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Establishment of an Integrated Agro-Industrial Special Economic Zone on Knowledge, Innovation, Science and Technology (KIST) Model in Isabela State University (ISU), Cabagan Campus, Philippines

Bagnos A. Quebral Jr. [1], Dr. Emerson V. Barcellano [2]
Isabela State University, Ilagan, Isabela, Philippines [1]
Isabela State University, Cabagan, Isabela, Philippines[2]
- bagnosarki214@gmail.com

RESEARCH ARTICLE INFORMATION

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ABSTRACT

The existence of a Special Economic Zone in the universities will improve the knowledge and skills of graduates and will create job opportunities for them. Isabela State University Cabagan Campus possesses a potential for KIST development due to its vast land holdings and strategic location. This study aimed to identify the policies and standards of establishing KIST Special Economic Zones to come up with a master plan that follows SEZ standards. Through stakeholder meetings, a proper consultation was made on the magnitude of the development which resulted in the inclusion of desired parks among the residents in the master plan. The survey showed that development shall consist of mid-rise buildings since this is the most preferred type of development among the respondents with mixed-use development for economic benefit. Personal interviews with ecozone development experts were very informative on the restrictions and strategies that may affect the design of the development like the provision of green architecture. The existence of the ISU Cabagan Agro-industrial Center is very important to sustain the needs of the agricultural research and production of the Province of Isabela. It can be concluded that the acceptability of the establishment of KIST ecozone development is highly acceptable from the respondents. All development plans shall follow its carrying capacity to avoid urban sprawl along the university campuses. This study could be submitted

to the SEZ Director of the University for the application of a KIST ecozone development of ISU Cabagan to PEZA.

Keywords: *Knowledge, Innovation, Science and Technology (KIST), Agro-Industrial Special Economic Zone, mixed-use development, master plan, KIST parks*

Introduction

The existence of Special Economic Zone establishments created so much economic activity in a particular municipality. There are samples of countries like Shenzhen, China, that have special economic zones that boost their economy and promote economic growth in their countries. In the Philippines setting, there is an agency called the Philippine Special Economic Zone Authority that is in authority in the establishment of Special Economic Zones. They are the ones who have control over the establishment of Special Economic Zones in the countryside and highly urbanized areas. The PEZA has the power to approve, disapprove, and give penalties among the economic zones. Looking for locators is also one of their major functions which could help the ecozone developer to create more linkages in the SEZs.

All SUCs in the Philippines are mandated to comply with the enforcement of RA 11396 which is known as SUCs Land Use Development and Infrastructure Plan (LUDIP). At present, lots of idle lands are not utilized in most of the campuses of ISU. President Rodrigo Duterte signed Administrative Order No. 18 (AO no. 19) which is mandated to institutionalize the spread of SEZ along the countryside and to enhance rural progress and accelerate human capital including infrastructure development. Thus, there is a need to provide rational, holistic, efficient, utilization, just allocation, development, and management of the country's land resources that is aligned with the principles of social justice, equity, and sustainable development for the betterment of the people.

Moreover, the ISU has large land areas that are not providing economic benefits and are under-utilized because of a lack of a long-term master plan for KIST Park Development, which is now an emerging strategy to capacitate countryside development in the provinces. The municipality of Cabagan is known to be an agricultural land and its potential to be developed into an Integrated Agro-Industrial Special Economic Zone is needed to make it more useful and relevant to the needs of the community. Hence, ISU-Cabagan produces a lot of graduates mostly in Agriculture and Information Technology which will be a good potential to maximize the existence of the proposed KIST in the agro-industrial special economic zone.

In addition, Isabela Province is known to be the second largest province in the Philippines and known to be the number one producer of corn and the number two producer of rice in the entire Philippines. The municipality of Cabagan is in the northernmost part of Isabela which is mainly agricultural land on its land use and its neighboring municipalities like San Pablo, Tumaini, and Ilagan.

Based on the land use cover, the entire Province of Isabela has a total land area of 139,928 ha. of land for corn production, 160,742 ha. of land for rice production, 27,327 ha for banana production, and 17,380 ha. for sugarcane production, which validates that more of the resources of the province are more on agriculture and the existence of the ISU Cabagan Agro-industrial Center is very important to sustain the needs of the agricultural research and production in the province. High-value crops grown in Isabela include mongo, tobacco, coffee, banana, and mango. Its livestock and

poultry industries are also on the rise, especially dairy processing, hog production, cattle breeding, and commercial poultry raising (Figure 1).

Furthermore, the identification of the needs of the development was according to the actual plans of the Planning Department of ISU Cabagan and the Executive Officer with consultation of the public especially its nearby barangays, which resulted in the inclusion of mixed-use development, parks, and green architecture strategies so as not to damage the environment.

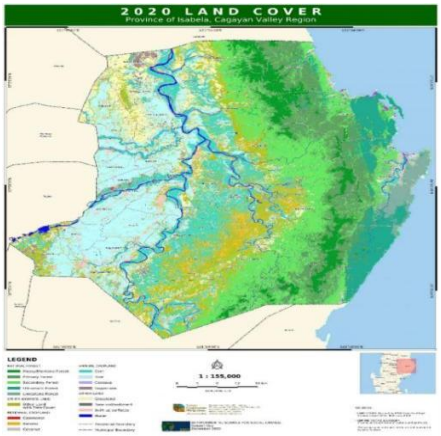

Figure 1. *Land Use Cover Province of Isabela Cagayan Valley Region*
(Source: *https://essc.org.ph/content/wp content/uploads/2021/07/Annex-D.-ILCA-Project-Map-as-of-December-2020-scaled.jpg.)*

Methods

The research design employed a mixed methods approach, incorporating both quantitative and qualitative data to conduct an in-depth investigation into the key aspects of SEZA's strategy development and implementation for sustainability.

Study Site

The study sites were in Isabela State University, Cabagan, Isabela as it has idle land that has the potential for Special Economic Zone KIST development (Figure 2).

Figure 2. *ISU Cabagan Access Road*

Data Collection and Instrument

Primary and secondary data had been utilized in this study using quantitative and qualitative analysis. The data came from ISU management, community, PEZA, LGU, DOLE, and other agencies that support the viability of the Special Economic Zone Development. The use of photographs, cameras, online search engines, and drones were part of the instruments in the data gathering.

Descriptive Method

In this method, the researcher studied the different ecozone development standards and restrictions including the characterization of the different components to be established in each KIST economic zone. A description of the different services offered by the campus was used as baseline data that served as a reference in the ecozone development. It also described indicators in the chosen KIST Special Economic Zone on how it operates through the identification of framework from all sectors that are affected in the SEZ. Geo-political and geographical features of the various locations of the economic zone had been systematically evaluated. Moreover, most of the desired benefits that are already existing in the site like infrastructure development, social and cultural aspects, and other amenities that may be useful in the development were also integrated. Likewsie, identification of the needed urban design development and recommendation of technologies and planning strategies to have a more vibrant and effective ecozone development design of the master plan were also done.

Personal Interview

The researcher conducted a special interview with the PEZA Officials and heads of the ISU, particularly with its President, Executive Officer, and Planning Director of the ISU Cabagan. Also, the LGU officials, department heads, and other experts in ecozone development were interviewed to further strengthen this study. The researcher also interviewed architects that are involved in the ecozone development for further realization of the proposed SEZA. An interview with the Batangas State University officials was also conducted, as they are the first KIST ecozone approved in the Philippines and served as a benchmark for the proponent.

Case Study

The researchers conducted a case study and site visit in similar economic zones, particularly at Batangas State University, which is the first approved special KIST economic zone in the Philippines, master-planned by a renowned architect and environmental planner in the country.

Stakeholders' Meeting

The researcher conducted stakeholders' meetings in all sectors of society to come up with a consensus on the type of development that is relevant and acceptable to the public. This stakeholder meeting served as a basis to adopt some of the suggested developmental constraints and proposals to satisfy some of the viable solutions in the SEZA development. The stakeholders were the ISU officials (i.e., Executive Officer, Planning Director), ISU students, LGU representatives (i.e., MENRO, Barangay officials), and the public to be involved in the development.

Site SWOT Analysis

A site SWOT analysis was also done to identify the restrictions and strengths in doing the master development plan of SEZA. The researchers investigated the possible strengths of the site on how the manner of development should be like knowing the

relationship to its neighboring land use, impact on the environment, and sustainable development. Weaknesses are also vital to include in the study, the researchers made sure that the land use will maximize the best use of the land for economic benefit as well as attaining the sustainable development goals of the municipality. Possible dangers and site design considerations were part of the assessment. Opportunities for PPP BOT and other economic funding agencies are also tackled in this study so that it will have a diversity of resources for funding and involvement in the said development. Opportunities for different specialized employment and synergistic collaboration between the industry and the education sector are more likely to be the top priority of development from which it tends to seek relevant industries. IT innovations and services to be part of the plan of development, opportunities for green building, and innovations were also studied in this research. Threats that had been taken into consideration like environmental threats (i.e., typhoons, flooding, Covid-19, terrorism, and waste management) were considered in doing the Master Development Plan.

Survey Method

A purposive sampling survey method was conducted in Cabagan for the special economic zone, particularly on the criteria preferred and needed in the establishment of an economic zone according to the evaluation of the respondents. The said criteria sought to evaluate the different factors needed in the composition of a special economic zone: educational level, transportation, resource reserves, structure, ecological protection, economic scale, business climate, external communications, development potential, and policy support. The respondents were composed of residents, ISU officials, ISU students, LGU, the business sector, etc. The researchers used a purposive sampling method with almost 60 respondents from different sectors of society in the municipality of Cabagan that are immediately affected by the KIST development. The breakdown is shown on Table 1. The 30 respondents include ISU participants, and 30 are from the LGU, representing community participation, which is deemed applicable in the municipality of Cabagan.

Table 1. Respondents of the Study

Location of Survey	Cluster of Respondents	Number of Respondents
Cabagan	ISU Key officials and students	30
	LGU key officials and residents	30
Total		**60**

Ethical Considerations

The researcher made an affidavit of data privacy to ensure the ethical and moral usage of all data gathered in the study was properly used. Conducted surveys and interviews were provided with written and verbal consent. The conduct of this study conformed to research ethical standards and protocols. The researchers also secured permission through emails and letters to the concerned authorities of the local government units.

Results and Discussion

Policies and Standards in Economic Zone Development

Republic Act no. 7916 is an act for the provision of legal framework and mechanisms for the operation, creation, coordination, and administration of various special economic zones in the Philippines. This Act is the creation of the Philippine Economic Zone Authority under Section 1 of this Article. Section 2 of the policy declaration states that there shall be recognition of the unwavering role of the private sector, encouragement of private enterprises, and incentives for sectors that wish to invest. It also promotes the preferential use of the Filipino workforce, locally produced goods, and domestic materials, and provides strategies to help make them competitive.

Additionally, this policy encourages the government to actively promote, accelerate, and induce a viable and balanced economic, industrial, and social development of the Philippines to promote employment opportunities, especially in far-flung areas like the provinces and rural communities and cities. Its primary purpose is to increase the quality of standard living conditions of the community and capacitate it through the establishment of economic zones along the strategic and suitable locations in the country and create attraction of legitimate foreign investments.

The criteria for ecozone establishment shall be issued by the presidents of the Philippines subject to the evaluation and recommendation of PEZA, based on detailed feasibility and engineering study in conformity with the following criteria:

a) Areas for the proposed economic zone must be in a regional growth center in the Medium-Term Philippine Development Plan of the Regional Development Council. ISU Cabagan is in a regional development growth area.
b) There must be an existing required infrastructure in the ecozone areas such as railways, airports, ports, telephones, roads, and capacity to absorb different improvements. Infrastructure facilities exist, however, railways cannot be seen in the area.
c) Ecozone shall have the availability of an electric source and water supply source for use. ISELCO is evident in the area and Cabagan Water District.
d) The existence of lands for commercial, industrial, and future expansion as well as residential areas shall be available for ecozone workers. ISU Cabagan is located near these areas.
e) Labor force availability like skilled, semi-skilled, and non-skilled trainable workers shall be considered in ecozone development. ISU Cabagan could be a possible source of manpower and its nearby barangays.
f) The development areas must have a noteworthy incremental benefit over the existing economic zones and its future profitability prospect can be established. KIST development will create economic activity around the area.
g) Must be strategically located. The proposed KIST Cabagan is strategically located with good access to land, seaport, and airport in its nearby provinces.
h) The ecozone shall be so located where controls in terms of security can easily be detected especially to curtail smuggling endeavors. DENR, MENRO, PNP exist to ensure security.

Personal Interview with Ecozone Experts

The researchers interviewed experts such as OIC Chief Zone Administrator, Baguio City Economic Zone Manager, and the Ecozone Development Department. On July 19, 2022, the OIC Chief said in an interview with the researcher that the Economic Zone Development of the KIST Special Economic Zone establishment shall undergo a thorough evaluation by the PEZA Board Officials. There is only one PEZA-approved KIST economic zone which is the Batangas State University and there is other two

universities that are in the application stage. KIST's special economic zone purpose should have synergistic collaboration with the industry from which through research and development, both benefit especially in innovation, research, and development. Moreover, the KIST special economic zone can manufacture or produce prototype or model research undertakings which can be subjected to mass production for the industry to use. The KIST special economic zone is limited only to the manufacturing of the research model and industry inside the special economic zone since the land use of ISU is still institutional; however, the land use can still be changed as long as the municipal council will approve its change of land use.

Evaluation and Description of KIST Economic Zone Strategies for Development in the ISU Cabagan Campus

The KIST economic zone in Isabela State University Cabagan was designed in a long-term development plan which is 15 years and is under the actual proposal of the planning department of the University. The researchers integrated all the necessary KIST proposals in ISU Cabagan and conducted survey to meet the needs and demands of the future users of the ecozone. They visited and gathered all baseline data on the unique and different KIST proposals of the Echague Campus with large land holdings and integrated it into the master development plan of the ecozones. A site SWOT analysis was conducted in the development area, revealing that most of the required infrastructure is already in place, including power supply, road networks, telecommunications, water supply, transportation access, and nearby airports, which are the primary requirements of PEZA. Based on the land use cover of the entire Province of Isabela, it has a total land area of 139,928 ha. of land for corn production, 160,742 ha. of land for rice production, 27,327 ha. for banana production, and 17,380 ha. for sugarcane production, which validates that more of the resources of the province are more on agriculture and the existence of the ISU Cabagan Agro-industrial Center is very important to sustain the needs of the agricultural research and production in the province.

The site is strategically located as a center for development growth, aligning with PEZA's primary aim of fostering economic activity in rural areas to aid in community capacity building. The site's characteristics are favorable for development, with generally flat to gently sloping terrain at the Cabagan Campus. It offers large areas for development, making its carrying capacity for KIST ecozone development substantial and beneficial not only to ISU but also to the LGU and neighboring communities.

According to the result of the survey conducted, most of the respondents in the Cabagan campus agreed on the establishment of KIST park inside the ISU Campus. The majority of the respondents are low-income earners but have a college education and could potentially serve as manpower for the KIST special economic zone. The development approaches were categorized as follows:

Development Potential

Biking and walking are the preferred means of transport for future users, which have been integrated into the site development plans of the master plan. This includes bike lanes, bike parking, and ease of access for persons with disabilities (PWDs).

SEZA Structure

The design of buildings and the built environment in the KIST ecozone is modern, emphasizing a high-quality urban environment. A central feature of this design is the urban park, intended to create a vibrant atmosphere conducive to work. The park is

also envisioned as a space for social interaction, particularly during leisure time, and is designed to mitigate urban heat island effects by providing natural cooling elements. Respondents favor a mixed-use development approach for land use, which will be incorporated into the KIST Ecozone's master plan. Fiber optics and internet connectivity are among the owner's recommendations, ensuring that even park visitors have access to high-speed internet, aligning with the ecozone's vision as a hub for economic activity.

Ecological Protection

Acceptability of the use of renewable energies can be seen in the different rooftops of development like solar panels to maximize the energy coming from the sun. Green building principles were integrated through proper orientation, choice of environmentally friendly building materials, and tropical design principles through cross ventilation on some parts of the master plan. A flood retention pond and provision for flood tunneling devices would be part of the KIST master plan located along the parking area. Heat detector devices and automatic fire sprinkler systems are part of the master plan to ensure the safety of well-being and properties inside the special economic zone. Material recovery facilities, sewage treatment plants, and hazard vaults ensure public health safety in the master plan.

Economic Scale

Part of the policy in the KIST economic zone is to create international linkages through research and development and develop a knowledge economy. Commercial establishment and knowledge of research and development industries are part of the development in SEZA KIST. Facilities like FABTECH and the convention center can be used by local researchers in the province which can house state-of-the-art facilities like 3D printers, laser cutters, mechatronics, etc. Most of the preferred locators had been foreign direct investments; however, provisions for local investors are also advised in the development. Small-scale eateries and merchandisers are included in the development plans for highly populated areas, aiming to provide food and other goods and services that can ignite local entrepreneurial efforts and contribute to economic stability.

Business Climate

Most respondents agreed to offering 4 to 6 years of tax incentives for new businesses as part of SEZA policy, including tax holidays. However, there is a need for an Information Education Campaign (IEC) in the Cabagan area, as many respondents are neutral towards tax incentive programs. Tenants and locators practicing green technologies will receive tax incentives, a policy to be recommended within the ecozone framework. Export-oriented manufacturing and service-oriented products are deemed acceptable within the economic zone, signaling that foreign direct investments are viable within the KIST economic zone. Residents in the KIST location support working within the Special Economic Zone, validating the appropriateness of establishing the ecozone. Foreign employees are welcome in the KIST ecozone, subject to certain restrictions as per PEZA requirements for employment policies.

External Communications

A fast internet connection from which fiber optics connectivity is evident and part of the master plan. The KIST website would be produced by the ICT Department of ISU specifically for the economic zone to provide knowledge and advertisement among other future locators and users. Part of the policy and process of information dissemination

is the promotion through newspapers and publications for advertisement. Social media advertisement and TV networks in the KIST economic zone are parts of the marketing strategy.

Policy Support

Part of the master plan policy is giving penalties for violators to ensure environmental sustainability and livability. Tax discounts for environmentally conscious businesses serve as a policy for the LGU to implement and for approval. Businesses collecting waste for implementing 4Rs are also given tax incentives. This would lead to a healthier and more environment-friendly community inside the economic zone. Budget allocation for research and development is vital in the sustainability of the sustenance of the ecozone to ensure gaps that need to be addressed while it is in operation. In case the availability of funds needs more alternative BOT between investors, the LGU can serve as a funding source, as agreed upon by the respondents. If ever the availability of funds needs more substitute, public private partnerships between foreign and local investors and LGU can be a source of funds. Participation of LGU to ensure peace and order inside the KIST master plan is the primary factor that would mitigate insurgencies along the areas that can hamper the economic activity within the special economy and gain full trust among the investors.

Green Architecture Development Approaches

The use of green architectural technologies, such as provision for rainwater harvesting in all buildings to be installed at the lower basement level and reused for toilet flushing, will help in reducing water consumption, especially during the rainy season. Solar panels on rooftops are part of the renewable energy usage strategy to minimize environmental impact, particularly during the summer in the tropical Philippines, maximizing heat energy for green energy strategies in the master-planned KIST ecozones. Low-e glass on the glass curtain wall and tempered glass cause lesser heat gain in the building to reduce the amount of cooling required for air conditioning during the hot season. However, the use of air-conditioning units is inevitable, which is why it is recommended to use eco-friendly air-conditioning units available in the market.

Cross ventilation and the use of natural daylight are part of the design to maximize wind and control sunlight to achieve proper thermal comfort inside the building. A green wall was also integrated into the design to mitigate the urban heat island effect of the building and attract more biodiversity within the area. A retention pond was provided to catch rainwater to prevent flooding within the master-planned KIST special economic zones. Bicycle lanes, bike parking, and e-trikes were provided in the master plan to minimize the carbon footprint within the development, creating a pleasant urban design for walks that can create an ambiance making the users less stressed and enjoy the master-planned KIST development with good place-making in the design. The use of louvers can serve as wind shutters during a typhoon, particularly in areas of buildings with a large number of glass panels. All parking spaces have deciduous trees on their center islands to create natural sun shade among the parking areas and prevent urban heat island effects. The center of the parking space is specified to have grass created to make it more permeable, allowing rainwater to percolate at the center of the parking spaces.

In addition, automatic sprinkler systems, building maintenance, and utility digital monitoring systems are advised to be installed in all buildings to ensure proper monitoring and data bank management on the energy usage of the entire development plan, including its protection during fires and other catastrophes. Heat-detecting

monitoring devices on all workers are placed at the entrances and exits of the buildings in case the proliferation of COVID-19 and other viruses is easily detected. A designated quarantine room per building is designated in the design to make it less accessible to the public. MRF and Vermiculture will create a better waste management facility in the area, and sewage treatment plants and hazard vaults will ensure good environmental quality in the KIST park, which is one of the major requirements of the ECC or environmental compliance certificate from DENR. All large buildings shall have built-in STP in the area so that wastewater will be properly treated.

The park was integrated since it was suggested by the residents during the stakeholder meeting. This park will serve as an open space for evacuation during earthquakes and will serve as a lung of the entire KIST development. All paintings shall be low Volatile Organic Compound paint, which is naturally a more sustainable solution and less harmful to the environment than traditional paints. All paintings of institutional buildings are generally white, and commercial buildings are painted white because white is an easy and effective way to help mitigate the effects of climate change by keeping spaces cooler than if they are painted in other colors. It can also cool surfaces by 8° Fahrenheit (4.4C) under strong sunlight during noon hours. Painting walls and roofs white to deflect heat has been done for centuries

Construction Management Strategies

A construction project management team will be formed by ISU management to ensure good quality of the buildings from design through bidding, construction, and operation, similar to the benchmark set by KIST SEZ. Soil tests must be conducted in all construction areas to ensure proper structural design in all buildings, emphasizing value engineering.

Regarding construction management, the researchers advocate for the use of excavated foundation debris (escombro) and lastillas for backfilling all necessary areas, eliminating the need to source soil from other locations. The use of I-beams, wide flanges, and metal decking in the structural system allows for faster completion compared to conventional methods that require 28 days for each concrete pour. This approach reduces noise, especially in areas with high biodiversity and ecological sanctuaries near the KIST site in ISU Cabagan.

Furthermore, precast concrete, pre-engineered steel frames, prefabricated SRC wall panels, and earthquake-resistant EPS panel systems are recommended construction methods for walls. These methods are faster, more efficient, and provide well-insulated panels suitable for tropical climates, reducing heat gain inside buildings and facilitating easier installation.

Likewise, the water system in KIST development will utilize wind-powered and solar-powered pumps. Automatic transfer switches will be installed in all electrical systems to enhance efficiency during power loss. Emergency lights and alarm devices will be included in the development plans to safeguard life, health, and property within the ecozone. Master-planned KIST zones will include provisions for open spaces for development and parks for recreational activities.

Profile of KIST Cabagan Campus

Natural Profile

The natural profile of ISU Cabagan is situated at the foothills of the Sierra Madre and near a sanctuary, making it ideal for future users to relax and enjoy the natural landscape, especially after office hours. Most of its land is currently used for agriculture,

highlighting the timeliness of establishing an agro-industrial area that will manufacture agricultural products such as biofertilizers and feed mills within the ecozone.

Due to its proximity to a sanctuary, the researchers recommend using fast construction materials and equipment to minimize pollution during building construction. The natural landscape of the KIST site has a 5 to 10% slope on its rear portion, suitable for locating the agro-industrial building. Large vegetation and a small creek are visible on the lower right side of the lot, which the researchers plan to incorporate as a natural retention pond. All development plans prioritize locating in less hazardous areas in harmony with the environment. Nearby attractions like Malasi Lake and Mabuaya Foundation offer potential leisure and educational opportunities for users. Most neighboring lots surrounding the site are used for agriculture and animal production.

The existence of the Cagayan Economic Zone Authority (CEZA) is crucial as it offers potential partnerships for all economic activities within the ecozone. There is an existing solar power farm at the rear of the site, which can serve as an energy source for the agro-industrial economic zone if needed. Utilizing biogas as an energy source is part of the master development plan to enhance sustainability and self-sufficiency. Three potential access points—via the agro-industrial area, oval area access road, and IT BPO area—aim to reduce traffic congestion in the vicinity. The development includes provisions for vertical gardens and vegetation to cool the environment and enhance existing biodiversity. All glass used is tempered for high resistance against shear and torsional forces from typhoons and earthquakes.

Typhoon and Earthquake

The KIST site is located in a tropical country and experiences approximately 20 typhoons annually. The researchers took this into consideration; therefore, most of the buildings were equipped with wind shutters, louvers, and low-e glass to ensure thermal comfort inside. Flood retention ponds and flood tunneling devices were incorporated into the master plan. The earthquake fault line is situated far from the site, ensuring safety from the devastating effects of earthquakes. The researchers recommend conducting soil tests and structural analyses for all buildings before designing their components (Figure 3).

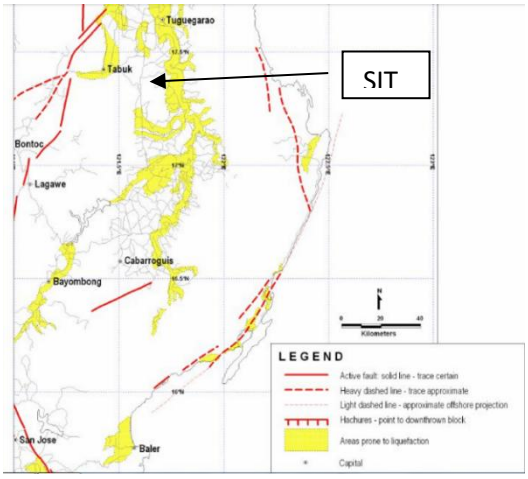

Figure 3. *Earthquake Fault Line Map*
(Source:http://www.phivolcs.dost.gov.ph/index.php...)

Educational Profile

Most residents of Cabagan are highly educated and are potential employees for the special economic zone. ISU Cabagan offers courses in Agriculture, IT, Business Management, Education, Forestry, and Environmental Management, which could serve as the top priorities and main sources of manpower for the ecozone.

Social Profile

The people of Cabagan are mostly Ybanag, known for their strong family ties and dependence on agriculture for livelihood. Most Cabagan residents primarily consume meat and rice daily, necessitating a large supply to meet their food needs. Professional development in the municipality is rapidly growing, indicating that the special economic zone's viability is pertinent, and reducing the need to seek manpower resources from other towns. They celebrate festivals like the Pansi Festival, showcasing their love for food, meat, and rice, highlighting the relevance of an agro-industrial zone for sustainable community development and self-sufficiency in agricultural products. Given their educational and technical capabilities, diverse employment opportunities such as IT-BPO, business, and hospitality services offer them avenues to enhance their quality of life beyond agriculture. ISU management has a vision to enhance research and development in Cabagan, crucial as it serves as the economic hub among neighboring municipalities like Sta. Maria, Tumaini, and San Pablo.

Evaluation and Description of KIST ISU Cabagan Through SITE SWOT Analysis Site Description

Its location is highly viable due to the gently sloping terrain in the industrial zone area, offering 42 hectares for land development. Existing electricity, road networks, and communication interconnectivity in the area also meet the policies required by the PEZA administration

***Site SWOT Analysis* Strengths**

- The site is accessible through an existing road network.
- It has large-scale land development for the KIST Special Economic Zone
- Land use development on the campus is well-established by the Planning Department.
- Sports ovals can be utilized for daily exercise among the users of the ecozone.
- Good mountain view of Sierra Madre at the back portion of the site.
- Near poultry and livestock warehouses.
- Supportive political affiliations of LGU Cabagan.

Weaknesses

- The location is quite far from the main entrance of the campus.
- There is no existing drainage system.
- Some residences on its frontage exist and become an eyesore.
- Sports ovals may produce unwanted sounds.
- More security facilities are needed in the area.

Opportunities

- Opportunity for mixed-use development is possible for income generation.

- Hotel and research facilities can be proposed and utilized by the students for OJT.
- Investors like BOT and PPP can be a possible joint venture to fund the proposed project.
- TESDA and DTI can collaborate in the KIST ecozone. Manufacturing prototype opportunities produced by research and development are possible.
- Foreign linkages and synergistic collaboration through research and innovation are possible.

Threat

- Typhoons are common in the area and earthquakes are evident.
- Coronavirus disease

Evaluation and Description of KIST ISU Cabagan Through Stakeholders' Meeting

A stakeholders' meeting was held on July 16, 2022, at the Barangay Angancassillian community center, with invitations extended to affected nearby barangays. The meeting included MENRO officials from the LGU municipality, the Planning Director of ISU Ilagan, the Executive Officer of ISU Cabagan, and students. Consultation with affected communities regarding the establishment of the KIST economic zone sought their input on plans and identified issues for consideration in the master development. The researchers queried stakeholders about potential community concerns to ensure consensus and inclusive development in crafting the ecozone's master plan. One such concern was whether local residents would have job opportunities within the ecozone. The researchers assured the public that residents are the top priority in the development plan, per PEZA requirements, with much of the workforce expected to come from Cabagan.

Another pressing stakeholder issue was whether the operation of new facilities would create pollution and possible interventions to mitigate it. Through green architecture and sustainable development principles like industrial symbiosis, the researchers elucidated how these approaches would mitigate climate change impacts from development. Residents also asked whether they could invest in potential opportunities for profit. The researchers then clarified that PEZA would assist in attracting both foreign and local investors to drive economic growth.

Moreover, major transportation concerns included bus services, tricycles, and biking lanes integrated into the development plan to improve mobility and safety within the ecozone, particularly for students. A family picnic park was designed to provide leisure and quality family time. Residents expressed hope for expanded course offerings, such as engineering and law, within the campus. These considerations were integrated into the master plan to foster a live, work, play, and pray environment in the development.

The proposed Integrated Agro-industrial (KIST) special economic zone at ISU Cabagan Campus strategically sits on the northernmost part of Luzon, approximately 49 minutes from Tuguegarao City International Airport (Figure 4), and three hours from the port of Aparri, Cagayan. Envisioned as an agri-industrial KIST economic zone, it aimed to maximize utilization of its 42 hectares of available land. Consideration of local manpower resources, particularly in dominant and competitive fields, is pivotal to serving both local and international transactions.

Figure 4. *Location of Integrated Agro-industrial (KIST) Special Economic Zone ISU Cabagan Campus*
(Source: Google Maps)

Result of the Designed Master Plan for an Integrated Agri-Industrial Special Economic Zone with Knowledge Innovation Science and Technology (KIST) Development

The KIST Park in ISU Cabagan survey results show that IT and BPO have the highest priority among respondents, with a turnout of 28.33%, followed closely by agriculture at 26.67%. Fabrication Technology Building, along with agri-tech innovation, feed mill production, palay and corn production, fertilizer production, and food processing, are designed to provide suitable venues for international and local productions, inventions, and discoveries in fabrication and modeling. The master plan (Figure 7) includes hotel and agro-industrial warehouses, as well as nurseries for research purposes. Biomass facilities in the agro-industrial zone ensure sustainable energy sources. Structures are predominantly less than 6 stories high, maximizing land use efficiency and promoting compact development. This is aligned with the survey results conducted by the researchers. Development plans, as proposed by the researchers, in collaboration with the Campus Planning Director and Executive Officer, reflect the survey's findings indicating the necessary scale of development for the Special Economic Zone's viability.

Based on Figure 5, the building designs prioritize walkability with well-planned access roads and optimal facility locations to enhance interfunctionality and service delivery. Green technologies, such as rainwater harvesting, solar panels, and intelligent building technologies like heat-detecting devices, are integrated into the development to mitigate the spread of diseases like COVID-19 and other communicable diseases. Parks are integrated into the design, catering to stakeholders who prefer parking within the Special Economic Zone. Commercial establishments, including food chains and banks, are also incorporated to meet diverse service needs. The Ecozone Administration Building plays a pivotal role in managing transactions within KIST, while the inclusion of hotel accommodations in the master plan ensures proper lodging for foreign and local researchers and visitors, thereby supporting the university's mission to lead in research. This infrastructure is intended to generate income for the university and foster a collaborative ecosystem between industry and academia, driving economic growth through knowledge generation both locally and internationally.

An iconic building design aimed to celebrate the cultural heritage of Cabagan and ISU, incorporating metaphors such as agricultural symbols (like corn granules and

palay), digital motherboards, and a salakot entrance to reflect Filipino cultural values. The Master Development Plan for ISU Cabagan (Figure 5) emphasizes creating a vibrant and conducive work environment for ecozone workers and visitors. Interconnected buildings with sky bridges promote walkability and easy access between facilities. Below-ground features, such as flood tunnels capable of holding 3,375 cubic meters of rainwater (instead of retention ponds), double as flood-mitigating devices. Harvested rainwater is used for fountains and plant irrigation. The fabtech buildings on-site facilitate prototype fabrication in IT and Agriculture, with upper floors designated for research and lecture rooms, an archives gallery, and conference areas for locators and ISU management.

Furthermore, the Agri-Tech Building and IT BPO Center provide dedicated research spaces for industry partners and projects within the KIST economic zone. The building facade features perforated metal sheets and incorporates corn granules as design elements, symbolizing its focus on the international and local agricultural knowledge economy. The IT BPO Innovation Center supports business process outsourcing and IT innovation, accommodating international locators, exchange students, ISU students, and residents alike. A 1500-seat convention center serves as a venue for conferences, aligning with ISU Cabagan's vision to lead in research within the ASEAN region (Figure 6). Waste management strategies include vermiculture facilities, Material Recovery Facilities (MRF), sewage treatment plants, and hazard vaults, strategically placed for efficient plumbing connections and engineering optimization.

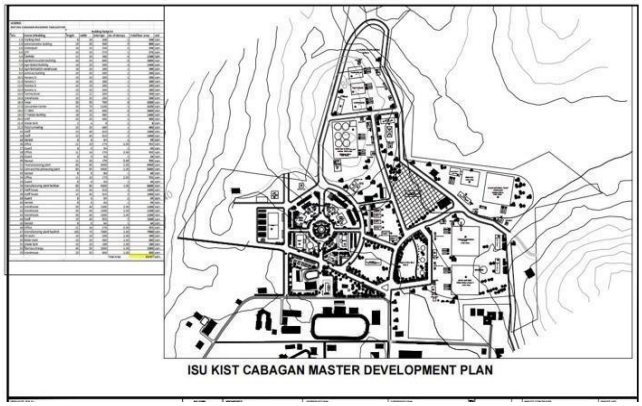

Figure 5. *ISU Cabagan KIST Park Master Plan*

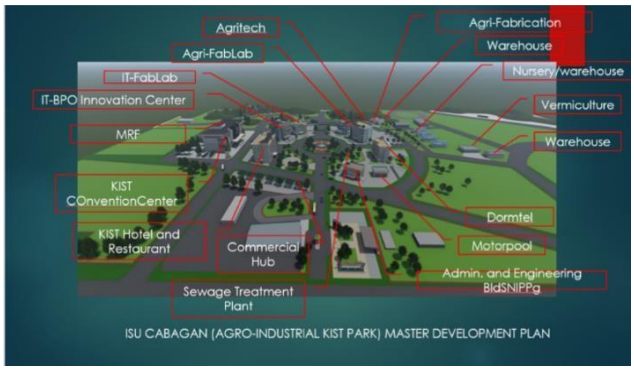

Figure 6. *Aerial Perspective (Master Plan)*

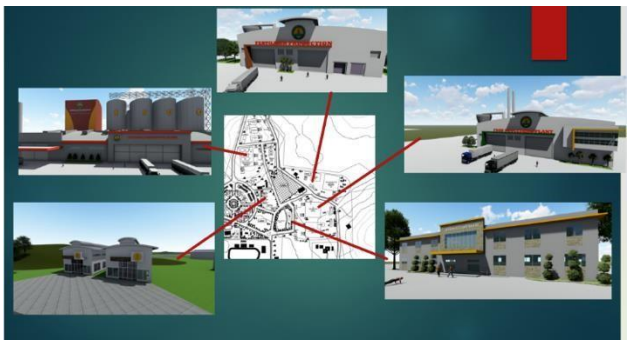

Figure 7. *Agro-Industrial Zone Location*

Conclusion and Future Works

This study concludes that the existence of the KIST economic zone is highly acceptable, with 63.33% strongly agreeing among the residents, indicating its potential to create job opportunities. The master plan was designed in accordance with PEZA policies and standards. The integration of green architecture within the KIST economy will ensure environmental sustainability at the site. The crafted master plan, incorporating IT and BPO components, will play a significant role in enhancing the knowledge and skills of ISU students, enabling them to stay current with technologies and effectively apply their acquired knowledge within the KIST development. This study will serve as a model for KIST ecozone developers at ISU seeking PEZA accreditation.

Additionally, the researchers recommend proper dissemination of information regarding the tax incentives provided by PEZA, as most survey respondents expressed neutrality on the matter. Likewise, Information, Education, and Communication (IEC) materials should be translated into the local community's mother tongue to effectively convey information about the tax holidays to potential locators. The use of green technologies is also recommended, given that a majority of respondents expressed agreement. Similarly, small-scale and medium enterprises are strongly encouraged to establish their businesses within the KIST Development. Lastly, there is a strong recommendation for further study of environmental impact assessments to ensure thorough consideration of all environmental aspects.

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