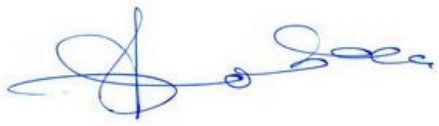
Format for an IUC programme application – Concept note South

Call Institutional University Cooperation (IUC) 2022

GENERAL INFORMATION

Programme data	
Country and region of the programme	
Vietnam, in particular Central Vietnam and the Highlands	
Programme title (linked to strategic/thematic focus area)	
Improving livelihoods and living conditions by the sustainable development of the South Central Coast and Central Highlands of Vietnam through enhancing the capacity of Quy Nhon University	
Programme Summary (Focus of proposed strategic area(s) and institutional strengthening activity)	
This programme aims to sustainably develop the region by boosting the livelihoods of local farmers and living conditions of local residents through the capacity enhancement of Quy Nhon University (QNU) in applied science, particularly in food science, environment and renewable energies. The strategic aims include (i) improving a flood early warning capability and climate change adaptation; (ii) enhancing the efficiency of solar energy and biogas production used in farming by employing novel nanomaterials; (iii) increasing the value of regional fruits by using natural-based post-harvest processes; and (iv) maximizing local farmers' benefits by consulting and instructing them about risk assessment and risk management obtained from research on a safe agricultural supply chain. At the institutional level, this programme focuses on two objectives: (i) establishing an effective and efficient waste management system at the entire university; (ii) modernizing and digitalizing university student services including implementing an e-mail system, e-learning, and an e-library.	
Applying local university (institution and proposed local coordinator)	
Full name of the institution (+ abbreviation)	Quy Nhon University (QNU)
Address	170 An Duong Vuong Street, Quy Nhon City, Binh Dinh Province, Vietnam
Website	www.qnu.edu.vn
Name of proposed local coordinator (details in annex 3)	VU Thi Ngan
Name of the authority of the local university (Rector, Vice-Chancellor, President,...)	DO Ngoc My (Rector)
Statute of the institute (private or public)	Public
Signature of the authority of the local university (Rector, Vice-Chancellor, President,...)	
	

Signature of the proposed local coordinator

PROGRAMME DESCRIPTION

1. Strategy of the institution

Briefly describe the overall institutional strategy. Highlight the institution's vision on its role as university and as a driver of change in society. Refer to other relevant internal policy documents, if relevant.

QNU, formerly known as Quy Nhon University of Education, was founded in 1977 and is affiliated with the Ministry of Education and Training. QNU is the largest public university in Vietnam's South Central Coast and Central Highlands region, including the eleven provinces of Quang Nam, Quang Ngai, Binh Dinh, Phu Yen, Khanh Hoa, Ninh Thuan, Binh Thuan, Gia Lai, Kon Tum, Dak Lak, and Dak Nong (hereafter mentioned as "the region"). The university's mission is training and developing high-quality human resources, fostering talents, conducting scientific research, disseminating knowledge and transferring technology to effectively serve the sustainable development of the country in general and the region in particular, and contributing to the promotion of social progress [cf. Annex 4]. In its 40 years of development, QNU has made great contributions to education, thereby providing a highly qualified labour force of about 90,000 undergraduate and 2,500 graduate students who are working in different sectors across the country.

In line with the trends of the fourth industrial revolution, globalization, international integration, and university autonomy [Decision No. 77/NQ-CP dated October 24, 2014 by Vietnam's Prime Minister], together with the requirements of socio-economic development, the university has outlined its development strategy plan for 2016-2020 with a vision to 2030 that "*QNU will be a prestigious multidisciplinary application-oriented institution that meets the quality standard of Asia Universities Network* (http://www.aunsec.org) *and is well positioned in its domestic and international cooperation in education, research, and academic cultural exchange*."

Elaborate on the capacity of the university to network with external actors: Governments, private sector, communities, civil society organisations, external funders, etc.

Recognising the pivotal role of QNU in the socio-economic development of the region, the Government, Ministry of Education & Training (MOET) and Ministry of Science and Technology (MOST) have recently launched key development policies and provided financial support to enhance QNU's capacity in education, research, and technology transfer. In addition, QNU receives support from Binh Dinh People's Committee and other neighbouring provincial authorities such as Quang Ngai, Gia Lai, Kon Tum, Phu Yen, and Khanh Hoa. The main goal of these support actions is to promote QNU as the pioneer for solving the existing challenges across the region including highly qualified human resources, mitigation of environmental pollution, natural disaster risk reduction, climate change adaptation, and sustainable development. Obviously, there is a significant increase in the number of national, ministerial and provincial level research projects conducted by QNU's staff members every year, which have partly addressed the demands of the local communities.

Along with governmental support, QNU has received ample academic support from networks of research groups at prestigious universities and research institutes in Vietnam, for instance Vietnam National University (Hanoi and Ho Chi Minh), Da Nang University, Can Tho University, Hue University, as well as from other countries. Notably, the university has effectively implemented bilateral and multilateral cooperation in education and research with many international higher education institutions and organisations via VLIR-UOS (SI and TEAM projects), the European Commission (Erasmus+ projects), UNESCO (TWAS, UNESCO-UNITWIN projects), South Korea Institute of Science and Technology, and Quy Nhon International Center for Interdisciplinary Science and Education. Thanks to these networks, the university's lecturers and students have the opportunity to broaden their knowledge as well as gain access to an advanced global educational and research environment.

In recent years, the cooperation between QNU and industry has become one of the key approaches to realise fundamental research and bring practical benefits to the local communities. Research grants and scholarships from Vietnamese companies, such as Vingroup Innovation Foundation, TMA Solutions and FPT software, provide QNU's researchers and students with better financial support to conduct their studies.

2. Context analysis

Provide a local context analysis, highlighting key development problems, their context, importance and underlying causes. Take into account the transversal themes gender and environment in this analysis.

Quy Nhon University is geographically centrally located in the region, which constitutes a total land area of 87,987km^2, accounting for around 27% of the country's area, with a population of nearly 13 million people or 14% of the total national population (data as of 2018). It is a well-established fact that this area is more prone to natural disasters than any other region in the country. First, due to the local unfavourable geographical, topographical, and meteorological conditions along with global climate change, the region experiences an increase in annual rainfall, occurring mainly during a short period in the rainy season. At the same time more water reservoirs are progressively being constructed for hydro-electricity production. Both factors are major contributions to frequent uncontrolled floods, which cause catastrophic damages not only to the life of local residents but also to the economic development of the region. For example, according to the Central Committee for Disaster Prevention and Control, the estimated economic loss for the region due to Typhoon Damrey in 2017 is approximately US$994 million, including human impact (123 dead and missing), housing (3,550 collapsed and 299,233 damaged), crops (11,327 hectares of rice damaged and 27,301 hectares of vegetables submerged). Forecasting and warning are of utmost importance to limit loss from natural disasters, and is currently provided and disseminated by the national and local authorities (i.e. the national and local centres for hydro-meteorological forecasting) via mass media. Unfortunately, the local population nowadays is very often not yet warned on time to provide the necessary preparations. Furthermore, the forecasting and warning are only made on a regional scale whilst specific forecast and warning for small areas are still lacking. In case of emergency, the communication between the local authorities and residents is still inadequate. Hence, it is imperative for this region to have an effective and efficient warning system for natural disasters in order to minimize not only their damages to human life, environment but also to housing and agricultural products.

Though the majority (71%) of the local residents rely on agriculture, their agricultural productivity remains relatively low (gross regional domestic product from agriculture, forestry and fishing accounts for only 28% of the country). In addition, this region has many typical and highly valued agricultural products, e.g. durian and avocado, but their economic value has not yet been maximized due to present rudimentary farming methods. Moreover, these products often suffer a high rate of damages and losses after harvesting, leading to a low income of the farmers. In order to increase the productivity and prolong the freshness of products, the farmers tend to overuse plant growth regulators and pesticides in the pre-harvest phase, and chemical preservatives in the post-harvest period, most of which have a doubtful origin. Such inappropriate farming practices lower product quality and pose a major threat to the public health and environment. In particular, more and more local residents suffer from various cancers and dangerous diseases. The highest content of chemicals found in the regional agricultural products is due to the freshness preservations, making them refused by consumers. The middle and upper class in Vietnam is moving their consumption patterns towards the more expensive organically grown products, leaving the poorer population consuming products of doubtful origin. Consequently, farmers could lose their source of income. The best solution for these problems is to apply green sciences and technologies to the agriculture sector, especially in post-harvest preservation to improve the quality and productivity of the regional products in sustainable ways for the sake of local farmers and consumers.

The demand for energy is increasing along with the growing demand for the economic development and modernization in agriculture. The effective use of energy, especially clean and renewable energy, will contribute to alleviate the high demand for electricity/energy produced from polluting non-renewable sources. The tropical climate supplies an abundant amount of solar energy to this region with around 2,500 hours per year, assisting farmers in different agricultural activities. Nevertheless, this advantage has not been effectively explored due to a lack of renewable energy research applications. As an alternative, biogas production is an eco-friendly strategy for energy production from biomass, which is largely produced in rural areas from animal husbandry. The same counts for the current biogas production in the region, which is also ineffective due to scarce advanced technology applications. The enhancement of biogas productivity targets a two-fold purpose: providing more energy accessibility to farmers and reducing the negative impact of biomass (animal waste) on the local environment, which releases pollutant gases such as ammonia, hydrogen sulphur, indole, skatole, mercaptan, and allows

hazardous micro-organisms (such as *Coliform*, *E. coli*, …) spread to food and cause diseases. Accordingly, farmers will be motivated to use more modern technology if scientific research can improve the efficiency of using renewable energies.

As a university active in this region, we also found out that the regional agricultural production is unresponsive to the high consumption demand for safe products that meet a certain safety standard. The agricultural production is mostly conducted by household farmers who have difficulties in obtaining food safety certificates such as VietGAP - one of the common standards issued by Vietnam's Ministry of Agriculture and Rural Development for agricultural product quality assessment. Since this certification follows an expensive and labour-intensive procedure, it thus remains largely inaccessible to the farmers. Meanwhile, the farmers have a desire to provide agricultural products which meet the strict standards for food safety. Fortunately, Rikolto, a Belgian non-governmental organization (NGO) with its international office in Leuven, Belgium, has started a project in Vietnam with the aim of producing safe food. They recently introduced the Participatory Guarantee System (PGS) in Vietnam, which has been widely applied in many other countries. This system is a reliable and affordable quality assurance mechanism, which encourages the participation of stakeholders in the quality monitoring process and enables the farmers to bring safe and secure products to the market. Therefore, the priority is to encourage local farmers to participate in a supportive quality assurance system like PGS. The farmers need to be consulted about the ways to assess and manage risks upon participation in different safety systems.

In addition, environmental pollution in the region is extremely serious and at an alarming level. According to the United Nations, worldwide material consumption has increased rapidly, seriously jeopardizing the achievement of ensuring sustainable consumption and production patterns (Sustainable Development Goal 12). The problem is worse in Quy Nhon city compared to the others mainly due to a lack of adequate centres for recycling and treating waste and a fast-growing of sea tourism, leading to significantly higher volumes of untreated waste being sent to landfill sites and thus bearing a heavier burden on the environment. More important, raising environmental awareness of residents, particularly in changing their habits and behaviors to waste disposal, has not been paid adequate attention. In order to enhance the awareness in this issue, well-educated young residents are most likely to become pioneers. With a large number of students and staff the university is well placed to induce a green lifestyle and inspire the community, QNU is an excellent role model of good waste management to become a driving force for societal change.

With regard to regional labour forces, there is a shortage not only in the number of interdisciplinary workforces, but also in their expertise to deal with current regional problems. Frequent natural disasters, problems of safe food, health services, education, and difficult living conditions in the region are forcing people to leave their hometowns. Although this region accounts for 27% of the country's total surface area, its population only accounts for 14%, so the population density is lower than the country´s average. On top of that, the rural areas have a traditional mind-set of prioritising male to female children. Sons of low-income farming families are often sent to the large cities (Hanoi, Ho Chi Minh City) for better education, while the daughters are kept close to home. This might be one of the explanations why there is an imbalance in the male-female student ratio at QNU being 67.9% of female while the national average ratio of female student is 53.1% reported by the Ministry of Education & Training (MOET) for the period 2016-2018. There is a higher barrier for women to pursue a career than for men in this region.

As the largest and longest-standing university in the region, QNU needs to enhance its performance in education and research to produce qualified human resources and provide research-based sustainable solutions for local problems, including gender inequality and negative environmental impacts. In conjunction with the local authorities and communities, QNU is expected to be the leading actor to bring about applicable solutions to the regional problems and play a pivotal role in the regional socio-economic development.

Provide an institutional context analysis, highlighting strengths and capacity constraints / needs of the institution. Take into account the transversal themes gender and environment in this analysis. Describe the position of your university in the national higher education landscape.

Located in Quy Nhon, a small coastal city, QNU had the single mission of educating, training, and providing high-school teachers for this region until 2003. Ever since, its mission has been changed to fulfil the social demand of providing an educated workforce in various fields and to enhance scientific research activities. For the

time being, the university is running 46 bachelor's, 20 master's and 3 doctoral programmes in disciplines of pedagogy, natural sciences, social sciences and humanities, engineering and technology, and economics, for nearly 15,000 students. In addition, it has obtained major achievements in several aspects. In *education and training*, QNU has educated a large number of graduates. Many of them hold important positions not only in large corporations but also in governmental bodies. In *research,* over the last 5 years, QNU has made great strides in publishing with over 348 international and 540 national publications. Nowadays QNU holds the 22nd place in publishing rate in Vietnam, according to the Ranking Web of University (webometrics.info, accessed on 19th August 2019). In terms of *technology transfer*, the Applied Research Institute for Science and Technology (ARIST) has recently been established by QNU to respond to the growing demands of local communities for effective resolutions towards sustainable development. So far, QNU has developed and successfully transferred technological solutions for local organizations/companies in health care, chemical engineering, and water resource management. QNU currently has 500 motivated lecturers and researchers. Many of them (more than 50) have obtained their PhD degrees and gained postdoctoral experience in natural sciences, information technology, and applied mathematics from highly-ranked international institutions, proving the QNU staff's competitive capacity in research. While the number of students is mainly female, the opposite counts when moving higher in the university hierarchy. The proportion of female staff holding a PhD degree is far lower than that of the male staff (35% and 65%, respectively). Regarding *national and international cooperation*, the university has recently developed a broad collaborative network with leading institutions and organizations at both national and international scales in education, research and cultural exchange. Through these collaborations, not only has the teaching and research capacity of the QNU staff been strengthened but the social and economic development of the region has also improved.

In addition to the above advantages, there are still many areas where QNU has opportunities to further develop its potential. Despite certain achievements in research, it still lacks a *professional research environment* due to a shortage of application-oriented research projects, inadequate facilities for high-quality research, limited research funding, etc. In fact, the ongoing research activities mainly focus on fundamental research with insufficient attention to application-oriented domains, limiting the engagement of local problems and development, especially in agricultural issues. Regarding to *education and training*, despite being the largest university in the region, QNU has not been recognized as a top-ranked university in the country, making it difficult to receive qualified students' enrolment in the region. Also, the existing graduate education programmes are still limited in terms of interdisciplinarity and responsiveness to demand, such as in food sciences, environment, and renewable energies. Furthermore, digital and online student services are limited. Most of the education activities at QNU are based on traditional methods, preventing students from taking advantages of distance-training and online courses. In this context, an e-learning system and a well-equipped library are one of the most urgent needs to enhance the students' outcomes. The e-learning system in QNU is missing due to the insufficient experience in e-learning development and implementation, and its enormous resource requirements. The present outdated library management system, which was equipped in the 2000s, no longer meets the growing demand of the more than 15,000 students and staff, and is identified as the crucial reason for inefficiently accessing existing resources, difficult updating new format resources, and limiting cooperation exchange with external libraries.

In order to contribute to the professionalization of the research and education environment, a good *Information and Communication Technology (ICT) infrastructure* is crucial. QNU has recently developed a new ICT infrastructure, but due to the complex integrated system and the limited resources, only the most basic requirements in training, finance and human resource management are fulfilled. The ICT systems for student services are relatively restricted in terms of student email system, campus-wide WiFi and students' administrative services. Next to these shortcomings, waste management is another issue. QNU is generating a massive amount of waste, a volume of more than 5 m^3 per day, due to numerous academic, educational activities, office operations, cafeterias and dormitories. Observations made clear that nearly half of solid waste is plastic. However, the waste management system at QNU has not been effective enough to handle this huge daily amount.

With the current capacity, QNU is believed to belong to the top 40% of leading universities in Vietnam. With the overwhelming desire to play a prominent role in driving changes of the region, QNU must overcome the existing constraints and effectively deploy its fullest potential. Together with QNU internal capacity, every possible external support is needed to realise this dream.

3. Proposed programme strategy

Long term desired change(s): Explain how the proposed IUC programme will contribute to the strategy of the institution. How does this fit with the objectives of institutional university cooperation? What are the ambition(s)/dream(s) of the proposed IUC programme?

The proposed IUC programme has a two-fold mission: addressing the needs of communities and boosting the role of QNU in the sustainable development process in the South Central Coast and Central Highlands region of Vietnam. This is consistent with QNU's Strategy and Vision for becoming a prestigious multidisciplinary application-oriented institution at national level. Specifically, via this programme, QNU is expected to provide the local community with advanced technology and highly qualified manpower to handle the regional socio-economic problems. That is in accordance to the general objective of Institutional University Cooperation for "Empowering the local university as institution to fulfil its role as development actor in society".

The ambitions of the programme are (i) to enhance the livelihoods of local farmers and the living conditions of the local community in this region and (ii) to strengthen QNU capacity in applied science and education, particularly in food science, environment and renewable energies. This approach is stimulated by the fact that this region is faced with some major problems as analysed above, including low agricultural productivity, poor food safety, low farmers' income, detrimental environment situation whereas QNU has insufficient capacities in terms of human resources and facilities.

Domains of change: What are the key challenges (cf. context/institutional analysis and strategy) the programme wants to tackle (can be both internal and external to the institution)? How to translate them into desired changes (i.e. "domains of change")? How does this contribute to the long term objective(s)?

In order to achieve QNU's dream, the programme focuses on four domains of change (DoC) at the regional level and two domains of change at the institutional one. At the regional level, this programme aims (DoC1) to create an early warning system for floods in the region, to enhance the capacity of the local authorities in flood monitoring, and to improve the community's adaptability to climate change; (DoC2) to enhance the efficiency of solar energy and biogas applications in farming by using novel nanomaterials; (DoC3) to increase the value of regional fruits by using natural-based post-harvest process; (DoC4) to increase farmers' benefits by conducting research on safe agricultural supply chain risk management and risk assessment. At the institutional level, this programme is expected to raise QNU's capacity in education and research. Accordingly, the following objectives are defined: (DoC5) to target effective and efficient waste management practices in the entire region so that QNU will be an aspirational pioneer in establishing a sustainable waste management system; (DoC6) to modernize and digitalize the university management, QNU would like to renovate the student services by building a student platform integrating all student activities at the university, an e-learning system and an e-library to provide better education for a larger number of students.

The DoC1's end results will include prompt responses and preparations by both authorities and community before floods. To fulfil the task, the authorities not only need to be able to provide early warnings and bring about prompt assistance, but the community also must have sufficient knowledge of the risks and how to adequately react to flood warnings. Therefore, an effective system of monitoring and promptly warning for floods must be constructed. The proposed system consists of three integrated sub-systems of data collection, data analysis, and communication. The data collection sub-system is expected to accurately collect updated data before, during and after floods. This can be improved by the use of satellite images, Internet of Things (IoT), drones, and existing databases (e.g. rainfall radar, measure of water level and weather forecasts), etc. The data analysis sub-system should be designed by applying statistical and mathematical models, geospatial analysis, big data and deep learning in order to analyse, process, and optimize input data. Mathematical models in hydrology and hydraulics for flood prediction and damage assessment will be studied. The communication sub-system should be built by applying advanced technology such as 3G, 4G, 5G in combination with the traditional modes of communication like radio and television. This system is expected to minimize damages and losses of the local community, especially women and children because of their high vulnerability.

The DoC2 strives for a higher efficiency of using renewable energy sources such as solar energy and biogas in farming and daily life in the rural areas. The smallholder farmers can facilitate their agricultural activities

such as crop drying and plant watering by utilizing effective solar panels. More biogas is available and accessible for various usages in animal farms in rural and remote areas as a low-cost and environmentally friendly solution. Designing novel nanomaterials at affordable cost is the key challenge for this change. This DoC includes three parallel research directions on nanomaterials. First, the drying processes in all weather conditions will be made possible thanks to the advantages of plasmonic nanomaterials. Second, the biogas production will be more productive and selective by using the right catalysts. Novel nanomaterials with desirable catalytic characteristics will be designed for the purpose. Lastly, new nanomaterials will be designed to serve the next domain of change to increase the value of regional fruits. To complete all proposed tasks, two research-based activities will be carried out: (i) research on the synthesis of novel nanomaterials including plasmonic materials such as degenerated semiconductors (i.e. Al-doped ZnO, TiN, Au/Ru-doped Co_3O_4) and low dimensional nanomaterials like carbon quantum dots, graphene, g-C_3N_4, transition metal dichalcogenides; (ii) research on the improvement of technologies, namely, further development of conventional drying processes/biogas production.

The DoC3 is realised by larger production and larger consumption of safe fruits in the region, thus increasing the value of fruits. Among many regional fruits, durian and avocado are selected as the priorities in this programme because of their high nutrition and economic value. Right now, the low economic value of these fruits is caused by the low number of farmers who follow the quality standard, by pest invasion in crops, by the employment of rudimentary techniques in fruit cultivation, and by the absence of safe post-harvest methods. Due to this last factor, the loss of quality and quantity of fruit crops is generally high and extremely high for durian and avocado as these two fruits get spoiled very quickly upon ripening. Therefore, this programme will focus on discovering safe and green solutions for longer shelf-life of durian and avocado using bio-active components (antimicrobial, antioxidant and insecticidal) extracted from local plants and sea creatures. To achieve the proposed objective, multi-disciplinary research in the fields of food science, chemistry of natural products, and biomolecular modelling will be carried out. The research in food science aims to investigate how the quality of the fruits changes after picking in terms of nutrition and morphology, as well as the behaviour of micro-organisms and respiration in the fruits over time in different packaging conditions. The research in chemistry is to discover bioactivity compounds from a rich diversity of local plants and marine creatures to minimize the changes of the fruits after harvesting. The research in biomolecular modelling will be performed along with experimental research to investigate the bioactivity of natural compounds to hazard micro-organisms, and to determine the mechanisms of microbial spoilage in the fruits. Moreover, big data analysis will be applied to examine the relationship between biological properties of the natural compounds and storage time of the fruits. Then, optimal storage conditions for the durian and avocado will be further identified through simulation modelling.

The DoC4 is completed when the income of smallholder farmers, who farm in sustainable conditions and offer safe agricultural products at a reasonable price, increases. At present, the major constraints for the consumption of safe agricultural products originate from the difficulty in building up a contractual relationship between the farmers and companies, and from the consumers' reluctance in purchasing products with a higher price. The main reasons are a lack of trust between the farmers and the companies who trade their products, and a shortage of consumers' trust in vendors and safety standards. The current standards, like VietGAP deployed in the apples and dragon fruits smallholder farms in Ninh Thuan and Binh Thuan provinces, cannot satisfy the increasing demands of these farmers. In this context, the PGS quality system proposed by Rikolto [c.f. Part 2. Context Analysis] is emerging as a potential candidate for these farmers. However, it has not been implemented in this region yet, and Vietnamese consumers and farmers do not know much about PGS. The proposed research will establish both a risk management model to effectively manage and operate the PGS, and a risk assessment model with significant support of Rikolto for the farmers. Accordingly, five steps will be introduced as follows: The first step is to analyse both the supply chain of the chosen fruits by collecting and analysing data relating to the farmers' costs and benefits and the value chain of the chosen fruits by applying the value links and making markets works for the poor (M4P) methods. The next one is to identify possible risks in the safe product supply chain through quality standards (i.e. PGS). The third step is to combine sensitivity analysis and scenario analysis to determine the types of risks by the probability impact matrix (PI). The fourth one is to set up the optimization problems in these models, and then to develop contingency plans that control

the risks to mitigate losses related to PGS and farmers in the supply chain determined by Monte Carlo simulation method. The last one is to recommend the risk management and assessment models for dragon fruits and apples to Rikolto for further implementation.

The DoC5 is finalised when a sustainable institutional waste management system (IWMS), which includes a waste segregation system (WSS), waste management practices (WMP) and good lab practices (GLP), is established at QNU. This DoC addresses four goals: (i) to reduce solid waste sent to the landfill, (ii) to implement a WSS on the entire QNU campus, (iii) to establish good WMP for QNU staff members and students, and (iv) to effectively control hazardous waste released to the environment. QNU realises that there is an urgent need to improve the IWMS within the university with the objective of creating a pleasant and healthy environment around the campus and encouraging local communities to move towards sustainable WMP. To attain DoC5, QNU will build a sustainable IWMS with a philosophy of waste reduction towards zero-waste management. Particularly, the cooperation between QNU and the recycling and environmental treatment companies in the region will be highlighted in order to minimize the waste. Since the organic waste can be easily treated at its source, an on-site organic waste treatment system will be set up to produce organic fertilizer. Accordingly, the WSS with labelled bins and containers distributed throughout the campus for different types of waste and proper regulations for strict control of the waste disposal in the whole university will be established. Enhancing both GLP and WMP will be sustainably solved the problems of hazardous waste, which is mainly produced in laboratories of chemistry, physics and biology. Training courses and institutional regulations for waste management and lab practices will be implemented. As a result, this institutional model will be spread and disseminated to the society through the networks with QNU alumni, companies and local authorities.

DoC6 is providing students access to professional student services and has a three-fold aim. Firstly, a student platform will allow individual QNU students to use a universal account to access all student services. This system will be developed as an integrated digital platform to ensure scalability and flexibility. The core module of the platform is an email system that not only provides an official means of communication for students during their tenure at the university but also as a universal account to access the platform's services. Secondly, an e-learning system provides an online learning platform to students, which potentially strengthens the present traditional training by offering other types of training such as distance training, and online training. Moreover, this enables the university to expand the cooperation with other higher education institutions through an exchange of high-quality courses. In this programme, a technical infrastructure for e-learning systems (hardware, software, studio rooms, etc.) will be installed. In conjunction, short training courses for academic staff in designing online lectures/courses are necessary. Creating selected soft skills and general courses are of the first priorities. Third, a library management system will be established to upgrade its capacity towards a modern library. This system, which consists of (i) a traditional library sub-system, (ii) an e-library sub-system, and (iii) an integrated portal, facilitates students/staff to quickly access and automatically borrow/return and opens new links to external libraries.

In short, upon handling all proposed DoCs, better livelihoods of the local farmers, living conditions of the local communities in the region as well as the enhanced multidisciplinary research capability of QNU are foreseen.

Programme strategy: Describe how the programme will approach these different challenges or 'domains of change'. What will be the key strategies of the programme? What will be the priorities of the programme in terms of capacity development? What are the key institutional strengthening domains to be addressed? Are there specific links with the transversal themes gender and environment foreseen?

In order to approach the six domains of change, the proposed IUC programme will follow the key strategies stated below:

(i) To minimize the locals' sufferings from floods, enhance the efficiency of solar energy and biogas production, increase the value of regional agricultural products, boost the income of smallholder farmers, and offer safe agricultural products with a reasonable price to the local residents, agriculture-oriented multidisciplinary research will be conducted. (Priority of the programme and key institutional strengthening domains)

(ii) To achieve and sustain positive outcomes from the research activities, the recruited PhD students are preferential to QNU academic staff members and local residents who have the best understanding of the region.

Therefore, they will remain active after the ending of the programme as staff members and play as bridges among QNU, the local farmers and the authorities when needed.

(iii) To empower the women capacity in the university, at least half of the PhD candidates participating in research activities are female. (Links with the transversal themes of gender)

(iv) To professionalize the research culture, QNU prioritises to strengthen the applied research on food science, environment, and renewable energies, and aims to build up a centre for nanomaterials at first in the near future. (Key institutional strengthening domain, links with the transversal themes of environment, and priority of the programme)

(v) To facilitate QNU capacity development in applied research, the active role of the ARIST is strengthened by (i) transferring internal scientific and technological achievements to local communities, and (ii) attracting funding from external sources.

(vi) To extend networks and strengthen the institutional research capacity, interconnections among researchers in different QNU's faculties and experts in high-ranked universities in Flanders would be intensified; new collaborations would be established with local companies, organisations and authorities and a network would be formed among the QNU alumni.

(vii) To establish the waste management system in the entire QNU campus and raise the locals' awareness of environmental protection, all QNU staff and students will participate in the activities. (Links with the transversal themes of environment)

How will the university ensure an appropriate institutional embeddedness of the programme?

QNU ensures to take a strong and active role in realizing the developmental and institutional dreams proposed in the IUC programme. The programme is in line with the QNU's long-term development strategy to the year 2030, and it is unanimously committed by QNU's leaderships, the University Council, and all administrative units for its successful implementation. Importantly, Prof. Dr. DO Ngoc My, the rector of QNU, is a member of Delegates of the Binh Dinh provincial People's Council where he could contribute to the provincial development strategies. Moreover, the Local Coordinator (LC), Prof. Dr. VU Thi Ngan - a female professor in chemistry, is directly appointed by QNU rector. This appointment is in line with long-term development plan of QNU that the LC will be promoted to higher leadership position. She is the Head of the Department of Chemistry, one of the five departments of the Faculty of Natural Sciences, the biggest academic unit of QNU; hence, she can coordinate with all relevant staff members as well as make decisions supporting the proposed IUC programme implementation. Concerning the academic career, the LC obtained her PhD degree at KU Leuven in 2011, and then worked as postdoctoral fellow for one more year. Upon her return in 2012, she has been putting much effort in initiating and stimulating the collaboration between KU Leuven and QNU via different research and education projects. She has good experience in coordinating multi-partner projects. Therefore, she is capable of coordinating an international team in this IUC programme. Summarily, the chosen LC can act as a bridge among QNU, Flemish partners, local authorities, local community, and all the related stakeholders.

IUC academic team, which consists of key academic members with about 40% female, has expertise and experience in the proposed research domains. Particularly, potential DoC leaders have graduated from highly-ranked universities in Europe and are able to facilitate effective communication with Flemish partners. Coupled with the academic team, the active participation of staff in all administrative units guarantees the successful programme implementation. The involvement of the related faculties and administrative units in performing all proposed DoCs is listed in the bellow table.

Domain of Changes	**DoC1**	**DoC2**	**DoC3**	**DoC4**	**DoC5**	**DoC6**
Faculty of Natural Sciences	x	x	x	x	x	x
Faculty of Engineering and Technology	x	x	x		x	x
Faculty of Information Technology	x				x	x
Faculty of Mathematics and Statistics	x		x	x	x	x

Faculty of Economics and Accounting	x	x	x	x	x	x
Centre for Information and Communication	x			x	x	x
Library					x	x
Administration Office					x	x

Explain how the proposed programme links to national/regional policies, strategies and/or priorities, and the VLIR-UOS country strategy (priorities and themes developed in the VLIR-UOS country strategy).

For some countries, the VLIR-UOS country strategy includes a list of potential partners. In case your university *is not on this list*, please motivate why an IUC programme with your university should be considered.

The proposed DoCs in the programme belong to the priorities of the national and regional policies and strategies relating to poverty reduction and national policies for higher education. The Vietnamese government considers the South Central Coast and Central Highlands region as one of the key economic regions, which is presented in Decision No. 1194/QD-TTg, dated July 22, 2014 by the Prime Minister on "*Approving the Construction Planning of the Central Highlands up to 2030*" and Decision No. 1874/QĐ-TTg dated October 13, 2014 by the Prime Minister on "*Approving the master plan for socio-economic development in the Central key economic region to 2020 and vision to 2030*". In particular, the ***DoC1*** is in line with Decision No. 2139/QD-TTg dated December 5, 2011 by the Prime Minister on "*Approving the National Strategy on Climate Change*". The ***DoC2*** is pursuant to Decision No. 2068/QD-TTg dated November 25, 2015 on "*Approving Vietnam's Renewable Energy Strategy to 2030, with a Vision to 2050*". The ***DoC3*** and ***DoC4*** are stated in Decision No. 124/QD-TTg dated February 2, 2012 by the Prime Minister on "*Approving the master plan on agricultural production development up to 2020 and a vision to 2030*". The ***DoC5*** is in consonant with Decision No. 1216/QD-TTg, dated September 5, 2012 by the Prime Minister on "*Approving the National Environmental Protection Strategy to 2020, with a vision to 2030*".

Moreover, the Prime Minister has decided that the regional higher education institution must act as a driver of change in the socio-economic development process, which is highlighted in Decision No. 69/QĐ-TTg, dated January 15th, 2019 by the Prime Minister on "*Approving the project for improving the quality of university education in the period of 2019 – 2025*". Vietnamese universities are strongly encouraged to strengthen and expand training and education programmes by making the best use of the internal and external resources, with the final aim of providing high-quality human resources to effectively serve the sustainable development of the country. In accordance with the governmental support, the Binh Dinh People Committee announced to create the Quy Hoa Science Urban Area of Vietnam in Quy Nhon city [Decision No. 680/2018/QĐ-UBND], in which QNU is one of the important initial nuclei for this urban area. This has greatly affected the effective exploitation of QNU potential.

The six DoCs are not only consistent with the national and regional strategies but also in line with the VLIR-UOS country strategy Vietnam in bio-sciences for food, environment and natural resources (climate change) and technology development. Especially, the DoC4 will be implemented in synergy and complementarity with Rikolto to generate more impact. Moreover, the South Central Coast and Central Highlands region with eleven considered provinces belongs to the geographical focus of VLIR-UOS to Vietnam.

Concerning the global priority, this programme will contribute to the seven sustainable development goals (SDG), including zero hunger (SDG2), good health and well-being (SDG3), quality education (SDG4), gender equality (SDG5), affordable green energy (SDG7), responsible consumption and production (SDG12), and climate action (SDG13).

4. Stakeholder analysis

In order for a programme to have impact, a thorough understanding of the key stakeholders is essential. Describe and analyse these **key** stakeholders These may include both internal and external (outside HEI) stakeholders, as well as direct and indirect beneficiaries.

Stakeholder	Analysis	Engagement strategy
Critical stakeholders (high influence, high interest)		
QNU faculties in research-relevant fields	- Influence: key stakeholder in the success of DoC1-4 and important role in DoC5-6 - Interest: direct beneficiary of the programme by upgrading facility, developing networks, enhancing research and education capacity	- Doing the research to deal with the proposed local problems - Co-supervising and supervising PhD students
Other QNU faculties	- Influence: key stakeholder in success of DoC5-6 - Interest: direct beneficiary from institutional developments of modern student services, e-library, and sustainable environment management	- Inspiring students in realising WMP and GLP in DoC5 - Participating in training courses, designing e-lectures in DoC6
QNU Rector's Board, University Council and Administrative Offices	- Influence: key stakeholder in implementing all the activities by supporting with issuing rules, guidelines, and other policies in the university; consulting the local government in making policies for sustainable development - Interest: enhanced university capacity in all aspects	- Supporting for the implementation of all the activities, especially in the institutional development - Leading the policy-making meetings in the context of the IUC programme
QNU students	- Influence: key stakeholder in DoC5-6 - Interest: benefit from the upgraded education programmes and advanced research culture; a safe and modern studying and living environment	- Participating in the workshops, training courses on WMP and GLP - Using student services
Local Farmers	- Influence: involved in research-related activities of DoC1 and DoC4 (end-users) - Interest: higher farming productivity, higher product's value, higher income from results of DoC1-4	- Participating in survey, workshops, supply chain, increasing awareness
Local residents	- Influence: involved in research-related activities of DoC1 and DoC4 (end-users) - Interest: better environment, more safe food, less sufferings from natural disasters	- Participating in supply chain, increasing awareness
Flemish partners	- Influence: key stakeholder by playing decisive role in cooperating-consulting-supporting the programme with their excellent expertise - Interest: higher impact, more expertise and technology transfer, larger international network	- Supervising PhD students - Exchange knowledge, skill and staff - Providing the training courses, consultancies
Central Steering Committee for Natural Disaster Prevention and Control	- Influence: being local authorities who allow implementing activities relating to the flood early warning system (DoC1) - Interest: better facilities for flood prevention and control.	- Consulting, installing infrastructure for the flood warning system - Consulting government in making policies relating to natural disaster prevention
High stakeholders (high influence, low interest)		
Rikolto	- Influence: an NGO headquartered in Leuven, Belgium, acting as a bridge between researchers,	- Added values from the research results in safe post-harvest

	farmers and consumers in DoC4 - Interest: enlarge its impact to the South Central Coast and Central Highlands region	process (DoC3), risk management (DoC4) for the specific regional agricultural products
Quy Nhon Urban Environment Joint Stock Company	- Influence: being a company who directly collect solid waste from QNU - Interest: less waste, better waste segregation	- Treating and recycling the waste from QNU
Local Farmer Unions	- Influence: being official bridge between researchers and farmers in Dak Lak, Dak Nong provinces for new post-harvest techniques (DoC3); applying new renewable energy facilities (DoC2); in Ninh Thuan, Binh Thuan provinces for implementing DoC4 - Interest: supporting their mission	- Inspiring farmers, facilitate in organizing workshop, training new techniques
Climate Change Coordinator Office	- Influence: being local authorities providing help to residents in flood prevention - Interest: less suffering from local people	- Using the scenarios and adaptability solutions of climate changes
Medium stakeholders (low influence, high interest)		
Local Red Cross	- Influence: being members of Vietnam Red Cross, a civil society organization, supporting local people in natural disasters - Interest: supporting their mission	- Increasing awareness and adaptability of flood event
Sub-department of Food Hygiene and Safety	- Influence: being local authorities in controlling food safety - Interest: cleaner and safer food for local people	- Providing data on safety of the regional agricultural products

5. Assumptions, preconditions & sustainability

Describe in detail the preconditions and external factors that can influence the realisation of the objectives of the programme (feasibility).

The implementation of this programme will be affected by the following preconditions and external factors:

Risks	Solutions
Availability of academic staff from Flemish partners to support the programme implementation	Provide a detailed plan far in advance
Availability and willingness of the external stakeholders to join the programme	Inform and involve them from the beginning stage of the programme
English proficiency of young staff and students to attend training courses, staff exchange	Self-training English courses (take advantage of the ongoing National Foreign Languages 2020 Project funded by Vietnam government according to Decision No. 1400/QD-TTg, dated September 30, 2008 by the Prime Minister
Difficulty in finding local qualified PhD students	Provide scholarship and good plan for dissemination
Difficulty of university administrative personnel's in adapting to digitalized systems	Provide them with relevant training courses
Sudden extreme weather events in the region preventing from implementing outdoor activities	Keep close contact with Central Steering Committee for Natural Disaster Prevention and Control. Have contingency plans for outside activities
Harsh tropical conditions could affect the performance of the outdoor devices	Choose appropriate devices withstanding the specific conditions

Describe the opportunities and challenges for the sustainability of benefits (capacity retention, continuation of research activities, outreach services, policy development, etc) after VLIR-UOS funding. This may include reflections on possible strategies to retain trained staff members, sustaining the enhanced research culture, continue the research activities, strengthen networking, making external international cooperation possible, etc).

This programme is expected to create a strong impact and bring new features to both QNU and the socio-economic development of the region, thus increase the ownership of QNU as a driver of change to a higher level.

Concerning capacity retention, after graduation, PhD students involved in DoC2 and DoC3 will become key academic members of the new divisions in Food Science and Materials Science (belong to the faculty of natural sciences) which are created within this programme. The other PhD students involved in DoC1 and DoC4 are/will be academic staff of the existing divisions, and responsible for developing new/upgraded courses and education programmes in the related fields. They also continue to develop the improved research culture in postgraduate programmes in the future. However, the trained staff may lose their interest in continuing academic career. Hence, for the sustainability of the institutional development, it is obviously necessary to construct appropriate policies in terms of salary, rewards, etc. in order to reduce brain drain.

The professional research culture is gradually strengthened in the involved faculties during the programme's implementation, which will spread to the whole university. The strong research groups in the related fields and good research policies are formulated throughout this programme. This will facilitate the continuous expansion and enhancement of the quality in education, research and services, thereby, attracting more external funding, talented students and good researchers for continuing research activities.

After the programme, the enlarged networking with local authorities, NGO and civil organizations is foreseen. This achievement will stimulate more applied studies at QNU to solve local problems. Specially, the networks with Flemish partners are definitely widened and strengthened, and hence will, on the one hand, motivate research; education and technology transfer activities in QNU, especially in the fields of food science, renewable energy, environment and climate change, and on the other hand increase the possibilities for QNU students to follow higher education in Flemish universities. The successful implementation of the programme strengthens both national and international cooperation, creating funding networks as an integral part of the IUC programme.

Relating to outreach services, the ARIST centre of QNU bearing active transfer services will attract more technological transfer requests from the local companies and communities. Furthermore, the outcome of the programme is expected to enhance the living standards of local residents, thus raising their awareness of green technologies, good waste management habits, contributing to the sustainable development of the local society.

6. Background of the proposal

Please explain how this concept note was developed (process, who was involved?).

This IUC proposal follows (i) successfully implemented and ongoing research/education projects, (ii) the long-term solid collaboration between QNU and KU Leuven, and (iii) the bi-lateral meetings between QNU and KU Leuven leaderships in 2018 (Rector Luc Sels and Rector Do Ngoc My). The initial goal of this proposal is to boost application-oriented research and further develop education at QNU. Recognizing the importance of this IUC programme, the Rector of QNU established a programme drafting team including 39 experienced researchers and lecturers with a variety of expertise. To develop the Concept Note, the team has organized a series of meetings and discussions. The first meeting was held in April 2018 to outline the key DoCs based upon an analysis of the existing practical issues in the local region and the objectives of the IUC 2022. The second meeting aimed to fit the contents of the individual DoCs and the corresponding composing team. After that, the first draft of the Concept Note was formulated. In the third meeting, an editorial board selected from the team intensively discussed, commented and revised the draft. Prof. Nguyen Tien Trung, Head of the Research Affairs and International Relations Office directly contributed to the Concept Note composing process. Elise Konings from the International Office of KU Leuven, Prof. Kristiaan Temst and Prof. Minh Tho Nguyen, KU Leuven professors in physics and chemistry, respectively, also supported the writing process of the Concept Note.

Please explain earlier or current links with Flemish Higher Education Institutions (if any):

- earlier collaborations with Flemish Higher Education Institutes (HEIs)
- specific links with Flemish HEIs and/or individuals?
- their role in the development of this concept note?
- how do you see their involvement in the proposed programme?

QNU has been seeking international cooperation thanks to the open international policies. The first official collaboration with Flemish universities commenced in 2012 through the first SI project coordinated by KU Leuven and funded by VLIR-UOS. This cooperation was then further developed by the TEAM and another SI projects. The success of these projects is thanks to the significant support from KU Leuven professors like Prof. Kristiaan Temst, Prof. Ewald Janssens (Department of Physics and Astronomy) Prof. Minh Tho Nguyen, Prof. Luc Van Meervelt (Department of Chemistry), etc. However, these projects mainly focussed on curriculum development, except for one TEAM project that was partly targeted at solving local problems. Coupled with the projects funded by VLIR-UOS, QNU has also cooperated with KU Leuven via other projects funded by the Erasmus+ programme of the European Union**.** Based on the bilateral projects QNU has established a firm collaboration with KU Leuven, especially with Departments of Chemistry, Physics and Astronomy. Prof. KristiaanTemst and Elise Konings promised to support this proposal in both academic and non-academic aspects. Lastly, Prof. Peter Lievens, vice rector of international policy at KU Leuven, who introduced IUC to QNU at first on his visit to QNU, suggested valuable ideas in developing this Concept Note.

Different KU Leuven faculties/departments can involve in this proposed programme, for example, Departments of Electrical Engineering, Geography can help with DoC1; Faculty of Sciences with DoC2; Divisions of Biochemistry, Molecular and Structural Biology with DoC3; Department of Mathematics and Faculty of Economics and Business with DoC4; Leuven Center on Information and Communication Technology with DoC6.

All QNU team members have already analyzed potential collaborations with the other Flemish universities and realise some potential partners such as Departments of Food Safety and Food Quality, Biochemistry (Ghent University), Department of Mathematics and Computer Science (Antwerp University), Faculty of Science (Hasselt University), Faculty of Economic and Social sciences and Solvay Business School (Free University of Brussels).

In case your university has applied for IUC funding earlier, please summarize the main reasons for non-selection by VLIR-UOS at that time, and what measures you have taken to remedy since then.

Not applicable

DOCUMENTS TO BE SUBMITTED

Annex 1: Format for a Concept Note South	*Main narrative document. This format is to be followed when drafting the proposal and to be submitted (with the signature of the rector enclosed).*
Annex 2: Institutional Fact Sheet	*The format is included and to be followed, except if indications are included that own data formats can be added*
Annex 3: Format for the application of a local coordinator (including a CV)	*The format is included and should in principle be followed. The CV of the proposed local coordinator is to be included in free format (relevant info for this mandate), however, with a maximum of 2 pages)*
Annex 4: Mission statement and latest strategic plan	*Free format*
Annex 5: Confirmation letter by the local rector	*Free format, The project proposal has to contain a confirmation letter (e.g. e-mail) of the rector of the university proposing itself for an IUC cooperation and supporting the proposed local coordinator*