Final evaluation of the IUC with Universidad de Oriente, Cuba

SHARING MINDS, CHANGING LIVES

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Seida Barrera Rodríguez
Antonio Carmona Báez

Abbreviations

AUF	Asociación Universitaria de la Francofonía (University Association of the Francophonie)
CATFLAg	Centre for Advanced Training in Foreign Languages
CBM	Medical Biophysics Centre
CEBI	Centre of Study of Industrial Biotechnology
CEMZOC	Centre of Study of Coastal Zone Management
CNEA	National Center of Applied Electromagnetism
CENPIS	Centre for the Study of Neuroscience Image Processing Signals
CIM	Centre of Molecular Immunology
CINTRO	Technology Transfer Company of Univ. de Oriente and Univ. de Guantánamo
FITIB	Faculty of Engineering, Telecommunications, Informatics and Biomedics
GFD	Doctoral Training Group
ICT	Information and Communication Technologies
IP	Intellectual Property
IPK	Pedro Kourí Institute of Tropical Medicine
IR	International Relations
JSC	Joint Steering Committee
KTTO	Knowledge and Technology Transfer Office
LABEX	Antibodies and Experimental Biomodelling Laboratory
MES	Ministerio de Educación Superior (Ministry of Higher Education)
MINED	Ministerio de Educación (Ministry of Education)
MINSAP	Ministerio de Salud Pública (Ministry of Public Health)
MIPYMES	Micro and Small Enterprises
OCPI	Oficina Cubana de la Propiedad Industrial (Cuban Office of Industrial Property)
PL	Project Leaders
TOXIMED	Centre for Toxicology and Biomedicine
UBPC	Unidad Básica de Producción Cooperativa (Basic Units of Cooperative Production)
UO	Universidad de Oriente
UCLV	Universidad Central de Las Villas
VR	Vice-Chancellor

Executive Summary

Subject and objective of the evaluation

The subject of this end of term evaluation is the IUC UO programme, phase II, implemented in partnership with the following higher educational institutions: Vrije Universiteit Brussel (VUB) (coordinator and home university), Universiteit Gent (UGent), Universiteit Hasselt (UHasselt), Universiteit Antwerpen, and KU Leuven.

This programme concerns 6 projects in phase II, deriving from 8 projects in the first phase:

1. Sustainable Risk Management Plan for Biodiversity and Food Production in The Eastern Of Cuba;
2. Biomedical Technologies and Services for Improving Medical Assistance in the Eastern Region of Cuba;
3. Natural Products and Pharmaceutical Services to Improve the Patient Quality of Life in Eastern Cuban Hospitals;
4. Safeguards of Cultural Heritage. Tools and Practices for Integrated Management in Santiago de Cuba and the Eastern Region of Cuba;
5. Obtaining, Characterization and Production of New Materials and Technologies for Industrial Systems;
6. Institution-wide Instruments for High Performance Research, Innovation and Technology Transfer

The objective of this end evaluation was to assess the effectiveness, impact and sustainability of the programme and its results in particular.

Context

For over 20 years, VLIR-UOS has supported partnerships between Cuban and Flemish universities; among these was the 10-year IUC Universidad de Oriente (UO) programme, which aimed 'to promote sustainable development in the eastern region of Cuba'. Within this context, the evaluators carried out an 8-day investigative field mission between Santiago de Cuba and Havana provinces. Taken into consideration were the complicated circumstances Cuba faces with the US blockade, the related series of crises the country has suffered for decades, and recent legislative changes with regard to property and decentralised spaces of production. Notwithstanding challenges due to scarcity, we answered 6 questions under the same number of criteria while applying the evaluation methodology, balancing data and conducting field visits.

Methodological approach

This evaluation is part of a more comprehensive evaluation of 5 VLIR-UOS IUC and 3 Network programmes in 5 countries. It is based on a shared evaluation framework that looks at the 5 OECD-DAC criteria and a shared methodological approach which starts from the self-assessments by programme stakeholders and entails attention for changes in institutional capacity, learning questions and analysis of a particular impact case.

The institutional capacity assessment analysis was based on a tool that appreciated changes in 5 core capabilities. It was applied between August and October 2023, and the corresponding field visits described in the report. Interviews were carried out with programme partners, supervisors, coordinators and those involved in the IUC programme since its inception 10 years ago. This tool was primarily used to highlight changes in capabilities that occurred between 2019 and August 2023, and to discuss the contribution of the IUC programme with the stakeholders. To analyse findings related to the learning questions and the impact case, the evaluators collected data in audio recordings, pictures, interviews and documents made by the beneficiaries during the field mission, and assessed the strength of evidence.

The selected impact case deals with development in biomedical technologies and services for improving the medical assistance and diagnosis in the eastern region of Cuba. This was done to get a more

profound understanding of the innovations achieved to support an essential and massive public service consisting of a broad network of various entities, from hospitals to research centres.

Thereafter, the evaluators exposed their analysis and findings at programme level using the above-mentioned 6 criteria, such as know-how transfers to 25 hospitals for the new products and services acquired thanks to VLIR-UOS. They then synthesised the assessments for the 6 projects related to the programme, in many different areas, from natural products and pharmaceutical services to cultural heritage. Finally, they went through the findings on 3 learning questions focused on diversity, inclusivity, effective coordination of programmes and new educational practices by political and societal actors and end-users.

Evaluation process

The evaluation was prepared by online key-informant interviews, desktop study and design of the methodological approach for the impact case. The analysed impact claim spoke to how the university increased its impact on hospital health services; reviewing it required a closer look into one of the most significant country-wide projects carried out by university professors and researchers. A variety of related entities were studied as a chain of providers and clients, considering all contributors, from hospitals to MINSAP.

In 2023, the second (5 year) phase of the IUC programme was concluded. A key component of the final evaluation process was a field visit by 2 external evaluators conducted in conjunction with the key program actors involved. This was preceded by the study of the partners' closure documents. During the 5 days field visit, 29 interviews were conducted with academics and practitioners, totalling more than 25 recorded hours, as well as 3 focus groups, and 36 documents were consulted. Furthermore, 157 pictures and videos were taken to better document the accomplished objectives. Additional individual interviews and conversations were held with the Belgian coordinators, representatives of the Minister of Higher Education and the Ambassador of Belgium in Cuba.

Main findings and conclusions

VLIR-UOS supported an IUC program of partnership between Cuban and Belgian universities at UO for a ten-year period. Six criteria with different questions were answered at program and project level. Evaluators consider that the results obtained at both levels were:

Relevant: the program's excellence was evident as the most important results and outcomes were adopted and generalised throughout all the universities of the country, contributing to MES policies, such as PI protection for the university scientific results. The programme adapted its goals to the country's priorities, defined in PNDES 2030, also following SDGs 3, 4, 6, 9, 11 and 12 in its operations. Furthermore, the programme contributed to the implementation of the 2010 Nagoya Protocol on access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation, more specifically in relation to the preservation of and valorisation of autochthonous microorganisms and endemic land snails species.

Coherent: all projects worked interconnectedly, and UO faculties, partners and researchers transcended disciplines to provide tangible results speaking to the UN 2030 Sustainable Development Goals. Furthermore, there was excellent support given by the university administration, which prioritised IUC UO research activities and operations. Synergy between institutional vision and programme processes was outstanding.

Effective: as the outputs were achieved at an outstanding level, solving problems in public services like health, education and cultural heritage, using the latest technology, overcoming the inhibiting factors and actors, and taking advantage of every facilitating opportunity.

Efficient: as the funds, donations and materials were used by mutual agreement between partners to ensure timely execution of research activities and results; when certain planned activities were not possible due to unforeseen circumstances such as the case following the outbreak of COID-19, alternatives were quickly developed and implemented, as the services and products which came out of the program are protected by law and (starting to be) commercialised.

Impact: All projects resulted in the production of tangible goods and services lending support to societal actors, positively affecting sustainable development of the region. Impacts are found in the quality of graduate school training, professional training, the delivery of health services, the conservation of cultural and heritage goods and the digitisation of archives. Furthermore, the programme saw the internationalisation of the university and the exposure of research results in international peer-reviewed journals.

Sustainability: as the evaluators could see the network of enterprises (LABEX, CINTRO, CUBA RON) in charge of commercialising/receiving the products and services obtained thanks to the program, and the ensuing contracts, benefitting higher education from the student and professor to the ministerial level. Current and future contracts speaking to the needs of the country can ensure income for the next few years. These will need constant updating, maintenance and training for the specialists in charge of the equipment at the client's offices.

The evaluators easily consulted with the focal point and societal partners, as there was an obvious operating network of clients all across the region, and among the university professors and researchers as providers. Innovation was perceived all the way, with impact in the delivery of services using the latest technologies in diagnosis, and data storage. Six major achievements were described, all technology related, with sustainability guaranteed for several years through contracts already signed, and others in review. The case accomplished every goal that the program stood for: know-how transfer obtained through training, prestigious publications, PhD and MSc. students formation, the winning of national and international awards, the internationalisation of programmes, and stronger partnerships among the public and private sector and between academic institutions in Cuba and abroad. Lastly, the findings on the 3 learning questions made the evaluators reflect and make recommendations on gender and uptake of research results. In essence, medical services were improved and made more efficient in both urban as well as rural/remote areas, and new technologies have been generalised throughout all the hospitals of the country.

The programme has encouraged changes in the RD&I practices at UO, leading to an innovative approach focused on stakeholder needs and demands, the development of 'products' and the envisioned change. In this scenario, the stakeholder, whether a museum, hospital, laboratory, pharmacy or research centre, plays a leading role, participating in all stages of the project cycle, from the diagnosis of the problem to developing and implementing research results. By placing the stakeholder at the core of the programme, its engagement and commitment with the results is encouraged, making them an active participant in continuous improvement. This approach had a major impact on the improvement of digital archives, urban planning, food production and medical services.

After assessing all the consulted materials and the results from the field visit, the evaluators conclude that the IUC program at UO performed with excellence. The goal 'to promote sustainable development in the eastern region of Cuba' is considered accomplished.

Overview of recommendations

For Cuban and Flemish universities:

- To align PhD requirements between Cuban and Flemish universities

For Cuban universities:

- To consolidate program-generated products and services for the Cuban export portfolio directed to the Ministry of Foreign Trade, Cuban Medical Services S.A., the Ministry of Tourism and other institutions
- To expedite commercialisation through the university interface company or other enterprises; to guarantee sustainability, motivating professors and researchers with (profit-driven) incentives and guarantee continuity in further projects.

For VLIR-UOS

- To encourage capacity building/development in the partner university focused on sustainable development objectives while leveraging appropriate management of the IP rights and benefits derived from joint research.
- To enhance the principle of gender equity and inclusive diversity by fostering contextualised approaches. This implies leveraging the country's official statistics for setting gender balance targets, and by giving attention to other aspects of diversity such as individuals with special needs and geographical origin in the selection process of Ph.D. candidates. This could be conceived as an opportunity to further integrate the social sciences into projects, especially if the program has a strong STEM component.

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Acknowledgements

Special thanks to the local coordinator Teresa Orberá Ratón, and the rest of the team in Cuba for their transparency, hard work, and commitment to research under the most difficult conditions. Challenges were overcome with well-deserved success, and the efforts of all involved have led to positive results for all partners. A vote of thanks to the team in Flanders is also called to order, as they journeyed along in the search for alternative routes and solutions in defence of science under the cruel circumstances imposed by the US blockade.

1 Introduction

VLIR-UOS supported a 10-year multidisciplinary partnership between Cuban universities and universities in Flanders (Belgium), collaborating in an IUC program to foster innovative responses to global and local challenges. The purpose of this end-term evaluation was to assess the empowerment of the university and research bodies working within the IUC programme, and to evaluate the impact of their role as a development actor in society.

In 2023, the second (5 year) phase of the IUC programme was concluded. A key component of the final evaluation process was a field visit by 2 external evaluators conducted in conjunction with the key program actors involved. This was preceded by the study of the closure documents prepared by the partners. During the 5-day field visit, 29 interviews were conducted with academics and practitioners, totalling more than 25 hours recorded, as well as 3 focus groups; furthermore, 157 pictures and videos were taken to better document the objectives accomplished. Additional individual interviews and conversations were held with the Belgian coordinators, representatives of the Minister of Higher Education and the Ambassador of Belgium in Cuba.

1.1 Background

Phase	Project title	Objective/s
1	Environmental scientific services for the development of a sustainable agriculture to face climate change in the eastern region of Cuba	To develop sustainable, multidisciplinary collaboration between different research groups at the university, and to create the Laboratory of Environmental Services
1	Research and applications in biomedical images and signal processing	To improve the efficiency and effectiveness of the Cuban National Health Care System through the introduction and integration of biomedical technologies developed by Universidad de Oriente and local stakeholders
1	Biopharmaceutical products from natural sources of Eastern Cuba	To create capacities in preclinical and toxicological studies, that speed up the process for the introduction of new drugs developed under the basis of natural products
1	The Social Sciences, Humanities and Architecture facing the challenge of local development in Santiago de Cuba. The enhancement of Heritage Preservation	To develop tools and practices that relate to cultural heritage, ICT and sustainable local development from the logic of public spaces, places and memory, in order to contribute to its integrated management
1	Energy, Biofuels & Clean Technology for sustainable development	To characterise activated carbons, zeolites and catalysts using new methods, such as acoustic emission analysis and X-ray images processing
1	Information and Communication Technology Infrastructure	To allow the University to structure its doctoral school while offering its doctorands an environment to acquire scientific skills, and train towards communicating research results, innovation and transfer of innovation to industry and society
1	Strengthening of Basic and Natural Sciences for innovation	To develop the infrastructure of basic sciences in areas with tradition for the innovation; to improve and increase the link between basic and applied sciences, and to improve human resources in basic sciences and transfer of technology
1	Strengthening Foreign Languages Skills for	To allow the University to offer an environment to acquire scientific skills, and train towards communicating research results

	Intercultural and International Academic Purposes	
2	Sustainable Risk Management Plan For Biodiversity And Food Production In The Eastern Of Cuba	To develop sustainable, multidisciplinary collaboration between different research groups at the university, and to create the Laboratory of Environmental Services
2	Biomedical technologies and services for improving the medical assistance in the eastern region of Cuba	To improve the efficiency and effectiveness of the Cuban National Health Care System through the introduction and integration of biomedical technologies developed by Universidad de Oriente and local stakeholders
2	Natural Products and Pharmaceutical Services to improve the patient quality of life in Eastern Cuban Hospital´s	To create capacities in preclinical and toxicological studies, that speed up the process for the introduction of new drugs developed under the basis of natural products
2	Safeguards of the cultural heritage. Tools and practices for its integrated management in Santiago de Cuba and the Eastern Region of Cuba	To develop tools and practices that relate to cultural heritage, ICT and sustainable local development from the logic of public spaces, places and memory, in order to contribute to its integrated management
2	Obtaining, characterization and production of new materials and technologies for industrial systems	To characterise activated carbons, zeolites and catalysts using new methods, such as acoustic emission analysis and X-ray images processing, correlated with other conventional surface and bulk analysis techniques
2	Institution-wide instruments for high performance research, innovation and technology transfer	To allow the University to structure its doctoral school while offering its doctorands an environment to acquire scientific skills, and train towards communicating research results, innovation and transfer of innovation to industry and society

Table 1. Projects

1.2 Context

1.2.1 Key social, political, economic, demographic contextual factors in the country

Cuba is at once a Latin American and Caribbean country that has a unique political system shaped by internal dynamics which in turn respond to geopolitical tensions. Its proximity to the United States, and the political and military tensions between the two nations for more than 100 years, has also affected the contours of its socio-economic and political development. The people of Cuba have borne the longest blockade in modern history from one country (United States) to the other. The blockade affects every sector and its 11,089,511 citizens, with nearly a 50-50 proportion between men and women, with approximately 77% of that population living in urban areas[1]. The island has had a decreasing birth rate since 1970, while the population aged 60 and more has been gradually increasing during the same period[2]. Parallel to this, the population between 15 and 59 years of age has been gradually decreasing, so there are (and have been) more elderly and infants than working people[3]. Since 1990, the external migration rate has been negative, except for the years 2013- 2014 and 2021-2022[4]. The first 2 cases

[1] Oficina Nacional de Estadística e Información (2022). Table 3.1- Población residente por sexo, tasa anual de crecimiento y relación de masculinidad, Havana, ONEI.

[2] Oficina Nacional de Estadística e Información (2022). 3.12 - Evolución de la estructura por edades de la población de Cuba, Havana, ONEI.

[3] Oficina Nacional de Estadística e Información (2022). Table 7.1 - Población económicamente activa, Havana, ONEI.

[4] Oficina Nacional de Estadística e Información (2022). Table 3.21 - Saldos migratorios y tasas de migración interna y externa, por provincias (1985-2022). Havana, ONEI.

took place right after migration policy changed[5], and in the last 2, COVID-19 had an impact as borders were closed.

Despite the US blockade[6], the government of Cuba has prioritized two areas of socio-economic development with a proven track record of increasing public investment even during times of dire economic turmoil; these being Health and Education. In both sectors, Cuban citizens are exempted from any fees related to these services provided by the State. Science and technological development aimed at improving quality of life, economic production and preparation for climate change were two additional concerns manifested in almost all research endeavours. Central to the country's technological development and scientific production is the concept of *technological sovereignty*, whereby advancement falls in line with the technological and digital needs of the country and, where possible, contribute to import substitution. During the Covid-19 pandemic, Cuba was capable of producing 5 vaccine variants, two of which have been marketed and used internationally[7].

Constitutional adjustments and legislative changes since 2019 have allowed for the recognition of new forms of property and more decentralized spaces of economic production[8]. Among these are laws and ministerial decrees regulating interface companies that operate between universities and industries for the patenting and trade of technological products. Since then, two scientific parks and 4 interface companies have been created among Cuban universities. Royalties are shared among the HEIs, research-authors and reinvested into maintenance and infrastructure to ensure continuity of research endeavours.

Since the COVID-19 pandemic, other crises have overlapped, including energy and scarcity of fuel, inflation, and food distribution. In 2021, the country implemented economic organisation measures called 'Tarea Ordenamiento', by increasing wages, suppressing the convertible Cuban peso as one of the currencies, and change in the exchange rates[9]. None of these have been enough to control the basic scarcities that the US blockade imposes and those produced by large military conflicts such as the Ukraine-Russia war which have led to higher prices of many vital products, internationally.

1.2.2. Higher Education and Scientific Research

Except for the study of Medical Sciences, the Ministry of Higher Education (MES) is the country's highest authority of the sector, governing 50 universities with more than 52 thousand professors, and more than 285 thousand students in 2022[10]. All HEIs are financed by the State. Each university has its own research centres and/or institutes where professors are encouraged to work in a multidisciplinary environment. MES designs the policies and controls the performance of the entire system. Degrees provided in the Cuban system of higher education are undergraduate, graduate and doctoral, in addition to certificates in training provided by faculties and research centres. The Ministry of Science Technology and Environment (CITMA), established in 1994, also has regulatory functions on scientific production and provides a support system for research institutes.

Accreditation is governed by the National Board of Accreditation (JAN), which is empowered to qualify and classify HEIs and academic programs. JAN also provides Awards of Excellence to programs and

[5] According to Law Decree 302 of 2012, which modified Law 1312 on Migration of 1976, an emigrated person is a Cuban citizen who travels abroad for particular issues for more than 2 uninterrupted years, Gaceta Oficial de la República de Cuba Extraordinaria Nr. 41 of 2015. Before 2012, the amount of time to be considered an emigrated was 11 months.

[6] Iturriaga Bartuste, M., Barrera Rodríguez, S. (2023). Sanciones de EEUU a Cuba (1950-2021) y Derecho Internacional Público, Études Caribéennes, 54.

[7] Gorry, C. (2022). Vaccines and Public Trust: Containing COVID-19 in Cuba, MEDICC Rev, 24 (1): 9-13.

[8] Asamblea Nacional del Poder Popular (2019). Constitución de la República de Cuba, Gaceta Oficial Extraordinaria 5.

[9] Ministerio de Economía y Planificación. Tarea Ordenamiento, in https://www.mep.gob.cu/es/tarea-ordenamiento (consulted 2nd December, 2023).

[10] Oficina Nacional de Estadística e Información (2022). Tables 18.5 - Escuelas por tipo de educación; 18.6 - Personal docente por tipo de educación; 18.9 - Matrícula inicial por tipo de educación, Havana, ONEI; Oficina Nacional de Estadística e Información (2022). Tables 18.5 - Escuelas por tipo de educación; 18.6 - Personal docente por tipo de educación; 18.9 - Matrícula inicial por tipo de educación, Havana, ONEI.

theses. Furthermore, the University Association of Ibero-American Postgraduate Studies (AUIP) is an important regional body, which is referenced in Cuba for quality assurance, best practices and accreditation or recognition.

There are also university-linked enterprises across the country, and one foundation in Havana, which operate as interface entities between their respective universities, the private sector and other entities. Regulated by Council of Ministers Decree No.363 of 2019, these enterprises help to market some of the products and services created by university faculty members and researchers, helping them to obtain an extra source of income, and/or to receive donations and equipment to improve their working conditions, thus sustaining higher education in general. The absolute majority of professors and faculty members (61.9% in course 2021/22) and students (65.7% in course 2021/22) in Cuba's system of higher education are women[11].

There are 3 types of higher education institutions (HEIs) in Cuba: universities, schools of medicine and a broad category 'other organisms'[12]. All of them follow the methodological instructions from MES, in terms of professor categorization, graduate programs or examination commissions. However, while universities are directly subordinated to MES, schools of medicine are subordinated to MINSAP, and the others are subordinated to different organisms depending on their level of specialisation, such as the Universidad de las Artes is subordinated to the Ministry of Culture.

In Cuba there is a singular criterion for PhD evaluation followed by all universities, emulating graduate schools in other countries. It uses a system of cumulative credits; adding a series of exams the students must take, including one to demonstrate the skill to use a foreign language and an analyses of science problems in all the programs; the publication of articles in indexed reviews; and a demanding procedure before 3 different examination commissions: one for the project, another for pre-defense and a last one for defence[13]. Postdoc research opportunities are provided for doctoral graduates who wish to continue their academic work.

1.2.2 University level

Founded in 1947, UO is Cuba's second largest university operating on two campuses in Santiago de Cuba, and 5 additional municipal campuses and learning centres throughout the province of Santiago. UO has 14 faculties in the humanities, arts and sciences and over 10 scientific research centres or institutes. The principal mission of the university is to direct, develop and promote higher education policies and practices in teaching, scientific research and innovation for sustainable and prosperous development. Its slogan is Science and Conscience(ness).[14] Throughout its 75 years of existence, UO has contributed to the socio-economic development of Cuba's eastern region, especially since the Revolution of 1959, by offering undergraduate and graduate degree programmes, professional training, scientific research and close collaboration with other social actors in the areas of education, health, arts, heritage and national patrimony. In July 2022, UO together with Universidad de Guantanamo officially opened its interface company CINTRO S.A., for the commercialisation of products and research results it has sponsored.[15]

[11] Oficina Nacional de Estadística e Información (2022). Table 18.9 - Matrícula inicial por tipo de educación; 18.10 - Matrícula inicial (mujeres) por tipo de educación, Havana, ONEI.

[12] Oficina Nacional de Estadística e Información (2022). Table 18.5 - Escuelas por tipo de educación, Havana, ONEI.

[13] Dirección de Educación de Posgrado (2020). Instrucción 1, Manual para la Gestión del Posgrado, Havana, MES.

[14] See UO website: https://www.uo.edu.cu/mision/

[15] Trabajadores (2022). Constituida en Santiago de Cuba sociedad de interfaz de la Universidad de Oriente, in https://www.trabajadores.cu/20220713/constituida-en-santiago-de-cuba-sociedad-de-interfaz-de-la-universidad-de-oriente/

1.3 Evaluation methodology and process

1.3.1 Evaluation framework

This evaluation is part of a more comprehensive evaluation of 5 VLIR-UOS IUC and 3 Network programmes in 5 countries. It is based on a shared evaluation framework that looks at the 5 OECD-DAC criteria and a shared methodological approach which starts from the self-assessments by programme stakeholders and entails attention for changes in institutional capacity, learning questions and analysis of a particular impact case.

The evaluation of collaborative processes was based on a spiderweb tool to assess key factors that can explain the success/failures in the collaborative process and visualises collaborative processes on 5 dimensions or axis of the spider web. The stakeholders' scoring for this tool was prepared between August and the field visit in September 2023. To analyse findings related to the learning questions and the impact case, the evaluators collected data in 29 interviews, 3 focus groups, 157 pictures and videos, and 36 documents reviewed during the field mission, while assessing the strength of evidence for the project-level self-evaluations.

Criterion	Evaluation Question	Judgement criteria
1. Relevance	EQ1. To what extent are the objectives of the programme/project consistent with beneficiaries' requirements, country needs, global priorities and partners' and donors' policies?	1.2. What is the relevance (*ex ante*) of the formulated outcome(s) and objectives? 1.2. Extent to which changes in the external context or within the organisation influenced the relevance of the intervention, and how this was handled?
2. Coherence	EQ2. To what extent is the partnership programme coherent, internally and externally? What is the level of synergy and complementarity with other relevant (Belgian) actors?	2.1. Internal coherence 2.2. External coherence
3. Efficiency	EQ3. To which extent resources/inputs (funds, expertise, time, etc.) are converted to results in an economic manner?	3.1. The cost-effectiveness (the usage of resources in relation to the achievement of objectives)
		3.2. The extent to which organisational management and structures of the programme/project are conducive for efficient implementation.
4. Effectiveness	EQ4. To what extent are the programme's objectives (expected to be) achieved, taking into account their relative importance?	4.1. The extent to which the programmes outputs and outcomes have been achieved and the likelihood that the predetermined outcomes will be achieved by the end of the implementation period.
		4.2. Inhibiting and facilitating factors and actors
		4.3. Scientific quality
5. Impact	EQ5. To what extent are (potential) positive and negative, primary and secondary long-term effects generated by the programme, directly or indirectly, intended or unintended.	5.1. Changes (intended and unintended, positive and negative) in stakeholders' lives and contexts contributed to by the programme
		5.2. Fostering 'collective impact'
6. Sustainability		6.1. Level of institutional sustainability

	EQ6. To what extent will the programme results continue after the programme is completed?	6.2. Level of financial sustainability
		6.3. Level of academic sustainability

Table 2. Evaluation framework[16]

The data collection methods were the following:
- Desk study (self-assessments, program documents, institutional documents and news items);
- Interviews (group or individual, with project leaders, professors, researchers, stakeholders from the universities involved, and others);
- Focus group discussions with beneficiaries;
- Workshop to analyse and discuss evolution in collaborative processes with the 5 core capabilities (CC)
- Workshop to share findings;

To analyse findings, the evaluators processed all the materials described above in point 1.3.1.

For the learning questions, the evaluators looked at the measures that were put in place by the IUC programme. For each measure the evaluators inquired after the effect/change of that measure, they assessed the strength of the evidence for that measure, noting what elements in the measure contributed to the effect and what other factors were of influence. For the impact case, a similar systematic approach was used.

1.3.2 Evaluation process and activities

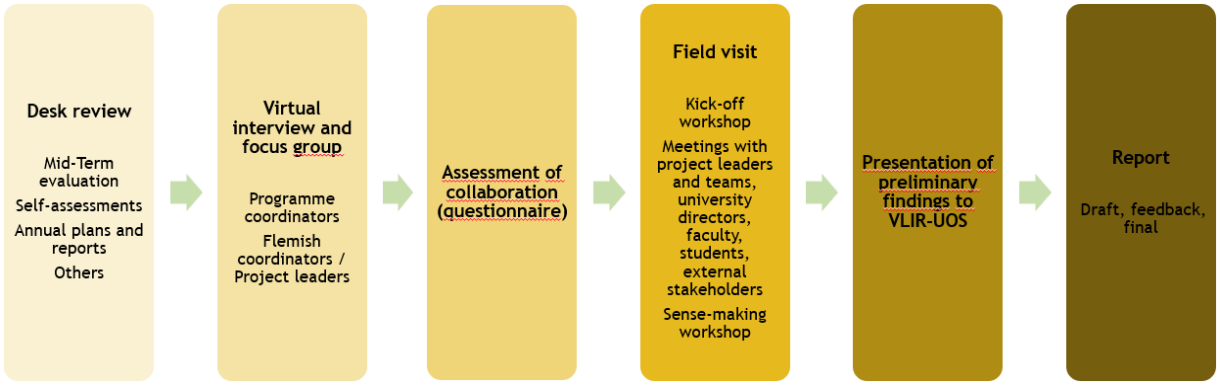

Figure 1. Evaluation process (IUC)

Activities

Prior to the field mission: the evaluation team organised meetings with the local coordinator to develop the impact case, requested information about other rival or related projects, sent the spider web collaborative processes tool to be completed in UO with the help of the project leaders, and studied the self-assessments which identified points to be validated during the field mission.

During the field mission: the field mission started with the presentation of the 5 CC analysis, delivered via e-mail by the focal points from the partner universities. There was a workshop on the topic introducing the tool, which was attended by the university leadership, a sample of stakeholders (online) and representatives of the faculties and administrative units of the university related to the program.

[16] For more information about the evaluation framework, the inception report of the framework assignment can be requested for consultation at the level of VLIR-UOS.

The workshop was organised as follows: the evaluators presented the consolidated spider web followed by brainstorming on the general results. The evaluators used the results to obtain an average and to make a visual when drafting the report (see Annex 4). See Annex 2 for the rest of the field visit program.

After the field mission: a presentation of findings was organised for the local coordinator, project team leaders and VLIR-UOS.

1.3.3 Limitations

The evaluators had to deal with the intermittent lack of internet connectivity, energy and transportation due to the broad crisis the country is suffering caused in great part by the blockade. Nevertheless, great efforts were made by all the team members at the university centres, including help from the rector, which all gave maximum priority to the evaluation-related activities during the week, putting their limited resources at the evaluators' disposal. However, as some beneficiaries were located too far away or inaccessible by public or private transportation, they could not be visited. Visits were indeed limited to university campuses, organisations, societal stakeholders and enterprises in the vicinities of Santiago de Cuba, Santa Clara and Havana provinces.

1.4 Description of impact case

Name of programme: Universidad de Oriente promotes sustainable development in the Eastern region of Cuba

Impact claim: The university increased its impact on hospital health services [1]

Performance story: Throughout the last decade the programme has had a positive impact on capacity building, human resources, infrastructure and the quality of services in the fields of health and medicine. During the first 6 years (phase 1), eight capacity-building projects were developed: five of them focused on different prioritised topics, and three supported internal university services, such as ICT infrastructure and English language teaching, as well as IP and technology transfer.

In phase 2, the programme was organised into six interdisciplinary projects articulated via the Theory of Change (ToC) methodology, because the former R&D practices did not encourage stakeholder engagement and commitment, resulting in low societal impact. The results have improved health care services at hospitals and other medical units, focusing on the development of biomedical technologies, natural drugs and science-and-technology services. These have been applied to diagnosis, drug policies and complementary therapies, among others. The evaluators choose to have a broad case, because they observed the research results during the field visit, many of them related to health services, interconnecting different projects to work as one, as a way to evaluate the level success and impact accomplished by the IUC program.

The stated goals were to increase UO research on methods, technologies and devices for medical services, particularly oriented to improve diagnosis in both urban and rural/remote areas; enhance technical sovereignty and import substitution through continuous training and innovation; improve work quality and conditions for physicians and to enhance export potential of medical goods services. The goals followed the premises stated by the program in phase II, encouraging changes in the RD&I practices of UO towards an innovative approach focused on the stakeholder need and demands, the development of 'products' and the envisioned change. In this scenario, the stakeholder, which comprised medical staff in hospitals, played a leading role, participating in all stages of the project cycle, from the diagnosis of the problem to the development and implementation of research results. By placing the stakeholders at the core of the programme, its engagement and commitment with the results was secured, making them active participants along the entire process, as they expressed to the evaluators during the interviews. This approach had a major impact on the improvement of healthcare services at different hospitals.

The medical staff and the researchers from the university centres were involved in 11 of the IUC-sponsored PhD research projects. The latter were related to the majority of the contributions, except for the development of the Video-nistamography device, which didn't have students involved.

PhD topics were:

1. Recommended Systems in e-Health Application Domains.
2. The cry analysis oriented to the diagnosis and study of child neurodevelopment.
3. Design and synthesis of glycogen synthase kinase 3 beta (GSK3β) inhibitors as potential agents for Alzheimer's disease.
4. Multi-modal photoplethysmography signal acquisition and processing.
5. Evaluation of pre and probiotic activity of fungal polysaccharides in experimental in vivo and in vitro models.
6. Development of methods for the identification of markers that could predict the evolution of people with Minor Cognitive Disorder to Major Cognitive Disorder (Alzheimer type), from electroencephalographic signals.
7. Development of a granulate for solid dosage forms from Pleurotusostreatus mushroom with hypoglycemic activity (3 PhDs related to this topic).
8. Alternatives in Medicinal Mushroom Research in Silico Predictive Evaluation of Epigenetic Modulatory Events and Anti-Inflammatory Potential of Polyphenols.
9. Chemical Regeneration of Activated Carbon Used in A Water Treatment System for Medical Services.

Data collection: Data collection was organised through visits, combined with interviews to the beneficiaries and the professors involved, and a study of the documentation provided (presentations with data on the results, pictures showing the software working, scientific articles and theses).

Mechanisms that can lead to change:

Project mechanisms (IUC programme)

- Investment in research and training and equipment of labs: according to the standard indicators in Annex 2 of the IUC report of phase II, publications in international and national peer reviewed journals surpassed the baseline for phase I by 50 articles. Following the same line of analysis, there were 25 new courses developed through the support of the project, with 110 students and 39 training module packages developed through the support of the project above the baseline. The training topics were electromagnetic characterization; use of devices such as DICOM digitizer and video-nistamography, in software such as WebIND; management of platform for pharmacological and toxicological services; molecular diagnosis of SARS-CoV2 through Quantitative Real Time PCR, among others. In this last case, professors and medical staff contributed to the control of the pandemic. All these results are related to the 13 contributions identified.

- PhD training between the programme and the universities played a significant role. It included scholarships in Belgium; access to high quality equipment at Flemish laboratories; and the development of skills in English. There were 11 PhD dissertations linked to the scientific results, some of them with double degrees in Flemish and Cuban universities. Intellectual property protection also played an important role, as in the case of the PPG device, a joint international patent requested by UO and VUB. We must highlight the successful mechanism designed to make donations, in spite of the United States blockade.

- The IUC programme also provided budget for infrastructure (computers, cameras to follow movement, sensors etc.), so that professors and PhD students could acquire the necessary information that was later used in the apps and devices.

- The IUC made all stakeholders more aware of the introduction to the importance of organising and having multiple feedback meetings to assess utility of products and services, helped to design and adjust them according to the client's needs.

Collaborative mechanisms (initiatives at the level of the university and external stakeholders having the same objective)

- The involvement and commitment of medical staff: Constant exchange between the PhD students and the medical staff. The first ones trained the seconds, but at the same time got feedback on how to improve the software, technology or procedure according to the users. From that came ideas such as making portable versions for tablets or cell phones, so that the doctors could carry the images with them, or transmit them wirelessly to the patients.

- Part of the medical staff were also researchers and became supervisors and members of their dissertation committees.

- Collaboration and synergy between the IUC at UO and Network at UCLV, through trainings carried out at all universities in the network, including UO. Mechanisms such as a common alarm system when a virus, risk or hacking affects a university's data system. There is a clear technical support network.

Contextual elements

- Students and professors from UO have the capacity to create and implement innovations. In the case of the professors, they also have strong national and international experience in the development of software applications, procedures and devices. MINSAP, LABEX and other State entities want them to provide their services and products across the country and for export.

- Cuba has a difficult socio-economic situation, due to the US blockade and its unpredictable impact, which have been present since the beginning of the Revolution in 1959. All economic sectors are affected by it, and health it's no exception, as many suppliers of devices, medicines and raw materials have refused to provide their products to Cuba, fearing sanctions. Also, the pandemic became a priority for the Cuban government, absorbing most of the resources, which limited the ones available for other areas, such as oncology or cardiothoracic medicine. Forcing all stakeholders to be creative.

- In 2021, the country implemented measures for economic re-organisation, jointly called 'Tarea Ordenamiento', by increasing wages, re-unifying the national currency, changing the exchange rates, among others. None of them have been enough to control the monetary inflation, taking into account that it's also a global phenomenon. International prices for health products have also increased, and the underground market in the Island has grown, inclusive of the trafficking with medical drugs that are no longer available at pharmacies. The energy crisis compounded the complex situation. Consequently, to no one's surprise, emigration increased, including many members of the medical staff, some of them while in international missions. As a consequence, health services are lacking personnel and resources.

Rival mechanisms (other projects): 5 in total, of which 2 also funded by VLIR-UOS

Other programs (rival mechanisms)	**Duration**	Promoter	Local partners
VLIR-TEAM Camagüey, installing a centre of excellence in the central-eastern region of Cuba to enhance production and research on bioactive plants	2017 - 2022	Paul Cos (UA), Flemish	Universidad de Camagüey, UO and Universidad de Ciego de Ávila
VLIR-SI 'IPK', Knowledge Transfer of New techniques for defining factors influencing Dengue/Zika infection evolution in Cuba	2019-2021	Xaveer Van Ostade (UA)	IPK and UO

PNCT Biotechnology, Generation of monoclonal antibodies for the development of hemo-classifying reagents of the ABO system and antiglobulin sera (Coombs Serum)	2021-2023	Centro de Inmunología Molecular (LABEX-CIM)	UO
National Program of Neurosciences and Neurotechnologies (PNAP) PN305LH13-004, Design and implementation of an intelligent platform for the management of child development care programs and services (SAVDI)	2020-2022	CNEURO	UO
Sectoral Program Cuban Software Industry and Informatization of Society, (PS) PS 161LH001-08, Digitalization of the Child Neurodevelopment and Disability Service in the Province of Santiago de Cuba (DiSeNlD)	2022 – 2025	MINCOM	UO

Limitations of the impact case analysis:

- Part of the scientific materials consulted were very detailed describing the contributions but didn't give enough data on the impact on the population (patients involved or their evolution) so they could not be properly used to provide a better image on the improvements. An insufficient link with social sciences with view to analysing impact, was noticed.
- Most of the research results were not ready to be implemented yet, so it was hard to assess sustainability. The evaluators could take a look at a report from CINTRO S.A, the university enterprise in charge of exploiting PI derived from research, which shared data on the potential of the health biomedical technologies, natural drugs and services created, all of them related to the impact case, but it was requested after the field mission, and there was no time to visit the company. Finally, a need for a closer link to social sciences was detected, in order to better document the social impacts of the different contributions.

1.5 Structure of the evaluation report

The report follows with an analysis on the findings at programme level, focusing on the criteria to be evaluated, according to the structure of the evaluation framework. This is followed by a brief description of the projects, based on the self-assessments, the information compiled during the field work, the analysis and conclusions related to the impact case, and the material collected on the learning questions. The conclusions are based on the analysis at programme level combined with the institutional analysis, impact case and learning questions. Recommendations follow at the end and address the different actors involved (VLIR-UOS, Cuban and Flemish universities).

2 Analysis and findings: programme level

2.1 Overview of programme performance the IUC

The programme is rated as excellent, based on the results obtained, and its degree of generalisation at country level.

Criterion	Excellent (4)	Good (3)	Weak (2)	Poor (1)
Relevance	4			
Coherence	4-			
Effectiveness	4-			
Efficiency	4			
Impact	4			
Sustainability	4			

2.2 Relevance

For the country

The programme adapted its goals to the country's priorities, following MES strategic planning and consequently UO's. Therefore, doctoral theses and research projects focused towards two strategic axes that were transversal: ***infrastructure & human potential***, and ***science, technology & innovation,*** defined in PNDES 2030[17], emphasising on closed-loop and technology transfer of results. In this sense, the different projects obtained relevant results which reached technological sovereignty and developed endogenous technology with some of their products, which saved resources and substituted imports. SDGs 3, 4, 6, 9, 11 and 12 were all implied in the IUC ambitions and operations.

For the universities

The newly developed devices, procedures, software, nutrition products or drugs are now incorporated as subjects of study at university level, thereby improving higher education. The number of PhD. and MSc. students involved in those research endeavours, their publications and how after graduation they have taken over new responsibilities to continue the legacy of university processes, was relevant to the perception of the institution as a real actor and driver of change. At the same time, the novel changes improved the quality of work and study for professors and students, by automating many bureaucratic processes. It also improved the speed and quality of management, as decisions related to those processes could be taken in less time, using the information collected. The results were handled with full support of all the universities directives, MES and involved government officials.

For the stakeholders

The population from the eastern provinces have benefitted from the innovations implemented in health, education, nutrition, pharmacology and other sectors, as they could get faster and more accurate diagnoses, interact with the different educational digital platforms to enrich their knowledge, have access to products that could improve their health, all of which are aligned with government policies

[17] *Partido Comunista de Cuba (2016). Plan Nacional de Desarrollo Económico y social hasta 2030: Propuesta de Visión de la Nación, Ejes y Sectores Estratégicos (PNDES,* National Plan of Socio-Economic Development until 2030: Proposal of Vision of the Nation, Axes and Strategic Sectors).

and priorities[18]. The list of external stakeholders participating in the programme, many of them national industries and social institutions of strategic sectors such as health and education, shows the relevance and pertinence reached. Among them, the evaluators had the opportunity to visit such important stakeholders as the general hospital, Toximed and LABEX enterprise from Biocubafarma, which are vital providers of massive medical services, medical products and metadata processing. Thanks to the program, alliances with other universities such as those in Granma and Guantánamo were strengthened, in areas such as cultural heritage management, English training, and information management among others. Donations were made as extension activities, such as the laminar flow cabinet for the Contramaestre Hospital, for the diagnosis of infectious respiratory diseases, which is one of the main causes of maternal and infant mortality in the province.

2.3. Coherence

Internal: the evaluators considered it was strong, as they could perceive excellent synergies between the projects, with different actors within the university and other members of academia. 18 disciplines representing all sectors, from STEM to Humanities, interacted and created new products and services, such as the doctoral programme in Cultural Heritage, which has new tools at its disposal: publications or the computer platform for managing cultural heritage. The pandemic delayed many results, but it was seen as an opportunity to test the connectivity and the rest of the infrastructure provided by the program, along with the information generated by researchers, which was shared in order to continue generating ideas. Another good practice was the reallocation of resources that could not be used in some centres (as meeting face-to-face was impossible), to other intermediate projects. In this regard, the hospital's antibiotic policy was reinforced, standard operating procedures for pharmaceutical services were validated, and a nutraceutical cookie was developed and tested in 2 hospitals as a food supplement for patients and health workers at risk of infection.

Projects P1, P3 and P4 created synergies and designed a new research project approved in the VLIRTEAM Call 2022, focused on the valorisation of medicinal plant crops with antioxidant potential for neuroprotection. P4 focussed on the valorisation of natural heritage. The IUC goals of valorising and developing research and academic capacity to generate goods and services with social impact, keep aiming for this new intervention. The transversal project played a central role, by reinforcing PhDs and MSc. programmes training with the newly incorporated resources.

External: the evaluators could perceive the coherence between projects P2, P3 and P5 when visiting the Juan Bruno Zayas Hospital, a common stakeholder, as they mentioned in the self-assessment report from phase II. It functions as an 'experimental station', so the evaluators could see the Imagis 2.0 functioning, the new management at the pharmacy, the cameras connected to the software studying movement at the Department of Neurophysiology Training and much more. Professors from the different projects explained how they exchanged in order to put the proof of concepts together. Another important factor was the training provided by the Belgium universities, the great material support they provided in infrastructure circumventing the US blockade, and the good advice from the Flemish project leaders, who were in constant contact and ready to exchange thoughts and planning about the development and management of the innovations produced.

The programme was in line with the main interest topics of VLIRUOS in the country, the projects established links with other VLIRUOS projects at the Universities of Camagüey and Ciego de Ávila, and stakeholders such as the Institute of Tropical Medicine (IPK). The ICT team has maintained its relationship with UCLV's networking programme and other partners since phase one.

[18] *Partido Comunista de Cuba (2021).* Lineamientos De La Política Económica Y Social Del Partido Y La Revolución Para El Período 2021-2026 (Guidelines for Economical and Social Policy of the Party and the Revolution for the period 2021-2026).

2.2 Effectiveness

Outputs and outcomes were achieved at an outstanding level, and one of the best examples lies in the impact case. The evaluators found that there was a shared and coherent vision and strategy at university/faculty level, and that is how they reached the maximum level of maturity in phase 2, although the initial score of 5 was not bad either. A set of factors contributing the success of the programme are are briefly described here:

1. Team working full time for the program, with the participation of professors and administrative staff from the UO.
2. The rector and the rest of the university directives closely followed the program, through regular meetings and visits to the stakeholders. At the same time, there was a recognition by the authorities of MES of the outputs and contributions of the programme. These gave their full support from the start by putting their specialists in foreign collaboration at the program's disposal, and giving all authorisations needed as fast as they could. This evaluation started and ended at MES because they gave maximum priority to the task.
3. The team had its infrastructure secured by the program, including a building which is now used for many other activities, including PhD defences, taking advantage of the material resources it possesses. Those interviewed remarked on the strong capacity for running projects of their leaders, and how practical they were at solving problems.
4. Regular meetings were held with the Flemish universities, stakeholders and other partners, which facilitated timely reporting. Research results at the programme/project level were discussed annually in both the science and administrative boards of the university. Budget planning around research, PhD. and MSc. students' needs were decided upon in mutual agreement, trying to be fair and keeping a balance when choosing candidates. In summary, management structures were effective, and they got maximum punctuation at the institutional capacity assessment.

The principles showed in the opinion of the evaluators, how different **factors and actors became facilitators of university processes.** The evaluators appreciated that there was a good combination between donations and purchases, where second hand and new equipment, set up by Cuban specialists sent to Belgium, successfully circumvented the US blockade. Thanks to the acquired infrastructure, virtual meetings with the Cuban stakeholders grew in quality, which meant better management of the programme as a whole, especially during the Covid-19 pandemic. The stability of project leadership also contributed to the success, as decisions were taken collectively between the Cuban and Flemish partners, with excellent communication between project leaders and stakeholders.

By the end of the implementation period, outcomes were achieved, and the resulted in the standardisation of (data) management platforms. The evaluators could see how the students could access research profiles and academic networks with good connection, and how the generation of content came from training and research results obtained in Flanders. At the same time, the creation of services based on the global data network encouraged a culture of accountability in order to mitigate risks related to staff changes or loss of intangible assets (software). Evaluators saw the evolution and sustained development of the software tools, systems and applications, in the automation of university processes, such as the different reports generated with information uploaded by the professors (articles, awards, books, presentations etc.). To add, as Orberá Ratón stated: "a culture of technology transfer and commercialization of scientific and academic services started to be created among professors, researchers, and decision-makers."[19]

Inhibiting factors and actors: with COVID-19, only virtual exchanges were preserved. This was possible thanks to the ICT merchandise provided by the programme. The pandemic produced a severe economic crisis which had many negative effects. Also, an increase in the severity and number of restrictions imposed by the United States blockade on Cuba, made it difficult to make money transfers,

[19] Orberá Ratón,T. (2023). Self-assessment IUC Partnership. Programme level. Universidad de Oriente, p.4.

and to ship the containers to Cuba. This created a more devastating impact on living and working conditions, provoking a wave of emigration, mainly of young and highly skilled people. VLIR as well as UO staff became victims of this situation, losing good professionals after putting so much effort in their formation. This, of course, is one of the risks the island has been facing since decades before the Revolution, due to the difficult economic conditions, media manipulation and lack of international credits to conduct foreign trade among other factors.

2.3 Scientific quality

Scientific articles in prestigious international and national peer reviewed journals increased, most of them written by the PhD candidates and their supervisors, some of these from the Flemish universities involved in the programme, totalling to 185 SCI publications. The updated Master's programmes and number of students participating in them also increased. There were 16 MSc. and 51 PhD. students directly supported by the programme. For the evaluators, this shows the high scientific quality achieved by the programme.

On the other hand, the selection process of candidates for short training or PhD scholarships was developed adhering to the procedure (management manual) accepted by all partner universities. This process was enriched with the online participation of experts and project leaders in Flanders taking advantage of the existing video conference facilities.

One of the most important outcomes was the implementation of inter- and transdisciplinary doctoral programmes, such as the one in Cultural Heritage. This increased the number and quality of enrolled students and graduates. To add, the quality of the academic staff and thus the curriculum was improved with the contribution of Cuban and Flemish professors. The offer of online courses was also increased as a response to the pandemic, also thanks to the newly donated/purchased infrastructure. Also, a summer school on biodiversity was designed with the support of Hasselt University and 2 State-owned companies, one of which is also a tourist facility. However, this was cancelled due to the COVID-19 outbreak followed by the energy crisis. Nevertheless, it is still a project ready to be implemented with CINTRO S.A.,as are other scientific results which are already in operation, such as the digital brain imaging software Imagis 2.0.

All academic and scientific development achieved by partner universities during the IUC programme have consolidated the vanguard position of the partner universities on ICT related sciences and technologies. In synergy with a VLIR-UOS joint project, the IUC programme founded the Cuban academic supercomputing network, made up by three nodes in UCLV, UO and the state-owned enterprise ETI, from Biocubafarma, strengthening the university-industry linkage.

2.6 Efficiency

The extent to which organisational management and structures of the programme were conducive for efficient implementation, could be seen through the following measures:

- The evaluators found that in the second phase the coordination team followed the recommendations of the mid-term evaluation, which among other things were to create conditions for successful technology transfer and capturing international students. The team implemented measures such as the support with university representatives and MES for the creation of CINTRO, a company that is helping to reinvest the profits obtained in research, and UO, or the participation in international fairs and other events to promote the portfolio of (training) courses UO can offer.
- The evaluators met the local Steering committee made up of the local coordinator, program manager, and all of the local project leaders. Thereafter they met other representatives of UO . These partners meet quarterly (although extraordinary sessions can be called if necessary) to discuss and approve the activities to be carried out in the programme, budget issues, and needed modifications to achieve a better implementation. These meetings are generally held by videoconference, and VLIR-UOS is invited, thanks to the good infrastructure created by the programme. Research and academic results were discussed in yearly meetings at both university science and administrative boards. Decisions and

agreements were made collectively between Flemish and Cuban partners. The JSC met in person at least once a year. Documents of the meetings were organised and shared among the participants in order to follow up the decisions taken.

- Both the project leaders and the representatives of the partner universities kept a systematic participation in all meetings held, most of them online. The stability of the project leaders was essential to achieve good understanding, teamwork and synergy between the different projects that make up the program. The evaluators could see the good communication and information flow between the parties.
- A Purchasing Committee (PC) was established at programme level, which was responsible for administrative activities. It used to meet weekly, and its decisions were validated by its homologue at university level. Project leaders and deputy PLs were invited to present and discuss their offers and requests.
- 90% of the budget that was executed was successful and according to the manual. However, during COVID-19 it was necessary to realign the budget. Although it was approved by VLIR, 10% of the budget will be shifted for a phase out year, as some of the objectives were still pending.
- The cost-effectiveness in our opinion was also fruitful: Cuba is famous for the intensive use of its resources, especially in massive services such as health and education. The programme was no exception when using the equipment provided by VLIR, as it had a strong presence in both areas according to its objectives.
- Annual planning was prepared one year in advance, and then followed up by the JSC.
- For the scholarships grant process, selection committees were made up with the participation of Cuban, Flemish experts, and project leaders from UO. In the case of Joint PhD scholarships, the Flemish and Cuban coordinators also participated, not only in the selection process but also in the follow-up.
- The program carried out a strategy to benefit from donations. Purchases were done through the Flemish universities, which have significant discounts from their suppliers. The annual shipment to Cuba of a container brought all the acquired goods and materials.
- All of the results, such as (Imagis 2.0), are or are waiting to be commercialised, as is demonstrated in the impact case and the sustainability criterion.

2.4 Impact

The evaluators found that all **changes** detected **except one** were **positive**. The IUC has supported the evolution of the university in becoming the motor of sustainable, socio-economic development whereby researchers were empowered to develop sustainable solutions to the region's most pressing needs, especially in the areas of medical and health services, culture, urban planning, and food security. Furthermore, the IUC fostered a culture of research consonant with global standards by the preparation of university personnel interacting with international HEIs and scientific platforms. For their part, UO has had a striking influence in both the community and the rest of the universities in the eastern part of the country, since the program has greatly contributed to both postgraduate and undergraduate education, with several capacity-building actions carried out with numerous researchers, software developers, faculty, and staff involved as beneficiaries. Most importantly, UO has had a strong impact on the research management culture of the academic system, since people have a better idea on how to work for a replicable and transparent model of research, which is linked from the very beginning to the industry. In this way the commercialization of results is much more consolidated.

The authorities at university level have also changed postures through the programme: for decades the goals were just teaching and research, without much focus on commercialization, or (potential) stakeholder needs. In the focus group with university leadership, it was clearly stated that the university needs additional and complementary funding which was provided by the State. With the diversity of economic actors in Cuba, this was an opportunity to develop institutional capacity with more decentralised resources, using small companies like CINTRO, with a more direct link to the university. Interviews with stakeholders also highlighted how the new equipment saved time and made the research more relevant, as many automated processes were introduced requiring little to no day-night supervision. This also made institutional follow up easier.

Before, CINTRO, which acted like **the Knowledge and Technology Transfer Office (**KTTO) did not exist, and its assets had to be recovered; the knowledge management system existed, but it was rudimentary and weak, as there were not as many applications and storage capacity to properly handle it. The supporting infrastructure was obsolete and insufficient for the university needs. It was not possible to execute big data analyses. Furthermore, to create conditions for successful technology transfer was not a clear goal, as there were no devices, procedures, technologies and software to be transferred. There was previously no proper space nor equipment for doctoral training and innovation.

After the IUC programme, the evaluators could notice many **intended changes**:

1. The ToC was incorporated in the formulation of the programme and the 6 projects, focusing on envisioned change to address the problems identified before the IUC started, closely following solutions. The stakeholders were correctly identified, as well as their roles in the project cycle, and they participated in every step of the way according to the interviews, so that their demonstrated commitment and gratitude to the programme/projects objectives and outcomes was palpable. This was considered the most important impact in the self-assessment report, and the evaluators agree: how the research culture of the university changed "from applied research to research focused on stakeholder needs"[20].
2. In phase one, the IUC program set up the KTT office at UO. This office collaborated with the School of Law, gave birth to the IP-Policy and recovered the IP-assets of the university registered in the archives of OCPI. At the same time, a culture of technology transfer and commercialization of scientific and academic services started to be created among professors, researchers, and decision-makers. The evaluators could sense this in every project visited, even in places with resources which had already an intense use, such as the Laboratory of the Group of Movement Analyses at Hospital Juan Bruno Zayas in Santiago de Cuba, with a device designed/constructed by the specialists to perform analyses imitating oar exercises, combined with last generation cameras donated within the VLIR-UOS programme.
3. Various stakeholders (staff from the hospital Juan Bruno Zayas, Toximed, Labex among others) shared how the IUC programme improved their quality of work, and the quality of life in patients, students and population in general during the evaluation mission. They highlighted the level of preparation of the university specialists involved, to assume difficult tasks in a context of scarcity, and how they could team up with the staff from both social and enterprise institutions. Some of the members of that staff have become students at the PhD. programs, such as the Director of the Province Centre for Cultural Heritage, inspired by the example of their peers.
4. When compared to the initial baselines in phase 2, the results have all increased in all of the projects, with few exceptions.[21] This meant 117 more articles were published in international and national peer reviewed journals; 16 more updated Master programmes and 436 more students participating in them; 64 more courses were developed through the support of the project and 715 more students participating in them among other indicators. There were 16 MSc. and 51 PhD. students directly supported by the programme, increasing the quality of courses in majors and graduate level, as the results have become part of the teaching content. At the same time, the portfolio of products and academic services also increased, with a high potential for export and commercialization within the country, as soon as some of those products reach commercialisation phase and are protected under PI.
5. A knowledge management system was designed and implemented not only for the programme, but for the entire university. It came as part of the synergies with the UCLV Network program, with the participation of UO specialists, who personalised many softwares. MES decided to embrace this new TICs focused environment, turning it into a policy. Here lies the reason behind the maximum level of maturity reached in the institutional capacity assessment (spider web). The supporting infrastructure and connectivity at UO is now first world level. Not only are big data analyses possible, but the

[20] Orberá Ratón,T. (2023). Self-assessment IUC Partnership. Programme level. Universidad de Oriente, p.10.

[21] Orberá Ratón,T. (2023). Self-assessment IUC Partnership. Programme level. Universidad de Oriente, Annex 2. Standard indicator monitoring.

capacity of storage has also improved to the extent that it could provide these services for other entities. Among the most used academic services today are the e-learning platforms that were key to guaranteeing teaching during the COVID-19 period.

6. The transversal project (TP) supporting doctoral training and innovation was formulated, which implemented different workshops and trainings to support the management of innovation. One of them was the «call for Proof of Concept (PoC) projects», through which two projects in the field of health technologies received coaching and funding to implement the ideas. Other activities of the former KTTO and CINTRO were supported by the TP, such as the workshop of «Management of Innovation and Tech Transfer» with Flemish experts, where the tools developed by them are used by CINTRO and other university processes such as RD&I, postgraduate education and extension. On the other hand, CINTRO facilitated the transfer of scientific and technical results to the industry through contracts with companies like BioCubaFarma (LABEX), Cuba Ron, the health system represented by MINSAP among others.
7. Compared to phase I, the partnerships with Flemish universities, and also among the 6 projects helped to make faster and better decisions. In the end, the IUC programme was finalised with significant institutional development of ICT related sciences, and it radiated in part to the entire higher education system, as well as to several strategic sectors of the country. This is the case of the repositories in UO available for all researchers thanks to achieved results.

One negative change was detected: Staff retention became a problem after the training and workshops, although only 2 candidates and 1 graduate left, representing 4.5% from the total student body directly supported by the programme. This made continuity and team cohesion difficult, but some of the former UO professors actually kept their relationship with the university in good terms and ties were sustained. Staff turnover thus is also leveraged as an opportunity to explore and consolidate new and maybe more profitable modalities of collaboration with former staff. Nevertheless, while UO is currently coping well with staff turnover and continuity is being ensured, the retention of ICT staff and English language instructors remains a challenge.

No **unintended changes were detected.**

2.5 Sustainability

2.5.1 Institutional sustainability

Cooperation with VLIR UOS has been acknowledged by MES as one of the most stable and influential, and the IUC Program consolidated that status. All projects resulted in the strengthening of a transatlantic and regional research network that can build on IUC programme outcomes to develop new scientific and technical inquiries at UO and its research centres. Through the training of technical personnel, technological know-how can be passed from one generation to another, in a train-the-trainer fashion. The instalment of data centres has made it possible for UO to safely keep and revisit data and research results. The donation and purchase of solar panels will contribute to energy independence from fossil fuel, which is currently at stake in the general energy crisis experienced throughout the country. Although there quite some turnover was noted in the ICT sector, responses obtained from UO indicate that sufficient personnel has been trained ensure continuity in ICT capacity and cope with inevitable staff turnover.

Thanks to the IUC, institutional capacity has become more reliant on decentralised and varied resources, using interface companies like CINTRO. The generation of revenues from patents and training services country-wide will contribute to the financial stability of the university. While there is a tendency for MSc. and Ph.D. graduates to enter the private sector or emigrate to foreign countries, sufficient numbers of local scientists benefitting the programme have expressed their desire to maintain relations with UO for further exploration of research endeavours and training. Notwithstanding periodical change in the university leadership, a strategy was adopted whereby all their responsibilities related to the programme became part of the handing over process to the new direction, which in some cases took days, as they jointly visited centres and social institutions. Four project initiatives took place to continue with the collaboration after the programme closed, 2 with VLIR and two with AUF (University

Agency of the Francophonie), so there was additional funding for new innovations, also taking advantage from the experience gained at drafting international projects.

2.5.2 Financial sustainability

Taking advantage of new legislation allowing for decentralised production and the creation of interface companies, UO has adopted the commercialisation of patents and services as a major strategy to attain financial stability. The first step was the creation of CINTRO S.A., a company that belongs to UO and the University of Guantánamo as stakeholder, with the mission to trade with the research results created by its workers. The consulting company International Centre of Havana (CIH in Spanish) has also been used as a way to commercialise some of the products and services. In this regard, about 15 contracts were signed for a total of $778,446.69 pesos and some of them have already been executed with Cuban clients. Examples of these are Cuba Ron or LABEX[22]. Some of the devices, software and procedures obtained have been exploited during the execution of the IUC programme, such as Imagis 2.0, but in those contracts there were also training services using the facilities equipped by VLIR.

The programme supported this commercialization process through training between academia and industry, with the participation of Flemish professors, like the workshop of «Management of Innovation and Tech Transfer». Improved work conditions, better wages and new jobs will help to increase the retention of staff. At the same time, specialists also trained within the program have helped other partner universities, such as UCLV with the training of staff. Over time, the profits will be reinvested into infrastructure for the data centres, new laptops, and printers among others.

There is a big project with LABEX, with high quality equipment donated/purchased by the IUC programme and another international collaborator named MEDICUBA Suiza, for different labs that will provide services for stem cultivation, molecular biology, chemical characterisation and pharmacology, in facilities provided by UO. These labs will aim at proof of concept, and financially will be very important for both the university and LABEX, as the industries will be the clients. 170 solar panels will provide clean energy to the labs and other places, guaranteeing a non-stop service in times of fuel scarcity; this was shared in the interviews when visiting the mentioned Biocubafarma enterprise.

PIs have played a substantial role, but in the future, it could be used not only for exploiting patents, but also for licensing brands, industrial models, drawings and other forms of protection which could be of benefit to the national and international prestige of UO.

2.5.3 Academic sustainability

UO strengthened the quality of research and education through courses, workshops and diagnostics, with other Cuban universities. The articles and book chapters were used as bibliography, and the new equipment supported the teaching process. Through commercialisation, part of the profits is being reinvested into new research, as well as for improving conditions at research centres and other facilities. CINTRO reported that from the 20% of profits, $52,500.00 pesos were used to repair air conditioners, supporting a scientific conference held at UO, and paid the fees for presenting in another international event.[23] All of these were considered as support for science and innovation.

The academic staff, as part of the programme, also seeks to include 38 talented students working part-time, in a good working environment. Two contracts are in negotiation for this, one with CINTRO, and another with the Faculty of Electric Engineering[24]. This system also allows the detection of young talent that could continue to work at the university and this company at the same time, in a virtuous circle. The talent plan is organised by MINED at secondary high schools to identify bright students before they

[22] Marañón Cardonne, M. (2023). Informe al Consejo de Dirección UO. Estado actual del funcionamiento de la Empresa Interface de Ciencia y Tecnología CINTRO S.A. (Report to the Board of Directors at UO. Current state of functioning of Interphase Enterprise of Science and Technology CINTRO S.A.).

[23] Marañón Cardonne, M. (2023). Informe al Consejo de Dirección UO. Estado actual del funcionamiento de la Empresa Interface de Ciencia y Tecnología CINTRO S.A. (Report to the Board of Directors at UO. Current state of functioning of Interphase Enterprise of Science and Technology CINTRO S.A.).

[24] Ídem

enter university, therefore feeding into future cohorts of scientists in training. The programme contributed to that, by finding spots for these talents to develop their ideas, with access to resources such as the data centres or high-performance computers. University professors from the programme give those talents lectures, then become their supervisors and also members of the tribunals where they discuss their dissertations, and finally turn into co-authors in articles, events and work with them as part of the teams that share the profits when the projects get income.

Other local follow-up activities also took place through scientific seminars, which allow the professors to track the PhD students' progress, and also transfer knowledge to master students who keep involved as members of the research pool at partner universities. Thanks to all these factors, a solid group of professors and specialists keeps active with excellent experience and expertise.

3 Brief assessment per project

Table 2. Scores by project[25] based on self-assessments[26]

Programme	IUC (UO)			
	P1	**P2**	**P3**	**P4**
Sustainability (Q3)				
Finance/economic sustainability	3	4	4	4
Level of ownership	4	4	4	4
Results will continue	4	4	4	4
Partnership (Q3)				
Quality of comm within the project/programme	4	4	4	4
Academic interest and commitment	non existent	non existent	non existent	non existent
Project management (Q5)				
Value for money	4	4	4	3
Working relations with PSU	4	4	4	4
Active involvement	4	4	4	4
Mutual trust and joint decision making	4	4	4	4

Source: Self-assessments by projects

3.1 Project 1. Sustainable Risk Management Plan For Biodiversity And Food Production In The Eastern Of Cuba

The evaluators accepted all the scores of the self-assessment.

Relevance and Coherence: The goal was to support integrated sustainable management for biodiversity and food production to face climate change and other environmental stressors in the eastern region of Cuba'. The main focus was on water quality, ecotourism, and bioindicators for sustainable food management which relied on the implementation of agroecological systems. CNEA in collaboration with the Faculty of Construction, the Faculty of Natural and Exact Sciences and the Faculty

[25] To avoid duplication of information, this section focuses on the specificities of each project. Other findings that cut-across the programme level are addressed in the section that discusses findings at programme level.

[26] These scores correspond to projects in phase 2.

of Computer Science and Telecommunications, responded to the objectives outlined in the priorities of the 2030 Agenda on research related to environment and food production; the strategic sectors of socio-economic development of the country on food, international tourism and professional technical services; and the SDGs (2 Zero Hunger, 4 - Quality Education, 6 -Clean Water and Sanitization,14-Life below water and 15-Life on Land). Collaboration and/or synergies were found with projects P3 by incorporating ecological methods of food production with regenerative impact on the environment, P4 by working with ecotourism and focussing on the unique butterfly collections and the Sierra Maestra landscape, and P5 by the development of new technological proposals and seeking gender balance. Synergies were also found with other such actors as the University of Guantánamo and Centre for Coastal Zone Management Studies (CEMZOC) where results were shared with the Cuban Ministry of Science, Technology and Environment projects related to early warning responses to emerging risks of cyanobacterial contamination in agriculture and husbandry, enhancing coffee production and diversification in meat production.

Efficiency: Notwithstanding challenges encountered in the purchasing and importation of materials, and fuel for transport, coordination meetings were held jointly with local and international partners to ensure continuity of the project, sound execution of the budget and the support given to and monitoring of the PhD students. All project members participated in meetings to discuss needs and related procurement. With the cancellation or postponement of activities such as field trips and the Summer School during the pandemic, the project carried out alternative endeavours such as the community beach cleaning initiative and the concentration of activities planned in other provinces at Santiago de Cuba. In this way, not only the creation of the Ecotoxicology and Environmental Services Laboratory was boosted, but also the installation of a new microscopy service in the Zoology Laboratory, the biotherium for the breeding of Polymitas and the acquisition of equipment for the implementation of the Early Warning System in the Eastern region as obtained.

Impact –Effectiveness: The project promoted a multidisciplinary culture of research involving various departments and faculties at UO, including the Centre for the Study of Coastal Zone Management and the Hydraulics Department of the Faculty of Construction, and the Faculty of Computer Science and Telecommunications. Furthermore, UO strategic goals were met in terms of achieving 6 MSc. and 11 PhD graduates, with an additional 6 continuing their doctoral programmes. Students of Biology and Agronomy, and professionals from BIOECO were trained in the use of new technologies. The internationalisation of university programming was most notable in the creation of a PhD programme in Environmental Sciences, in which professors from Europe, South America and Cuba are involved. By the time of this evaluation the doctoral programme hosted 51 students hailing from the eastern region of Cuba, including the 7 joint PhD students directly related to the project, four of which have successfully defended their dissertations. Scientific output resulted in 27 publications in the Web of Science, of which 8 received national awards of excellence and 1 international award. The application of new technologies in farming irrigation and the commercialisation of the same were realised. A team of researchers brought the endemic Polymita snail to win the Mollusc of the Year at the Germany-based Senckenberg Society. The acquisition of equipment allowed for the establishment of the Ecotoxicology and Environmental Services Laboratory, the installation of a new microscopy service in the Zoology Laboratory and the implementation of the Early Warning System for the region. The evaluators witnessed the use of the equipment by undergraduate and graduate students and researchers. The project resulted in the training and upgrading of a regional network of highly qualified researchers with excellent qualifications, capacity and scientific authority that is recognised by the academic community, at regional, national and international level.

Sustainability: The development of technical services such as water and soil analysis and the processing of plant samples have been designed for commercialisation. Attempts at developing new services such as electron microscopy and the biotherium for the handling of Polymitas have been made and partners continue to explore further commercialisation opportunities that are still in the initial stages of creation, are being explored for their commercialization. The project has been successful in the (continuous) training of (new) research and technical personnel. The signing of MOUs and partnership agreements between UO and other stakeholders has aligned the university strategic objectives with this project, ensuring continuity. Among the stakeholders are provincial authorities of hydraulic resources, flora and fauna enterprises, Alejandro de Humboldt National Park and a UBPC. It is worth highlighting the training of specialised personnel for the execution of these services, which will

guarantee the continuation of these analyses and training of new staff, ensuring sustainability of these analyses after the project has finished. Out of this, a new research project proposal has been approved by VLIR, namely “Improve growth of climate-adapted plants in the South-Eastern region of Cuba and use of their antioxidant potential for medical application”. Demonstrated synergies among all the projects of this programme have contributed to the sustainability of P1 results.

3.2 Project 2. Biomedical technologies and services for improving the medical assistance in the eastern region of Cuba

The evaluators **accepted all the scores in the** self-assessment.

Relevance and Coherence: This project sought to remedy problems of scarcity and effectiveness in the Cuban national health care system, as per customer experience in terms of waiting time for services, and physician access to biomedical technologies which can support the efficient delivery of diagnosis and medical intervention. Supplementary to this was the backing of continuous improvement and change processes, particularly in educating and training professionals in the areas of technology, innovation and research. These speak to SDGs 3 (Good Health and Wellbeing) and 4 (Quality Education), while local production of biomedical technology speaks to SDG 9 (Industry and Innovation) and the collaboration between partner universities, social institutions and manufacturers speak to goal 17 (Partnership supporting the SDGs). Project partners are involved in two other actions funded by AUF. Within the program, synergies have been established with P3 by developing a software tool, still under development, for managing pharmaceutical information inside the hospital, and P5 by developing worklinks in the area of sound analysis, digital signal processing and application of nuclear magnetic resonance; and the maintenance of an equitable gender balance on the 50/50 principle.

Efficiency: With an annual budget of approximately €70.000 from year for the life of the project, P2 created two laboratories, CENPIS and CBM, where the latter was equipped with a classroom supporting the Msc and PhD programmes. CNEA saw the establishment of a small facility for electromagnetic characterisation. An additional special laboratory for prototyping with 3D printing capabilities was created for CBM. With this amount two laboratories for biosignal acquisition have been created (CENPIS and CBM). One laboratory of NMR has been equipped with new technology (CBM), a specialised classroom to support the MSc and PhD programs has been created (CEN-PIS), and a small facility for electromagnetic characterisation has been equipped (CNEA). A special laboratory for prototyping has been created at CBM with possibilities for 3D printing and Printed Circuit Board (PCB) prototyping. Challenges were identified mainly in the purchasing of equipment and the acquisition of electronic components, chemicals and reagents. The late delivery of the NMR devices, for instance, made certain testing impossible. Nevertheless, frequent meetings were held to ensure continuity and the use of digital communication tools allowed the team to maintain solid lines of communication with Belgian counterparts which ensured mutual trust and joint decision making.

Impact- Effectiveness:
The project has had an enormous impact on three main areas. These are: UO scientific output, research culture in the biomedical engineering sector and the quality of diagnosis and medical intervention in hospitals across the country. A total of 16 team members received their PhD and 5 of these were joint doctoral students. Thanks to this project, UO now serves the country with a PhD program of Biomedical Engineering UO Faculty of Engineering in Telecommunications, Biomedical and Informatics (FITIB) has seen unprecedented and successful efforts in collaboration with and among such research centres CNEA, CENPIS and CBM. Acquired equipment has been used by societal actors such as the Juan Bruno Zayas hospital and other medical centres in eastern Cuba. Twenty-five hospitals have installed technology produced by the project (Imagis) with an income of 3 million Cuban pesos during the last two years, and Imagis 2.0 is ready to be marketed. Three more prototypes of medical devices (DICOM digitizer, WebIND and Video-nistamography device) are currently under test at the hospital as well as a methodology (Dynamic Viscosity using NMR). Other four prototypes (ANGIODIN, Medical Briefcase and Magnetic Bed and Spirometer) were ready by the time this evaluation was carried out 2023 and 2024.

Sustainability: Many efforts have been made to ensure sustainability. Most notably are the partnerships that have been fostered by the project, lending to continued production of local medical

technologies; institutional support and involvement of project partners in setting university goals; continued partnership between Cuban and Flemish researchers. Furthermore, the acquired technology, creation of laboratories and specialised classrooms will be used for training new students and researchers in perpetuity.

3.3 Project 3. Natural Products and Pharmaceutical Services to improve the patient quality of life in Eastern Cuban Hospitals

The evaluators **accepted all the scores in the** self-assessment.

Relevance/Coherence: The project's stated objectives were the exploration and pre-clinical validation of pharmacological and toxicological effects of natural products obtained from microorganisms and plants for medical practices, and improvement in the provision of pharmaceutical services to increase the patient's quality of life. These fall in line with prioritised areas of research at UO and that which is articulated in the National Plan for Economic and Social Development. With regard to the 2030 SDGs, the project speaks to SDG 3 (Good health and Wellbeing), SDG 4 (Quality Education), SDG 9 (Industry and Innovation), and SDG 17 (Partnerships). The project provides a relevant framework for the articulation and integration of institutions of the territory and the legal framework for production. Synergies are found among other VLIR projects such as the VLIR Team at Universidad de Camagüey. Communication with other projects has been very fluid, especially with TP1, TP2 and TP3 (Phase 1), and P1, P2, P4 and PT (Phase 2). The transversal project TP1 offered good ICT opportunities (more Wi-Fi points, video conference rooms, PCs). P3 contributed to the development of PhD Program on Basic Sciences and co-promoted two PhD students (TP2). The continuous qualification offered by the transversal project related with foreign languages (TP3) increased the communication abilities in such a way that today our South members received excellent feedback not only from their supervisors, but also from the personnel working at the host labs in Belgium. P3 is compromised with the environment (working in synergy with P1 team members in the conservation of the natural biomass used as source of natural drugs). The publication of the joint paper "Antioxidants in Plants: A potential for commercialisation emphasising the need for conservation of biodiversity among plants. The actions focused to the digitalization of the services designed at the hospital illustrate the synergy with P2 team members. Actions together with P4 arise from the generalisation of the Cuban traditional knowledge-practices related to the use of medicinal plants as part of our natural heritage.

Efficiency: The evaluators consider that the project has a good cost–results relationship based on the impact of biotechnological and pharmaceutical research/ services, the acquisition of high-level lab equipment, the mobility for doctoral and postdoctoral training, commercialisation of products, as well as the training of technicians and medical/healthcare professionals. Results were limited by factors such as the US embargo, delay in arrival of equipment and COVID-19 pandemic which limited mobility and access to physical spaces at health centres. Clear lines of communication between Flemish and Cuban partners, good working relations between the coordinators and the PSU, and the active involvement of team members in the financial, operational and strategic planning ensured successful procurement, sufficient support for doctoral students, tremendous scientific output and the creation of core facilities. While the financing of materials in Phase I lent to capacity building and infrastructure used, as well as to the establishment of a cell culture, in Phase II the acquisition of diverse equipment (including ICT), reagents and consumables continued, which contributed to raising the credibility of the research done and to the academic improvement of specialists from Universidad de Oriente and the territory. An overview of the investment amounts of the project between equipment, reagents and consumables reached 304 465.88 euros (207 157.88 in phase I and 97 308.00 in phase II).

Impact-Effectiveness: This project has contributed to the development of a new interdisciplinary model of research and innovation in the fields of natural products and pharmaceutical services by integrating UO faculty and research centres which have provided capacity building and specialised human resources. Furthermore, P3 had a significant impact on curriculum development locally, nationally and in the Latin American region. It has helped to build strong alliances between UO and other social actors such as the Juan Bruno Zayas Hospital, and between the interface company CINTRO and local and regional MYPES. The operation of a functional Preclinical Centre as a management platform for pharmacological and toxicological services has led to the creation of CEBI as a new entity of science,

technology and innovation. Traditional knowledge-practices of plant medicine were validated through scientific review. Practices in mushroom production applied the principles of circular economy.

- 59 Bsc. degrees in Pharmacy, Biology and Chemistry have been awarded within the context of P3. Honour awards have been given to at the provincial and national level.
- At the graduate level, 3 new accredited Master degree programmes in Biotechnology, Pharmaceutical Services and Chemistry have evolved out of this project at UO, with 26 graduates to date.
- Doctoral programmes in Biotechnology, Basic Sciences and Biotechnology were created by 2019 and are awaiting accreditation by JAN. The last of these has been exemplary in its interdisciplinary features contributing also to the internationalisation of the university with academic staff hailing from Cuba, Flanders, Mexico and France. Of the 19 students enrolled in this PhD programme, 14 are P3 team members. At the time of evaluation, 5 Joint Phds have defended and 3 were in process of completing their requirements. Similarly, among the local PhDs, 3 have defended and 5 are in the process of completion; seven graduated PhDs were incorporated as professors in the Master degree and PhD programs aforementioned.
- Creation and approval of the Centre for Studies on Industrial Biotechnology (CEBI) to the category of “Entity of Science, Technology and Innovation” (ECTI), the third of Universidad de Oriente, a condition granted by the Ministry of Science, Technology and Environment (CITMA) in agreement with the new Cuban policies for science and innovation.
- In terms of scientific output 158 articles were published over a 10-year period; 137 of these indexed in peer review journals (Groups I and II according MES classification), and half of them are abstracted in the Web of Science. Other publications include chapter contributions across Latin America. With this, 250 papers were presented in 29 at international conferences such as FARPRONATURA and 6 international awards by scientific societies in Cuba and Latin America
- Unexplored endemic plants were also studied with the participation of BIOECO, contributing to the knowledge of our biodiversity and natural heritage. In
- Other important contributions for the Cuban health system are the Improvement of the antibiotic policy and setting up a monitoring system of antimicrobials and disinfectants and an update of the hospital microbiological maps through the identification of circulating strains and their resistance/sensibility patterns.
- Through monothematic courses, more than 250 professionals have been qualified by MINSAP in agreement with the strategic axis of “Human Potential: Science, Technology and Innovation” of PNDES 2030.
- The creation of Cell Culture Lab, which was used in the training of students and young professors at UO in P3 and P1 projects for the molecular diagnosis of SARS-CoV2 through Quantitative Real Time PCR. Moreover, the “Biodrop” equipment and its consumable materials (e.g. 96-well plates) were also used in the external validation of the precision and linearity of new PCR equipment arrived in Santiago de Cuba province for the diagnosis of COVID-19 and thus, contributing to the control of the pandemic.

Sustainability: Through the strong alliances fostered by the project locally and internationally, permanent relations supporting future related research endeavours have been secured. The participation of project members in new calls for national and international projects, as well as in collaboration networks will also make it possible to dedicate new investments for sustaining the project results. An example of this is the approval of a new VLIR TEAM project with the University of Hasselt as continuity of the results obtained by the synergy between P1 and P3 projects. Local and joint PhD researchers will ensure the continuity of research, education and commercialisation of the scientific results and discoveries. The facilities installed as part of the Preclinical Centre with the Platform for Pharmacological and Toxicological Services are an important resource for developing specialised scientific and technological services that ensure the income of resources for the acquisition of the necessary reagents and other merchandise. The signing of a collaboration agreement between UO and BioCubaFarma ensures the creation of a joint laboratory. P3 team members have trained and supervised two private producers of malt and cassava starch and flour. The impact of their production on society is notable, and an agreement was signed between CINTRO and one of these MIPYMES for the quality control of these productions. Moreover, the results and effects of the intervention will continue through the motivation of the students with the results and new research on the subjects covered by the project, and from the sustainability of the Master Degrees Programs on Biotechnology

and Pharmaceutical Services, and the Doctoral Program on Biotechnology. Together with P2 team members, the informatics platform will continue to support the antimicrobial policy and pharmaceutical services by the registration of clinical studies with new natural products in the Eastern region of Cuba, specifically at Juan Bruno Zayas Hospital. The designing and production of biofunctional cookies with antioxidant activity developed in the Provincial Enterprise of Food Industry (EPIA) in Santiago de Cuba, became an affordable solution for vulnerable persons as studied by the Group for Food Supply of Juan Bruno Zayas Hospital. The approval of a new VLIR TEAM project as continuity of the results obtained by the synergy between P1 and P3 will also contribute to sustain the effects of the project. Projects promoting local development represent an option to be explored. On the other hand, the facilities installed during the project development are an important resource to perform specialised scientific and technological services that en-sure the income of resources for the continuity of intervention.

3.4 Project 4. Safeguards of the cultural heritage. Tools and practices for its integrated management in Santiago de Cuba and the Eastern Region of Cuba

The evaluators **accepted all the scores in the** self assessment.

Relevance and Coherence: the goal was oriented to acquire new knowledge about the conservation, safeguarding and valorisation of cultural heritage in the eastern region of Cuba from an interdisciplinary perspective. The evaluators could perceive coherent and relevant changes derived from the project:

- a new Heritage Management software demonstrates the achievements obtained, and helps to organise the information on the topic at different levels. At the same time, it is a cultural-technological product and an academic service tool. The evaluators visited the web site and spoke with managers;
- several local institutions articulated and integrated (Schools of Construction, Social Sciences, Law, Humanities at UO, universities in Belgium, Spain, Italy and Ecuador, Province Centre of Cultural Heritage in Santiago de Cuba);
- new subjects created, and others were improved in pre and graduate school;
- increased scientific level of PhD. and MSc. researchers: 6 MSc. theses defended, 7 PhDs, 5 of them with double title;
- elaboration of the file asking for the Declaration as National Monument for the Patrimonial Complex of the Universidad de Oriente, obtained in 2021;
- the development of a PhD. programme on cultural heritage with an interdisciplinary perspective that faces the social problems in different territories and their derivations to local development. The file was shared and taken as a reference for the Province Centres of Cultural Heritage of the provinces of Granma, Guantánamo and the Museum of the Image and the Sound, this latter with the goal to declare the museum as national heritage, which is unique in the country;
- all project members have had the same opportunities and rights to contribute from their research to the general goal of the project. The project leaders in its two phases were women, as well as the leaders of the 3 subprojects. From the total number of PhD students (9), 6 were women. From 265 students who participated in the project in different techniques of research, approximately 150 were women. From the 2 international awards won, 1 has a woman as main author; the same with the Award of the Academy of Sciences of Cuba, 1 woman is co-author, while in the CITMA Province Award, 2 women are main authors.

Efficiency (including partnership and project management): the evaluators could not see evidence of the commercialisation of products and services created at the project yet, but found out during the interviews that there are plans to give commercial use to the Heritage Management software, which is the main result of P.4, using CINTRO. Also, there are plans to attract foreign students for the PhDs and MSc. programs. Nevertheless, the evaluators could confirm an efficient relation cost-result, as their graduates have occupied new roles in the leadership of the university, such as dean, member of the doctoral committee, advisors for different groups on marketing, IP or national networks. At the same time, they have reached higher teaching categories. The infrastructure donated/purchased was distributed in 4 laboratories, providing important academic services to professionals of UO and other collaborators outside of the university. The digital platform was created with that equipment.

Impact- Effectiveness: Prior to the project, there was a lack of specialisation in cultural heritage, a deficient implementation of ICT tools for information management, historical documents and archives were endangered and not digitised among other factors[27].
The **changes** detected after were **positive**. Among the **intended**, the evaluators visited the Province Centre of Cultural Heritage in Santiago de Cuba and interviewed their Director, along with some of the professors and researchers linked to the project, finding the following:

- The digital platform for the valorisation of cultural heritage makes visible the results achieved and disseminates the local culture in the most consulted way possible today using TICs.
- Except for the Master's programme and the number of training module packages developed through the support of the project, which remained the same as their respective baselines, the rest of academic results have all increased compared to the baselines at the beginning of phase II: the number of students that have effectively participated in the new or substantially updated Master's programmes (116 more): the articles and chapters published in books, international and national peer reviewed journals (20 more); the number of new courses developed through the support of the project (9 more); the number of students that have effectively participated in new courses developed through the support of the project (30 more); the number of (non-academic) extension/outreach activities (presentations, trainings, sensitisation activities) through the support of the project (12 more) and the number of people reached through these (more than 160). There were 6 MSc. and 7 joint PhD. students directly supported by the project;
- A study on the regulatory potential of intellectual property for cultural heritage in activities such as restoration and conservation was developed, and included into the modifications of the new IP law in Cuba, accompanied by the creation of a training strategy on the subject;
- All of the research results became part of the teaching program for undergraduate and graduate students, for example the Master programmes mentioned above.
- Several awards were won by students and professors linked to research and reflected in their 186 final diploma studies, and 75 theses at graduate level, such as the AUIP Award.
- The Doctoral Program in Cultural Heritage elaborated during the project is unique in the country for its interdisciplinary conception. It can count on professors from several Cuban and foreign universities and institutions (Technological University of Havana, University of the Arts, National Assembly of People's Power, University of Antwerp, University of Lobaina, both in Belgium; Polytechnic University of Valencia, University of Oviedo).
- The synergies achieved of the doctoral programs with the Doctoral Schools of the University of Antwerp, University of Lobaina, the Raymond Lemaire International Conservation Centre, and the Research Centre for Visual and Digital Culture (Belgium), the University of Cuenca, with the VLIR – CPM project (Ecuador), the University of Bordeaux, (France), and the General Archive of Las Indias, Seville, Spain. These centres became the source for the training of PhD. candidates
- The creation of a digital archive of documentary films in the eastern region of the country, also integrated in the platform;
- The rescue, transcription and analysis of 352 documentary sources;
- New data and characterisations were provided to the Overseas Collection of the General Archive of the Indies (Seville, Spain), as knowledge of the legislative character in the colonial period and its imprint in Santiago de Cuba;
- A theoretical reconstruction of racial identity in Cuba was provided to Aponte Commission, an organisation against racism which belongs to the National Union of Artists and Writers of Cuba, facilitating the implementation of cultural and public policies;
- New characterisations of historical urban areas of Santiago de Cuba were provided using TICs;
- for the first time, constitutional values were characterised as an expression of the moral, historical and cultural heritage of the people of Cuba;
- Training programs for community leaders were updated (Vista Alegre neighbourhood), primary school teachers (Clodomira Acosta, Roberto Fernández and Nacho Martí school)

[27] Several authors (2023). Theory of change of the P.4, in IUC-UO. Safeguards of the cultural heritage. Tools and practices for its integrated man-agement in Santiago de Cuba and the Eastern Region of Cuba. Presentation.

and specialists from different institutions in the territory (Office of the City Conservator, Provincial Centre of Heritage and museums).

Unintended changes: none detected

Negative changes detected: none detected

Inhibiting factors and actors: the impact of COVID-19 pandemic, mainly in the activities attendance, and migration due to the bad economic and social conditions in the country. Nevertheless, the doctors trained in the project who do not work at UO anymore, continue their research on heritage, give lectures in the Doctoral Program in Cultural Heritage and participate in international congresses that contribute to the project.

Facilitating factors and actors: the university authorities who fully supported the candidates, and closely followed the project's evolution.

Sustainability: On the financial side of things, CINTRO S.A. is set to market products and services. One researcher is part of a new VLIR Project associated with the study of natural heritage, so this will mean some funding for research.. With the collaboration of P1, another new VLIR Project will support a new Summer School, which may attract foreign students.
On the institutional side, the promotion of the project researchers in important responsibilities will guarantee the reshuffle of many university processes.
On the academic side, graduate students have become supervisors and members of tribunals in their topics of specialisation. The maintenance of the digital platform will consolidate the links with FITIB, and also the possibility to exploit and share the revenues. A new international project it's been designed to compete for funding: "Mobility, urban spaces and society". There are requests from other institutions in the eastern region for spots in the MSc. and PhD programmes of cultural heritage. The connections with the other projects had many of benefits, such as the training in English language and the preparation of specialists provided to design the digital platform.

3.5 Project 5. Obtaining, characterisation and production of new materials and technologies for industrial systems

The evaluators **accepted all the scores in the** self-assessment.
Relevance and Coherence: The goal was to achieve sustainable industrial development to generate benefits at economic, social and environmental scale. The scientific results of this project are relevant in terms of green-friendly technology, to reduce waste thanks to an optimised process in terms of energy, water consumption and raw material management, as described by the project leader in an interview with the evaluators. Measurement, a better resources control system and the knowledge to manage it was crucial to get these achievements, and the project provided for all of that. As a consequence, Cuban industrial processes were improved, the environment was better cared for and resources were saved. Among these achievements are the regeneration of activated carbon for rum industry, medical services and electrical power production; promising materials for energy storage, agricultural waste transformed into valuable activated carbon-based materials for industrial waste treatment. The project's objectives were structured to be linked to other research groups at UO, but also with the institutional and governmental strategies for the development of the country.

Sustainability: CINTRO S.A., from the 20% reserve obtained from the profits, were used for repair air conditioners at CENPIS, FITIB and two other research centres, using $15,506.00 pesos[28]. That also reverted more benefits for the professors who provided the scientific services described below with better work-place conditions, which at the same time reverts to research quality.
The project adopted a strategy to offer the lab infrastructure and human capacities created. In this sense, the Applied Acoustic research group is working with La Rioja University (Spain), meaning a budget for research and a postdoctoral stay. La Rioja University was interested in training and potential international joint patent recognition and commercialisation for UO. CUBA RON SA is a client for CINTRO SA, for the quality control analysis of the activated carbon imported for Cuban rum production

[28] Marañón Cardonne, M. (2023). Informe al Consejo de Dirección UO. Estado actual del funcionamiento de la Empresa Interface de Ciencia y Tecnología CINTRO S.A. (Report to the Board of Directors at UO. Current state of functioning of Interphase Enterprise of Science and Technology CINTRO S.A.).

technology. The profits will be reverted in reagents, raw material and dedicated infrastructure to keep providing the services, gaining sustainability after VLIR.

Impact and Effectiveness: Before, the equipment for research was obsolete. The English knowledge of PhD. and MSc. students was poor. The project resulted in the visibility of scientific output through English-language publications. Internet connection was very slow, without storage capacity, nor potency for data analyses. Opportunities for training abroad and gaining access to resources were scarce. Postdoctoral research was rare. The strategic alliances between research groups within UO didn't exist.

The **changes** detected after were **positive**. Among the **intended**, we found the following:

- The academic results have all increased compared to the baselines at the beginning of phase II: the articles published in international and national peer reviewed journals (21 more); the number of new or substantially updated Master programmes developed (7 more); the number of students that have effectively participated in the new or substantially updated Master programmes (92 more); the number of new courses developed through the support of the project (17 more); the number of students that have effectively participated in new courses developed through the support of the project (45 more); the number of (non-academic) extension/outreach activities (presentations, trainings, sensitization activities) through the support of the project (23 more) and the number of people reached through them (more than 77); the number of training module packages developed through the support of the project (14 more). There were 2 MSc. students directly supported the project, and 8 PhD. students.
- The evaluators visited CENPIS and interviewed their Director and researchers, and saw the new equipment that was incorporated, and how it was used for different purposes, allowing more high quality research. They could also see some of the innovations which are now in the process of being exploited with CINTRO S.A., such as the Medical briefcase vital kit, connected with other faculties at UO. They saw some of the samples being processed with the new equipment for research, and heard about the future plan to sell those services to companies like Cuba Ron. They could see some of the awards the researchers got for their results.
- The evaluators could take a look at the ruling recognizing a patent protected by OCPI, as one of the innovations obtained thanks to the equipment and training provided by VLIR. They could also interview one of its authors, Harold Crespo Sariol.
- All of the research results became part of the teaching program for undergraduate and graduate students, for example the Master programmes mentioned above.

Unintended changes: none detected

Negative changes detected: none detected

Inhibiting factors and actors: the impact of COVID-19 pandemic, mainly in the activities attendance.

Facilitating factors and actors: the university authorities who fully supported the candidates, and closely followed the project's evolution.

Efficiency (including partnership and project management): All of the products and services created at the project are in the way, or already in exploitation. The newly equipped Acoustic Lab gave 2 services to Cuba Ron enterprise using CINTRO S.A., which implied $21.948,80 pesos already received, from the initial figures in the contracts for $77.398,40[29].

3.6 Project 6. Institution-wide instruments for high performance research, innovation and technology transfer

The evaluators accept all the scores in the self-assessment, as we agree with the position that sometimes university administrations do not preserve adequately the structures donated/purchased, and do not maximise their potential. This attempts against sustainability, and it's one of the risks every program faces when it finishes.

[29] Marañón Cardonne, M. (2023). Informe al Consejo de Dirección UO. Estado actual del funcionamiento de la Empresa Interface de Ciencia y Tecnología CINTRO S.A. (Report to the Board of Directors at UO. Current state of functioning of Interphase Enterprise of Science and Technology CINTRO S.A.).

Relevance and coherence: The evaluators could confirm how the project was aligned with the country strategies, such as the National Socio-Economic Development Plan until 2030, a document they consulted. At the same time, they visited the biggest hospital of the eastern region of Cuba, and LABEX, an export company that belongs to Biocubafarma, the biggest biotechnological group in the country, both part of the project's stakeholders, as many of its specialists were trained and used the facilities created by the program. The list of social institutions and industries benefited more broadly. The project managed to build a Data Center, which is connected to its homologues in UCLV and UCI. It raised the level of scientific research, as bigger samples and big data universes could be processed in the shortest time ever. Steps are taken to provide for a market to give profits to the university, by selling the services derived and the store capacities in and outside of Cuba. Internet connectivity at the university was also improved. Research results derived from doctoral theses successfully defended in the VLIR Project are beginning to be exploited by CINTRO SA. With regards to IP, the evaluators could interview one of the doctoral graduate professors supported by VLIRUOS, as a member of the team who wrote the joint patent application between UO and VUB. Now he is part of the team behind research results, and is also forming others, in order to take over if needed in the future. The change in the way of designing technology transfer is then tangible.

Three technological observatories were fully equipped in the universities of Oriente, Granma and Guantánamo. The evaluators tried to visit at least one of them but it was impossible due to the lack of fuel, so they turned to the testimonies in interviews, pictures, and visited the warehouse where photovoltaic cells are stored, which will be distributed between those centres and UO, this lending to gained autonomy to provide non-stop services. In some remote areas these are the only places where people can gather during long-lasting blackouts; they also can provide relief as evacuation centres in case of natural disasters.
The evaluators could also perceive in the interviews how the respondents said the project could connect different disciplines and research centres that were previously isolated. The interactions during the English-language trainings and the PhD diplomat favoured this. In the case of gender equality, the TP put together women and men without distinction to work together. In the last four years manager women in the projects were the majority.

Impact and Effectiveness: Before, the infrastructure for PhD. and language training was obsolete. Internet connection was very slow, without storage capacity, nor potency for data analyses. Opportunities for training abroad and gaining access to resources were scarce. The strategic alliances with other actors were not that strong.
The **changes** detected after were **positive**. Among the **intended**, we found the following:

- The academic results have all increased compared to the baselines at the beginning of phase II: the articles published in international and national peer reviewed journals (7 more); the number of new or substantially updated Master programmes developed (1 more); the number of students that have effectively participated in the new or substantially updated Master programmes (76 more); the number of new courses developed through the support of the project (6 more); the number of students that have effectively participated in new courses developed through the support of the project (460 more); the number of (non-academic) extension/outreach activities (presentations, trainings, sensitization activities) through the support of the project (18 more) and the number of people reached through them (more than 203); the number of training module packages developed through the support of the project (84 more). There were 4 MSc. students directly supported from the project, and one PhD. student.
- The evaluators could visit the Doctoral School, which is recognized at national level as a Doctoral Training Group (GFD). The Doctoral School and English teaching School were built and provided with the best technology, creating better conditions for innovation and communication. New alliances could be built from the students who came to train, above all the ones outside of UO.
- During the interviews with the specialists who worked with the project, they referred to the Doctoral Training Initiation Diploma, as a way to prepare the candidates in comprehensive courses, such as academic English or innovation transfer.
- The support from the university permitted to pay full wages to the PhD. candidates, for them to devote to their research full time for 3 years. This impacted in the high number of graduates, which is an exception, because the law and practice in Cuba treats graduate school as a right, but mostly part time.

- The creation of an Interface Company which belongs to UO (CINTRO.SA). The evaluators could see some of the contracts, were the interests of all parts were protected, including IP. The evaluators can confirm that CINTRO helped to diversify the portfolio of products and services developed by Universidad de Oriente, and increased the clients and providers markets, while contributing to the transfer and commercialization of research results generated in the institution, sometimes in collaboration with other companies, such as Lavex from Biocubafarma.
- Training courses and workshops related to GFD are now part of the researchers preparation, in aspects such as research results transfers, the protection of intellectual property or English, which could be confirmed through the interviews with some of the professors.
- The project provided for international training given by Flemish experts and the British Council for more than 250 English teachers. Thanks to this, the trained professors could publish more in that language, increasing scientific visibility, which could be assessed when consulting some of their work[30].
- A team of TOEFL trainers was created.
- The English teaching School has become a centre for external evaluation, national foreign language festivals, and scientific dissertations. It uses the platform www.cursos.uo.edu.cu, which was visited by the evaluators, as an important part of the automation of the university's academic products and services.
- The Data Center, which was visited by the evaluators, was born thanks to the project and its specialists, also trained thanks to Vliruos. They developed free softwares to help manage university processes such as labor files, international affairs, contracts, events (see https://convenciones.uo.edu.cu/) among others, visited by the evaluators visited. The system facilitates notifications and reports given its multiplatform capacity, which the evaluators could see functioning when they interviewed some of their specialists. The platform connects the different administrative departments, so it improves management, as workers and directives can see and analyse multiple activities in real time. It saves time and improves user's satisfaction, protecting electronic data and reduces costs by saving resources such as ink and paper. Updated training was provided to the computer specialists of the areas, using a technique provided by the Belgian specialists..

Unintended changes: the creation of CINTRO.SA was a new opportunity, as the evaluators could see, so it was considered positive in terms of sustainability.
Negative changes detected: 3 of the PhD students directly supported by VLIR left the project and the UO. In their cases, they lost contact with the university, so it was not possible to recruit them as adjuncts and/or supervisors for dissertations, which has been one of the ways to keep the results obtained by them in use.

Inhibiting factors and actors: the impact of COVID-19 pandemic, mainly in the activities attendance.

Facilitating factors and actors: the university authorities, who fully supported the candidates, and closely followed the project's evolution.

Efficiency (including partnership and project management): The quality-price ratio is evaluated as excellent, thanks to the infrastructure provided by VLIR, the possibilities to transform new products and services into profits to be distributed between UO, MES and other enterprises increased at levels never seen before. The project contributed to the creation of three areas that provide services and are currently been used to capture income: The Data Centre, CATFLAg and the GFD. It also supported the creation of computer teaching laboratories located in three faculties, the student residence and the III Frente Municipal University Centre, among other areas.

[30] Lambert Cause, J. et al. (2023). Novel Multi-Parametric Sensor System for Comprehensive Multi-Wavelength Photoplethysmography Characterization. Sensors 23(14); Mariño Peacok, Thayse et al. (2021). Mathematical Tool Based on Breakthrough Curves to Evaluate the Economic Advantages of Chemical Regeneration of Activated Carbon in Power Plants: A Comparative Study. Applied Sciences 11(24); Cano-Ortiz, S. et al. (2018). A web-based tool for Biomedical Signal Management, in Auer M., Zutin D. (eds) Online Engineering & Internet of Things. Lecture Notes in Networks and Systems, (22), Springer.

All of the products and services created at the project are in the way, or already in exploitation. More information on the **Sustainability** criterion.

The UO ICT network was evaluated in February 2023 by national cybersecurity auditors (MINCOM); obtaining the highest rating, which could be confirmed through interviews with the project leader and the local coordinator. The evaluators could confirm when visiting the data centre, that the high-performance equipment acquired made it possible to strengthen the UO website with national and international visibility. They both have visited the web site many times as well. Users can count on a detailed explanation online with 24-hour support for users to work on the HPC from the early stages of research.
There was a doctoral course with international students, according to the same interviews above mentioned, that had to be suspended due to covid19. After that, the evaluators could not find evidence that the course could take place, although there was an interest from different universities to make summer and winter schools.

Sustainability: The Doctoral School and English teaching School meant new opportunities for services commercialization: in 2023 for example, 2 students from Angola and Italy hired services from both schools, which meant $8600.00 USD using CINTRO S.A.[31]. The report also describes 3 services with 6 professors from CATFLAg, which implied $25.331,20 pesos received, from the initial figures in the contracts for $44.743,30 pesos[32]. This shows that the intention of sustaining the results achieved have become a reality.
On the other hand, in a presentation for the conference Universidad 2022, the local coordinator for the program described how the graduates from phase 1 have become the supervisors in phase II[33], acting as take over for the years to come. This measure will ensure academic sustainability.
Services in science management by the Group of PhD training, will request financing in calls for international projects from other European agencies. The goal is to continue strengthening capacities at the implementation of services in English, as well as the preparation of new services through the implementation of new IT services for process management and research. Good practices on production marketing are being shared with UCLV, through the links created through the VLIR Project itself, and others.

[31] Marañón Cardonne, M. (2023). Informe al Consejo de Dirección UO. Estado actual del funcionamiento de la Empresa Interface de Ciencia y Tecnología CINTRO S.A. (Report to the Board of Directors at UO. Current state of functioning of Interphase Enterprise of Science and Technology CINTRO S.A.)

[32] Ibídem.

[33] Orberá Ratón, T. (2022). La formación doctoral en el proyecto VLIR de la Universidad de Oriente. Conference Universidad 2022.

4 Impact case

4.1 Working towards impact

Impact claim defined in consultation with UO: **the university increased its impact on hospital health services**.

The RD&I activities in the hospitals were supported by the University's capacities and facilities. Three research centres, one study centre, and six academic departments across two faculties at UO were involved. They all participated in tasks aimed at enhancing health services. The IUC programme created and improved nine laboratories that were related to the 'products', which improved healthcare services. These included nuclear magnetic resonance, molecular biology, drug formulation and characterisation, cell culture, microbiology, chemical characterisation and other innovative processes. The infrastructure was in place to support these services. In addition, two doctoral programmes in Biomedical Engineering and Biotechnology, alongside master's programmes in Biomedical Engineering, Biotechnology, Pharmaceutical Services and Computer Science, facilitated the training of professors and healthcare professionals related to the new products and services. The coordination of training and research activities was based on the IUC planning. Monitoring of progress was done within the PhD and MSc. research. The IUC programme facilitated the student's mobility, access to labs in Belgium to perform series of tests that could not be done in Cuba, the possibility to improve academic English to better communicate research results, and to add more visibility by enabling them to write their articles in that language, among other forms of support. The IUC saw the promotion of 15 doctors in Biomedical Engineering, Biology, Health Science and Chemical Engineering, with research outcomes aimed at improving healthcare services.

Among the outputs and impact indicators of RD&I activities, numerous papers were published in peer-reviewed journals, five national awards from the Cuban Academy of Sciences (ACC) were won, as well as other awards from scientific societies. In terms of innovation, the contributions included digital technologies, prototypes of biomed devices, natural drugs, food products and procedures. A major accomplishment resulting from a joint PhD thesis supported by the P2-project was a joint patent application between VUB and UO in the field of biomed technologies. The development of these technologies and products may involve an 'intermediary' in the value chain for scaling up and producing, i.e. companies of Biocubafarma and other industries. In the case of medical equipment such as the 'PPG device' and the 'medical briefcase', the Centre for Medical Biophysics (CBM) and COMBIOMED signed a contract for production and commercialization. The medical briefcase is the first product of the Universidad de Oriente added to the portfolio of Biocubafarma as a developmental product. A natural drug derived from edible mushroom, was formulated by Laboratorio Farmacéuticos Oriente (LBF), a local company, and is currently undergoing regulatory registration. The edible mushroom cookie, a nutraceutical product, was produced by the Provincial Food Production Company (EPIA-Santiago de Cuba) and has been validated in hospitals and maternity homes as nutritional supply with preventive and therapeutic uses.

4.2 The changes and their significance

The table below presents an overview of the mechanisms that were present, and were identified in the self-assessment reports, the interviews and the study of other documents such as scientific articles, theses and presentations and that can explain the contribution of the IUC to changes.

The evaluators were able to identify and validate changes at the level of health services in the Eastern region of Cuba, with projects P2 and P3 completely involved.

Changes validated based on documents and interviews during the field mission are presented as follows are listed in the table below. More concretely, it concerns 13 research products (to which the IUC programme contributed). One (7.7%) was considered proven or in the last stage (stage 9) of Technology Readiness Levels (TRL); 6 (46.2%) were validated in a relevant environment (stage 7 of TRL); two (15.4%) were validated in laboratory environment (stage 4 of TRL); one (7.7%) was in proof of concept (stage 3 of TRL); and 3 (23.1%) were in the phase technology concept (stage 2 of TRL). Therefore, the majority of the changes (53.8%) are in advanced stages of research.[34]

It should be underlined that all of the products/services developed have export potential, and through the recommendations Flemish universities have made, their Cuban counterparts are working in order to include Imagis 2.0, the only one in the impact case ready to be part of the export portfolio of the Cuban Ministry of Foreign Commerce, so this is another important step towards financial sustainability.

The significance of the changes for the health system in the Eastern region of Cuba (impact claim) cannot be underestimated, as the projects developed 3 devices, 3 procedures, 3 technologies, 2 softwares, 1 food product and 1 natural drug, with 11 PhD dissertations (out of the total 51 directly sponsored by the IUC programme in Phase II). All of them were useful for the medical services, as there were improvements detected in patient diagnosis at hospital level, remote and rural areas, in the quality of work for medical doctors, in the dialysis and hemodialysis service for patients, in the quality of life for patients and medical staff. At the same time, there were changes in the hospital's policy for the care of nephrotic patients, in the environmental policy of the hospitals and the environmental culture of the staff, and in the hospital's drug policy and the drug management culture of the staff, as a new procedure automatized many of the services of medicine distribution.

Medical staff in hospitals and maternal homes became trainers of other specialists, and some of the doctors participated in international and national conferences presenting research results as co-authors with the university professors. Reducing residues and saving resources have also become part of the environment protection culture in the sector, for example with the avoiding of waste of water in the dialysis device.

Nevertheless, the evaluators could identify how costs were reduced in paper, ink or payments for patent licensing, and how imports were substituted for by using free software and different forms of innovation.. This was aligned with the country's priorities to save resources in order to be able to use savings to ensure import for other necessary products for the health sector, which cannot be found as natural resources, or cannot be produced locally.

Research products and changes	Evidence	Significance for the health services
Development of software Imagis	Proven (stage 9 of TRL)	1. **Improvement of diagnosis at hospital level, remote and rural places**: There was a change in the hospital policy of diagnosis services based on non-invasive image and biosignal technologies, and in the general medical culture about diagnosis procedures focused on the use of rational and less invasive technologies that increase the accuracy, quality and time efficiency of diagnosis. 441 specialists were trained to use of this software, which uses free software (Linux), thus guarantying technological independence. It is projected to expand diagnosis procedures based on non-invasive methods to other hospital services. The improvement was also reflected in the cost-benefit of the technological innovations, with a consequent reduction in costs for hospitalization and therapy. Other secondary economic
Software WebIND	Demonstration in relevant environment (stage 7 of TRL)	
Device and technology: PPG device	Component validated in laboratory environment (stage 4 of TRL, joint patent requested)	
Procedure: Electrophysiology biomarkers	Technology concept and application formulated (stage 2 of TRL)	

[34] See Sauser, B. and Verma, Dinesh (2006). From TRL to SRL: The concept of systems readiness levels. Conference on Systems Engineering Research, Los Angeles, CA, April 7-8: 1-11. The IUC program coordinator in Cuba decided to use TRL to show the level of readiness level, when discussing the impact case.

Research products and changes	Evidence	Significance for the health services
Device and software: Video-nistamography	A **system prototype** was developed and demonstrated in relevant environment (stage 7 of TRL)	benefits for the hospital include reduced costs for logistics and consumables. In the specific case of the Medical briefcase vital kit, it concentrates diagnosis devices, software and information transmitters in one mobile unit, so in case of an emergency, the medical staff wastes less time diagnosing, increasing the possibilities of the patient's survival. It is mostly used in angiology and other basic services. This is the case of the potential joint patent by UO and VUB. For the domestic market, concrete commercial agreements are being implemented: for example with MINSAP for Imagis 2.0, which have been transferred to 25 hospitals across the country, with profits for the Centre of Medical Biophysics ($ 3.1 million of pesos) and for the National Centre of Applied Electromagnetism ($148 000.00 pesos). Both centres belong to UO, so profits are reinvested in innovation projects, the improvement of working conditions for the research staff, and the payment of professors. 2. **Improvement of quality of work for medical doctors** in the case of Imagis 2.0, as they can just send the images instead of walking the usual long distances from the diagnosis room to the operation or treatment room. The constant exchange between the medical staff and the professors during research and subsequent training contributed to this, as both stated during the interviews.
Technology and device: Medical briefcase vital kit (iCABA®)	Phase of technology concept (stage 3 of TRL)	
Technology: Regeneration of activated C, raw material of dialysis water plant	System validated in relevant environment (stage 7 of TRL)	3. **Change in the hospital's policy for the care of nephrotic patients**, with a focus on improving quality of life and potentially extending patient lifetime through integrated healthcare management based on the improvement of engineering systems to support dialysis therapy, by avoiding waste of water in the supply for the dialysis device. 4. In addition, **the environmental policy of the hospitals and the environmental culture of the staff has also changed** by increasing the rational use of medicines in therapy, and making more efficient the elimination of residues of persistent raw materials, toxic chemicals, antibiotic residues and antibiotic-resistant nosocomial microorganisms. The cost-benefit of the technological innovations is also reflected in the reduced costs for treatment and disposal of clinical waste.
Procedure: Assessment of reuse of the dialyzer device	System validated in relevant environment (stage 7 of TRL)	5. **Improvement of dialysis and hemodialysis services for patients**, because it allows the chemical regeneration of Activated Carbon, extending the use of this material. The procedure was used in treatments of chronic renal disease patients from a general Hospital of Ciego de Avila, Cuba. It was detected an increase of approximately 24% in the removal capacity towards free chlorine in the granular activated carbon regenerated, and a lower (4.78%) ash content, among other results.[35]

[35] Puente Torres, J. (2023). Chemical Regeneration of Activated Carbon Used in A Water Treatment System for Medical Services, *Advances in Environmental and Engineering Research*, 4(2): 1-23.

Research products and changes	Evidence	Significance for the health services
Food product: Nutraceutical cookie made of edible mushroom extract	System validated in relevant environment (stage 7 of TRL)	6. **Improvement of the quality of life for patients and medical staff:** The introduction, production and consumption of mushrooms of the genus Pleurotus (fungus oyster) in the health system have been promoted in several provinces as part of the National Program of Urban Agriculture due to its high nutritional value. It a positive immunonutritional effect was described, involving the recovery of liver function and the induction of cellular synthesis processes in the Intestinal mucosa.[36] A drug made from the same mushrooms was used in patients admitted to oncology, maternal homes, intensive care rooms and HIV-patients. It was also provided to risk-exposed nurses and doctors, and for pandemic and epidemic situations. The product was validated in relevant environments such as hospitals and delivery wards where women at risk are closely monitored. The cookie was a complementary treatment, improving both the nutrition and immunity. The Pharmaceutical Laboratory of Oriente (LBF in Spanish) and the Enterprise of Productions from the Food Industry (EPIA in Spanish) are studying the introduction of the mushroom for tablets and partial substitute for flour in bakery respectively.[37]
Natural drug: Pharmaceutical supplement made of extract of edible mushroom	Characteristic proof of concept	
Standard Operating Procedure (SPO) for Pharmaceutical Services	Validation in laboratory (hospital pharmacy and other services) environment (stage 4 of TRL)	7. **Change in the hospital's drug policy and the drug management culture of the staff**, i.e. doctors, nurses, pharmacists and technicians, focusing on rational use of drugs and implementing practices based on combined therapies supported by complementary nutritional treatment and immunomodulation with nutraceutical foods and/or natural drugs. It was conducted a diagnosis of the main problems with medicaments with 329 patients in 5 hospitals in Santiago de Cuba[38], and on that base a management system automatized many of the services for medicine distribution.

4.3 Contribution of the IUC programme

The partners involved in this impact case accomplished every goal that the program stood for: know-how transfer obtained through training, scientific publications, awarded PhD and MSc degrees, prestigious international awards, new academic programmes and the strengthening of alliances between UO faculties and research centres and institutes. Export services in the training of software use can be effectuated. This project qualifies as being an outstanding success story.

The research output/products had a profound impact at the local, regional and even national level, including the improvement of health care services at hospitals, the development of marketable biomedical technologies and natural drugs, and services applied to diagnosis, prescription policies and complementary therapies.

The products were highly significant in terms of improved quality of health care and diagnosis.

[36] Morris-Quevedo, H. *et al.* (2018). Evaluation of the immunomodulatory activity of bioproducts obtained from the edible-medicinal mushroom Pleurotus ostreatus, *Biotecnologia Aplicada* 35 (3): 3511-3514.

[37] Reyes-Bravo, R. and Orberá Ratón,T. (2024). Planeación estratégica, evaluación de impactos e innovación en proyectos de cooperación internacional. Estudio de casos. Forthcoming in Entramado 20 (1): 1-17.

[38] Megret-Despaigne, R. *et al*. (2023). Problemas relacionados con los medicamentos en pacientes de Santiago de Cuba hospitalizados (Medicament related problems in inpatients of Santiago de Cuba), Ars Pharm. 2023, 64(2):89-99.

The project mechanisms as identified in the introduction of the impact case, more in particular the PhD training and the training allowing PhD students to acquire the necessary knowledge were confirmed.

The IUC contributed in particular through funding in order to advance in the research stages of the 13 research products/outputs identified, to put them at the hospital and other medical units disposal. Highly specialized training was provided by the Belgium universities to the PhD scholars, and access to their resources (labs, reactives, devices etc.) in order to develop the products. The Belgian specialists who visited Cuba also trained the medical staff and university professors, which was very much appreciated and thanked according to the interviews given to the evaluators.

The nine labs that were created within the program benefitted with equipment donated/purchased by the Belgian universities, without them it would have been impossible to preserve and analyse samples, make accurate measures and other processes to develop the procedures, technologies and devices. Knowledge transfer helped to improve the software Imagis 2.0, Webind and the Video-nistamography, and introduced the concept of ensuring exchange with the stakeholders from the early stages of development to the end.

Other mechanisms also played their role: VLIR-TEAM Camagüey and VLIR-SI 'IPK' both funded the acquisition of equipment and raw materials that were used when obtaining part of the contributions. The national program on Biotechnology and Generation of monoclonal antibodies paid an extra percentage of the professor's wages involved in the projects to stimulate them, along with other minor expenses. The National Program of Neurosciences and Neurotechnologies, together with the Sectoral Program on Cuban Software Industry and Informatization, co-funded with the IUC, the creation of WebIND and Video-nistamography. Their respective funding was not as comprehensive as IUC's, and in the case of national programs, they could only provide national currency, which cannot be used abroad. Nevertheless, they were a good complement, which permitted to buy more equipment, and offer other scholarships using IUC resources.

Further to the collaborative mechanisms and synergy between the IUC at UO and Network at UCLV, the evaluators found evidence of trainings carried out at all universities in the network, including UO which served the IUC. Mechanisms such as a common national alarm mechanism when a virus, risk or hacking affects one ICT or Data system. There is a clear technical support network that is shared.

Taking into account all of the above, the evaluators considered that the project mechanisms had a wider influence than expected and extended to the collaborative mechanisms. The IUC at UO fit into other initiatives being realised in throughout the country. It was the common efforts of programmes and institutions that allow for greater collaboration in science and technical know-how which in turn strengthened partnerships.

5 Findings on the learning questions

5.1 How to support PhD trajectories, with a focus on optimising diversity/inclusivity (gender and Leave No One Behind)?

There was a healthy gender balance among PhD and MSc students, with 36 females and 31 males. When we looked at official statistics, for the last 5 years women have been more than 53% of the physical workers in science and technology, except for year 2021, where they were 45.7%. These figures include directives, technicians, administrators, operators and services workers39. In our opinion, the selection of the students followed the tendency, and we find it could have counteract it, because although the difference was not that big, choosing more men when there is a majority of women in the science sector could have been one of the ways to keep the balance. Also, as the selection process of candidates was developed adhering to the procedure (management manual) accepted by all partner universities, this meant that gender was not a bias, at least not in the way the evaluators have just synthetized. The Joint PhD scholarships and the scholarships for Cuban PhD students were based on a selection process, which considered the level of preparation of the candidates, the definition of the research work to be carried out, their skill in the English language, and their previous link built with Flemish researchers.

13 out of the 21 female successful doctoral candidates were mothers. Reasonable accommodation was given to one mother who due to health issues had to return to Cuba, she was given an extra year to finish her articles. In terms of scientific output (publications), women were underrepresented. Attention and collective support was rendered at the University and PSU.

We must highlight the special situation in the island, as the Cuban Federation of Women has done much work over the years to bring equality for women40, so that in important areas such as science, law or the Parliament, they are a majority.41 However, gender perspectives in Cuba have gone beyond numbers and statistics. The local programme coordinator and project team members felt that new dimensions of gender approaches to research programme management were learned; whereas consideration had to be given to the role and responsibilities of women at home and how that impacted their wellbeing at work, even though performance between men and women remained the same. Programme members suggested that more support can be given to women in the scientific output and publications. For this reason, one of our recommendations goes in that direction.

With regards to 'Leave No One Behind', all of the students finished their studies with the support of their respective institutions. In Cuba, according to the Labor Code, workers have the right to study under the principle of using their free time, except for cases of special State interest.42 Based on that, university authorities exempted PhD students, who were also professors, from teaching and other bureaucratic processes, such as group guide or control inventories. Thanks to those measures, the doctoral students could focus only on research, and also felt stimulated to stay in the higher education sector, feeling a support that it's hard to find in the private sector. At the same time, they could see sooner how their results were introduced through publications, events, and even get profits for providing scientific services. Nevertheless, as in the case of gender perspectives, programme participants feel that further analysis can be done to support and safeguard diversity norms.

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[39] Oficina Nacional de Estadística e Información (2022). Table 16.2 - Trabajadores físicos en la actividad de ciencia y tecnología según categoría ocupacional, Havana, ONEI.

[40] Álvarez Suárez, M. (2022). Igualdad de Género en el Sector Público en Cuba. Informe de sistematización de experiencias [Gender equality in the Public Sector in Cuba. Report on experiences systhematization]. La Habana, Centro de Estudios de la Mujer; Diaz Medina, Y., Alvarez Suárez, M. (2021). Mujeres en Cuba. Una revolución en marcha, La Habana, Centro de Estudios de la Mujer.

[41] Ibídem; Oficina Nacional de Estadística e Información (2022). Table 4.1 Proporción de mujeres juezas en instituciones del Poder Judicial; Table 4.4 Proporción de mujeres fiscales; Table 4.3 Proporción de escaños ocupados por mujeres en el Parlamento Nacional. Havana, ONEI.

[42] Asamblea Nacional del Poder Popular (2014). Ley 116, Código de Trabajo. Gaceta Oficial No. 29 Extraordinaria.

5.2 What factors and measures, at VLIR/IUC level and/or at partner institute level, support effective coordination of programmes?

At VLIR level: the evaluators could see the deep level of understanding of the Cuban reality that VLIR representatives achieved. Many trips to Cuba, with constant exchange with partner universities through multiple field visits can bear witness to the amount of effort which has been put in. The results are clear, for example the creativity when circumventing the US blockade when shipping containers to Cuba, with all the equipment donated/purchased, or when transferring money every year.

VLIR was also flexible when the pandemic began, as they gave an extension for the program to finish pending tasks, which also made it possible to achieve the good results the evaluators perceived. All the interviewed focal points talked about this topic, also remarking their thankfulness in general.

At partner institute level: there was a clear priority given by MES, which considered the program the most important they had for the past 10 years. No wonder the field visit started and ended there, the only reason the Minister himself was not at the meetings was because he was traveling to China, but nevertheless, he left instructions to ensure that all the specialists who worked with the program at MES level were available for any information or consultation the evaluators could need. Governmental support is therefore a very important factor.

We must also highlight the choice of forming a good team. As described in the Effectiveness criterion at program level, the focal points and other coordinators were stable, some of them even came from the former IUC program, so this was also important, as there was less time needed to train the new staff, which could focus directly in the pending tasks and the new goals for the programme.

Another important factor was how university integration deepened with the program, as many inter- and transdisciplinary teams had to be formed in order to solve the problems. The impact case is a good example demonstrating how the 3 projects were integrated to better manage health as a public service at a national level.

Last but not least, the evaluators witnessed good engagement with the local governments of Santiago de Cuba, Villa Clara and Havana during the field visit. With so many crises creating scarcity in basic needs, critical resources such as fuel were centralised. Since the evaluation was a priority, everything was guaranteed. For example, without the help of the local government, use of the public train to get in and out of UCLV campus from the city centre would not be possible, and today it's the main source of transportation for students and professors there.

5.3 How to ensure uptake of research results or new educational practices by political and societal actors and end-users?

In Cuba there was already an awareness from the authorities at all levels about new educational practices, that's why the recommendations coming from the program, concerning open science and open education, were generalised by MES at the national level. The directives know this broadens the reach of education, and at the same time saves resources in hard currency by circumventing the need for certain imports.

The desired sustainability of services and production resulting from the program are yet to be evaluated, but the ways to achieve it have also broadened, both in the public as well as in the private sector. Just 2 years ago it would have been impossible to think about the private sector as an active actor in university processes, and the evaluators see it as a positive sign of changes in the country, with an impact in the program. At the university, there are processes that naturally need to be maintained, such as training, the updating of repositories and know-how transfers. Sustainability is a key factor in acquiring new equipment due to programmed obsolescence, and this must also be well planned financially, in order for the accountancy departments to create mechanisms, such as creating special sub-accounts for the most complicated and expensive items, such as the servers for the data centres.

The updating of the created softwares and devices must be well protected by intellectual property, so the existing alliances with the Law Department through a monitoring system, which allows entities and

persons to start the paperwork from the moment a new product or service is envisaged, to avoid delays in future commercialization is also paramount. This could be inserted into future projects of collaboration. Also, the socialisation of good practices at places linked to production like UCI, would also be recommended.

Increasing the enrolment in advisory committees at the country level where educational policies are made, is the last measure the evaluators conceive to ensure the uptake of research results or new educational practices. Following the 2011 National Guidelines for Social and Economic Policy, the Cuban government has increased the use of academics in temporary work groups where policies are made. This ensures that at least part of the content of the policies has a scientific background, as the experts recruited in these groups usually use their own research when conducting specific research required by legislators.

6 Conclusions

VLIR-UOS supported an IUC program of partnership between Cuban and Belgian universities at UO for a ten-year period. Under the given circumstances, the collaborative process was considered to be strong with competent representation in programme structure, leadership and process. The embracing of diversity and sustainability has been duly noted, and the common efforts and positive attitude allowed for all parties involved to mutually benefit from the venture. Six criteria with different questions were answered at program and project level. Evaluators consider that the results obtained at both levels:

Relevant: The program's excellence was evident as the most important results and outcomes were adopted and generalised throughout all the universities of the country, becoming part of MES policies in the topic, such as PI protection for the university scientific results. The programme adapted its goals to the country's priorities, defined in PNDES 2030, also following SDGs 3, 4, 6, 9, 11 and 12 in its operations.

Coherent: as all projects learned how to work interconnected, transcending disciplines, and were complemented with other foreign actors.

Effective: as the outputs were achieved at an outstanding level, solving problems in public services like health using the latest technology, overcoming the inhibiting factors and actors, and taking advantage of every facilitating opportunity.

Efficient: as the services and products which came out of the program are protected by law and (starting to be) commercialised

Impact: as the evaluators could detect the changes, and assess if they were positive, intended or not. Even the intended changes were considered good, as the complementarity with the private sector came as a surprise after so many years of debate regarding the market in a socialist system. There were negative changes experienced as well. For instance, the Covid-19 pandemic delayed several tasks for months and some of the staff even abandoned the country, including some of the students supported by VLIR. Nevertheless, good lessons and perspective changes took place, like consolidating ties with emigrant professors who expressed their desire to continue collaborating with the university.

Sustainability: as the evaluators could see the network of enterprises (LABEX, CINTRO, CUBA RON) in charge of commercialising/receiving the products and services obtained thanks to the program, and the contracts derived, benefitting higher education from the professor to the Ministry level. The current and future contracts can ensure income for the next few years, as there are country level problems that could be solved. These will need constant updating, maintenance and training for the specialists in charge of the equipment at the client's offices.

The impact case related to improving medical services through UO and hospital collaboration was clearly evident. The evaluators easily consulted with the focal point and societal partners, as there was an obvious operating network of clients across the region, and among the university professors and researchers as providers. Innovation was perceived all the way, with impact in the delivery of services using the latest technologies in diagnosis, and data storage. Six major achievements were described, all technology related, with sustainability guaranteed for several years through contracts already signed, and others in review. The case accomplished every goal that the program stood for: know-how transfer obtained through training, prestigious publications, PhD and MSc. students' training/graduation, the earning of national and international awards, the internationalisation of programmes, and stronger partnerships among the public and private sector and between academic institutions in Cuba and abroad. Lastly, the findings on the 3 learning questions made the evaluators reflect and make recommendations on gender and uptaking of research results. In essence, medical services were improved and made more efficient in both urban as well as rural/remote areas, and new technologies have been generalised in all the hospitals of the country.

The programme has encouraged changes in the RD&I practices at UO leading to an innovative approach focused on stakeholder needs and demands, the development of 'products' and the envisioned change. In this scenario, the stakeholder plays a leading role, participating in all stages of

the project cycle, from the diagnosis of the problem to developing and implementing research results. By placing the stakeholder at the core of the programme, it's engagement and commitment with the results is encouraged, making them an active participant in continuous improvement. This approach has a major impact on the improvement of healthcare services at the hospital.

After assessing all the consulted materials and the results from the field visit, the evaluators conclude that the IUC program at UO performed with excellence. The goal 'to promote sustainable development in the eastern region of Cuba' is considered accomplished.

7 Recommendations

7.1 For Cuban and Flemish universities:

- To align PhD requirements between Cuba and Flemish universities (e.g. required number of articles to be published in order to defend a thesis).

For the Cuban universities:

- To consolidate products and services for the Cuban export portfolio, directed to the Ministry of Foreign Trade, Cuban Medical Services S.A., the Ministry of Tourism among other institutions, for the services and products obtained with the support of the program.

- To expedite commercialization through the university Interface Company or other enterprises, to guarantee sustainability, motivate more the professors with the profits, and guarantee continuance in further projects.

7.2 For VLIR-UOS

- To add to the management manual accepted by all partner universities, gender and other approaches, such as taking into account the individual's special necessities, in the selection process of Ph.D. candidates, taking into account the country's official statistics on the topic, for a better balance. This could be conceived as an opportunity to connect with the Social Sciences sector, above all if the program has a strong component from the STEM Sector, like this one. Sociologists, economists, psychologists and other social scientists normally work with that kind of data, and have more experience in its synthesis.

8 Annexes

8.1 List of documents consulted

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8.2 Field visit programme at UO

Day	Activities
1.	Interview with the program coordinator
2.	Reception at UO by the Rector, VRs, Director of IRs, Deans of main stakeholders of the IUC and PLs. Presentation of the IUC self -evaluation and the 6 projects
3.	Visit to 2 hospitals and other public health institutions
4.	Visit to the Province Centre of Epidemiology and Microbiology (Covid's Lab).

Day	Activities
5.	Visit to the School of Basic Sciences (Dept. of Pharmacy), CEBI and CBM
6.	Visit to CNEA and Faculty of Basic Sci. (Dept. Biology). Exchange wit PSU team members
7.	Visit to CENPIS and university warehouses.
8.	Visit to the Province Directorate of Heritage and museums, Schools of Law, Humanities and FITIB. Focus group with VRs, exchange with Directors of University processes related with the IUC management and English teaching. Interview with the Rector

8.3 Lists of people consulted/interviewed in Flanders and Cuba

Prior to the visit

Nr.	Name	University/Institution	Position	Date
1.	Ann Nowe	Brussels	ICT NETWORK (UCLV) Coordinator	14 September
2.	Hichem Sahli	VUB	Former Flemish IUC Coordinator (Phase 1, start Phase 2)	14, 15 September
3.	Paul Cos	Antwerpen	Project Leader	20 September
4.	Ann Cuypers	Hasselt	Project Leader	21 September
5.	Roger Vounckx	VUB	Flemish IUC coordinator since year 7	13 September
6.	María Victoria Villavicencio Plasencia	International Affairs, Ministry of Higher Education, Cuba	Head of Department	22 September
7.	Raúl Hernández	International Affairs, Ministry of Higher Education, Cuba	Adviser	22 September
8.	Philipe Meers	Antwerpen	Project Leader	24 October

Field visit

Kick-off workshop

Nr.	Names	University/other	Position	Date
1.	Peter De Lannoy	VLIR-UOS	Global Partnerships Coordinator (IUC, TEAM&SI)	28 June
2.	Joshua Eykens	VLIR-UOS	Monitoring and Evaluation Manager	28 June
3.	Patrick Stoop	C-lever	Consultant - general managing partner	28 June
4.	Teresa Orberá Ratón	UO	local coordinator	28 June
5.	Hector Cruz Enriquez	UCLV	local coordinator NETWORK ICT	28 June
6.	Antonio Carmona Báez	C-lever	Evaluator	28 June
7.	Seida Barrera Rodríguez	C-lever	Coordinator	28 June

*online

On campus

Nr.	Name	University/Stakeholder	Position	Date
1.	Teresa Orberá Ratón	UO	Program Coordinator	23 Sept
2.	Abel Pouló Mendoza	Hospital Juan Bruno Zayas	Director	25 Sept
3.	Julio Brossard	Hospital Juan Bruno Zayas	Neurosurgeon, professor	25 Sept
4.	Arnaldo Ramírez	Hospital Juan Bruno Zayas	Head of Department of Microbiology	25 Sept
5.	Yamilé Rodríguez	Hospital Juan Bruno Zayas	Specialist	25 Sept
6.	Samuel González Rodríguez	Hospital Juan Bruno Zayas	Specialist Hematology Service	25 Sept
7.	Yarina León Caballero	Hospital Juan Bruno Zayas	Professor, School of Pharmacy UO	25 Sept

Nr.	Name	University/Stakeholder	Position	Date
8.	Evelyn Rojas Vázquez	Hospital Juan Bruno Zayas	Director of Pharmacy Department	25 Sept
9.	Arquímedes Montoya Pedrón	Hospital Juan Bruno Zayas, Grupo de Análisis de Movimiento	Head of Department of Neurophisiology Training	25 Sept
10.	Humberto J. Morris Quevedo	UO	Head of Project 3, professor	26 Sept
11.	Juan Carlos García Naranjo,	UO	Director and Head of Project 2	26 Sept
12.	Cariana Reyes	Hospital Juan Bruno Zayas	Head of Department Imagenology	26 Sept
13.	Jenly Alfonso Rodríguez	Hospital Juan Bruno Zayas	Specialist, Department Imagenology	26 Sept
14.	Javier Barbados	Hospital Juan Bruno Zayas	Resident, Department Imagenology	26 Sept
15.	Manuel Fong Lores	Center for Toxicology and Biomedicine (TOXIMED)	Subdirector	27 Sept
16.	Isabel Palacios	TOXIMED	Director	27 Sept
17.	Roxana González Fernández	TOXIMED	Specialist	27 Sept
18.	Justa Carmen Colombié Deulofeu	TOXIMED	Specialist	27 Sept
19.	Beatriz Macías	TOXIMED	Specialist, Toxicology Service	27 Sept
20.	Suyén Rodríguez Pérez	Center for Molecular Immunology (LABEX-CIM, BioCubaFarma)	Director	28 Sept
21.	María Elena Toledano	LABEX-CIM	Researcher	28 Sept
22.	Ernesto Guevara Fernández.	UO	Joint PhD. graduate, professor, IP specialist	28 Sept
23.	Mayelin Cabezas Salmon	UO	Project leader 6, professor	29 Sept
24.	Harold Crespo Sariol	UO, CENPIS	Project leader 5, professor	29 Sept
25.	Erislandy Omar Martínez	UO	Head of CENPIS	29 Sept

Nr.	Name	University/Stakeholder	Position	Date
26.	Elizabeth Isaac Alemán	National Centre of Applied Electromagnetism, UO	Director and Project leader 1	30 Sept
27.	Margarita Victoria Hernández Garrido.	UO	Director and Project leader 4	2 Sept
28.	Diana Sedal Yanes	UO	Rector of UO	2 Sept
29.	Freider Santana Lescaille	UO	First vicerector	2 Sept

Focus groups

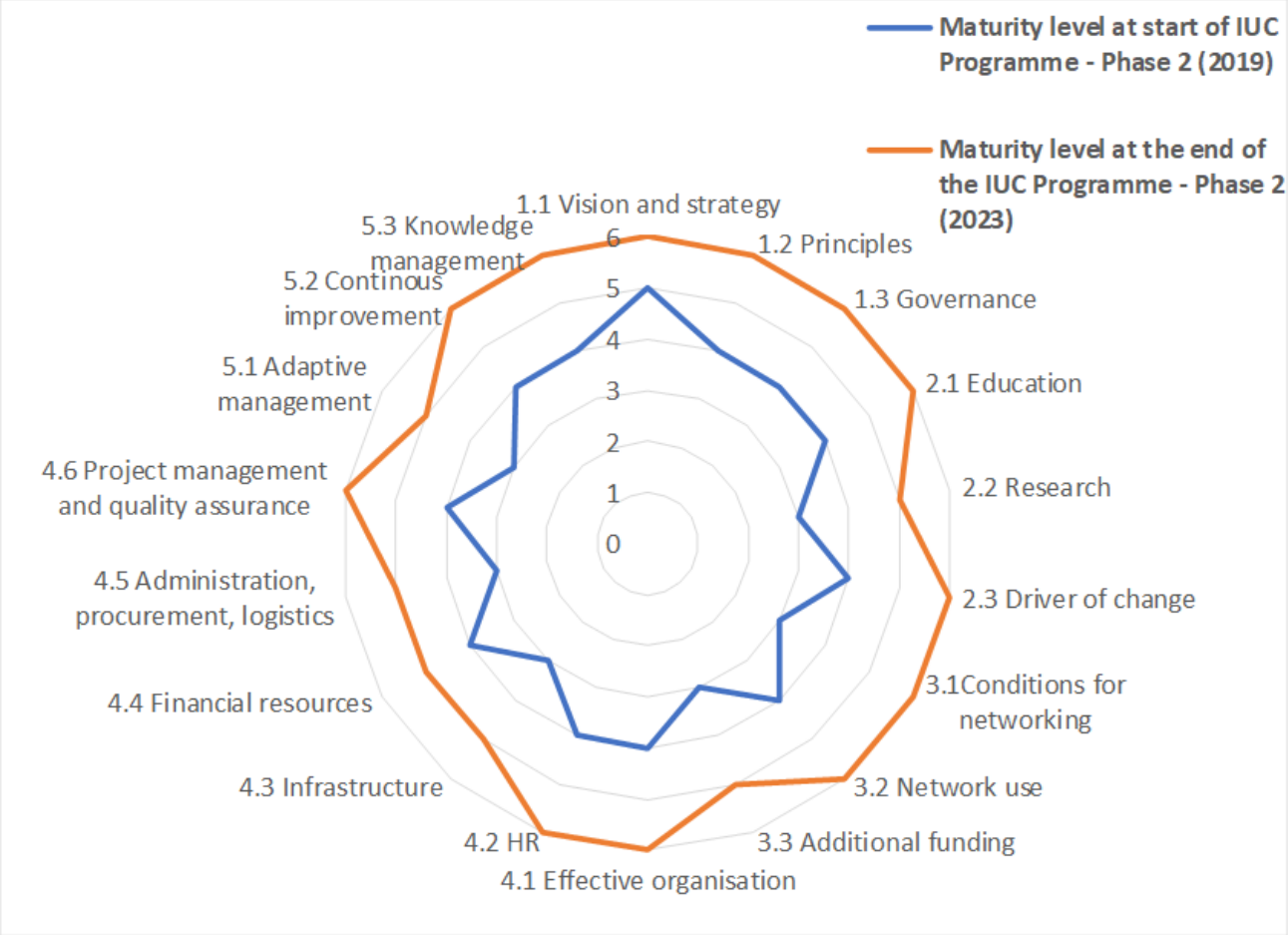
Name	University/Institution	Position	Date
PSU team members	UO	professors	25 Sept
Researchers at CNEA	CNEA	Researchers and professors	28 Sept
Directors of University processes related with the IUC management and English teaching	UO	Directors and professors at the same time	2 Oct

*online

Restitution workshop with VLIR-UOS and Flemish coordinators / project leaders 15/11/2023

Name	University	Position
Seida Barrera Rodríguez	Havana	Evaluator
Antonio Carmona Báez	San Martín	Evaluator
Teresa Orberá Ratón	UO	local coordinator
Peter de Lannoy	Vliruos	Global Partnerships Coordinator (IUC, TEAM&SI)
Joshua Eykens	Vliruos	Coordinator
Patrick Stoop	C-lever	Consultant - general managing partner
Mayelin Cabezas Salmon	UO	Leader of the project
Roger Vounckx	Vrije Universiteit Brussel (VUB)	Responsible for project
Juan Carlos García Naranjo	UO	Leader of the project
Elizabeth Isaac Aleman	UO	Leader of the project

8.4 Overall scores for the assessment of the collaborative process/ overview of scores of analysis of institutional capacity



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to global and local challenges

VLIR-UOS
Julien Dillensplein 1, box 1A
1060 Brussels
Belgium
Tel. +32 (0)2 289 05 50
info@vliruos.be

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