used for research or thesis work.	12,811.20	 

	OS : Windows 11 Pro, English WARRANTY : 3Yr Pro Support Warranty : 3Yr ProSupport and Next Business Day Onsite Service MONITOR: Lenovo Think Vision 24-28 23.8” FHD				
	Desktop Computer Lenovo Desktop TC M70t CPU : 12th Generation Intel® Core™ i7-12700, 25 MB Cache, 8 Core, up to 4.8 GHz RAM : 32GB DDR4-3200MHz, UDIMM HDD : 256GB Solid State Drive M.2 2280 Gen 4 PCIe + 3.5 inch 1TB 7200rpm Hard Disk Drive VGA : AMD Radeon 5X6400, 4 GB G6 NIC : LAN 10/100/1000 CHASSIS : Tower OS : Windows 11 Pro, English WARRANTY : 3Yr Pro Support Warranty : 3Yr ProSupport and Next Business Day Onsite Service MONITOR: Lenovo C 24-20 23.8” FHD	4	These equipments are used for teaching purpose in class.		
2.	**Software** 1 Unit	1	The Ansys software is a important tool for	25,854.75	

	Ansys academic multiphysics campus solution (10/100)		numerical simulation. It is used for simulating the working process of equipment.		
	Estimated Total Price			38,665.95	

Table 4 Equipment Specifications, Quantity, Justifications And Estimated Price (NU)

3.2.1.Procurement procedures

According to work scope of APPLY project, Naresuan university as partner university receives budget for purchasing a set of equipment for setting CFD lab about 38,760 euros consisting of a set of computers and a commercial software.

Equipment specification of a set of computers and a commercial software were designed and made cost estimation under project budget. All documents were submitted and run in university procurement method in type of single source procurement for a software because only one supplier is authorized to sell the ANSYS software for Naresuan University in Thailand. Three procurement committees were appointed for tendering. A purchase order with equipment cost being 915,759.10 baht was signed to a supplier, CAD-IT Consultants (Asia) Pte Ltd, on May 17, 2021. The software was delivered and accepted by three evaluation committees on July 1, 2021. Finally, it was registered in university inventory.

Moreover, all required documents were submitted and run in university procurement method in type of request for quotations procurement for a set of computers because of cost under 500,000 baht. Three procurement committees were appointed for tendering. A purchase order with equipment cost being 480,000 baht was signed to a supplier, GOLD PC NETWORK Co, Ltd, on October 17, 2022. All computers were delivered on February 06, 2023 and accepted by three evaluation committees and reported on February 06, 2023. The registration in university inventory was done on February 28, 2023.

However, Naresuan University is not eligible to claim VAT refund as stated by the revenue department of Thailand.

The equipment has been demonstrated in CFD courses of modernized mechanical engineering master program such as Renewable energy resources and Solar thermal energy process in first semester/ academic year 2023. The summary tables of tendering procurement are given in Table 1 and Table 2.

Table 1 Summary information of tendering of a software named ANSYS.

ACTIVITY	
Submission of request documents for tendering according to NU process Reference: request documents for tendering.pdf	

Appointment for Procurement committee and Evaluation committee:

Procurement committee:

Assoc.Prof. Koonlaya Kanokjaruvijit

Asst.Prof. Ananchai U-Kaew

Assoc.Prof. Patomsok wilaipon

Evaluation committee:

Asst.Prof. Kwanchai Kraitong

Asst.Prof. Piyanun Charoensawan

Asst.Prof. Arwut Lapirattanakun

Reference: Appointment for Bidding committee and Evaluation committee.pdf

Public announcement:

Reference: Invitation announcement.pdf

Tendering report:

Result of tendering was reported to Faculty on February 17, 2021.

Reference: Tendering report.pdf

Quotation.pdf

Winner announcement:

Winner announcement was published on March 15, 2020. Winner was CAD-IT Consultants (Asia) Pte Ltd

Reference: Winner announcement.pdf

Award Contract:

A purchase order was done with the winner, CAD-IT Consultants (Asia) Pte Ltd, on May 17, 2021. The period of contract is 30 days. The equipment delivery date is by May 17, 2021

Reference: Contract.pdf

Payment:

Payment was done with 915,759.10 Baht on June 17, 2021.

Reference: Receipt.pdf

Evaluation report:

Supplier delivered all equipment on July 1, 2021 and Evaluation was performed by Evaluation committee. The report was submitted to Faculty on July 1, 2021. Reference: Evaluation report.pdf	
Inventory registration: Inventory registration of all equipment has been done.	

Table 5 Summary information of tendering of a software named ANSYS

ACTIVITY	TIMESCALE
Submission of request documents for tendering according to NU process **Reference: request documents for tendering.pdf**	July 2022
Appointment for Evaluation committee: **Evaluation committee:** **Asst.Prof. Kwanchai Kraitong** **Asst.Prof. Piyanun Charoensawan** **Asst.Prof. Arwut Lapirattanakun** **Reference: Appointment for Evaluation committee.pdf**	October 2022
Tendering report: **Result of tendering was reported to Faculty on October 17, 2022.** **Reference: Tendering report.pdf** **Quotation.pdf**	October 2022
Winner announcement: **Winner announcement was published on October 17, 2022. Winner was GOLD PC NETWORK Co Ltd.** **Reference: Winner announcement.pdf**	October 2022
Award Contract: **A purchase order was done with the winner, GOLD PC NETWORK Co Ltd, on October 17, 2022. The period of contract is 120 days. The equipment delivery date is by February 06, 2023.** **Reference: Contract.pdf**	October 2022
Payment: **Payment including VAT was done with 480,000 Baht on February 06, 2023. Naresuan University is not eligible to claim VAT refund as stated by the revenue department of Thailand.** **Reference: Receipt.pdf**	February 2023
Evaluation report:	February 2023

Supplier delivered all equipment on February 06, 2023. **and Evaluation was performed by Evaluation committee. The report was submitted to Faculty on February 06, 2023.** **Reference: Evaluation report.pdf**	
Inventory registration: **Inventory registration of all equipment has been done.**	February 2023

Table 6 Summary information of tendering of a set of computers.

3.2.2.Actual Equipment Ordering, Price and Deliver Date

Table 3.1.2 : Actual Equipment Ordering, Price, and Delivery Date							
Name of Institutions: Naresuan University (NU) **Location of APPLY lab: Department of Mechanical Engineering, Faculty of Engineering, Naresuan University, Phitsanulok, Thailand**							
No	Equipment & Model Ordered	Unit	Price per Item (in Baht)	Total price (in Baht)	Total price in (€)	Date of Order	Date of Delivery
1.	Lenovo Workstation PS T620 CPU : Processor AMD Ryzen™ Threadripper™ PRO 3995WX 64 Core, 2.7 to 4.2 GHz	1	316,400	480,000	12,811.20	17 Oct 2022	06 Feb 2023
	Desktop Computer Lenovo Desktop TC M70t CPU : 12th Generation Intel® Core™ i7-12700, 25 MB Cache, 8 Core, up to 4.8 GHz	4	40,900				
No	Equipment & Model Ordered	Unit	Price per Item (in Baht)	Total price (in Baht)	Total price in (€)	Date of Order	Date of Delivery

2.	Software 1 Unit Ansys academic multiphysics campus solution (10/100)	1	915,759.10	915,759.10	25,854.75	17 May 2021	01 July 2021
	Total Purchases				38,665.95		

Table 7 Actual Equipment Ordering, Price and Deliver Date

3.3. Setup of Equipment and Establishment of “APPLY Labs" in Universiti Technology Mara

The ERASMUS+ Resource and Learning Centre was established in 2022 located at the Tun Abdul Razak Library, Samarahan Campus 2, Universiti Teknologi MARA Sarawak, Kota Samarahan, Sarawak, Malaysia. The Centre was officially launched by Professor Datuk Ts. Dr Hajah Roziah Mohd Janor, the former Vice Chancellor of Universiti Teknologi MARA on the 26 September 2022. It was officially opened by His Excellency, Mr. H.E. Michalis Rokas, Ambassador and Head of the European Union Delegation to Malaysia on 13 October 2023. The Centre acts as the foci for teaching and learning, research and innovation, consultancy, meeting or discussion, workshop and seminars and supporting international cooperation projects based on multilateral partnerships between organisations active in the field of higher education.

The Centre has 4 rooms and a Forum Space. Room 1 houses the necessary ICT equipment as a supporting system to deliver the Master Programmes and Professional Courses and conduct research. The list of equipment was acquired under the guidance of the EU Higher Educational Institute and the industrial partners, to tailor it to local contexts and facilities (Note: This room is still waiting for upgrading such as cupboard for small equipment, table and chairs for small group discussion). Room 2 is a round table discussion room, while Room 3 is a seminar cum classroom. Room 4 is a computer room, specifically for teaching and learning. Meanwhile, Forum Space is used for holding mini-conferences, public talks and workshops.

Figure 6 Room 1 houses the necessary ICT equipment

Figure 2: *Room 2 for round table discussion.*

Figure 7 Room 3 for seminar or class.

Figure 8 Room 4 as a computer room for teaching and learning.

Figure 9 Forum Space for holding mini-conferences, public talks and

All equipment supported from APPLY project was installed and operated though the class of CFD module including research project and master thesis.

3.3.1.Equipment Specifications, Quantity, Justifications And Estimated Price

Table 3.3.1B (PO1):

Equipment Specifications, Quantity, Justifications And Estimated Price

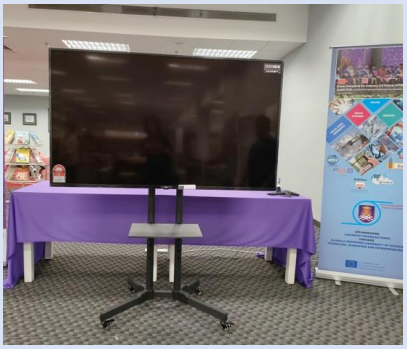
	Name of Institutions: Universiti Teknologi MARA (UiTM) Location of APPLY lab: ERASMUS+ Resource and Learning Centre, Tun Abdul Razak Library, Samarahan Campus 2, Universiti Teknologi Mara Sarawak, Kota Samarahan, Sarawak, Malaysia				
Item No	**Equipment description &Technical Specification**	**Quantity**	**Justification of Needs**	**Estimated Price (€)**	**Photo of the equipment/ lab where the equipment is located**
1.	**Laptop - Dell Precession M3561** Specification: * Intel® Core TMi7-9750 or better * 6 Cores or higher/min 12M Cache/4.5GHz or higher) * 8GB unified memory, configurable to 16GB * 2 DIMM slots. Up to 32GB 2666MHz *Dual Pointing Backlit Keyboard * Intel® Wi-Fi 6 AX201 2x2 .11ax 160MHz + Bluetooth 5.1 * 4 Cells, 68 Whr ExpressCharge™ Capable Battery * Dell Pro Backpack 15 * Dell Mobile Wireless Mouse MS3320W – Black * 3 Years ProSupport Warranty Software: * Operating System: Windows 10 64bit (English) **or equivalent specification**	4	This equipment is used for teaching and learning, research or thesis work.	5826.09	

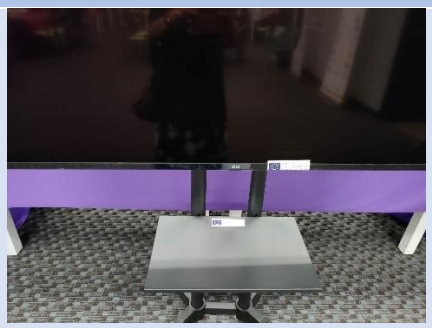
2.	**Desktop Computer - Dell Optiplex 5090 Tower XCTO I7-11700 and Dell E2422H 24" Monitor** Specification: * Intel® Core™ i7-10700 (8Cores/16MB/16T/3.0GHz to 4.8GHz/65W) or better. * 2DIMM slots; up to 16GB 2933MHz DDR4 Memory. * 8GB 2x8GB 2933MHz DDR4 Memory * M.2 512GB PCIe NVMe Solid State Drive * AMD Radeon RX RX 550,4GB * Dell USB Keyboard/Mouse Black * Intel® Wi-Fi 6 AX201, Dual-band+ Bluetooth 5.0 * Internal Audio Speaker * 3 Years ProSupport Warranty * Dell P2419H IPS Monitor **or equivalent specification**	3	This equipment is used for teaching and learning, research or thesis work.	4173.91	 
3.	**Desktop Computer - Dell Optiplex 7090 Tower Desktop and Dell S2421HN 23.8" FHD IPS LCD Monitor (HDMI Port)** Specification: * Intel® Core™ i7-10700 (8Cores/16MB/16T/3.0GHz to 4.8GHz/65W) or better. * 2DIMM slots; up to 16GB 2933MHz DDR4 Memory. * 8GB 2x8GB 2933MHz DDR4 Memory * M.2 512GB PCIe NVMe Solid State Drive * AMD Radeon RX RX 550,4GB * Dell USB Keyboard/Mouse Black * Intel® Wi-Fi 6 AX201, Dual-band+ Bluetooth 5.0 * Internal Audio Speaker * 3 Years ProSupport Warranty * Dell P2419H IPS Monitor **or equivalent specification**	3	This equipment is used for teaching and learning, research or thesis work.	4564.57	 

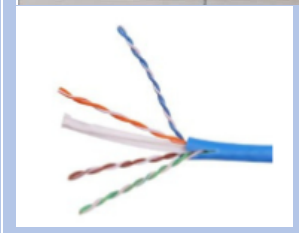
4.	**3D Printer - Proteus Maker** * 200mmX200mmX200mm Print Size Technology * FDM (Fused Deposition Modelling) * Printing Speed up to 150mm/s * Resolution: 5 microns * Operation: File transfer or USB 2.0 **or equivalent specification**	3	This equipment is used for teaching and learning, research or thesis work.	1043.48	 
5.	**Projector - Epson EB-FH52** * Projection System: 3LCD, 3-chip technology * Native Resolution: 1920 x 1080(Full HD) * Color Brightness: 4,000 lumens * White Brightness: 4,000 lumens	1	This equipment is used for teaching and learning, research or thesis work.	836.96	
6.	**Magnetic Glass Whiteboard** (2400mm x 1200mmx 4mm)	1	This equipment is used for teaching and learning, research or thesis work	510.87	 

7. **8.**	**Ace Smartone Multi-Touch** **Mobile Rack** Ultra hd led multi-touch display (20 points) with hybrid system (android + windows) virtual access menu industry leading smart mcu touch menu dual mode remote control	1	This equipment is used for teaching and learning, research or thesis work	5713.05	 
9.	**Laserjet Printer - HP Color Laserjet Pro MFP M183FW** * Print, Copy, Scan, Fax, Wireless * Processor: 800MHz * Hi-Speed USB 2.0 port; built-in Fast Ethernet 10/100 Base-TX network port, 802.11n 2.4/5GHz wireless, Fax port	1	This equipment is used for teaching and learning, research or thesis work	536.96	  

10.	**Kandao Meeting Pro 360 All in One Conferencing Camera** *AI-based 360° video conferencing device, * equipped with 360-degree lens, Omni-directional audio system, Hi-Fi Speaker, * built-in android system. *designed to be four-in-one for being the most powerful one.	2	This equipment is used for teaching and learning, research or thesis work	2086.52	 
11. **12.**	**LQ UQ75 65" Series 4K Smart UHD TV With AI Thin** * Touch Panel (with multiple touch point) * USB capable* Built-in automatic WIFI hotspot * Support Windows	3	This equipment is used for teaching and learning, research or thesis work	2934.78	 

					 
13.	**Tablet - Apple Ipad Mini 6thGen/Wifi/256GB** * 8.3” LED-backlit Multi-Touch display with IPS technology * 2266-by-1488 resolution at 326 pixels per inch (ppi)	2	This equipment is used for teaching and learning, research or thesis work	1282.17	
14.	**Active Optical Cable - Aten 30M True 4K HDM (True 4K@30m)** * Extends True 4K signals up to 30m * Reduced EMI and RFI for lower noise interference * Gold-plated connectors for reliable transmissions	2	This equipment is used for teaching and learning, research or thesis work	543.48	 

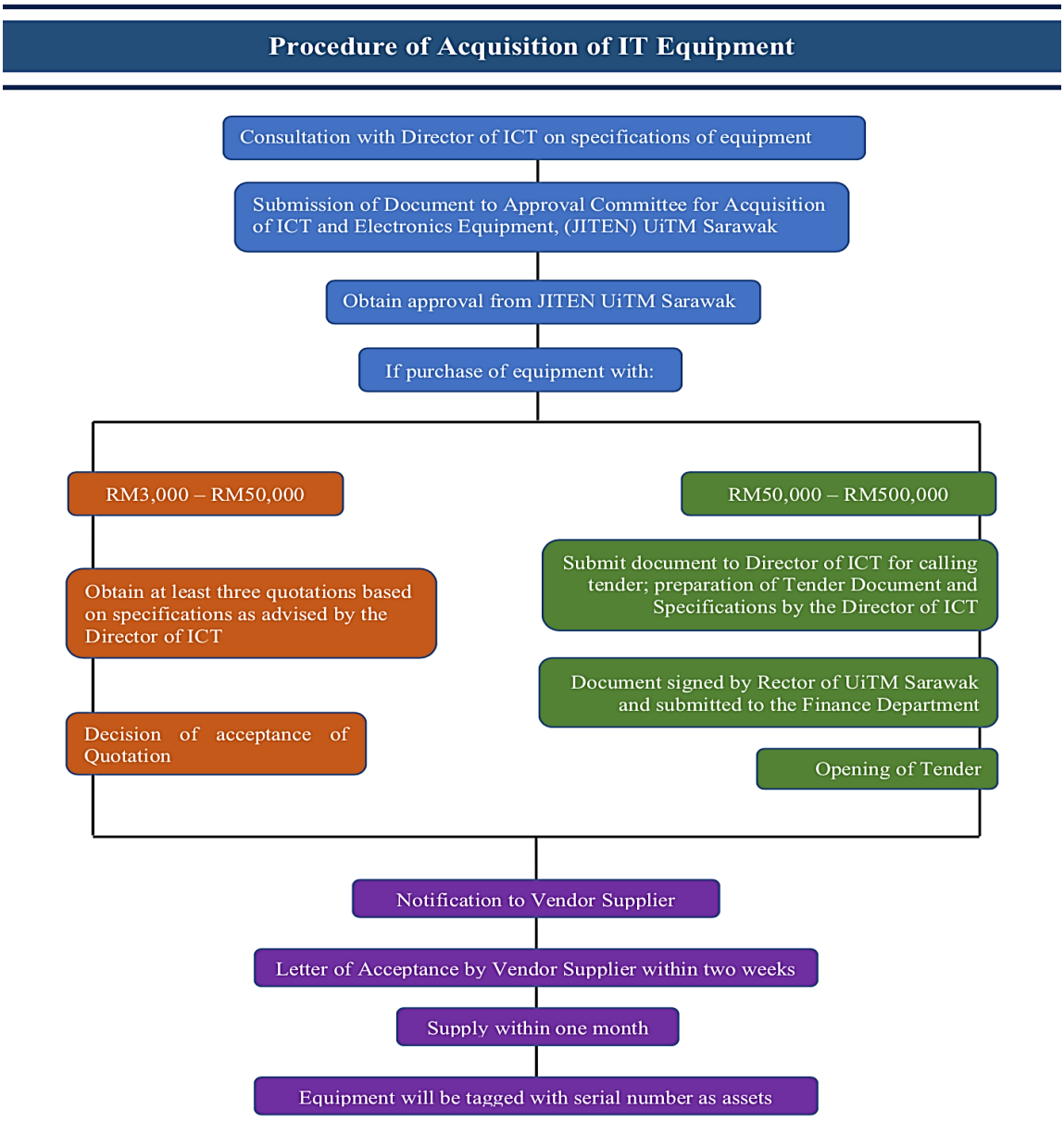
15.	**USB C- PEPPER JOBS (TCH-11) Ultra USB C Multiport & Network HUB** *It is an 11-in-1 multiport USB-C adapter. *It converts a Thunderbolt 3 or USB-C 3.1 source to *HDMI & VGA video outputs, Gigabit Ethernet connection, USB-C PD charging port, SD/TF card readers and USB audio. * It has 2 USB 3.0 ports and 2 USB 2.0 ports	2	This equipment is used for teaching and learning, research or thesis work	182.17	 
16.	**32”-65” Portable TV Display Stand with Wheels (50kg)** * Compatible with most 32" to 65" LCD LED Flat Screens with a maximum load capacity of 50 kg (110 lbs) and max VESA pattern up to 600x400mm *Equipped with four heavy-duty casters for easy transport of TV cars,built-in locking mechanism allows the cart to be fixed or moved as needed.	2	This equipment is used for teaching and learning, research or thesis work	295.65	 
17.	Laptop bag	2		282.61	 

18.	**Leather Sleeve For 13.3 Inch Macbook**	1		147.61	
19.	**Commscope CAT6 UTP 24AWG Cable** * 4 pair network cable (blue) (305m) * Cable Type U/UTP (unshielded) * Conductor Type, singles Solid Conductors	1		141.30	 
20.	**32”-70” Double Arms 4 Way Adjustable Wall TV Bracket**	1		54.35	 

21.	**VR Headset - PICO 4 ALL IN ONE 256GB** * Processor: Qualcomm XR2, 8 Cores 64 bit, 2.84GHz, 7nm process technology * Storage: 8GB+128GB / 8GB+256GB * Wi-Fi: Support Wi-Fi 6, 2.4GHz/5GHz dual band * Bluetooth: Support Bluetooth 5.1 * Resolution: 4,320 ⨯ 2,160 (2,160 ⨯ 2,160 per eye) * Refresh rate: 72Hz / 90Hz * Optics: Pancake Lens, 105°FOV, 20.6 PPD, 62-72mm inter-pupillary distance adjustment	1		521.52	 
22.	**TARGUS TSB96001GL-70 GEOLITE 15.6" BACKPACK**	4		282.61	  
		Estimated Total Price		**31960.66**	
		Actual Allocated Price		**31860.00**	

Table 8 Equipment Specifications, Quantity, Justifications And Estimated Price

3.3.2.Procurement Procedures



3.3.3.Actual Equipment Ordering, Price and Deliver Date

No	Equipment & Model Ordered	Doc. Ref. Number	Unit	Price per Item (MYR)	Total price (MYR)	Total price in (€)	Date of Delivery /Invoice	Date of Receipt
1.	Dell Precession M3561	EQ-P3-INV08675	4	6700	26800	5826.09	7/12/2021	24/12/2021

2.	Dell Optiplex 5090 Tower XCTO I7-11700 and Dell E2422H 24" Monitor	EQ-P3-INV08675	3	6400	19200	4173.91	7/12/2021	24/12/2021
3.	Dell Optiplex 7090 Tower Desktop and Dell S2421HN 23.8" FHD IPS LCD Monitor (HDMI Port)	EQ-P3-INV09844	3	6999	20997	4564.57	7/6/2022	22/6/2022
4.	Proteus maker 3D printer	EQ-P3-INV09844	1	4800	4800	1043.48	7/6/2022	22/6/2022
5.	Epson EB-FH52 Projector	EQ-P3-INV10559	1	3850	3850	836.96	27/9/2022	14/10/2022
6.	Magnetic Glass Whiteboard - 2400mm x 1200mmx 4mm	EQ-P3-INV10559	1	2350	2350	510.87	27/9/2022	14/10/2022
7.	Ace Smartone Multi-Touch	EQ-P3-INV10559	1	23680	23680	5147.83	27/9/2022	14/10/2022
8.	Mobile Rack	EQ-P3-INV10559	1	2600	2600	565.22	27/9/2022	14/10/2022
9.	HP Color Laserjet Pro MFP M183FW	EQ-P3-INV10559	1	2470	2470	536.96	27/9/2022	14/10/2022
10.	Kandao Meeting Pro 360 All in One Conferencing Camera	EQ-P3-INV10560	2	4799	9598	2086.52	27/9/2022	14/10/2022
11.	LQ UQ75 65" Series 4K Smart UHD TV With AI Thin Serial No. 206INPT4F432	EQ-P3-INV10560	1	4500	4500	978.26	27/9/2022	14/10/2022
12.	LQ UQ75 65" Series 4K Smart UHD TV With AI Thin Serial No: 206INTX4F201, 206INZY4f389	EQ-P3-INV10560	2	4500	9000	1956.52	27/9/2022	14/10/2022
13.	Apple Ipad Mini 6th Gen/Wifi/256GB/8.3"	EQ-P3-INV10560	2	2949	5898	1282.17	27/9/2022	14/10/2022
14.	Aten 30M True 4K HDMI Active Optical Cable (True 4K@30m)	EQ-P3-INV11014	2	1250	2500	543.48	12/12/2022	19/12/2022
15.	PEPPER JOBS (TCH-11) Ultra USB C Multiport & Network HUB	EQ-P3-INV11014	2	419	838	182.17	12/12/2022	19/12/2022

16.	32"-65" Portable TV Display Stand with Wheels (50kg)	EQ-P3-INV11014	2	680	1360	295.65	12/12/2022	19/12/2022
17.	Laptop bag	EQ-P3-INV11014	2	650	1300	282.61	12/12/2022	19/12/2022
18.	Leather Sleeve For 13.3 Inch Macbook	EQ-P3-INV11014	1	679	679	147.61	12/12/2022	19/12/2022
19.	Commscope CAT6 UTP 24AWG Cable	EQ-P3-INV11014	1	650	650	141.30	12/12/2022	19/12/2022
20.	32"-70" Double Arms 4 Way Adjustable Wall TV Bracket	EQ-P3-INV11014	1	250	250	54.35	12/12/2022	19/12/2022
21.	PICO 4 ALL IN ONE Vr HEADSET 256.G	EQ-P3-CS151868	1	2399	2399	521.52	10/11/2022	10/11/2022
22.	TARGUS TSB96001GL-70 GEOLITE 15.6" BACKPACK	EQ-P3-CS151203	4	325	1300	282.61	4/10/2022	4/10/2022
	Total					**31960.66**		
	Actual Allocation					**31860.00**		

Table 9 Actual Equipment Ordering, Price and Deliver Date (UiTM)

3.4. Setup of Equipment and Establishment of "APPLY Labs" in Universiti Malaya

Universiti Malaya (UM) has purchased 3 units Apple Macbook Pro and 2 units of Apple 12.9-inch iPad Pro Wi-Fi 512GB -Space Grey. We initiated to purchase CFD software and computers, but due to eprocurement process and pricing of CFD, we could not complete it. The purchase of the computer has been cancelled because the supplier cannot fulfil the delivery.

3.4.1.Procurement requirements

The purchasing process in UM very standard process. We need to apply through e-procurement system. (https://eprocurement.um.edu.my/). Before we submit the purchase we need to get 3 quotations from different supplier. Then we must prepare a market survey report and submit online. Then the approval from Head and Dean for the tender opening. The tender will be opened for certain time and then the companies will take part. The project leader will select the lowest price or the best supplier in terms of specifications then the purchase order will be issued. (there will be approval by Head and Dean). Once PO is given, the supplier will deliver as per the conditions, the project leader approve the delivery in the system then the payment will be cleared to the supplier.

3.4.2.Actual Equipment Ordering, Price, and Deliver Date

Name of Institutions: Universiti Malaya (UM)
Location : Department of Physics, Faculty of Science, Universiit Malaya, 50603 Kuala Lumpur.

No	Equipment	Unit	Doc. Ref. Number	Total price in (€)	Date of Delivery /Invoice	Date of Receipt
1	**Macbook 16" M1/16GB/512 GB**	3	IN11-03605	6175.80	20/04/2023	20/04/2023
2	**Apple - 12.9-inch iPad Pro Wi-Fi 512GB - Space Grey** AppleCare Protecton Plan For Ipad Smart Keyboard Folio for 12.9 inch iPad Pro Hard Portable Case for iPad 12.9inch Protective Sleeve 20W USB-C Power Adapter withUSB-C Charge Cable	2	INK 00025932	3621.66	20/04/2023	20/04/2023
	Apple Pencil (2nd Generaton Targus Sleeve Pulse 13-14" (Bl					
	Total			**10337.46**		
	Actual Allocation			**31860.00**		

Table 10 Actual Equipment Ordering, Price, and Deliver Date

3.5. Setup of Equipment and Establishment of “APPLY Labs" in Manipal University Jaipur

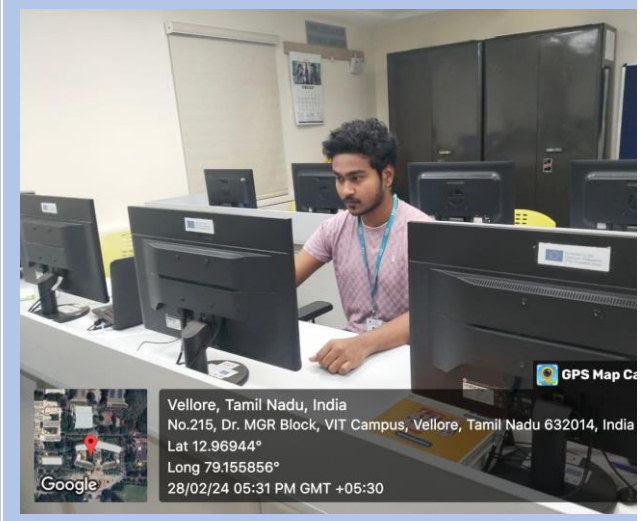
Manipal University Jaipur could not utilize the funds allocated since the FCRA approval from Government of India was received very recently. Therefore, funds could not be utilized since it was closer to the end of the project period. MUJ however is benefited in terms of equipment through the APPLY Cluster.

3.6. Setup of Equipment and Establishment of “APPLY Labs" in Manipal Academy of Higher Education

Manipal Academy of Higher Education, India could not utilize the funds allocated due to FCRA regulations by Government of India. MAHE however is benefited in terms of equipment through the APPLY Cluster.

3.7. Setup of Equipment and Establishment of “APPLY Labs" in Vellore Institute of Technology, India

Table 3.3.1B (PO1): Equipment Specifications, Quantity, Justifications And Estimated Price	
	Name of Institutions:Vellore Institute of Technology, Vellore

	Location of APPLY lab: MB 108, CFD Laboratory				
Item No	Equipment description &Technical Specification	Quantity	Justification of Needs	Estimated Price ($)	PHOTO OF THE EQUIPMENT/ LAB WHERE THE EQUIPMENT IS LOCATED
1.	HP Z2 G5 Workstation, Intel Xeon W-1290, 3.2 Ghz,10C 80W,32 +32 Gb DDR4 Ram,2TB SATA HDD,with DVD RW,mini DP to DP adapter, HP 24" Monitor	07	As per the M.tech program guidelines to meet out the course objectives and outcomes we have utilized the Erasmus funding effectively to improvise our computer facilities to carry out CFD simulations	14995	
2.	HP ET800 G9 Workstation, I9-12900, 64 GB ram,1 TB HDD, HP P24v G5 FHD Monitor	09		16020	
	Estimated Total Price			31015	

3.7.1.Procurement procedures

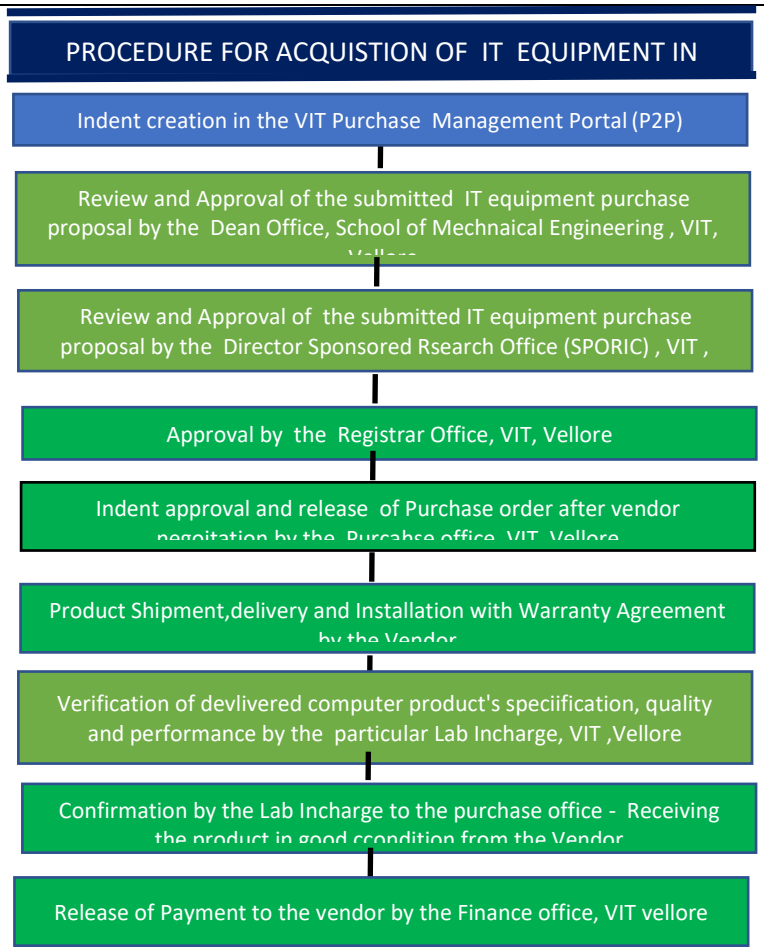


Figure 10 procurement procedures (VIT)

SECTION 3

3.7.2.Actual Equipment Ordering, Price and Deliver Date

No	Equipment & Model Ordered	Unit	Price per Item (in USD)	Total price (in USD)	Date of Order	Date of Delivery
1.	HP Z2 G5 Workstation, Intel Xeon W-1290, 3.2 Ghz,10C 80W,32 +32 Gb DDR4 Ram,2TB SATA HDD,with DVD RW,mini DP to DP adapter, HP 24" Monitor	07	2142	14995	30 Aug 2021	13 Nov 2021
2.	HP ET800 G9 Workstation, I9-12900, 64 GB ram,1 TB HDD, HP P24v G5 FHD Monitor	09	1780	16020	29-12-2022	09-03-2023
	Total Purchases		3922	31015		

Table 11 Actual Equipment Ordering, Price and Deliver Date

Summary: Purchase and Development of “APPLY Labs” in Asian HEI’s

The “APPLY Labs” were established in all Asian HEI’s except in Manipal Academy of Higher Education, India and Manipal University Jaipur, India due to FCRA regulations of Government of India. These established labs will serve to provide hands on training to faculty and students involved in teaching and learning the Masters Program/ courses relevant to APPY CFD in the partner countries.