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Technological and Enterprise Upgrading Programme on Agro-Chemical and Agriculture Machinery Production Sector

INDUSTRIAL UPGRADING AND MODERNIZATION IN CUBA

FINAL PROJECT REPORT

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Industrial Upgrading and Modernization in Cuba

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ACRONYMS

CEDEMA	Agricultural Machinery Development Center
CIIQ	Centre for Engineering and Chemical Research
CIPIM	Research Center for the Metallurgical Mining Industry
CITMA	Ministry of Science, Technology and the Environment
EMPREQUIN	Liquid Calcium Nitrate Production Plant, Chemical Company “October Revolution”
GEIQ	Cuban Chemical Industry Enterprise Group
GELMA	Logistics Business Group of the Ministry of Agriculture
GESIME	Business Group of the Steel-Mechanical Industry
IAGRIC	Agricultural Engineering Research Institute
INICA	Sugarcane Research Institute
INIFAT	Institute for Fundamental Research in Tropical Agriculture
MES	Ministry of Higher Education
MINAG	Ministry of Agriculture
MINCEX	Ministry of Foreign Trade and Investment
MINDUS	Ministry of Industries
TE	Terminal Evaluation
UNIDO	United Nations Industrial Development Organization

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I

Executive Summary

In 2016, UNIDO launched the project “Technological and Enterprise Upgrading Programme focused on agro-chemical and agriculture machinery production sector” (Industrial Upgrading and Modernization in Cuba), with a total tentative budget estimated at USD 4 million. It was implemented over the period of 6 years based on UNIDO’s Industrial Upgrading and Modernization Programme (IUMP).



The UNIDO project “Technological and Enterprise Upgrading Programme on Agro-Chemical and Agriculture Machinery Production Sector” (Industrial Upgrading and Modernization in Cuba), with a total tentative budget estimated at US\$ 4 million, was implemented over the period of 6 years based on UNIDO’s Industrial Upgrading and Modernization Programme (IUMP).

Launched in 2016, the project supported a series of technological upgrading and industrial modernization activities that helped fine-tune scientific research leading to the elaboration of innovative formulas, production, application and market promotion of eco-fertilizers. Ultimately, the project contributed to the country’s efforts in achieving food security and promotion of local fertilizer production and sales.

The IUMP approach consists of remedial actions at three levels of intervention (micro-, meso- and macro-levels) employed to strengthen the agrochemical and agricultural machinery sectors in Cuba. The project kicked-off with a comprehensive analysis of the Cuban fertilizers and agricultural machinery production sectors resulting in a Sectoral Strategy that allowed to prioritize developmental efforts in a strategic action plan. At the same time, enterprise diagnosis and industrial upgrading of selected pilot manufacturing enterprises was conducted to determine their development gaps and opportunities. The second implementation phase aimed at upgrading and modernizing the agricultural machinery industry, with a special focus on maintenance, technological upgrading, refurbishment of production facilities and related services. The third – and likely the most important – element of the project’s intervention consisted in reinforcing human and technical capacities of national counterpart institutions and locally available pool of expertise through extensive capacity building programmes, thus ultimately enabling

sustainable replication of best practices and continuous provision of industrial services, such as enterprise diagnosis and industrial modernization, sectoral analysis, market promotion, etc.

Overall, the IUMP Cuba contributed to inclusive and sustainable industrial development of Cuba by improving food security through upgrading and modernization of industrial sectors of fertilizer production and agricultural machinery. The objective was achieved by enhancing industrial performance and competitiveness of pilot enterprises operating in the target industrial sectors within the existing industrial hubs in Havana and Camagüey province.

During the project’s inception phase, a specific focus was placed on analysis, stakeholder engagement, as well as development of a long-term project strategy and work plan, which served as a roadmap for innovative upgrading and promotion of liquid fertilizer production and application systems in Cuba. Inputs provided by local counterparts, stakeholders and interest groups to the work of the project’s advisory group, formed an important element in ensuring national ownership of the project, as well as its relevance for local industries. The inception phase resulted in the finalization of “Sectoral Strategy for the technological and enterprise upgrading of fertilizers and agricultural machinery” that helped establish the project’s overall framework, determining the necessary feasibility, engineering and procurement activities.

The second phase of the project opened with high-level project conferences that focused on the project’s strategies and work plans introducing attendees to approaches and methodologies associated with the Industrial Upgrading and Modernization Programme and the “Sectoral Strategy for the technological and enterprise upgrading of fertilizers and agricultural machinery”¹ developed specifically for this project. During those events, the

major challenges faced by the target sectors were analyzed and opportunities arising from the IUMP approach highlighted.

In its final phase, after the implementation of extensive capacity building programme, one of the three main components, namely, the procurement of modern agricultural machinery, revitalization of selected workshops in the agricultural machinery sector and further training, on-the-job coaching sessions and a study tour were conducted for the national counterpart representatives and project beneficiaries who received guidance and advisory services on the regular basis.

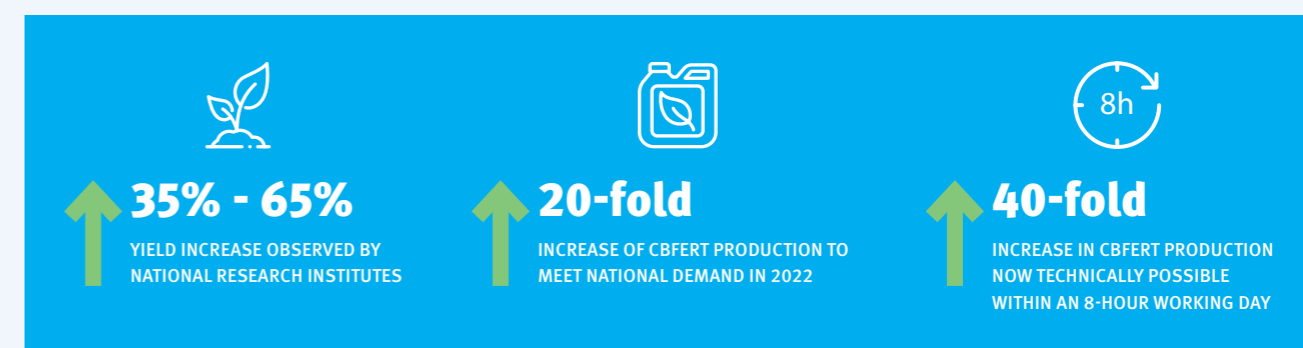
Following technological modernization of the calcium nitrate production plant of the Chemical Company “Revolución de Octubre” EMPREQUIN, located in Nuevitas, Camagüey, and of the pilot plant for the production of an ecological liquid fertilizer at the Chemical Engineering and Research Center (CIQ) in Havana and the mentioned capacity building activities the project supported the registration of CBFERT/VITAPLIC Foliar fertilizer brand. At the same time, validation of the agronomic effectiveness of CBFERT/VITAPLIC Foliar, with yield increases between 35% and 65% observed by national research institutes, was obtained leading in a sharp increase in demand for such product. Subsequently, an ambitious 40-fold increase in CBFERT production was requested, which is now technically possible within an 8-hour working day thanks to the project’s impactful modernization and capacity reinforcement efforts.

To address the need to promote this scientifically tested and highly efficient eco-fertilizer on the national and international markets, the project ensured the development of a marketing and value chain strategy for calcium nitrate and CBFERT. The original CBFERT product was subject to international patenting and rebranding to “VITAPLIC Foliar”— the new brand presented in several regional and national reports, conferences and exhibitions receiving awards and wide national recognition. By protecting the innovative formula adopted by the upgraded fertilizer production plants, sales and marketing could be brought to a new level.

The end of the project saw the commissioning and operationalization of a new calcium-nitrate production plant in Nuevitas, Camagüey province. Technological Modernization of the CBFERT Plant in Havana ensured that the envisaged production of CBFERT liquid fertilizer could see a manifold increase in 2021. However, those expectations were not fully met due to the COVID-19 pandemic and related economic repercussions. Additionally, an R&D Project proposal was developed in coordination with the Ministry of Agriculture of Cuba aiming at introducing recycling practices that would allow to reuse solid waste from the CBFERT production for agricultural purposes.

Due to its high quality, positive impact on crop yields and wide recognition by the scientific and agro-industrial community, the Ministry of Agriculture (MINAG) of Cuba continues to support the increase of CBFERT production to meet the ever-increasing national demand projected to reach more than 400 000 liters from 2022 onwards, which is expected to be satisfied in full owing to the project’s contribution.

According to the assessment of the Ministry of Foreign Trade and Foreign Investment of Cuba, the international cooperation project “Technological and Enterprise Upgrading Programme on Agro-Chemical and Agriculture Machinery Production Sector” has had “a great impact on agricultural development and food sovereignty in the country.”



1) Sectoral Strategy for the technological and enterprise upgrading of fertilizers and agricultural machinery, April, 2017: https://www.unido.org/sites/default/files/2017-05/Cuba_report_v_2.3__EN-LS2_0.pdf

I.1 INDUSTRIAL UPGRADING AND MODERNIZATION



Due to the substantial potential of increased liquid fertilizer production identified by the project, taking into account the high quality of the CBFERT/Vitaplic foliar liquid fertilizer and its positive effects on crop yields, the Ministry of Agriculture (MINAG) requested to increase the local production of CBFERT by 40 times to meet the national demand. MINAG’s decision to ensure the supply of the foliar fertilizer based on local production of upgraded CBFERT allowed local production of the agrochemical substance and substantial international exchange savings for the country.



The Ministry of Agriculture (MINAG) put a high priority on supporting the fertilizer production of the project beneficiaries to accomplish the food production targets set by the Cuban Government. As per the contractual commitments with Logistics Group of the Ministry of Agriculture (GELMA), the envisaged production of CBFERT liquid fertilizer was estimated to reach 259,000 liters, which would have amounted to a sizable 2490% increase in 2021. However, the COVID-19 pandemic and ensuing economic difficulties in Cuba, limited the CBFERT production to 200,000 liters, which still represents an impressive increase of 1900%. The project thus ensured a solid 20-fold increase in demand and production of CBFERT/VITAPLIC Foliar by 2021 with technological and production capacity upgraded to allow 40-fold increase.



Based on the identified criteria for production capacities and the identified processes (production of Calcium nitrate/Magnesium nitrate and CBFERT at two plants in Cuba), the specific equipment and machinery were identified and an engineering plan developed for upgrading the pilot liquid fertilizer plants following best international practices and respective procedures (mass balance, flow sheet, plot plan, equipment specification).



A calcium nitrate production plant was upgraded and commissioned, increasing Cuba’s production potential for liquid fertilizers by ensuring the necessary fine-tuning within the production process of calcium nitrate, which has today been recognized as an agrochemical breakthrough for its technical relevance and efficiency in addressing the country’s key food security issues.



The CBFERT/VITAPLIC foliar production was already ongoing before the UNIDO project, but thanks to the intervention processes could be fine-tuned and automated, the quality increased through a series of capacity building measures at laboratories which helped improve recipes making them easily applicable. A key pillar to achieve this was the certification process of testing laboratories.



In the long term, the analysis of local demand suggested that there is secure demand in the respective sectors for the proposed liquid fertilizers: Calcium Nitrate and CBFERT/VITAPLIC Foliar as they do allow more precise dosage and better access to plants (roots as well as leaves) allowing to avoid over-fertilization. This is also one of the reasons why liquid fertilizers generally gain significant market share.



I.2 CAPACITY BUILDING



Twelve capacity building activities were conducted during the project implementation period, with training support provided to dozens of target industry experts, machine operators, maintenance workers and others. A study tour to Spain was organized with the objective of improving the expertise of a delegation of Cuban experts, which exposed them to international best practice examples, enabled peer learning. There were training events, conferences and study tours provided to national project beneficiaries throughout the project period.



Continuous coaching on the application of the best international practices focusing on project management procedures for technical investments was conducted along with the technological modernization of beneficiary enterprises.



Capacity building activities were conducted in various forms, including workshops, trainings, on-the-job coaching sessions and a study tour with involvement of the national counterpart representatives, including MINDUS, MINAG, CIIQ, GEIQ, EMPREQUIN, GESIME, CEDEMA and other stakeholders.



A capacity building program was developed and shared with the National Partners to ensure its compliance with their needs. Trainings were organized in parallel with the completion of procurement and installation of the equipment at the respective production/research facilities. Most notably, the capacity building activities were continuously expanded and adapted based on additional requests and guidance received from the project team and other stakeholder institutions.



During the Study Tour of 10 Cuban national experts from MINAG, CIIQ, GEIQ, EMPREQUIN, CEDEMA to Spain, conducted between 30 September and 13 October 2017, the best international practices and know how were demonstrated to national experts as they received specialized training in the area of liquid fertilizer production and application.

I.3 ADVOCACY ACHIEVEMENTS



As part of the marketing strategy, a campaign to promote and disseminate the benefits of locally produced fertilizers is being developed and implemented. Subsequently, a TV spot about CBFERT was launched on the Cuban national television and a special episode of a television program has been prepared to disseminate the results of the UNIDO Project. Additionally, a video to promote the benefits of CBFERT application was filmed and aired on the national television.



At the “CubaIndustria 2018” week, the project-supported CBFERT foliar fertilizer received a Quality Award for its performance and contribution to sustainable industrial development of Cuba and for its technical relevance and agronomical efficiency in supporting the country’s food security objectives. CBFERT and its field level results were featured in the GEIQ National Forum, in November 2019 in Havana, where CBFERT was awarded the First Prize of the Science, Technology and Environment Commission. The CBFERT field results were submitted to the Science, Technology and Environment Delegation in Havana, and won the “Technological Innovation Prize.



The UNIDO project was featured in a number of global fora, international-, regional- and national-level conferences, exhibitions, information briefings and other promo events. Most notably, visibility was provided during “Brand Global Summit”, an annual international forum series co-organized in 2019-2021 by UNIDO and the European Brand Institute (Austria). The project in Cuba and its branding component, namely, the CBFERT/Vitaplic foliar brand, were showcased during three annual editions of the Summit as a sustainability-oriented national branding example that embodies forward-looking eco-branding philosophy that leads to improved food security, job generation and economic development through promotion of local industrial output.



An extensive social media updates covering the project’s progress and achievements on UNIDO official Twitter, Facebook and LinkedIn accounts with broad outreach and visibility.



Press releases on the main UNIDO website showcasing the project’s milestone successes and achievements, as well as articles in the national media outlets.



I.4 MONITORING AND EVALUATION



The project steering committee was established gathering designated focal points from respective counterparts. It held meetings on a biannual basis and performed the function of a coordination and monitoring mechanism.



The project team also met the UN country representatives and reported on the project objectives, and activities and expected output during the process of project implementation.



The project established a result-oriented management mechanism to ensure the timely identification of possible challenges and provide support in addressing these challenges. Gender indicators were included in the monitoring and evaluation tools developed for this project. The results of this mechanism were distributed and discussed during the steering committee meetings.



An independent terminal evaluation of the project was conducted enabling the Government, counterparts, UNIDO, other stakeholders and the donor country (Russian Federation) to verify prospects for development impact and sustainability, providing an analysis of the attainment of project objectives, delivery and completion of project outputs/activities, and outcomes/impacts based on indicators.



I.5 PROJECT MANAGEMENT



Project implementation was made possible with financial support from the Government of the Russian Federation.



UNIDO wishes to express its gratitude to the National Project Team: Bárbara Ivette Tortosa Ferrer, UNIDO Project Associate and Hireily Santana González, National Project Coordinator, who contributed to the methodological approach and project implementation in remote areas of Cuba. The project was managed by Farrukh Alimdjanov, UNIDO Industrial Development Officer, Innovation and Digitalization Division.



UNIDO greatly appreciates the collaboration and support of the many stakeholders and operators in Cuba that dedicated so much time and resources in support of this project. UNIDO is particularly appreciative of the project steering committee members, who guided and advised the project, including the representatives from MINAG, MINDUS, CIQ, CEDEMA, GEIQ, EMPREQUIN, MINCEX, donor country of the project the Russian Federation, as well as other governmental agencies that were present at the project meetings. The project results were made possible thanks to their extensive and generous support.



FERTILIZANTE MINERAL BIOLÓGICO
ENRIQUECIDO CON MICROALGA





Project Overview

To achieve its goals, the UNIDO project targeted enterprises in the fertilizer production sector, as well as industry support institutions to establish good practices that helped Cuba achieve higher levels of self-sufficiency. Improved food security helps the country to retain more value added from tourism at the same time serving as a driver of accelerated job creation and poverty reduction.



	PROJECT TITLE	Program for technological and enterprise upgrading of the agro-chemicals and agricultural machinery production sectors (Industrial Upgrading and Modernization Programme in Cuba)
	THEMATIC AREA	EC12 Business, Investment and Technology Services
	DURATION	4 years (2 years extension)
	PROJECT SITE	Havana, Camagüey province, other regions in Cuba
	DONOR	Russian Federation
	TOTAL BUDGET	US\$ 2,000,000
	MAIN COUNTERPARTS	Ministry of Industries of Cuba (MINDUS)

II.1 BACKGROUND

After 1989, as a result of drastic reduction in trade and frequent changes in domestic economic policies, GDP dropped 35% between 1989 and 1993. In 1999-2001, the structural reforms towards the economy of services were reflected in growing participation of services exports, representing around two thirds of total exports in 2001 (10% in 1989). The country achieved some progress in structural reforms, such as productive activity by the non-State economy. The State continued to play a predominant role in the economy and thus the private sector had limited scope for its activities. On the other hand, 3,700 agricultural co-operatives and the 147,000 private farmers continued as a viable option supported by the State.

In 1991 Cuba faced challenges that provoked a prolonged economic crisis that resulted in shortages of fuel and major fertilizers and pesticides, thus depriving the country of a reliable food supply. Growth in the agricultural sector has been insufficient and domestic food production has traditionally been far below domestic consumption needs. As a result, approximately 80% of the demand for agricultural products is met by imports.

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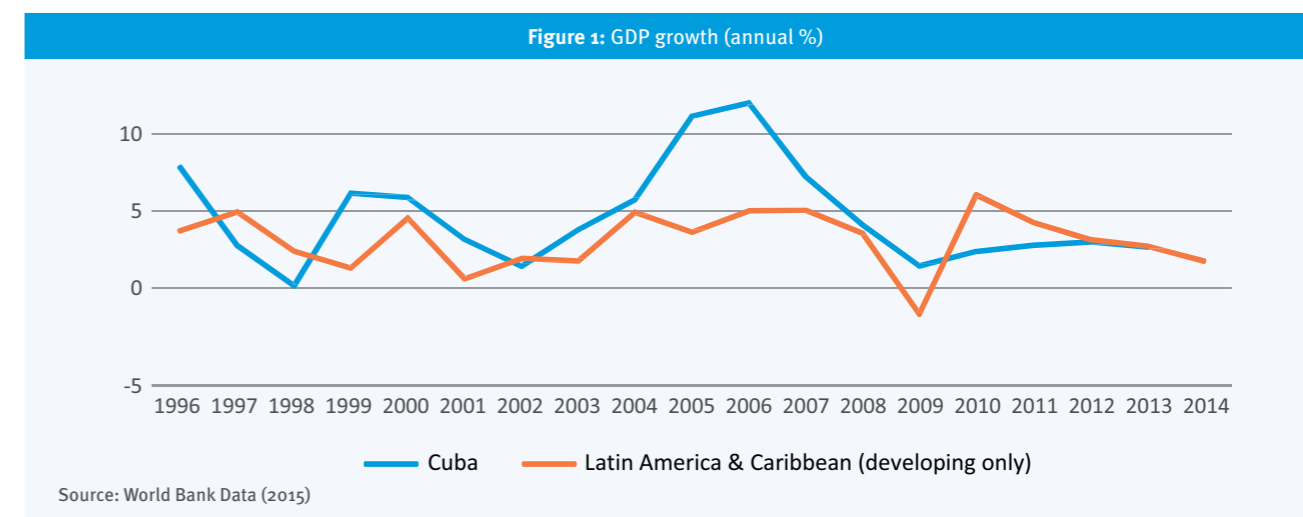
Between 2007 and 2011, the agricultural sector of Cuba employed about 19% of the labor force. In Cuba, agriculture is now practiced by some 40,000 urban workers on an area estimated at 33,500 ha. It includes 145,000 small farm plots, 385,000 backyard gardens, 6,400 intensive gardens and 4,000 high-yielding organoponics. Agricultural production volumes, however, were not sufficient to meet local demand, mainly due to low productivity levels, insufficient resources, low levels of capitalization and outdated technology.

Among the major agricultural crops produced in Cuba, sugar cane remains the dominant good, amounting to

about 76% of the total crops produced in the country. Sugar cane has historically been an export crop providing a major part of the country's income. Despite considerable production volumes of sugar crops, production quantity has dropped in 2003, while the production of vegetables and fruits has drastically increased since 1990s. These changes were mainly a result of the limitations imposed by the crises that had a negative impact on yields, in

addition to other challenges such as the aging plantations, inadequate care for crops; fuel, fertilizers and pesticide shortages.

Along with the increasing domestic demand for agricultural and food products, the boom in the tourism sector and expected growth of tourist inflow also forced the country to address its challenges and reinvigorate the agri-industry.



II.1.1 Major mineral fertilizers production and consumption trends in Cuba

In 1989, Cuba produced about 146 thousand tons of Nitrogen, 15 thousand tons of Phosphate and 161 thousand tons of potash based fertilizers, thus, meeting up to 28% of the domestic consumption of fertilizers through local production. Between 1999 and 2001, Cuba already had to rely on imports of all mineral fertilizers. After a major

decline in the use of mineral fertilizers by 80% during the 1990s, the consumption has been increasing since, exceeding the limited supply of produced and imported fertilizers. The local production of mineral fertilizers remains low.

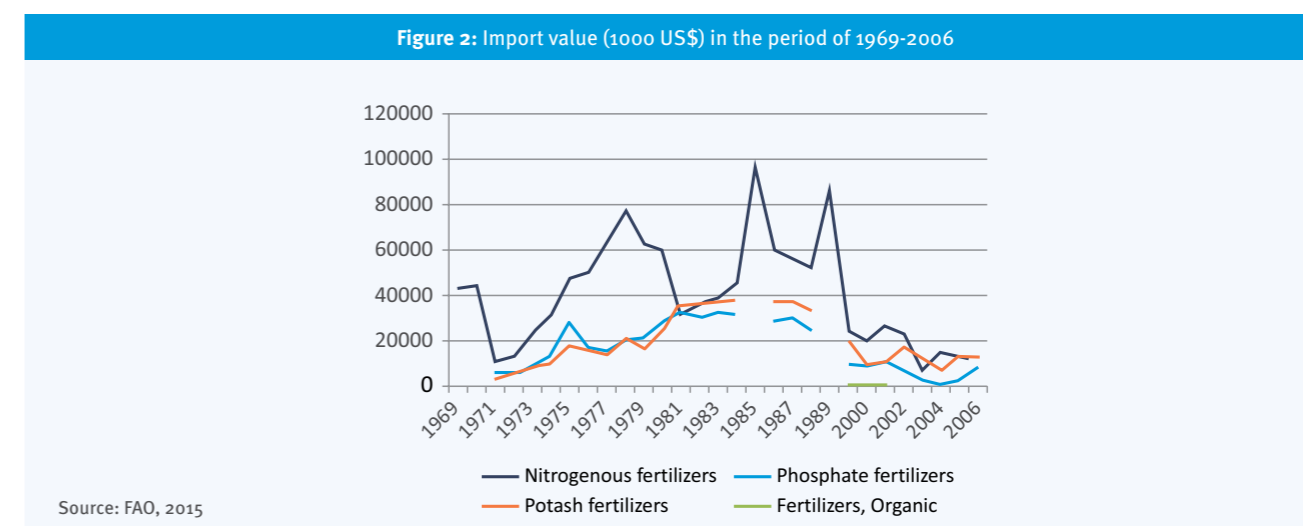
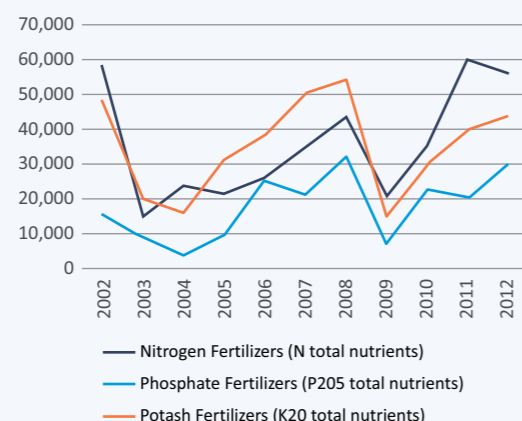


Figure 3: Import quantity in nutrients in the period of 2002-2012 (tonnes of nutrients)



Source: FAO, 2015

Currently, there are three major public enterprises producing fertilizers and pesticides in Cuba, which are the Fertilizer Company October Revolution in Camagüey province, Fertilizer Company Rayonitro, and Artemis Pesticides. Two of those were established in 1970s, while Fertilizer Company Rayonitro was established in 2013. About 777 people are currently employed by these enterprises.

All the above mentioned public enterprises producing fertilizers are associated members of “Grupo Empresarial de la Industria Química”, GEIQ (Cuban Chemical Industry Enterprise Group). Among the Group’s objectives are the promotion of the local development and production of fertilizers and to reduce the revenues spent to purchase these products abroad. The production capacities of the major fertilizer and pesticide enterprises are provided in the table below.

Table 1: Major fertilizer and pesticide producers and their production capacities

Name	Main products	Annual production capacity
Fertilizer Company October Revolution Camagüey	Ammonium nitrate fertilizer	120,000 tonnes
	Calcium nitrate solutions	48,0000 litres
	Nitric acid	300 tonnes
Fertilizer Company Rayonitro, Matanzas	Granular NPK fertilizer mixed	150,000 tonnes
Artemis Pesticides	Insecticide and fungicides dry powders	12,000 tonnes
	Insecticide concentrates with emulsifying agents	1,400 litres
	Herbicides water-soluble concentrates	3,600 litres
	Rodenticides granules	800 tonnes

Source: Questionnaire responses received during the UNIDO Cuba Country Programme Formulation mission conducted 29 June-3 July 2015

Sugar cane production dominates the agricultural industry in Cuba, accounting for almost half of the cultivated area, and being the main crop to which most fertilizers are applied. In the period of 1986 and 1990, other categories of crops, including vegetables and cereals, consumed a total of 856,416 tons of complex fertilizers, while in 1995

the consumption has drastically fallen to 50,843 tons and dropped further to 15,000 tons in 2009. This drastic decline in supply of fertilizers forced Cuba to optimize the use of fertilizers, and lead to an increase in the use of organic and organo-mineral products and bio fertilizers.

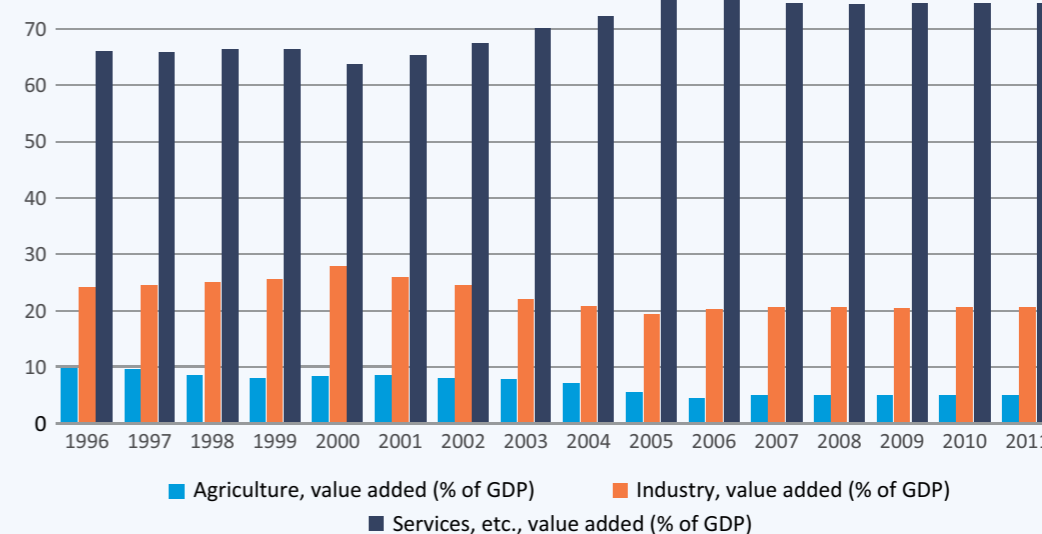
Cuba’s structural transformation in 2011 triggered many positive developments for its economy, such as increased tourism which sustained higher levels of job creation and had effects on other parts of the economy. One of these sectors is agriculture, even though the effects were not purely positive, mainly associated with the limited national capacity to ensure food security amid the ever-growing demand

The major local producers of agricultural machinery in the country are public and united under El Grupo Empresarial de la Industria Sidero Mecánica, GESIME (Cuban Ferrous Metallurgy and Machine-Building Enterprise Group).

GESIME was established in December 2012 under the Ministry of Industries of Cuba with the aim to contribute to the development of the Ferrous Metallurgy and Machine-Building sector in Cuba and to organize and support the productive and trade (including exports) activities of the companies belonging to this sector.

The country’s (and GESIME’s) major producers of agricultural machinery is a public enterprise “Heroes of July 26”, which is located in Holguin and currently employing about 500 persons.

Figure 4: Structure of Cuba’s value added as % of GDP (1996-2011)



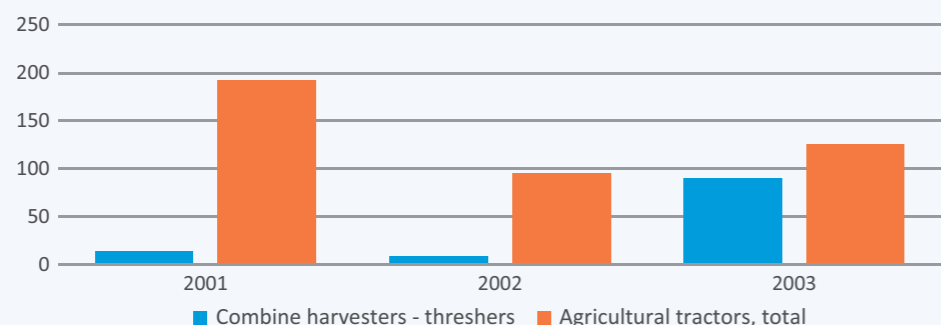
Source: FAO, 2015



A challenging situation in the Cuban agriculture, particularly related to the production of fertilizers and agricultural machinery, weighs heavily on its capability for self-sufficiency, a clear goal set by the Government. The UNIDO project “Technological and Enterprise Upgrading

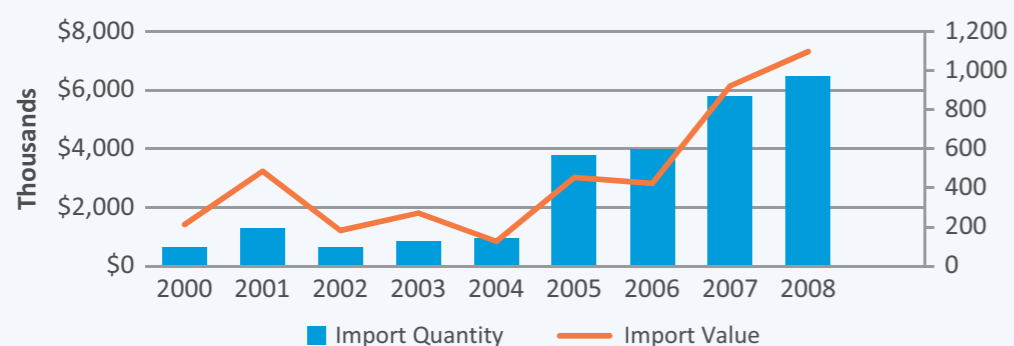
Programme on Agro-Chemical and Agriculture Machinery Production Sector (Industrial Upgrading and Modernization in Cuba)” contributes to that goal.

Figure 5: Agricultural machinery (tractors and combined harvesters) import quantity, 2001-2003



Source: FAO, 2015

Figure 6: Agricultural tractors, imports, 2000-2008



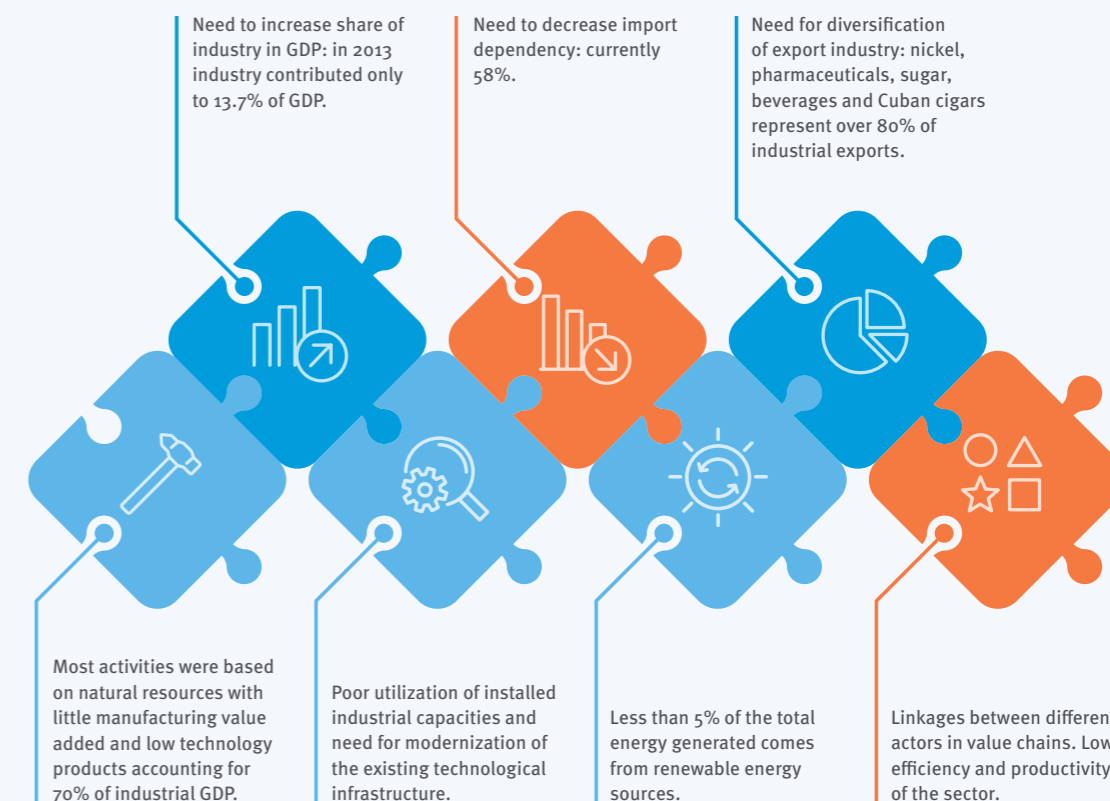
Source: FAO, 2015

Table 2: Quantity of agricultural machinery produced by enterprise “Heroes of July 26” in 2015

Agricultural equipment produced	Quantity of production in 2015
Tractors	115
Various types of trailers	925
Tractor implements	165
Tools and systems	3,206

Source: Questionnaire responses received during the UNIDO Cuba Country Programme Formulation mission conducted 29 June-3 July 2015

Figure 7: Main industrial challenges highlighted for Cuba



Source: FAO, 2015

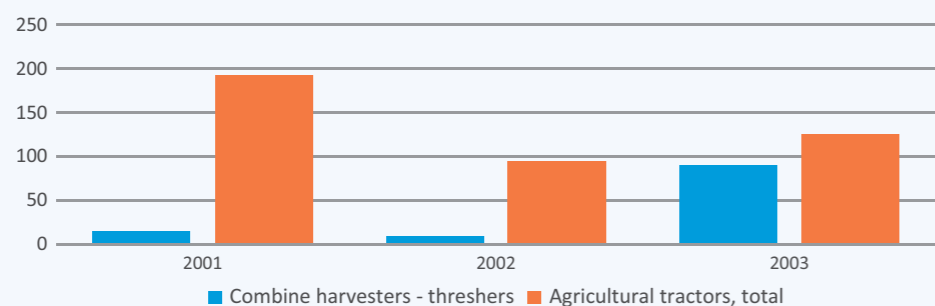
To achieve its goals, the UNIDO project targeted enterprises in the fertilizer production sector, as well as equipment providers and through selected pilot initiatives establishes good practices that could help Cuba achieve higher levels of self-sufficiency. Improving food security not only retains more value added from tourism in the country but is generally driving job creation and poverty

eradication. It was identified that innovation in the sector can be boosted via the overall revision of the prevailing agricultural model based on the capacities in place, as well as by introducing the best practices in production, quality control, distribution and application of fertilizers available nationally and internationally.

Major issues as identified by the key producers of fertilizers and pesticides in Cuba:

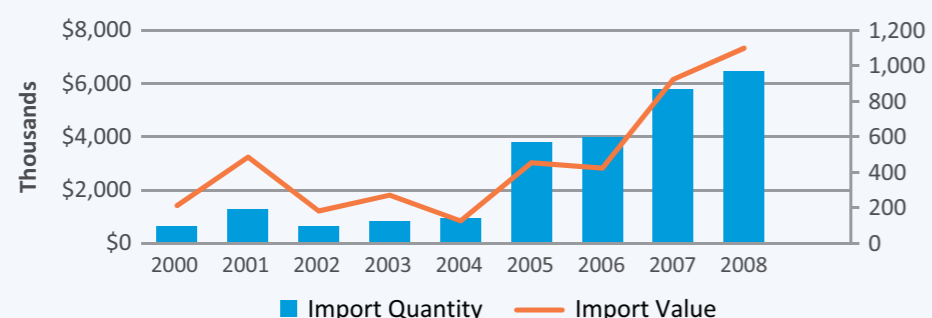
- Local demand in fertilizers was exceeding the limited supply of produced and imported fertilizers.
- Domestic production of mineral fertilizers remained low, while consumption is steadily increasing.
- Production of crops other than sugar cane (vegetables and cereals) required optimization of the use of fertilizers and their wider application.
- Damages to production equipment and loss of goods produced occurring in the production process due to limitations in storage capacity.
- Insufficient skills and knowledge and limited availability for reliable provision of maintenance services.
- Installed equipment at the production units was estimated to be between 30 to 60 percent in a regular condition, while the rest of equipment was outdated.

Figure 8: Agricultural machinery (tractors and combine harvesters) import quantity, 2001-2003



Source: UNIDO

Figure 9: Agricultural tractors, imports, 2000-2008



Source: UNIDO

II.1.2 Government development priorities at the time of project design

To reach a new stage in the economic development, the Cuban Government has decided to update the country's economic model. The new context is based on:

- The Guidelines for Economic and Social Policy approved in 2011.
- Creation of the Ministry of Industries (MINDUS) in 2012, with the aim of ensuring sustainable and inclusive industrial development.
- The change process to boost the economy or economic development on the basis of greater efficiency and competitiveness, preserving social progress, without leaving any unprotected person.
- Approval of new foreign investment law and the creation of the Special Development Zone in Mariel.
- The adoption of a UNDAF signed by the Cuban Government (including 22 different actors) and the UN system (15 agencies) in June 2013 where UNIDO can contribute to three of the four outcomes agreed in line with the UNIDO Inclusive and Sustainable Industrial Development (ISID) approach.

The economic policy was aimed at enabling higher income generation in the productive sector(s) in Cuba, increase in efficiency, and income distribution, creating the infrastructure for productive activities. At the same time, the long-term goal was to achieve high food and energy self-sufficiency, efficient use of human potential, high competitiveness in traditional productions, as well as developing new production of high value added goods and services. All these aspects are in line with the thematic priorities of UNIDO: poverty reduction through productive activities, trade capacity-building, and environment and energy.

In response, authorities in charge of the selected economic sectors have been proposing a policy package to facilitate the change. Several new policies were approved: food production, packaging, energy, water and recycling.

In line with the economic and industrial transformations above, UNIDO supports Cuba's efforts in investment and strategic alliance promotion, to strengthen its industrial capabilities and competitiveness in priority industrial sectors through the formulation of a Country Programme Framework (CPF).

One of the priority areas in the UNIDO Country Program for Cuba for the period 2016-2020, as per the main outcomes agreed with the Government of Cuba, was to enhance industrial performance and competitiveness of national food industries, improving food supply and security through technological and enterprise upgrading of agro-chemical and agriculture machinery production sector.

Figure 10: Outputs or expected results (ER) on which the project design was focused



Source: UNIDO

II.2 OBJECTIVE

UNIDO was supporting Cuba's efforts in investment and strategic alliance promotion endeavours for strengthening its industrial capabilities and competitiveness in priority industrial sectors through the formulation of a Country Programme Framework, in line with the economic and industrial transformations decided by the Government and with the UNDAF signed for 2014-2018. The Country Programme Framework (CPF) focuses on three main outcomes as agreed with Cuban authorities: a) Improvement of business environment and sustainability; b) Improvement of industrial competitiveness; and c) Attraction of foreign investment. The UNIDO Country Programme Framework for the period of 2016-2020 was signed by UNIDO Director General, Mr. Li Yong and Minister of Industry of Cuba, Mr. Salvador Pardo Cruz, on 2 December 2015 in Vienna, Austria at the 16th Session of the UNIDO General Conference. One of the priority CPF areas as per main outcomes agreed with the Government of Cuba is the development of an Industrial Upgrading and Modernization Programme (IUMP) focusing on priority agro-chemicals and agricultural machinery production sectors.

A UNIDO Country Programme Mission to Cuba took place between 29 June-3 July 2015 which included negotiations with key national stakeholders and several interested potential donors. During the mission, high level officials from the Ministry of Foreign Trade and Investment, the Ministry of Industries (MINDUS), and representatives from the Cuban Ferrous Metallurgy and Machine-Building Enterprise Group (GESIME), the Cuban Chemical Industry Enterprise Group (GEIQ) and other stakeholders endorsed the project concept on Technological and Enterprise Upgrading Programme on the Agro-Chemical and Agriculture Machinery Production Sector (Cuba IUMP). In the Note Verbale from the Permanent Mission of the Russian Federation to the International Organizations in Vienna dated 18 April 2016, the Russian Federation expressed its readiness to allocate US\$ 2 million (50% of the initially envisaged funds) from the voluntary contribution of the Russian Federation to the Industrial Development Fund of UNIDO (IDF) for the years 2016-2019.

IUMP Cuba aimed to contribute to inclusive and sustainable industrial development of Cuba and improve food security through upgrading and modernization of industrial sectors of fertilizers and agricultural machinery. This was envisaged to be achieved through enhancement of industrial performance and competitiveness of pilot enterprises operating in the fertilizers and agricultural

One of the priority CPF areas as per main outcomes agreed with the Government of Cuba was the development of an Industrial Upgrading and Modernization Programme (IUMP) focusing on priority agro-chemicals and agricultural machinery production sector.

machinery industrial sectors within existing industrial hubs. The programme was implemented via three main modules: I) sectoral analysis and building a strategic action plan for the Cuban priority fertilizers and agricultural machinery industrial product lines/sub-sectors; II) enterprise diagnosis and industrial upgrading of selected pilot manufacturing enterprises operating within the priority sub-sectors/existing hubs; III) strengthening human and technical capacities of national counterpart institutions/expertise in the provision of enterprise diagnosis and industrial modernization, sectoral analysis and other best practices.

II.3 CONTEXT OF THE PROJECT

The Project was implemented in alignment with the United Nations Development Assistant Framework (UNDAF) approved in Cuba for the period 2014-2018. In particular, the Project intervention was agreed upon in two priority areas: sustainable economic development, increased food and nutrition security through improved fertilizer availability and agro-machinery supplies.

The proposal and its outcomes were presented in different meetings to integrate all considerations and contributions as well as looking for synergies, such as UN institutions in Cuba, mainly with FAO; European Union Delegation in Cuba; UNDP project "AGROCADENAS" and the Ministry of Agriculture, MINAG.

The most important aspect was to leverage synergies with the AGROCADENA project related to fertilizer demand for specific crops and the information on the diagnosis formulated in the project.

In addition, the objectives of the projects were discussed with two national counterparts: the Ministry of Industries (MINDUS) and the Ministry of Agriculture (MINAG) in order

The Project intervention was agreed upon in two priority areas: sustainable economic development, increased food and nutrition security through improved fertilizer availability and agro-machinery supplies.

to collaborate for the best project outcome and ensure a greater impact supporting inclusive and sustainable industrial development in Cuba. In addition, several rounds of discussions were held with CIQ in Havana, at the "Revolución de Octubre" fertilizers manufacturing plant in Nuevitas.

As local offsprings in Camagüey, and CEDEMA in Holguin, it became clear that the recognition of the local governments of Camagüey and Holguin provinces is important for the project development in these areas.



II.4 COUNTERPARTS

The project’s main counterpart was the Ministry of Industries of Cuba (MINDUS). During the project inception phase, a Project Advisory Group was created, with representatives from MINDUS, the Ministry of Foreign Trade and Foreign Investment, the Cuban Metallurgy and Machinery Business Group (GESIME), the Cuban Chemical

Industry Business Group (GEIQ), other institutions in charge of industrial and agricultural development, related support and research institutions, industrial groups/centers/cooperatives.

II.5 PROJECT TARGET BENEFICIARIES

Direct beneficiaries of the project:

- Industrial enterprises/hubs and cooperatives the Fertilizers and Agricultural Machinery industrial sectors.
- National technical expertise and enterprise support institutions, ministries and other institutions.

Indirect beneficiaries of the project included:

- Final consumers, both local population of Cuba and tourists, thanks to improved and sustainable access to high quality products meeting their demand and requirements.
- In the mid-term – a wider industrial and enterprise community of Cuba benefiting from established enterprise support services.



II.6 PROJECT MANAGEMENT AND COORDINATION

II.6.1 Project funding and Budget

The Russian Federation expressed interest in principle in co-funding of the UNIDO Country Programme for Cuba. In particular, the Russian Federation indicated its readiness to consider co-funding of the “UNIDO Technological and Enterprise Upgrading Programme on Agro-Chemical and Agriculture Machinery Production Sectors” (Industrial Upgrading and Modernization Programme in Cuba or IUMP Cuba) from the budget of the special purpose contribution of the Russian Federation to the UNIDO Industrial Development Fund upon receipt of the project document.

Initially, a total budget of US\$ 4 million was envisaged for the full-fledged project implementation. As per the funding commitment from the Russian Federation, US\$ 2,000,000 was received from the donor. This constituted a challenge for product management in terms of redirecting resources to the activity that the management group determined as fundamental to achieving the project’s objectives, with half of the available resources. US\$ 950 thousand had been earmarked for international experts, of which approximately US\$ 420 thousand were executed under

the new financial conditions. This represents 44% of the planned US\$ 4 million and 24% of the total resources obtained. These expenditures were approved by the project management group, with the participation of key stakeholders.

The largest portion of the total budget, 46%, was allocated towards acquiring technological equipment. 8.3% was allotted to hiring national experts, 3.3% to staff training, and the remaining funds were used for contractual services and other project-related expenses.

The Industrial Upgrading and Modernization Programme in Cuba was funded from the sources of a special purpose contribution of the Russian Federation to the UNIDO Industrial Development Fund.



II.6.2 Project steering

An inter-institutional cooperation approach was used among project stakeholders, including national business associations, exporting and investment agencies, as well as other business support institutions in Cuba, in order to complement Cuban public sector capacities to meet the growing demand in the local market, investment and the development of other technical capacities.

This allowed the project to align with national development strategies, including the Economic and Social Policy Guidelines approved in 2011, and other related national programs; as well as with UNIDO commitments within the United Nations Development Assistance Framework (UNDAF) for the Republic of Cuba 2014-2018 approved in June 2013.

The overall technical management, and coordination of project implementation, was undertaken by a team of male and female project experts, consisting of the International Expert/Team Leader, international experts and national staff headed by the National Technical Project Coordinator, under the technical guidance and supervision of the UNIDO Project Manager at Headquarters. The International Expert led the project's team of experts, and worked closely with the National Technical Project Coordinator and key national stakeholders, and liaised with UNIDO and the Project Working Group.

An Advisory Group was established to support the project implementation team, including the International Expert/Team Leader and the National Technical Project Coordinator, responsible for overall project coordination and management. The Advisory Group served as a platform for public-private sector dialogue, enabling greater cooperation and helping to increase the role and participation of the private sector in the country's efforts towards inclusive and sustainable industrial development.

The Advisory Group consisted of representatives of the Ministry of Industries (MINDUS), and other institutions in charge of industrial and agricultural development, as well as support and research institutions, industrial groups/centers/cooperatives, the Donor and the executing agency (UNIDO). Project Advisory Group meetings were held at least twice a year. Donor representatives participated in the main meetings as observers.

The overall technical management, and coordination of project implementation, was undertaken by a team of male and female project experts, consisting of the international expert and team leader, international experts and national staff headed by the national technical project coordinator, under the technical guidance and supervision of the UNIDO project manager at headquarters.

This governance format allowed for effective project management. Five annual reports (2016/2020) and one partial report in 2021 were reviewed. The project kick-off workshop was held on 21 June 2016 with the participation of more than 20 representatives of local chemical and metal-mechanical sectors, agriculture-soil, and the Embassy of the Russian Federation representing the Donor.

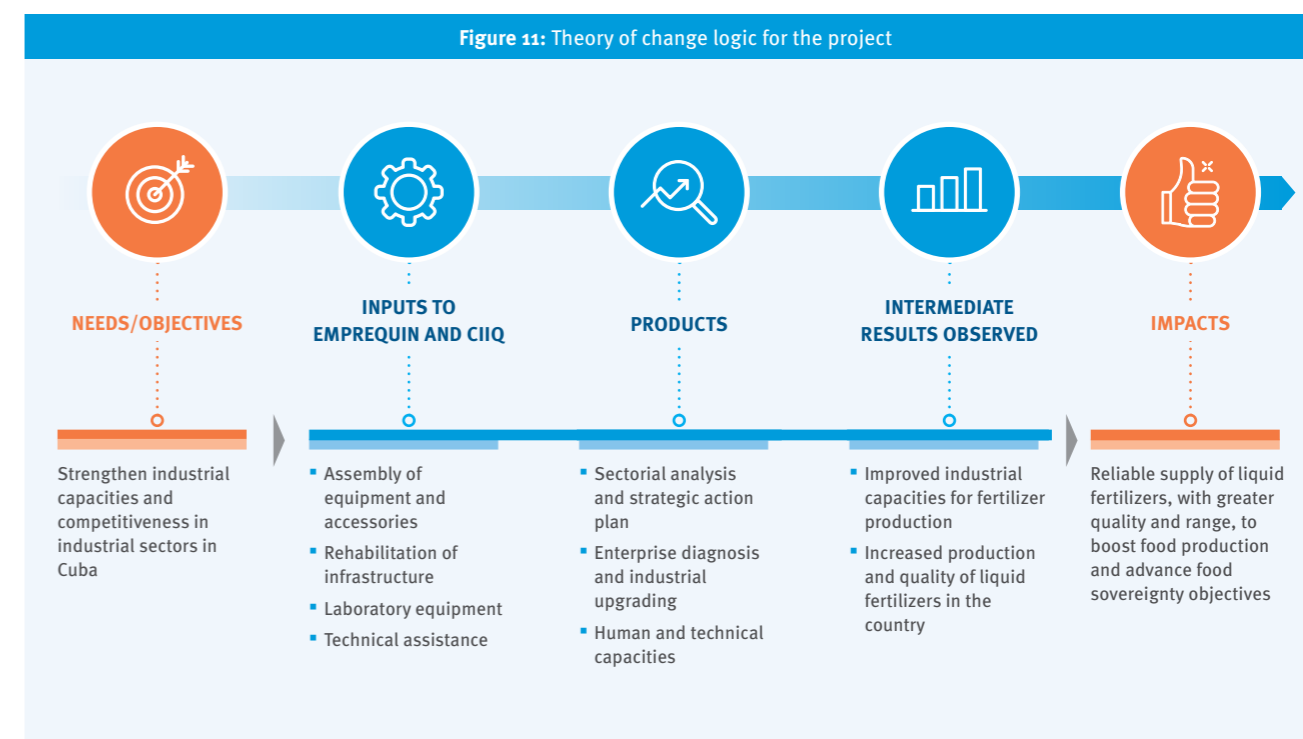
II.7 RECONSTRUCTED THEORY OF CHANGE

Based on the structure and intervention logic of the project and in accordance with the evaluation guidelines, the project's Theory of Change (ToC, see below) was reconstructed during the technical evaluation, identifying the project's causal and transformational pathways from project outputs/components to expected longer-term impact. It schematizes also the conditions to bring about behavioral changes required for long-term impact to take place. These conditions constitute drivers or barriers – some of which are outside the control of the project or of its target enterprises, yet could affect project performance. Regarding results, a distinction is made between

intermediate changes expected to occur by the end of the project as well as those that are likely to produce impact in the long run.

The Theory of Change represents the causal link between: needs/objectives; inputs; products; intermediate results; impact (expected and undesired); facilitates definition of hypotheses to verified; construction of indicators to measure different goals of the program.

Figure 11: Theory of change logic for the project





Project Activities

The official launch of the “Technological and Enterprise Upgrading Programme on Agro-Chemical and Agriculture Machinery Production Sectors” took place on 21 June 2016.

The project’s intervention was elaborated based on the following three outputs:

- I. Sectoral analysis and preparation of a strategic action plan;
- II. Enterprise diagnosis and industrial upgrading;
- III. Enhancing human and technical capacities of national counterpart institutions/ expertise.

III.1 PROJECT OUTPUTS

III.1.1 Output 1



- **Sectoral analysis and preparation of a strategic action plan for development of the Cuban priority Fertilizers and Agricultural Machinery industrial product lines/sub-sectors based on the key food and agricultural crop development needs.**
-
- Identify key pilot beneficiary product lines/sub-sectors within existing Fertilizers and Agricultural Machinery industrial hubs based on the country's priority food and agricultural crop development needs.
 - Conduct comprehensive analysis of production and supply of the identified products to the agricultural sector (both quantitative and qualitative).
 - Analyze local distribution, after-sales services and maintenance network (quantitative and qualitative).
 - Analysis of current local demand and supply and future local demand and supply to cover Cuba's food demand (including general quantitative and qualitative trends in consumption) and of customer and consumer behavior related to Fertilizers and Agricultural Machinery.
 - Analysis of local demand and supply (including general quantitative and qualitative trends in consumption) of Fertilizers and Agricultural Machinery products for farming practices. Consideration of fertilizer composition and application formulas/recipes based on local food crops and soils avoiding over-fertilization and with respective rationalization (or adoption, adaption, customization) in fertilizer production.
 - Carry out benchmarking of priority Fertilizers and Agricultural Machinery product lines/sub-sectors at the local market and compare with appropriate international levels.
 - Produce Gap Analysis Studies for selected and relevant products.
 - Build a road map for further development of the Cuban priority industrial sectors identifying the bottlenecks, constraints and opportunities (SWOT) affecting productivity and supply and define appropriate intervention areas to obtain an enhanced food supply level.
 - Identify partnership opportunities offered by bilateral/friendship agreements (trade, finance, technology, joint venture).

III.1.2 Output 2



- **Enterprise diagnosis and industrial upgrading of selected pilot manufacturing enterprises operating within the identified priority Fertilizers and Agricultural Machinery product lines/sub-sectors/existing hubs through technological modernization, optimization of business processes and improvements of enterprise performance and competitiveness**
-
- Conduct full-fledged diagnosis study and assist in the formulation and implementation of industrial modernization activities at the selected beneficiary enterprises operating within existing industrial hubs.
 - Coach selected beneficiary enterprises on the implementation of comprehensive measures with focus on productivity, quality and industrial performance of enterprises.
 - Identify and procure selected number of appropriate technologies and equipment at the pilot enterprises to improve productive performance in compliance with international standards and technical requirements.

III.1.3 Output 3



- **Human and technical capacities of national counterpart institutions/expertise established/strengthened in the provision of enterprise diagnosis and industrial modernization, sectoral analysis and competitiveness building and other best practices and related services to the Fertilizers, Agricultural Machinery and other priority industrial sectors.**
-
- Capacity building activities targeting staff of relevant Ministries, technical support institutions, sectorial associations, national experts (experts, trainers, engineers and technicians), consultancy centers on UNIDO's approach, techniques, tools and the best practices in the area of industrial modernization, sectoral analysis and market awareness and positioning.
 - Provide guidance and advisory services to the national (technical support) institutions, sectorial associations, professional and vocational training centres on Developing/revising technical procedures related to sustainable industrial modernization according to best international practices; (ii) Conducting respective training activities, including training sessions for development of suppliers, enterprise partnerships and investment promotion for the purposes of modernization; and Producing communication materials related to modernization.
 - Build inter-institutional cooperation between national enterprise associations, export and investment promotion agencies and other enterprise support institutions in Cuba in order to supplement Cuba's public sector capacities to meet the growing demand at the local market, investment and other technical skills development.

III.2 INCEPTION PHASE

On 21 June 2016, the official launch of the project “Technological and Enterprise Upgrading Programme on Agro-Chemical and Agriculture Machinery Production Sectors (Industrial Upgrading and Modernization in Cuba)” was held at the conference hall of the hotel “Palco” in the CUBAINDUSTRIA 2016 International Convention framework. The first technical consultations were conducted after the event, resulting in the approval of the main technical regulations and the project work plan, as well as candidates for the position of the UNIDO Project National Coordinator and National Director.

On 30 September 2016, following the endorsement of the Project Document by the local governments of Camagüey and Holguin provinces, and the final clearance by the Ministry of Foreign Trade and Investment (MINCEX), the **First Project Advisory Group Meeting** was held at the Floridita Hall at the United Nations Office in Havana. Members of the Project Advisory Group include the representatives of the following institutions: Cuban Ferrous Metallurgy and Machine-Building Enterprise Group (GESIME), Center for Engineering and Chemical Research (CIIQ), Development Specialist, Cuban Chemical Industry Enterprise Group (GEIQ), Cuban Ministry of Industries (MINDUS), Development Center Agricultural Machinery (CEDEMA), Ministry of Foreign Trade and Investment (MINCEX). As per the UNIDO Project Document, Representatives of the Donor were invited to participate

in the Advisory Group meeting as an observer status. Also, the representatives of the Ministry of Agriculture of Cuba (MINAG) and “Revolucion de Octubre” fertilizer manufacturing plant in Nuevitas were invited to attend the AG meetings as observers to the Advisory Group.

The project primarily focused on sectoral analysis seeking to clarify and quantify the challenges of the target industrial sectors that needed to be addressed.

The focus of the work plan for the first 6 months of the project implementation was on sectoral analysis, especially with the goal to clarify and quantify the challenges of the target industrial sectors to be addressed by the UNIDO Project. **Sectoral analysis** included an analysis of the relation between production of food and production/ use of fertilizers with special consideration of promoting and reinforcing local production capacities. Furthermore, the study was seeking to establish a quantified relation among production of crops, demand of crops and required fertilizers considering average specific consumptions and yields; suggestions regarding the road map for

investment implementation of the intended Ca-Nitrate and CBFERT ecological liquid fertilizer plant including a rough product evaluation. To verify the current situation and, especially, to identify priorities for suggested actions, a draft for the final study was developed bringing the most influential matters into a defined relation between each other, which allowed providing qualified and prioritized improvement suggestions. The UNIDO National Team provided contributions required for sectoral analysis. For this purpose, the UNIDO National Team had continuous contacts and discussions with the experts from CIIQ, EMPREQUIN and MINAG. As next step, the work plan included the discussion of the findings with fertilizer manufacturing plant, EMPREQUIN in Nuevitas and MINAG on the occasion of the next UNIDO mission in November 2016.

The Project participated in the International Cuban Industry fair FIHAV 2016 on 3-4 November 2016 in Havana, Cuba. The participation at the event facilitated the establishment of partnerships with major producers and suppliers of agro-machinery. Among others, important meetings were held with KhimPromProekt, Russian Federation, and also with the SCHIESS GmbH Company from Germany.

The first working meetings, in accordance to the tasks and obligations defined in the 1st Project Advisory Group Meeting on 30 September 2016, took place between 21 and 25 November 2016. Among the working group Members were representatives from Nuevitas fertilizer manufacturing plant, MINDUS, MINAG and the UNIDO Project Team, who gathered to approve the draft sectoral analysis study, collect additional required information from Nuevitas, and MINAG necessary for finalization of the report. Basis for the discussions for the working meetings of November 21

to 25, 2016 was a comprehensive draft which determined and demonstrated the structure of the project and which simultaneously defined the tasks for the National counterparts.

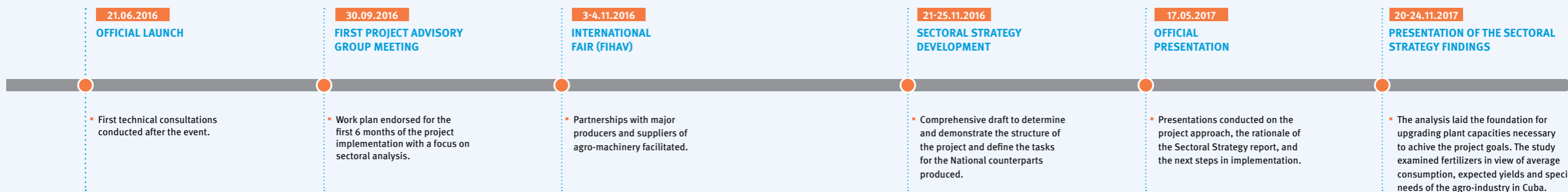
After the first months of the project and once the inception phase concluded, the following milestones and work plans were set up to guide the project in its next steps.

The official presentation of the **Sectoral Strategy for Technological and Enterprise Upgrading of Fertilizers and Agricultural Machinery Industries in Cuba** was conducted at the Headquarters of the Cuban Chemical Industry Enterprise Group (GEIQ) on 17 May 2017 and was attended by several specialists and officers from GEIQ and MINDUS. The presentations included the history of the project, the elaborated findings leading to the presented and distributed Sectoral Strategy report, and the next steps of the implementation of the project.

The findings of the Sectoral Strategy were presented under the topic of “Current and trends in the production and consumption of fertilizers in Cuba” at the International Congress of Agricultural Sciences” AGROCIENCIAS 2017” held 20 to 24 November 2017.

A draft for the one-year **Marketing Plan for Cuban-developed CBFERT Fertilizer plant** was formulated to secure necessary actions to increase CBFERT market share. This marketing plan also contributed to securing necessary resources for production and company growth, as well as to informing employees and stakeholders of company about current status and strategic direction.

Milestones of the Project’s Inception Phase



III.3 INTRODUCING BENEFITS OF CUBAN KNOW HOW AND INTERNATIONAL EXPERTISE FOR NATIONAL CAPACITY BUILDING

Capacity building activities were conducted in various forms, including workshops, trainings, on-the-job coaching sessions, a study tour with involvement of the national counterpart representatives, including MINDUS, MINAG, CIIQ, GEIQ, EMPREQUIN, GESIME, CEDEMA and other stakeholders. A capacity-building program was drafted and shared with the National Partners to ensure its compliance with their needs. Trainings were organized in parallel with the completion of procurement and installation of the equipment at the respective production/research facilities.

Notably, the capacity building activities have been continuously expanded and adapted based on additional requests and guidance received from the project team and affiliated institutions. During and following the Study

Tour of Cuban national experts from MINAG, CIIQ, GEIQ, EMPREQUIN, CEDEMA to Spain, conducted between 30 September - 13 October 2017, the best international practices and know how were demonstrated to national experts and they received specialized training and acquired knowledge and know-how about the state-of-the-art technologies for liquid fertilizers production and their application. The target country for Study Tour was identified based on: (i) availability of extensive expertise and experience in development, production and application of liquid fertilizers and respective technologies, including the country wide research institutions and manufacturing; (ii) relatively comparable climatic conditions for agricultural activities; (iii) extensive experience in development of glasshouse cultivations and existing partnerships

between Cuba and Spain in this area; (iv) advanced level of application of the best practices in agricultural development in Spain and success stories. To get the most effect out of this tour, appropriate Spanish enterprises were identified disposing about exactly the same production plants, to which Cuba is intending to invest.

Following the Study Tour that demonstrated a promising potential of liquid fertilizer production systems internationally and taking into account high quality of project-supported CBFERT liquid fertilizer and its positive effects on crop yields, the Ministry of Agriculture decided to incorporate CBFERT into state fertilizer strategies.

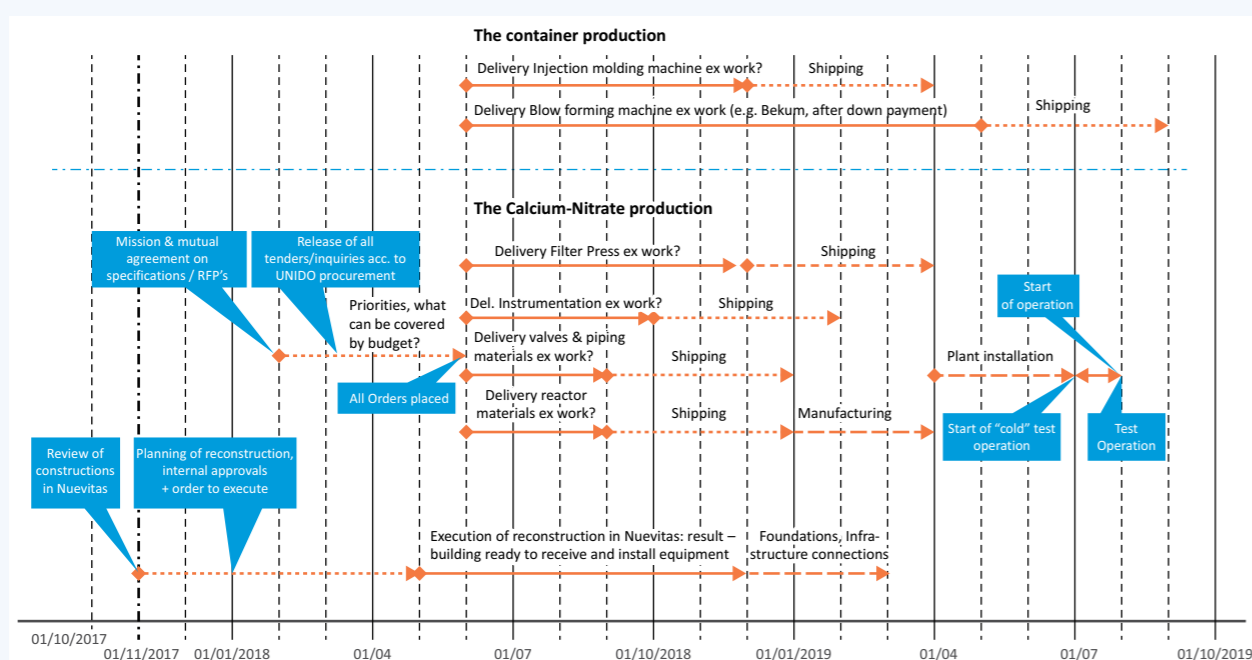
The project as such can be considered as oriented towards national capacity building with regards to the transfer of best practices in engineering and contracting management including sophisticated demands towards process design, equipment specifications and precise procurement procedures to obtain the appropriate goods. National experts representing MINDUS, CIIQ, EMPREQUIN, GEIQ contributed to the completion of the engineering plan for

industrial modernization of the two pilot liquid fertilizer production plants, including development of flow sheet, mass balance, overall budget planning and distribution of required equipment between the national investor and UNIDO.

The project as such can be considered as oriented towards national capacity building with regards to the transfer of best practices in engineering and contracting management.

Furthermore, the basics for the technical specifications of the fertilizer production and agro-machinery were provided by trained national experts. The national counterparts were invited to define additional areas of interest to be integrated into the suggested capacity-building concept.

Figure 12: Work schedule for the establishment of a new Calcium Nitrate liquid fertilizer production plant*



* on the basis of the existing solid fertilizer production Liquid Calcium Nitrate Production Plant, Chemical Company "October Revolution", located in Nuevitas, Camagüey, Cuba

Source: UNIDO

III.4 TRAINING EVENTS AND WORKSHOPS

Continuous coaching regarding the application of the best international practices focusing on project management procedures for technical investments was a constant factor conducive to the project's long-term sustainability. As a result of the continuous coaching and training activities, comprehensive measures to optimize fertilizer production could be introduced at the selected pilot fertilizer plant.

Business coaching and technological guidance was a major component of the project, which can be considered a key pillar of its success. The continuous activities helped overcome emerging problems and allowed national counterparts and beneficiaries to learn from international experts and industry specialists and respond to challenges in the most appropriate manner.

Guidance and advisory services to national counterparts and beneficiaries were provided throughout the project implementation period. MINDUS, MINCEX, MINAG, GEIQ and CEDEMA are the major beneficiaries of the advisory services. This guidance follows the needs identified and outlined in the Sectoral Strategy.

Business coaching and technological guidance was a major component of the project, which can be considered a key pillar of its success.

The advisory services to CIIQ and EMPREQUIN were extended beyond the project implementation with a view to ensure sustainability of the acquired knowledge and skills, thereby providing opportunities to apply and test skills acquired during the development of the modernization plans for two fertilizer production plants in Cuba.

The national capacities and pool of expertise created by the project will continue to provide support to ensure the full-fledged commissioning/maintaining of the Calcium nitrate production plant and launching of the stable and ever-increasing production of the CBFERT/"VITAPLIC Foliar" liquid fertilizer to meet the internal demand and expand export horizons.

III.5 TECHNOLOGICAL MODERNIZATION AND INDUSTRIAL UPGRADING RESULTS

Cuba's prowess in agricultural engineering was the basis on which the project could introduce additional measures which would help reinforce the target sectors in the long-term. The project placed particular focus on technological modernization of the most critical sectors of the Cuban agricultural production: fertilizer and agro-machinery.

Most notably, at the initial stage, a diagnosis of the fertilizer industry in Cuba was made, suggesting that the intervention should focus on:

- the rehabilitation and modernization of the largest and most important ammonium nitrate fertilizer plant in Nuevitas, which will make it possible to significantly reduce imports of other nitrogen carriers;
- the introduction of a Cuban liquid fertilizer production that is based on Cuban proprietary technology and is intended to promote a niche strategy.

This strategy consists in the introduction of a liquid fertilizer system – calcium/magnesium nitrate and the introduction of CBFERT, a Cuban branded fertilizer. Since both fertilizers are liquid (of foliar application), the upgrading program was defined as “Introduction of a liquid fertilizer system”. Both directions (a) and (b) served as the basis for securing Cuba's food supply and contributed significantly to the sector's improved external balance as well as foreign exchange savings.

The diagnosis also provided the need to design the appropriate agricultural machinery for the distribution of liquid fertilizers to the plantations within the cultivation houses, for this reason UNIDO in coordination with the business group GESIME, agreed that the Center for the Development of Agricultural Machinery (CEDEMA), develop a fertilizer for protected crops, for the use of these liquid fertilizers that will produce the industries of the country, reducing imports.

III.5.1 Technological Modernization of the CBFERT/Vitaplic foliar Plant (CIQ, Havana)

One of the project's beneficiaries was the Engineering and Research Center of the Chemical Industry (CIQ), which besides the wide range of scientific and engineering services also produced the nationally known CBFERT

liquid fertilizer, subsequently identified by the project as a priority national fertilizer to increase its production at a larger scale and rebranded into Vitaplic foliar for local and international market promotion purposes.

Figure 13: Modernized CIQ pilot plant producing CBFERT fertilizer



Source: UNIDO

The diagnosis at CIQ's CBFERT production plant revealed that in order to increase production capacity, it was necessary to:

- Improve the dosing system.
- Introduce a heating system to the reactor.
- Use diaphragm pumps for transferring solutions with suspended solids.
- Incorporate a new filtration stage.
- Incorporate a filling system.

The project has facilitated the structural maintenance of CBFERT/Vitaplic foliar production in the plant at CIQ, which included the assembly of 2 geared motors in the reactors, assembly of the three extractors to improve ventilation, assembly of the two centrifugal pumps, a mobile filtration unit and a dosing machine. Also, the assembly of the 20-liter laboratory reactor to obtain essential oils that can be used to obtain new formulas combined with CBFERT/Vitaplic foliar for agricultural use. Transfer of technological equipment, including new laboratory equipment was also facilitated. CBFERT fertilizer had initially been a product developed by CIQ, with thanks to UNIDO it was possible to expand its production capacity and automate its processes. Quality control of liquid fertilizer production was achieved by improving and certifying laboratories.

The test results demonstrated yield increases ranging from 35% to 65% compared to the reference samples.

The Horticultural Research Institute “Liliana Dimitrova” endorsed the technological and social advantages of CBFERT/Vitaplic foliar as it can satisfy the demand for quality fertilizers for fertigation in the cultivation houses, also commending the use of formulas that are easy to handle at the time of making the mixtures. It was experimentally demonstrated that CBFERT/Vitaplic foliar, via its foliar application, supplies nutrients that are directly absorbed and assimilated with the simultaneous contribution of amino acids, vitamins, and minerals that optimize metabolic processes, acting as a stimulant for plant growth, increasing plant resistance to adverse conditions, phytotoxicity, pests, or diseases, increasing crop yields and product quality. Moreover, the environmental impact of CBFERT/Vitaplic foliar is less than

that of other fertilizers, as it incorporates spirulina and reduces the use of chemicals in the soil.

In consultations with the Ministry of Agriculture of Cuba (MINAG), a close cooperation was established within the network of highly qualified soil and nutrition institutes across the country. New joint efforts of the CIQ and IAGRIC were supported to validate the CBFERT/Vitaplic foliar application for the soybeans and corn crops with reference benchmarking compared to the effectiveness of the World's leader in this area. A significant increase in the number of grains in the pods of soybean crops in relation to the control sample was observed.

Field/crop application of CBFERT/Vitaplic Foliar was validated at a large scale at the “Indio Hatuey” Experimental Station in Matanzas province. The innovative fertilizer was tested on the following crops: carrots, beans, cucumbers, lettuce, peppers and tomatoes. The test results demonstrated yield increase ranging from 35% to 65% compared to the reference samples.

The CBFERT/Vitaplic Foliar was additionally tested at the “Experimental Rice Station” in Los Palacios, Pinar del Río province where it will be included in the fertilization technology package. The first tests started in December 2020 and favorable results are continuously reported.

CBFERT/Vitaplic Foliar was delivered to INICA (Sugarcane Research Institute) for evaluation of its effects on sugarcane crops. A site specific test protocol was developed.

Additionally, circular economy related R&D activities were supported jointly with CIPIIM (the Research Center for the Metallurgical Mining Industry) in relation to the production of new fertilizers based on solid waste generated by the CBFERT/Vitaplic foliar manufacturing.

Fulfilment of the contractual commitments regarding CBFERT/Vitaplic Foliar sales was agreed with the Logistics Group of the Ministry of Agriculture.

reached 119 260 liters (1093% increase) in 2021 despite the limitations and restrictions imposed by the COVID 19 pandemic, and other challenging economic conditions.

Due to its high quality and positive impact on crop yields, the Ministry of Agriculture (MINAG) requested to increase the production of CBFERT/Vitaplic Foliar to meet the national demand. According to the MINAG, in 2018 this demand was 10.000 liters, while the demand in 2019 was estimated at approximately 200.000 liters. From 2020 onwards, according to MINAG, it reached 400.000 liters. With the support of the UNIDO project, in 2019 the supply of CBFERT satisfied the demand accompanied by improved quality control measures. The annual production

In order to achieve the foreseen production of 400.000 liters to meet the national demand, sources of raw materials for CBFERT/Vitaplic Foliar liquid fertilizer production, currently mostly supplied by the Ministry of Agriculture (MINAG) depending on the availability of budget, should be diversified to increase the production responding to the high demand for the liquid fertilizer in Cuban food production sector using the project-supported new brand "VITAPLIC Foliar".

III.5.2 Technological Modernization of the Calcium nitrate plant in EMPREQUIN (Nuevitas, Camagüey province)

The Pesticide and Fertilizer Enterprise "Revolución de Octubre" (EMPREQUIN) located in the Municipality of Nuevitas was another project beneficiary. EMPREQUIN's services focused in providing NPK fertilizers to farmers

at the national level and in the context of the project, the existing Calcium Nitrate plant was upgraded to produce liquid Calcium Nitrate with a better quality and the production's manifold increase.

The diagnosis proposed the incorporation of a filter press to improve the quality of the product and replace the settling tanks.

- A filter press and the steel materials for the structural base of the filtration system.

Based on the Sectoral Strategy findings, for the EMPREQUIN Calcium Nitrate plant the project intervention ensured:

- Upgrading of the Calcium Nitrate production technology including delivery of all needed technological equipment;
- Delivery of laboratory equipment for further improvement of the Calcium Nitrate technology.

Main efforts were channelled into the refurbishment works at the existing premises where the new Calcium nitrate production plant was established.

Based on the Sectoral Strategy and the related technological upgrading plan, the following equipment and machinery transfer catering to the needs of the Cuban greenhouse agriculture was accomplished originating from different suppliers and countries:

- A set of laboratory equipment;
- A set of welding and metal materials for the construction of a second reactor, as well as two geared-motors agitators;
- Four centrifugal industrial pumps, a piping and valves system;

The national counterparts reported on significant constraints impeding refurbishment works at the Nuevitas premises that had to undergo partial reconstruction to host the newly established Calcium nitrate plant. In particular, a need in basic structural steel materials in the existing premises (profiles, sheets, welding consumables, anchor bolts, fasteners and paints) was reported. Since the listed materials were only available against hard-currency (in which the country experiences critical deficits), the Cuban partners approached the Project Team with a request to support the procurement of this basic structural steel thereby fulfilling demands in basic materials, which was crucial for the refurbishment of the old building and the launch of plant operations.

The diagnosis of the Calcium Nitrate Plant yielded the following results:

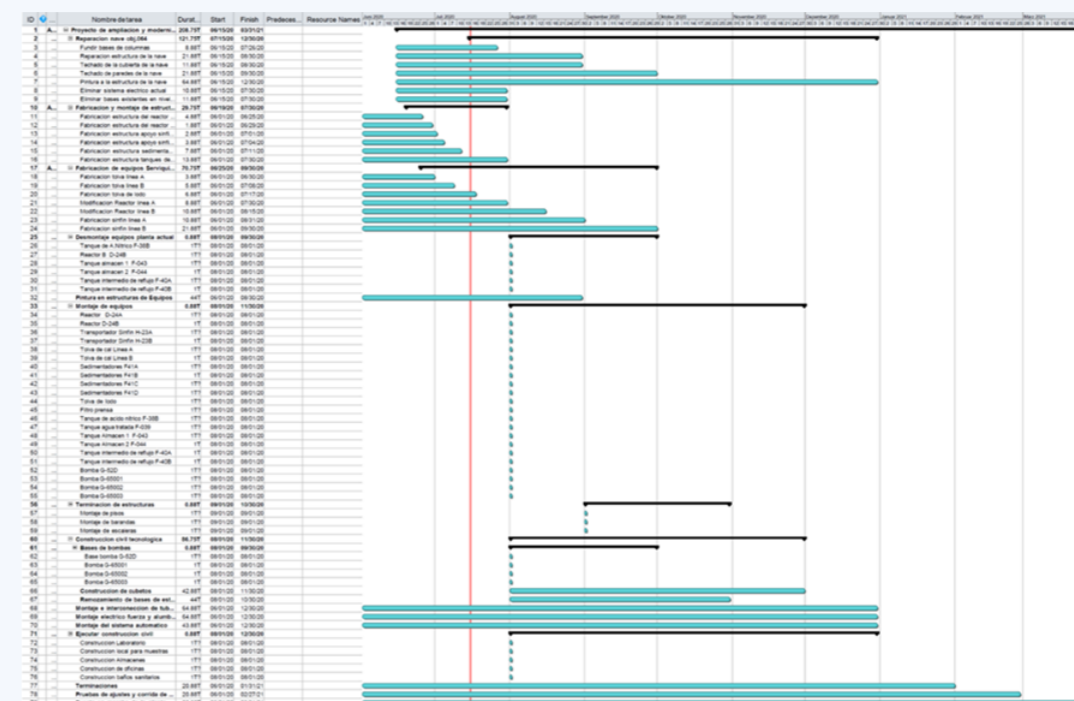
- The plant, comprised of several levels, did not allow the integration of all the elements of the process.
- The laboratory was in poor condition.
- The delivery of calcium nitrate to the settling tanks was by gravity, thus increasing the process time.
- Clarification of the final product was delayed by 24 hours due to the sedimentation process.

Figure 14: Refurbishment process at the calcium nitrate production plant in EMPREQUIN, Nuevitas



Source: UNIDO

Figure 15: Gantt chart showing the schedule for the rehabilitation of the calcium nitrate plant as in-kind contribution of EMPREQUIN to the project



Source: Chemical Industry Business Group (GEIQ)

UNIDO agreed to this request under the condition that the respective infrastructure reparation/installation works would be carried out by the Cuban side. Development of specifications for the required steel materials was initiated in the fourth quarter of 2019. The team finalized the selection of materials, reconfirmation of specifications, review of deliverability, identification of appropriate suppliers. The steel materials were delivered by UNIDO to support the refurbishment works that restarted in June 2020 despite the lockdown.

III.5.3 Upgrading of agricultural machinery sector (Holguin)

In June 2019, the UNIDO technical team assisted the Agricultural Machinery Development Center (CEDEMA) in the development of the initial draft for technical documentation on the potential of liquid fertilizer value chain and its establishment in Cuba. Similarly, the project has reinforced capacities of the CEDEMA's Focal Team by supporting with CIQ, the introduction of the procured equipment to improve the distribution and application of the innovative formula for liquid eco-fertilizers optimizing their performance both in open fields and protected crop areas.

Subsequently, in November 2019, the project team visited IAGRIC to support the evaluation of sprayers' efficiency and their innovation capacities to improve the application of fertilizers. Following the recommendation from IAGRI, CEDEMA developed a new technical proposal based on the delivered sprayers and aimed at adapting the current sprayer design to local application needs. The draft document was finalized and a new prototype was developed to apply fertilizer in greenhouses located in the Eastern region of the country.

In addition, GESIME (Business Group of the Steel-Mechanical Industry) designed a fertilizer spreader for protected agricultural crops, capable of mechanically and efficiently supplying liquid fertilizers to protected crops, having as a background and justification the modernization of fertilizer production plants for the increase and quality of these products, a determining factor in agricultural production.

A new time schedule was formulated by the EMPREQUIN to channel the investment in the Calcium nitrate production plant as the country's in-kind contribution to the Project. The general schedule is depicted in the The Grantt chart (Figure 15), and the investment execution timeline is brought in line with the updated schedule.

These achievements provide basis for further modernization of agricultural machinery sector, as the project had a limited scope in terms of machinery production due to the partial (50%) funding subsequently received for implementation.

The main focus of the project was on upgrading the agro-chemical sector, while laying the foundation for further modernization of the agricultural machinery sector, which will be reinforced upon the receipt of additional funding.

This way, the liquid fertilizer system was reinforced in Cuba and industrial modernization plans were implemented, including the technological upgrading of liquid fertilizer pilot plants and application machinery, hence the acquisition of fertilizer production equipment in Havana and Nuevitas, and the modernization of agricultural machinery in Holguín. Local capacities were reinforced enabling former national project beneficiaries to meet about 90% of the country's current and future demand for liquid fertilizers, based on the Cuban know-how and accompanied by the best international practices and technological upgrading measures introduced thanks to the UNIDO project.

III.6 GENDER MAINSTREAMING PERSPECTIVE

Women benefited from the improvement of working conditions. During the mapping exercise, it was established that mainly women work in the laboratories. As part of the upgrading efforts in the laboratories, female employees benefited from workshops and upgrading activities.

Overall, the project encouraged women to take part in the trainings and benefit from learning opportunities covering different topics and practical skills across the production cycle and related business processes, including management. While the sectors in Cuba are mixed in terms of gender representation, the project activities always ensured women participation to the highest extent possible.

Additionally, women were reported to occupy high-level managerial positions in business entities and research projects in partner institutions UNIDO has worked with and played a crucial role in the overall success of the project. Women were also well represented in the positions in the companies interviewed.

III.7 BRANDING

The project team supported the international patenting and rebranding of the CBFERT product to VITAPLIC Foliar, which would help Cuba's efforts in international sales and marketing. UNIDO supported the development of the brand VITAPLIC Foliar and its visual identity that is now used as the main trademark with a view to unlock the eco-fertiliser's export potential. Both registered trademarks belong to project beneficiaries.

Branding strategies in general contribute to the long-term sustainability of a project, as many previous branding related projects have demonstrated. Brands are recognisable and yield higher sales margin, but do require strategic brand management, which includes strategic positioning and constant efforts to place a product or

Women were also well represented in the project coordinating team. The national project director is a young female manager in the Business Group and the national project coordinator is a woman.

- Women were well-represented on the project's Board of Directors.
- The results of the project generated jobs for women, as well as professional learning opportunities enabling them to improve their competencies and advance their careers.
- Families benefited from more stable incomes resulting from the project.

These results served strategic gender interests insofar as they contributed to a better status and position of the women who were involved in the project.

service internationally. The exposure project beneficiaries enjoyed contributed to their knowledge on these efforts and can help them sustain a level of competitiveness without constant UNIDO intervention.

Brands are recognisable and yield higher sales margin, but do require strategic brand management, which includes strategic positioning and constant efforts to place a product or service internationally.

Figure 16: CBFERT/VITAPLIC Foliar Rebranding by UNIDO Project



Source: UNIDO

III.8 TECHNOLOGY AND EQUIPMENT TRANSFER

- The installation of the CBFERT quality control and laboratory equipment provided by the Project was fully completed.
- The project also supported structural maintenance of the CBFERT/Vitaplic Foliar production plant at CIQ, including, inter alia:
 - » Assembly of 2 gear motors in the reactors, one of the reactors is already in operation with the new gear motor;
 - » Assembly of the three extractors to improve ventilation;
 - » Assembly of the two centrifugal pumps, a mobile filtration unit and a dosing machine;
 - » Assembly of the laboratory reactor 20 liters to obtain essential oils that can be used to achieve new formulas combined with CBFERT for agricultural use.
- As in-kind contribution, CIQ supported infrastructural rehabilitation of the plant by:
 - » Roof and window replacement;
 - » Repair of plateaus;
 - » Construction of a pool to store the solid waste from the production Plant.

The following equipment and machinery for production and application of liquid fertilizers were delivered and installed at the EMPREQUIN Calcium Nitrate Plant production factories in, Nuevitas:

Production plant

- 2 gear agitators and a motor for reactors
- 5 centrifugal pumps
- Filter press including accessories
- Compressed air and service water units for upgrading infrastructure
- Complete set of 64 valves
- Complete set of piping
- Complete set of electrical units and devices for installation
- Stainless steel sheets
- Stainless bars
- Welding consumables

Laboratory equipment

- Flame photometer
- Air compressor, M851, 230V
- Regulator, propane, primary assembly
- Instrument for sieve analysis 100/200/230 mesh
- Waterproof portable pH/ORP/ISE and Temperature meter
- Professional waterproof portable pH/ORP/ISE Meter
- UV-1900 UV VIS spectrophotometer and accessories

Annex A.XII provides a full list of technological equipment provided to EMPREQUIN and CIQ.

III.9 COOPERATION AND SYNERGIES WITH OTHER PROJECTS

The Project was aligned with the United Nations Development Assistant Framework (UNDAF) approved in Cuba for the period 2014-2018 (extended until 2019). In particular, the Project intervention was agreed to be focused on two priority areas: Sustainable economic development and Food and nutrition security in relation to fertilizer availability and agro-machinery supplies. Also, the project was aligned with the new United Nations Cooperation Framework in Cuba 2020-2024.

The proposal of the project and its outcomes were presented in different meetings to integrate considerations and contributions as well as looking for synergies to ensure fine-tuning of the project, (UN Country Office in Cuba, mainly in the inter-agency group “Food and Nutritional Security” and the Ministry of Agriculture, MINAG).

The most important aspects were aimed to the synergies with the actions developed by other agencies of the UN in Cuba in order to increase the food production in Cuba. Likewise, the systematic and fruitful meetings with Dr. Theodor Friedrich, FAO Representative in Cuba, contributed with valuable experience and lessons learned in working with the agricultural sector in Cuba.

In addition, the aims of the projects have been discussed with two national counterparts as: Ministry of Industries (MINDUS) and Ministry of Agriculture (MINAG) in order to collaborate for the best project performance and greater impact on the inclusive and sustainable industrial development in Cuba. Also, sustainable cooperation was established with CIIQ in Havana, the “Revolución de Octubre” fertilizers manufacturing plant, EMPREQUIN in Nuevitas, Camagüey and CEDEMA in Holguin. MINAG considers as high importance the production of the fertilizers involved in the project to comply with the food production plans agreed with the Cuban Government.

The project played a major role in reinforcing linkages and strengthened partnerships between the major national stakeholders in fertilizer production, agro-machinery and food production at all levels (e.g. the continuous integration of MINAG, and IAGRI, missions from CIIQ, GEIQ to Nuevitas and from Nuevitas to CIIQ/GEIQ) were established. A positive outlook could therefore be given in relation to the continuity of the inter-institutional cooperation, that has to be maintained to ensure sustainability of the CBFERT/“VITAPLIC Foliar” liquid fertilizer production and the successfulness of market outreach efforts. Meetings between the main national project partners will continue to take place after the end of the project with the aim to identify all prevailing conditions for the sustainable launching and development of the fertilizer production and agro-machinery value chains involving and benefiting all stakeholders.

The project played a major role in reinforcing linkages and strengthened partnerships between the major national stakeholders in fertilizer production, agro-machinery and food production at all levels.

At the final stage of implementation, negotiations were initiated regarding the R&D partnership with Venezuelan partners with focus on the area of innovative fertilizer production and export potential. This was promoted on the occasion of the respective UNIDO project “Industrial Upgrading and Modernization Program for the Bolivarian Republic of Venezuela” (ID 190068). These negotiations are currently ongoing with a view to arrange a transfer of relevant know how and promote the CBFERT/“VITAPLIC Foliar” liquid fertilizer regionally.

III.10 PROMOTIONAL ACTIVITIES

The opening ceremony of the UNIDO Country Programme for Cuba, comprising the signing ceremony of the three UNIDO projects, including the project “Technological and Enterprise Upgrading focusing on agro-chemicals and agricultural machinery production sectors” (Industrial Upgrading and Modernization Programme in Cuba or IUMP Cuba) was held in 24 June 2016 in Havana in the framework of the International Industrial Exhibition and International Convention “CubaIndustria 2016” at the Havana International Conference Centre and Exhibition Complex “PABEXPO” in the period of 20-24 June 2016.

As part of the marketing strategy, a campaign to promote and disseminate the benefits of locally produced fertilizers was developed and implemented. Specifically, a TV-programme about CBFERT was launched on the Cuban national television and a special episode was prepared to disseminate the results of the UNIDO Project. Additionally, a thematic video promoting the efficiency of the CBFERT application was developed and launched on the national television. On November 26 and 27, 2019, an international TV program “Mesa Redonda” (as part of the thematic category “The Chemical Industry in Cuba”) presented the CIIQ activities, including an episode covering the UNIDO-project upgraded CBFERT pilot plant and its current functioning achievements.

The UNIDO project was featured in a number of global fora, international-, regional-and national level conferences, exhibitions, information briefings and a wide variety advocacy and news materials. The UNIDO Project was subject of a series of presentations and debates held at the II International Convention and Exhibition of the Cuban Industry “CubaIndustria 2018”, the III Congress of the Chemical Industry (Panel Session on Liquid Fertilizers in Cuba), V International Convention Agro-Development, Scientific and Technical Symposium “Chemical Industry for the country’s economic growth and a sustainable future”, Science and Technology Forum (at its different national and regional level editions), GEIQ National Forum, Cuba Forma 2019, etc. These and other events served as a great basis for implementation of the project’s communication campaign receiving an ever-growing attention of local, national, regional and international media coverage.

At the closing session of the “CubaIndustria 2018”, the CBFERT/Vitaplic foliar liquid fertilizer received a Quality Award for agronomic performance and contribution to sustainable industrial development of Cuba and for its technical relevance and agronomical efficiency in addressing the Country’s food security objectives. This project supported foliar fertilizer and its field level results were demonstrated at the GEIQ National Forum that took place in November 2019 in Havana. CBFERT was awarded the First Prize of the Science, Technology and Environment Commission. The obtained field results were then submitted to the Science, Technology and Environment Delegation in Havana to be subsequently included in the nomination “Technological Innovation” in December 2019. As a result, this Prize was received for the development and application of the CBFERT in the Cuban agriculture in January 2020.

At the international level, visibility was provided during “Brand Global Summit”, an annual international forum series co-organized in 2019-2021 by UNIDO and the European Brand Institute (Austria). The project in Cuba and its branding component, namely, the CBFERT/Vitaplic foliar brand, were showcased during three annual editions of the Summit as a sustainability-oriented national branding example that embodies forward-looking eco-branding philosophy that leads to improved food security, job generation and economic development through promotion of local industrial output.

A marketing and value chain strategy was developed with the CIIQ to establish a full-fledged liquid fertilizer production and distribution cycle in Cuba. In addition, the Capacity Building Program was implemented in line with the marketing and value chain strategy of the Project. In this regard, 3 workshops were designed (one for each region: Eastern, Central and Western Cuba) in order to identify skills and knowledge gaps among companies, farmers and cooperatives introducing efficient practices enabling them to apply liquid fertilizers developed within the project. Additionally, this strategy allowed to identify flaws and inefficiencies of the fertilizer transportation system and to propose the best way to do that as part of the newly established liquid fertilizer value chain.

IV

Impact

The UNIDO project has contributed to strengthening fertilizer production and agricultural machinery, thereby improving the quality of products and boosting agriculture in Cuba.

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Based on the results demonstrating significant increases in fertilizer production, the competitiveness of Cuba's priority industrial sectors has improved. The project intervention has also contributed to the development of higher quality and value-added products and processes. Within the project framework, a strategy for branding, marketing, and promoting the value chain at an international scale was formulated for calcium nitrate and CBFERT/

VITAPLIC Foliar fertilizers. This has increased visibility and provided opportunities to unlock the export potential of this innovative local product, especially to developing economies in the Latin American and Caribbean region. The sustainable supply of food in the local market will contribute to food security while meeting the needs of the growing tourism sector. The project has introduced a set of innovative practices that have led to effective industrial modernization in the agrochemical and agricultural machinery sectors, which can be applied in other developing countries facing similar challenges, especially in the Latin American and Caribbean region.



Economic Impact

Improvements have been made in the balance of solid fertilizer exports and imports, as well as in equipment production. The economic results of the CBFERT Plant have increased workers' remuneration by 30% through a performance-based payment system. CBFERT production has increased by 40 times. With two factories, one in the west and one in the central part of the country, there is greater efficiency potential. The Agricultural Machinery Development Center (CEDEMA) has developed a prototype for a fertilizer manufacturer for protected crops, which will use the liquid fertilizers produced by the country's industries in a later stage. The evolution of orders indicates that the quality meets market requirements and customer expectations.



Technological and Social Impacts

CBFERT fertilizer was already a product developed by CIIQ, but thanks to UNIDO, its production capacity could be expanded, and its processes automated. Quality control in the production of liquid fertilizers has been achieved through laboratory improvement and certification. The "Liliana Dimitrova" Horticultural Research Institute supported the technological and social advantages of CBFERT by meeting the demand for quality fertilizers for fertigation in greenhouses, as well as the use of easy-to-handle formulas for mixtures. EMPREQUIM plans to increase the number of people working in the plant and prioritize the hiring of women. The waste generated by CBFERT production is reused as fertilizer in the municipality where CIIQ is located, which has a social impact on agricultural producers.



Scientific Impacts

It has been experimentally proven that CBFERT, when applied foliarly, provides nutrients that are absorbed and assimilated directly, along with the simultaneous contribution of amino acids, vitamins, and minerals that optimize metabolic processes. It acts as a plant growth stimulant, increasing plant resistance to adverse conditions, phytotoxicity, pests, or diseases. Furthermore, it increases crop yields and improves product quality while reducing harvest time, application costs, and usage rates.

By allowing precise dosing and better access to plants, both through roots and leaves, liquid fertilizers prevent over-fertilization and have a higher demand in the market, resulting in increased income for the company. The decision of the Ministry of Agriculture to guarantee the supply of foliar fertilizer based on the improved local production of CBFERT allows the introduction of a new product and generates significant savings for the country. A 40-fold increase in CBFERT production has been requested for the years 2019 and 2020. The Agricultural Machinery Development Center (CEDEMA) has developed a prototype for a fertilizer manufacturer for protected crops, which will use liquid fertilizers produced by the country's industries.

The volume of CBFERT production reached 200,000 liters between January and December 2020 as a result of the implementation of the modernization and expansion project of the plant in Havana carried out by UNIDO. Annual production can exceed 400,000 liters in an 8-hour workday. Achieving these production volumes is related to the limitations and restrictions derived from the COVID-19 pandemic and the economic embargo measures imposed on Cuba.

Yields have increased by 35% to 65% compared to reference samples in carrot, bean, cucumber, lettuce, pepper, and tomato crops, and the number of grains in soybean cobs has increased compared to the control sample. These results were tested and validated on a large scale in the cultivation field of the "Indio Hatuey" Experimental Station in the province of Matanzas.



Annexes



A.I METHODOLOGICAL APPROACH

Industrial Upgrading and Modernization Programme

In developing countries and economies in transition, small and medium-sized enterprises (SMEs) operating in different industrial sectors often lack managerial capacities and have insufficient knowledge of business processes, as well as of operational and production cycles. Furthermore, their performance is often hindered by poor technologies and limited access to finance needed to expand production capacities. Individual SMEs also find it very difficult to deal with policy and regulatory challenges that produce negative impact on their sector or on business performance in general. This results in obstacles and barriers that many SMEs struggle to overcome in order to compete on domestic and international markets. Tackling these challenges in a holistic way will allow SMEs to produce innovative, cost effective, safe, reliable, and quality

products in sufficient volumes, while retaining the value added.

Moreover, in the age of intensified competitive pressures accelerated by the global pandemic, an increasing number of SMEs are forced to turn towards innovation-intensive production and wider export outreach, intelligent marketing and branding approaches, which become crucial in terms of ensuring business continuity amid crises. To help SMEs in developing and emerging economies address these challenges, UNIDO adopts a crisis mitigation perspective taking into account major trends with a view to accelerate inclusive and sustainable industrial development of their industries and SMEs.



The Industrial Upgrading and Modernization Programme (IUMP) aims to contribute to economic growth and facilitate regional integration of developing countries and economies in transition by increasing the capacities of local industries for value added generation, economic diversification,

exports and employment creation. UNIDO advocates that reinforcing competitiveness and innovation helps to create an enabling environment for different economic actors that can take advantage of liberalization and drive economic development and growth.

An Integrated Solution for Industry Competitiveness

A number of internal and external factors play a critical role in the performance and competitiveness of SMEs. Factors related to business environment, industrial and economic policies and support institutions are as important as internal factors influencing production and growth of SMEs. Addressing one or a set of factors in a fragmented and uncoordinated manner is unlikely to enhance SME competitiveness and trade performance. Therefore, the

integrated technical assistance offered by IUMP consists of remedial actions at three levels to maximize industrial competitiveness. A holistic IUMP focuses on promoting competitiveness and diversification of manufacturing sectors along with improving regulatory frameworks and the business environment and reinforcing institutional capacities of technical and business support infrastructure.

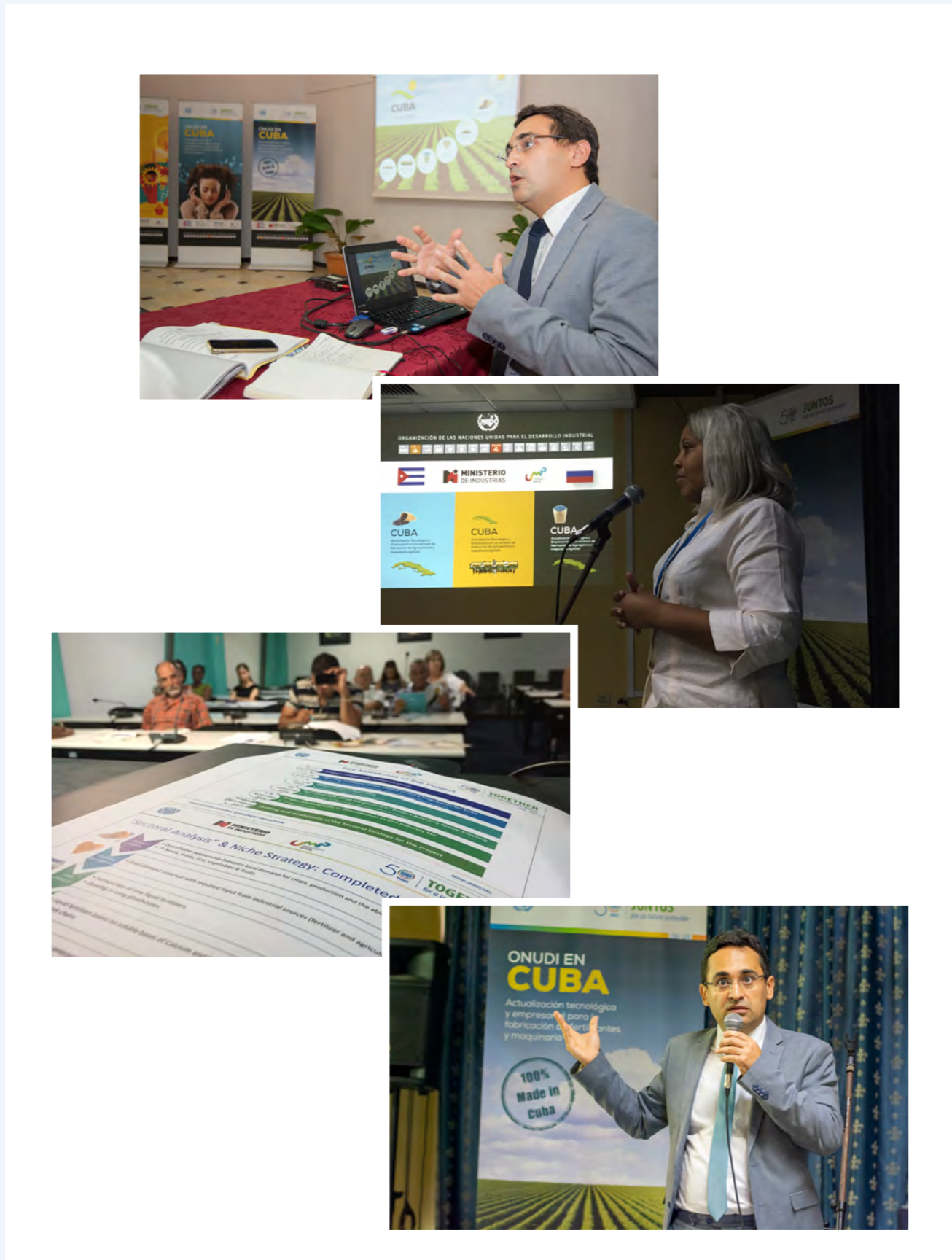
A.II RELATED PUBLICATIONS





A.III KEY PROJECT MILESTONE EVENTS





A.IV AGRICULTURAL MACHINERY ENTERPRISES AND RESEARCH CENTRE (GESIME AND CEDEMA) IN HOLGUIN

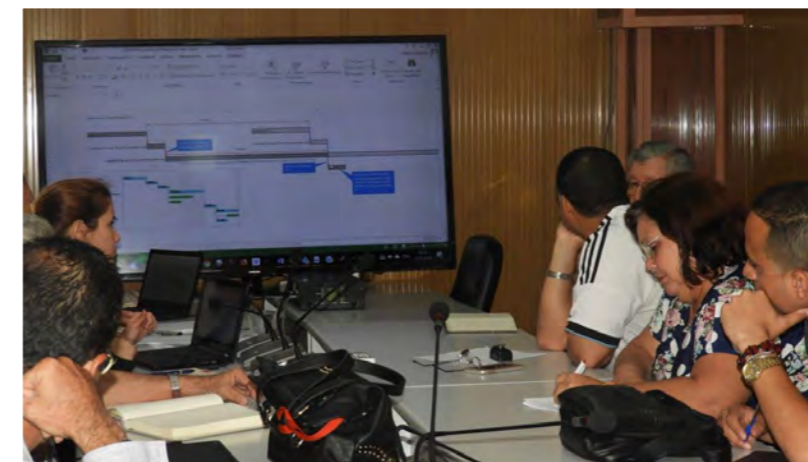


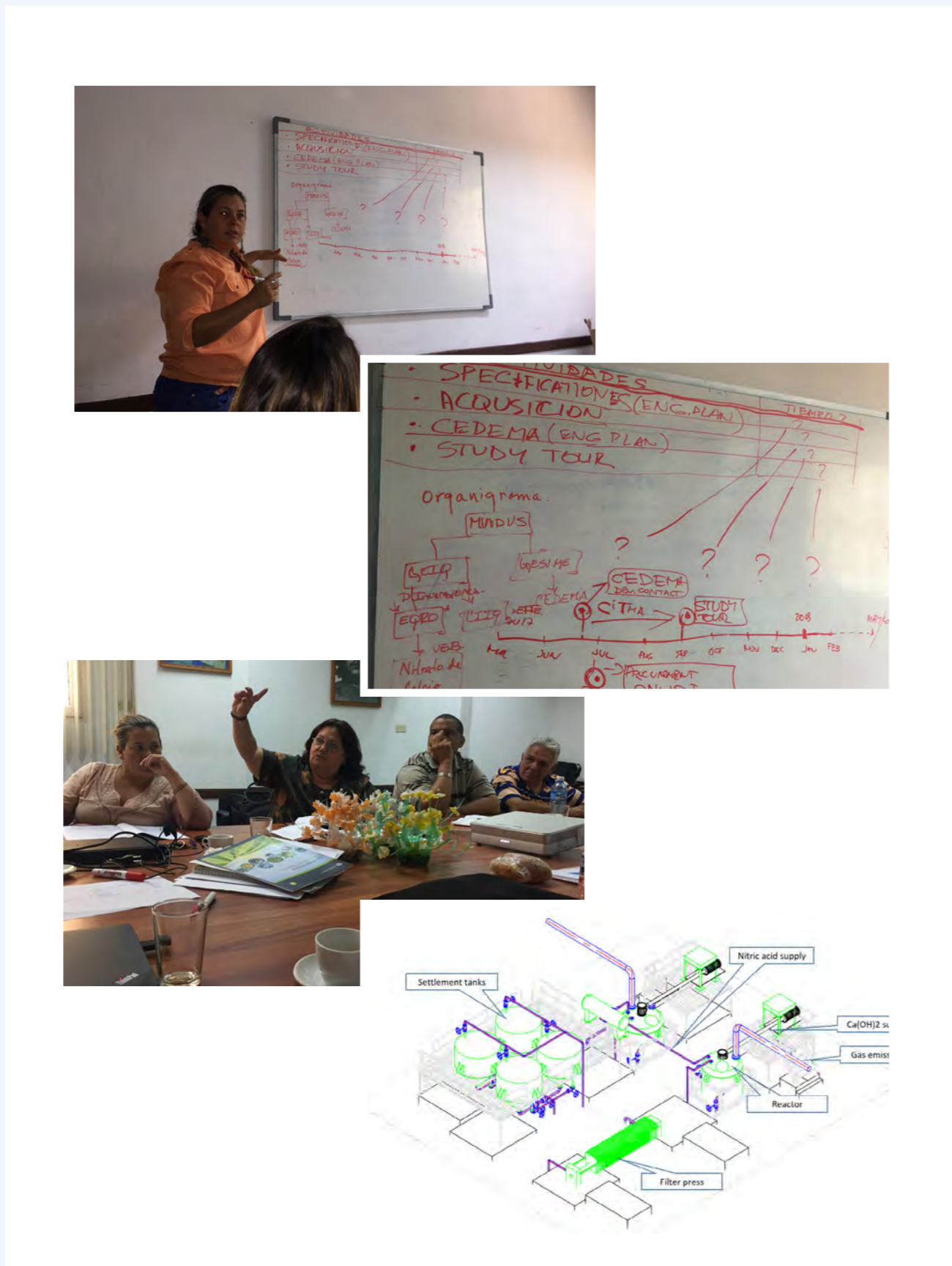
A.V SCOPING MISSION TO THE EMPREQUIN CALCIUM NITRATE PRODUCTION PLANT IN NUEVITAS





A.VI STRATEGIC PLANNING AND COACHING SESSIONS



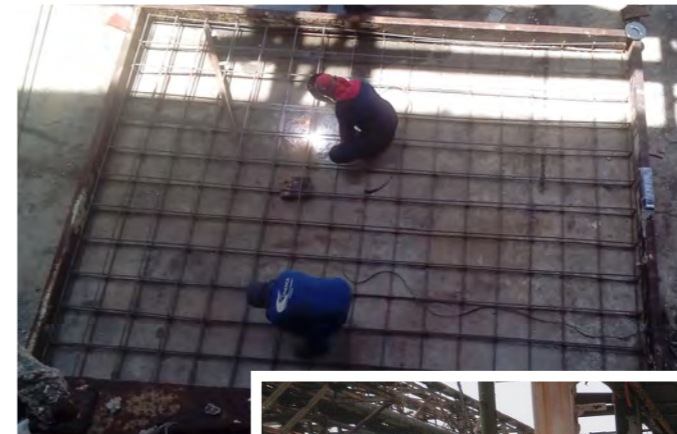


A.VII STUDY TOUR





A.VIII RENOVATION OF THE EMPREQUIN CALCIUM NITRATE PRODUCTION PLANT IN NUEVITAS





A.IX UPGRADING PRODUCTION AND LABORATORY OF THE EMPREQUIN CALCIUM NITRATE PRODUCTION PLANT IN NUEVITAS





A.X UPSCALING CBFERT-VITAPLIC PRODUCTION AT THE CENTRE FOR ENGINEERING AND CHEMICAL RESEARCH





A.XI CONFINDUSTRIA AND AWARD CEREMONY ACTIVITIES



A.XII EQUIPMENT PROVIDED TO EMPREQUIN AND CIIQ

Customer/Technology Type	Equipment	Delivery Status	
Calcium nitrate Plant (EMPREQUIN, Nuevitas)			
1	Laboratory equipment	Flame photometer	Delivered
2		Air Compressor, M851, 230v	Delivered
3		Regulator, Propane, Primary Assy	Delivered
4		Waterproof, portable pH/ORP/ISE and Temperature	Delivered
5		Professional Waterproof portable pH/ORP/ISE Meter	Delivered
6		Instrument for sieve analysis 100/200/230 mesh	Delivered
7		UV-1900 UV VIS SPECTROPHOTOMETER; including accessories	Delivered
8	Production plant	Stainless steel sheets	Delivered
9		Stainless bars	Delivered
10		Welding consumables	Delivered
11		2 gear agitators + motor for reactors	Delivered
12		5 centrifugal pumps	Delivered
13		Sheets, profiles, tools, etc for refurbishment; outside of contract	Delivered
14		Filter press including accessories	Delivered
15		Complete lot of piping	Delivered
16		Complete lot of 64 valves	Delivered
17		Complete lot of electricals for installation	Delivered
18		Compressed air and service water units for upgrading infrastructure	Delivered

Customer/Technology Type	Equipment	Delivery Status		
CBFERT plant (CIIQ, Havana)				
19	Laboratory equipment	4 Fans, 2 ventilators	Delivered	
20		Filtering Tissue	Delivered	
21		Mechanical agitator with accessories	Delivered	
22		Electronic contact thermometer with digital reading	Delivered	
23		Magnetic stirrer with accessories	Delivered	
24		Set of equipment for of termination of nitrogen	Delivered	
25		Ultraviolet and visible range spectrophotometers with accessories	Delivered	
26		Water distiller	Delivered	
27		Muffle furnace	Delivered	
28		Flame photometer	Delivered	
29		Technical precision scale	Delivered	
30		Analytical precision scale	Delivered	
31		Multiformeter pH meter and accessories	Delivered	
32		Laboratory Reactor 20 Liters	Delivered	
33		Production plant	1 Mobile filtration unit	Delivered
34			Agitator with gear motor	Delivered
35			1 Semiautomatic dosing machine	Delivered
36			2 Centrifugal Pumps	Delivered
37	1 Vacuum Pump		Delivered	
CEDEMA (Holguin), CIIQ & IAGRI				
38	Liquid fertilizer distribution	3 Sprayers	Delivered	

A.XIII PROMOTIONAL MATERIALS



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