INCOED: A STATE-OF-THE-ART NATURAL SCIENCES FACILITY FOR RESEARCH AND DEVELOPMENT AT NVSU BAYOMBONG CAMPUS

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ABSTRACT

The Philippines' low Human Capital Index reflects persistent challenges in enhancing human capital, particularly in the quality of learning environments and educational infrastructure. Research indicates that well-designed, student-centered facilities have a positive impact on learning outcomes, aligning with the United Nations Sustainable Development Goal 4 on Quality Education. The Philippine Development Plan also emphasizes the importance of inclusive, equitable, and climate-resilient school infrastructure in fostering nationwide progress. In response to these priorities, Higher Education Institutions (HEIs) like Nueva Vizcaya State University (NVSU) are integrating sustainability into academic operations and campus development. NVSU, renowned for its excellence in forestry and commitment to environmental responsibility, continues to champion innovation through initiatives such as the Interdisciplinary Connect Education (INCOED) facility. This building serves as a model for collaborative, experiential learning that supports interdisciplinary education and sustainable practices. As the impacts of climate change intensify, there is a growing demand for resilient, adaptable, and future-ready educational spaces. This study examined how sustainable academic infrastructures, such as INCOED, can contribute to human capital development, improve educational quality, and support institutional goals aligned with national and international development agendas. Ultimately, the research underscores the role of modern educational spaces in shaping a more skilled, adaptable, and environmentally conscious generation.

Keywords: Human capital development, sustainability, Nueva Vizcaya State University, interdisciplinary, educational infrastructure

INTRODUCTION

In 2020, the Philippines recorded a Human Capital Index (HCI) score of 0.52, highlighting major obstacles in advancing its human capital. Children born in that year are projected to reach just over half of their potential in terms of health and education by age 18. Making enduring change begins with recognizing the importance of our learning environment. Education is vital for our society's future. Improving our educational system will help the next generation make a positive impact. Good school facilities are necessary for effective learning. It is crucial to thoroughly assess the Philippine educational system to pinpoint areas for improvement (UNICEF, 2023).

In recent years, research has demonstrated the importance of investing in quality infrastructure, showing that well-designed educational facilities enhance student performance. This relationship is evident in international programs, namely SDG 4, Quality Education, which emphasizes the role of learning environments in ensuring student success. Students with access to safe, well-equipped, and stimulating spaces are more likely to stay motivated and engaged, and to achieve their full potential. The Philippine Development Plan also emphasizes enhancing school infrastructure to foster inclusive and equitable education (National Economic & Development Authority, 2022). Apart from infrastructure issues, the Philippines faces the serious challenge of climate change, which endangers accessibility and academic standards (Baguio City, 2022). To mitigate climate change and serve as role models in their communities, higher education institutions (HEIs) are increasingly integrating sustainability practices into their curricula and operations (Calderon, 2023). Programs such as the Universitas Indonesia

(UI) GreenMetric World University Ranking promote sustainability in higher education institutions by evaluating their energy efficiency and waste management efforts.

The Nueva Vizcaya State University (NVSU) Bayombong Campus exemplifies leadership in sustainability by promoting innovative campus planning, environmentally responsible infrastructure, and community-based conservation efforts within the higher education sector. Through its sustainable resource management initiatives, such as watershed rehabilitation, organic farming practices, and renewable energy adoption, NVSU has been recognized as a Center of Excellence in Forestry since 2009, demonstrating excellence in research, instruction, and community engagement (CHED, 2016). Nueva Vizcaya State University (NVSU) envisions itself as "A Premier University in a Global Community," promoting sustainability throughout its functions and pursuing ISO 9001:2015 certification for its Quality Management System—demonstrating its dedication to ongoing enhancement in instruction, research, and community outreach (NVSU LUDIP, 2023–2032).

At NVSU, the Interdisciplinary Connect Education (INCOED) natural sciences building goes beyond the usual definition of a laboratory. The INCOED center fosters innovation, collaboration, and experiential learning by bringing together different disciplines. Teamwork, critical thinking, practical discovery, and advanced research are emphasized. The university is committed to fostering an environment that drives progress for students and researchers, promoting growth and learning within the academic community.

METHODOLOGY

Research Design

The study used an applied research approach, guided by the criteria set by the UI GreenMetric, the Philippine Green Building Code, and the CHED Memorandum Orders. Data collection combined qualitative and quantitative methods, including site inspections, professional consultations, and literature reviews.

Data Gathering Procedure

The data-gathering process for this study began with selecting an appropriate project site. Through consultations with their thesis adviser, Ar. Tomas B. Binbinon Jr., the researchers finalized the Nueva Vizcaya State University Bayombong Campus as the location, based on a recommendation from a fellow student enrolled at the institution. An initial meeting with Engr. An Andres M. Sabungan Jr. of PDIS was conducted, during which a draft communication letter was submitted, and a formal letter requesting the necessary data was submitted to the Office of the University President (OUP). Consequently, a formal request was addressed to Dr. Wilfredo A. Dumale Jr., the University President, seeking permission to carry out the study and access the NVSU Land Use Development and Infrastructure Plan (LUDIP) covering the years 2023 to 2032.

To inform the project's initial design phase, the researchers conducted a case study of local and international green campuses, science laboratories, and natural sciences buildings, and compiled relevant building codes, laws, and reference materials. A site visit, supervised by Ar. Justine Louie A. Labao of PPSDS, involved surveying and optimal orientation. To obtain more specific data on existing campus buildings and utilities, a separate request was sent to Dr. Lori Shayne A. Busa, the OIC Dean of the College of Arts and Sciences. The gathered data were carefully assessed and organized to ensure their effective application in formulating the facility’s architectural and planning strategy.

Consultations

Essential insights were gathered from key figures, including the University President, the Dean of the CAS, the Natural Sciences faculty, and the planning office staff, who all offered technical expertise and a firm grasp of the local context.

Site Visitation/ Ocular Inspection

Site inspections were conducted to better understand the physical considerations and environmental factors not fully captured in the documents. This provided valuable data on the site's condition, strengths, limitations, opportunities, and threats.

Architectural Books and Other Resources

Additional information was required to enhance the study area, including books, e-books, manuscripts, manuals, building codes, regulations, published studies, journals, articles, and online resources.

a. National Building Code of the Philippines (PD 1096)
b. Revised National Plumbing Code of the Philippines (RA 1378)
c. Batas Pambansa Blg. 344 (Accessibility Law)
d. Revised Fire Code of the Philippines of 2008 (RA 9514)
e. Commission on Higher Education (CHED) Memorandum Order No. 49, Series of 2017
f. UI Greenmetric World University Rankings Criteria
g. Department of Health (DOH) Manual on Clinical Laboratories
h. Research and Development Design Guide by the US Department of Veterans Affairs
i. Laboratory Biosafety Manual, Fourth Edition and Associated Monographs: Laboratory Design and Maintenance by WHO (World Health Organization)
j. Philippine Green Building Code (PD 1565)

Demand and Supply

The growing enrollment in science-related programs at NVSU (2020-2024) highlights the pressing need for modern laboratory facilities. The steady increase in STEM students has strained existing resources, leading to space limitations, outdated equipment, and restricted capacity that hinder hands-on learning and research opportunities. Additionally, the rise of interdisciplinary studies underscores the necessity for an advanced facility that fosters collaboration across scientific fields.

NVSU's laboratory infrastructure faces challenges in accommodating the growing student population and the swift evolution of technology, which affects the overall quality of education and research outcomes. The lack of well-equipped laboratories puts students at a disadvantage, underscoring the need for modernizing science facilities. The development of INCOED supports sustainable campus initiatives under UI GreenMetric standards and UN SDGs, namely SDG 4, SDG 9, and SDG 11, by strengthening educational and research capacities.

Marketing Program

At Nueva Vizcaya State University (NVSU), marketing aims to promote and deliver valuable academic services that support institutional goals while attracting prospective students and stakeholders. The administration plays a crucial role in expanding enrollment, enhancing visibility, and fostering community engagement through various promotional platforms. To

effectively market the INCOED Natural Sciences Building, NVSU will implement a comprehensive multi-platform strategy to maximize outreach and engagement. This includes:

- **University Website and Online Platforms**: Offers brochures, virtual tours, testimonials, and FAQs. SEO strategies will enhance online visibility for prospective students and partners.
- **Social Media Campaigns**: Facebook, X (Twitter), Instagram, TikTok, and YouTube will feature student stories, research updates, and live Q&A sessions. Targeted ads will reach audiences interested in STEM and sustainability.
- **Radio and Television Promotions:** Local radio and TV segments will broadcast interviews and highlight the university's contributions to science education and research.
- **Print and Outdoor Advertising**: Flyers, brochures, posters, and billboards will be distributed in schools and public areas to promote INCOED and its academic benefits.
- **Community Outreach and School Visits**: Campus tours, career talks, and STEM workshops will engage high school students and foster interest in science programs at NVSU.
- **Industry and Local Government Partnerships**: Collaborations with private sectors, research institutions, and LGUs will support funding, internships, and events that align with regional development goals.

TECHNICAL STUDY

Project Location: Nueva Vizcaya State University, Bayombong Campus

Region: Region II (Cagayan Valley)

Climate: Tropical Monsoon Climate (Am)

Design Philosophy

"Design is a plan for arranging elements in such a way as to accomplish a particular purpose best." -Charles Eames.

In architecture, design is a deliberate process aimed at achieving specific goals. Every element within a space is thoughtfully arranged to support its function, whether for work, learning, or recreation. The design process thoughtfully examines how every element interacts to form a cohesive, efficient environment with a clear purpose.

"If a community is given the chance to shape its environment, it will create schools that inspire learning and pride." -Diébédo Francis Kéré.

This quote emphasizes the significance of community involvement in architectural design. When a building's users, such as students, faculty, and staff, actively shape the space, the result is an environment that fosters pride and inspires its users. Architecture becomes a reflection of the people it serves, fostering a sense.

"Good design is sustainable design. It is not only about aesthetics, but about creating environments that are practical, efficient, and respectful of the environment." – Tadao Ando.

Architecture's sustainable design ethos combines aesthetic vision with the imperative to build efficient, environmentally responsible spaces. By seamlessly integrating appropriate materials, innovative technologies, and thoughtful planning, buildings can satisfy practical demands and minimize their ecological footprint

Figure 1
Exterior Perspective

The building's form evolved with a focus on simplicity and ease of movement. It began with a basic, linear layout, where spaces were arranged in a precise sequence to facilitate straightforward navigation. As the design progressed, a ramp was introduced at the front and centrally positioned, serving as both a functional and a visual element. This ramp serves as the façade, making it easier for people to access different levels and enhancing wayfinding throughout the building. The utility core was strategically placed in the southwest corner, allowing smooth operations without interfering with main paths. The building's form reflects a balance between practicality and visual appeal, ensuring easy circulation and a welcoming design.

Structural Concept

The building's structural concept uses a concrete slab-and-beam system, chosen for its cost-effectiveness, durability, and ability to support heavy loads, especially from laboratory equipment. The concrete slabs, supported by strong beams, create a stable framework that evenly distributes weight and minimizes the risk of structural failure. Concrete's resistance to fire, wind, and seismic activity adds to its long-term reliability. The design must be coordinated with structural engineers to ensure proper installation and compliance with safety standards, following the NBCP, the Philippines Fire Code, and the Philippines Structural Code.

Other Allied Professional Services Concept

Electrical Concept

The building's electrical concept prioritizes efficient power distribution for lighting and laboratory equipment in compliance with the Fire Code of the Philippines and the National Electrical Code of the Philippines. A centralized panel manages power, with dedicated circuits for high-powered equipment. Energy-efficient solutions, including LED lighting and solar panels, reduce consumption and enhance sustainability. The design and installation will be coordinated with allied professionals to ensure compliance with safety standards, including the NBCP and the Philippine Electrical Code (PEC).

Mechanical Concept

The building's mechanical concept emphasizes efficient HVAC systems to maintain comfort and safety. Air handling units and ductwork will provide adequate ventilation, particularly in laboratory areas. Energy-efficient systems will control temperature and humidity, with air conditioning and dehumidifiers ensuring optimal conditions for lab equipment. All systems will be designed to comply with the National Building Code of the Philippines and will be coordinated with allied professionals to ensure proper installation and functionality.

Design Considerations

- **Sustainability and Energy Efficiency:** Incorporates solar panels, passive cooling, rainwater harvesting, and green roofing. Buildings will use energy-efficient lighting, sensors, and locally sourced, eco-friendly materials.
- **Water Conservation and Waste Management:** Features low-flow fixtures, drip irrigation, composting, recycling stations, and sustainable materials used to reduce waste and promote environmental responsibility.
- **Green Mobility and Open Spaces:** Promotes pedestrian pathways, bike lanes, EV charging stations, and preservation of green areas for biodiversity, recreation, and hands-on agricultural learning.
- **Educational Integration:** INCOED serves as a living laboratory with flexible classrooms, interdisciplinary laboratories, and spaces that embed sustainability and innovation into instruction and research.
- **Laboratory Safety and Functionality:** Equipped with ventilation systems, fire safety features, ergonomic layouts, and strict access control. Routine maintenance ensures safety compliance and equipment functionality.
- **Accessibility and Inclusivity:** Universal design principles ensure access for all through ramps, elevators, wide corridors, braille signage, and gender-neutral restrooms across campus and within the facility.
- **Safety and Security:** Infrastructure is disaster-resilient, with emergency exits, alarms, sprinklers, and surveillance systems (CCTV, motion sensors) for a safe and secure learning environment.
- **Site Integration and Aesthetic Harmony:** Designs respond to the site's natural slope, preserve scenic views (e.g., Bangan Hill), and incorporate landscaping with native plants for ecological and aesthetic value.

Site Analysis

The proposed building site is situated in the existing research experimental area in the northeastern part of the NVSU Bayombong Campus. It is opposite the College of Arts and Sciences Building 3, beside the cafeteria, near the new administration building, and the registrar's office. Currently, the site serves as agricultural land for cultivating tomatoes, *okra, sitaw, pechay*, and maize, with some areas allocated to rice fields.

Figure 34

Proposed Building Site Analysis

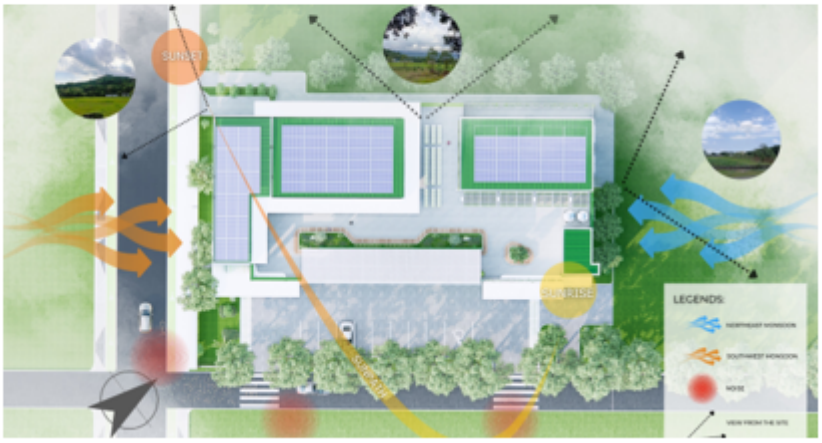


Table 1

Proposed Building Site SWOT Analysis

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Proximity to academic buildings, administrative offices, and campus facilities provides convenience for students and faculty.	Limited parking spaces and potential congestion may impact accessibility as student numbers grow.	Enhanced student and faculty engagement through modern facilities that foster collaboration and experiential learning.	Removing vegetation or altering land use could increase erosion, flooding, or heat vulnerability.
The site is surrounded by green spaces and agricultural land, creating a sustainable and serene learning environment.	The lack of covered walkways leading into buildings is inconvenient during extreme weather.	Sustainable development by integrating green infrastructure, rainwater harvesting, and energy-efficient building systems.	Long-term maintenance costs to ensure sustainable operations could strain university resources.
Abundant natural light and ventilation due to open landscapes and the absence of high-rise obstructions.	The site is agricultural land, requiring soil stabilization and land preparation before construction.	Eco-friendly landscape design incorporates green spaces, shaded seating areas, and urban gardens to complement the natural surroundings.	

Building Space Description

The INCOED Natural Sciences Building was thoughtfully designed to fulfill the academic, research, operational, and sustainability needs of the Nueva Vizcaya State University. Each space within the facility was purposefully planned to promote interactive learning, scientific innovation, faculty productivity, and environmental stewardship. The following outlines the building's spaces according to their intended functions:

1. **Instructional and Learning Spaces**

- Lecture Rooms: Designed for interactive instruction, each room accommodates 50 students and includes teaching lab features such as sinks, whiteboards, and audiovisual tools.
- Exhibit Room: Enhances science engagement by displaying preserved specimens, research outputs, and reference materials for extended learning.
- Defense Room: A formal setting for thesis presentations and research defenses, equipped with a presentation system and seating for evaluators.
- Multipurpose Area: Supports academic and social functions like collaborative projects, workshops, and events. Includes a stage, kitchen, and seating for 120.
- Auditorium (AVR): A 150-seat hall for lectures, seminars, and conferences, with support spaces including a vestibule, control room, storage, and rehearsal room.

2. Research and Laboratory Spaces

- Biochemistry–Microbiology Laboratory: Supports interdisciplinary experiments on biochemical processes and microbial studies using shared equipment and protocols.
- Bioanalytical–Medical Biology Laboratory: Facilitates biological analysis and diagnostic research with integrated tools for medical biology.
- Physics Laboratory: Equipped for hands-on physics experiments, with adjacent storage for apparatus and tools.
- Support Rooms:
  - *Preparation Room:* Used for PPE handling and material prep before lab entry.
  - *Lab Technician Room:* Manages lab operations and materials, including access control and inventory tracking.
  - *Microscopy Room:* Specially designed for detailed specimen analysis.
  - *Tissue Culture Room:* Maintains controlled conditions for cell and plant growth.
  - *Fume Hood Room:* Ventilated space for safely handling hazardous chemicals.
  - *Emergency Shower Area:* Provides a safety response in case of chemical exposure.

3. **Faculty and Administrative Spaces**

- Faculty Room: A collaborative office with a kitchenette, restroom, and lounge for meetings and workspace sharing.
- Department Chair's Office: A private office with storage and a secretary station for academic management and coordination.

4. Support, Operations, and Maintenance

- Utility Core:

- *Utility Room:* Houses mechanical, electrical, and plumbing systems for building operations.
- *Waste Collection Room:* Temporary storage for collected waste.
- *Waste Holding Room:* Ensures segregation and safe handling of hazardous and non-hazardous waste.
- *Comfort Rooms:* Located on each floor, with PWD-accessible cubicles for inclusivity.
- *Service Elevator and Stairs:* Facilitate equipment movement and safe vertical circulation.

- Storage Rooms: Secure spaces for janitorial supplies and building equipment.
- Battery Room: Stores backup power from solar energy systems to ensure uninterrupted operations.

5. **Accessibility and Safety**

- Ramp: Provides barrier-free access to the facility in compliance with BP344.
- Fire Exit: Includes refuge areas and clearly marked egress routes to support safe evacuation.
- Parking Area: Offers general and PWD-designated parking spaces for students, faculty, and visitors.

6. Sustainability Features

- Rooftop Garden: A hydroponic system that supports sustainability education, food production, and green living principles while enhancing air quality and well-being.

SOCIO-ECONOMIC STUDY

Social Benefits

The development promotes inclusive academic environments that foster collaboration among students, faculty, and the wider community. Shared spaces, outreach programs, and partnerships with agencies such as DOST, PAGASA, and CSC improve access to science and public service delivery. INCOED's interdisciplinary setup and community engagement activities enhance regional development through science education and outreach.

Cultural Benefits

By integrating local heritage into design and activities, the campus reinforces cultural identity and pride. Cultural events, indigenous materials, and proximity to Bangan Hill strengthen ties to regional traditions. INCOED also supports cultural exchange and learning that connect local values with global perspectives.

Educational Benefits

Expanded facilities such as modern laboratories, lecture halls, and digital learning centers support outcomes-based, interdisciplinary education. INCOED offers updated labs for biology, chemistry, physics, and environmental science, promoting hands-on learning and global competitiveness. Both developments attract skilled educators, research funding, and partnerships that boost academic quality and opportunities.

Health Benefits

Well-planned buildings with proper ventilation, natural lighting, ergonomic design, and open green spaces promote physical and mental wellness. INCOED prioritizes lab safety with

features such as fume hoods, emergency showers, and rooftop gardens that encourage relaxation, reduce stress, and support cognitive health.

Economic Benefits

Campus development generates long-term employment, stimulates demand for local goods and services, and attracts student enrollment. INCOED's specialized facilities enhance university-industry-government partnerships, bringing in funding, research collaborations, and internship programs that contribute to regional innovation and resilience.

Environmental Benefits

The preservation of Bangan Hill and integration of green strategies such as solar energy, rainwater harvesting, sustainable landscaping, and eco-friendly materials reduce ecological impact. INCOED, in particular, serves as a living laboratory for sustainability education and environmental stewardship.

FINANCIAL STUDY

The cost estimate is primarily based on material and construction expenses. Note that the rate per square meter used in the computation was based on the 2024 average construction cost of a house in the Philippines. These rates serve as general guidelines and are intended solely as a starting point for preliminary budgeting

Table 2
Project Rough Cost Estimate

Space	Total Net Area (sq.m.)	Rate per Square Meter	Cost in PHP
Lecture Room	275.40	35,000	9,639,000.00
Exhibit Room	130.00	35,000	4,550,000.00
Faculty Room	99.90	35,000	3,496,500.00
Faculty Kitchenette	19.60	35,000	686,000.00
Faculty Comfort Room	14.00	30,000	420,000.00
Faculty Lounge	41.60	35,000	1,456,000.00
Department Chair's Office	12.25	35,000	428,750.00
Department Chair's Secretary	10.50	35,000	367,500.00
File Storage	14.30	35,000	500,500.00
Storage Room	7.20	35,000	252,000.00
Battery Room	7.20	35,000	252,000.00
Waste Collection Room	27.30	35,000	955,500.00
Biochemistry Laboratory	135.90	35,000	4,756,500.00
Tissue Culture Room	27.30	35,000	955,500.00
Fume Hood Room	17.45	35,000	610,750.00
Microscopy Room	15.40	35,000	539,000.00
Auditorium	172.50	40,000	6,900,000.00
Vestibule	30.30	35,000	1,060,500.00
Control Room	10.20	35,000	357,000.00
Rehearsal Room	26.08	35,000	912,800.00
Storage	9.60	35,000	336,000.00
Waste Holding Room	19.775	35,000	692,125.00
Multi-Purpose Area	236.70	40,000	9,468,000.00
Kitchen Area	27.30	35,000	955,500.00
Rooftop Garden	563.30	35,000	19,715,500.00
Machine Room	8.80	30,000	264,000.00
Main Stairs	21.20	30,000	636,000.00
Fire Exit	108.80	30,000	3,264,000.00
Female Comfort Room	74.74	30,000	2,242,200.00
Male Comfort Room	74.74	30,000	2,242,200.00
Utility Room	50	30,000	1,500,000.00
Service Elevator	26.40	30,000	792,000.00
TOTAL			**81,203,325.00**

Table 3
Construction Environmental Impact Analysis

Environmental Aspect	Cause	Impact	Mitigation
Land	Conversion of agricultural land for institutional use	Loss of arable soil, reduced food production, soil erosion, and habitat loss for insects and small fauna	Preserve topsoil for reuse, retain mature trees where possible, and replant native species.
Water	Excavation, concrete mixing, and site runoff	Contamination of irrigation water, sedimentation, and disruption of local water cycles	Use silt fences, treat wastewater, and properly manage construction chemicals.
Air	Dust generation and equipment emissions	Temporary reduction in air quality, affecting nearby residents and workers	Apply dust suppression (e.g., water spraying), and limit heavy machinery use during peak time .
Noise	Machinery and truck operations, especially during peak hours	Disturbance to learning environments and community routines	Schedule noisy work during less disruptive times and use sound-reducing equipment.
Biodiversity	Disruption of micro-ecosystems near green zones or natural landmarks	Stress or displacement of local wildlife and reduced biodiversity	Identify and protect sensitive zones like Bangan Hill, and establish green buffers.

MANAGEMENT STUDY

The implementation and operation of the Natural Sciences Building will be managed within Nueva Vizcaya State University's existing administrative framework. The university President will lead oversight, supported by key university officials in academics, finance, research, planning, and campus administration. The Vice Presidents will provide strategic management for their respective areas, ensuring alignment with institutional goals.

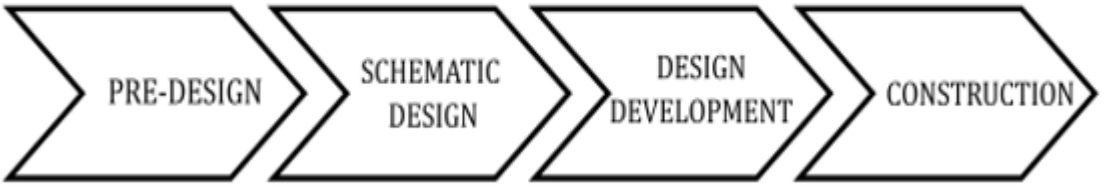
The Bayombong Campus Administrator will oversee operational leadership at the campus level, while academic and departmental responsibilities will be under the Dean of the College of Arts and Sciences (CAS) and the Department Chair of Natural Sciences. The faculty and staff will be directly involved in the facility's day-to-day use, academic programming, and maintenance.

Phases of Implementation

During the pre-design phase, data was gathered, user needs were identified, and site analysis was conducted to guide the project scope. In the schematic design phase, initial layouts and spatial planning were developed into a basic building form. During design development, design details are refined, materials are selected, and engineers are consulted. Finally, in the construction phase, the final documents are completed, and the project is built according to the design.

Figure 58

Planning Process Diagram



Environmental Study

This section examines the environmental impact of the construction of the natural sciences building, identifying potential harms and opportunities for sustainable action. While development can disrupt ecological systems, it also offers an opportunity to implement responsible design practices that align with NVSU's sustainability goals.

CONCLUSION

As outlined in Chapter 1, the following conclusions can be made based on the objectives and research questions:

1. The proposed campus development plan aligns with the UI GreenMetric World University Rankings, supporting NVSU's vision for a greener, more sustainable campus by 2030. It reinforces the university's commitment to global sustainability goals.
2. The INCOED building fulfills its general objective by serving as a modern, interdisciplinary science facility that promotes collaboration and research. It integrates solar panels, passive cooling, LED lighting, and rainwater harvesting to support environmental responsibility.
3. In line with specific objectives, the building features modern laboratory technologies like fume hoods, modular benches, and data systems. These elements ensure adaptability, user safety, and full compliance with RA 4688 and DOH standards.

RECOMMENDATION

Based on the findings and conclusions of this study, the following recommendations are proposed to further enhance the development and long-term sustainability of the NVSU Bayombong Campus:

1. NVSU should prioritize sustainable infrastructure and green technologies in all future campus projects to reinforce its position as a green university. This will also contribute to national and global climate action goals.
2. Regular updates of laboratory equipment are necessary to stay aligned with scientific advancements and support interdisciplinary learning.
3. Additional green initiatives such as green roofs, EV charging stations, and improved waste management systems should be considered to strengthen campus sustainability.

4. Continuous consultation with faculty, students, and facilities staff is essential to improve design practicality and long-term usability.
5. Facility personnel should undergo regular training to ensure effective maintenance and operation of sustainable building systems.

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