Supply Chain and Operational Practices of Nodes Digital Limited: An Internship Experience

This report is submitted to the school of Business and Economics, United International University as a partial requirement for the degree fulfillment of Bachelor of Business Administration

Supply Chain and Operational Practices of Nodes Digital Limited: An Internship Experience

Submitted to:

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Major: Supply Chain Management

Registration Trimester: Fall 2025

School of Business and Economics

United International **University**

Date of submission: July 21, 2026

Letter of Transmittal

Dr. Saad Hasan

Associate Professor

School of Business and Economics

United International University

Subject: **Internship Report Submission**

Dear Sir,

I am happy to submit my internship report on “Supply Chain and Operational Practices of Nodes Digital Limited: An Internship Experience”. I started my internship at Nodes Digital Limited’s Corporate Office on 11th April, 2026 and it ended on 11th July, 2026. Throughout my employment, I got to learn and deal with the company’s operations and business functions.

I had tried to finish the report using personal observations and secondary data sources. I have worked hard to complete this report with proper feasibility and thoughtfulness. I believe that this work will help you to move forward with similar type of enterprise. However, if you need any type of relevant information, please do not hesitate to contact me. I hope that this report has meet the objectives of the Internship program, and you will accept it.

Thank you for your constant support and guidance.

Sincerely yours

Md. Jonayed Hasan Sami

ID No: 111 221 113

Major: Supply Chain Management (BBA)

Certification of Similarity Index

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Declaration of the Student

As the author of the report “Supply Chain and Operational Practices of Nodes Digital Limited: An Internship Experience, I, Jonayed Hasan Sami, acknowledge my personal accountability. Before being used in the study, every piece of data in this report was gathered and examined. Every single fact in the study is accurate and pertinent. All information is included with proper authorization and approval. Furthermore, no content is shared or directly duplicated from another website without giving due credit to the original author.

Md. Jonayed Hasan Sami

111 221 113

Bachelors of Business Administration

United International University

Corporate Evidence

Nodes Digital™

Sustainable Agriculture Through Innovation

Ref: ND/07/2026/01

Date: 07/07/2026

TO WHOM IT MAY CONCERN

This is to certify that Jonayed Hasan Sami, as part of his BBA Degree requirement at United International University (UIU) has successfully completed Three Months long internship at Nodes Digital Limited.

He worked as a supporting role to the Business team and his job required collaboration with cross functional team like PMO, Development team and Admin. He has contributed crucially in Process Improvement, Business Analysis and Project Management domain. He was involved in task like:

- Requirement Elicitation from clients.
- Preparing Business Requirement Specification.
- Prepared other project documents like Process Flow and Project Schedule and Project Update slides.
- Follow up different stakeholders to maintain the project timeline.
- Arrange and manage different meetings and sessions.
- Supported client field visits by coordinating logistics, documenting observations, and assisting with follow-up actions.

During the span he had been exposed to different processes was found punctual, Inquisitives and hardworking for which the institution is extremely thankful. His learning abilities were outstanding and he picks up swiftly. His feedback and evaluation proved that he learned keenly. Moreover, his interpersonal and communication skills are brilliant.

We wish him best for his future as he has indeed been a valuable intern to our branch, as I am sure he will continue to be at any future organization he works in.

For Nodes Digital Limited

Shaiak Salahuddin
Head of Logistics and Field Operations
Nodes Digital Limited

Shaiak Salahuddin
Head of Logistics & Field Operations
Nodes Digital Ltd.

Acknowledgement

First, I want to show my gratitude to the Almighty for giving me the chance to finish my internship report under the supervision of some excellent individuals. Heartfelt thank you to Dr. Saad Hasan sir for guiding me throughout the whole report writing. His constant encouragement kept me motivated and inspired me to finish this report.

I'd also like to thank Dr. Mohammad Rashedul Hoque, Managing Director and Shaik Salahuddin Seaum, Head of Logistics and Field Operations, for their valuable time, concern, advice and consistent co-operation compiling this report. I show my heartfelt gratitude to Nodes Digital Limited's Software Engineer Ovijit Sarkar and IoT Engineer Lion Ahmed and all personnel who on boarded me and provided their valuable time presenting me with the essential materials from which I was able to complete the report. Their contributions and co-operation made this study possible.

I would like to express my gratitude to all the faculty members of School of Business at United International University, there in class motivation and guidance has enriched my academic life and pursuit of knowledge.

Lastly, I want to show my respect and gratitude to my parents who believed in me, supported me and encouraged me in every step of my educational journey and personal development.

Executive Summary

This report has been prepared for the completion of the Bachelor of Business Administration (BBA) program's requirement at United International University. The internship was completed at Nodes Digital Limited, one of the leading IoT based agri-tech company in the industry under Business Department. In the internship, I was privileged to have a clear understanding of its field of operations and concerns. Nodes Digital Limited's two flagship IoT devices are E-irrigation and E-fisheries, controls through server dashboard and mobile application.

The main objective of this papers is to illustrate the practical experience and company insights perceived throughout the internship period. During the period, I was actively involved in supporting the company's internal operations, sourcing of IoT components, stakeholder management, supported in device deployment and backend paperwork, coordination in training and feedback collection sessions. These responsibilities provided me with an opportunity to get an exposure to company's procurement process, use of different allowance forms, logistics, inventory management, stakeholder coordination, after sales support and customer relationship management.

This report highlights the operational activities for Nodes Digital Limited and key challenges faced during the internship. Includes device related problems and end user issues. These challenges have helped me to develop my adoptability skills, problem solving abilities, communication skills and a better understanding of the essence of efficient coordination between cross functional teams.

Based on the experience and collected observations, several recommendations have been made to enhance NDL's operational workflow and customer centric approach such as effective use of the ERP integrated system, voice tap installation in the mobile application, frequent training sessions to create awareness among farmer communities.

Overall, the internship experience was intensely valuable and insightful. Through which I gained practical experience of how a real-world business operates through its different functions and supply chain developing both technical knowledge and interpersonal skills which significantly contributed to my personal and professional growth.

Table of Contents

List of Figures

Liste of Tables

CHAPTER 1: INTRODUCTION

Nodes Digital Limited (NDL) is an Agri-tech company based in Bangladesh that focuses on integration of Internet of Thing (IoT) and Artificial Intelligence (AI) enabled solutions for precision agriculture and aquaculture. As a final year student internship was an academic requirement to complete my BBA program. After some period of joining NDL I was able to experience an exposure to different aspects of its functions such as procurement process, inventory recording, ERP system operations, Logistics, Documentation process, training and event coordination. During my internship I got opportunity to directly overview the whole value chain process of IoT based solutions used for agriculture from sourcing components and inhouse assembling to deployment of the device till all necessary backed documentation.

The agriculture and aquaculture sectors of Bangladesh remain highly vulnerable to climate change, inefficient resource use, and fragmented market linkages. NDL is trying to mitigate these problems with IoT based data driven solutions which can help in operational decision making for agriculture. Understanding how a firm like NDL manages souring, procurements, vendors, financing and documents using their ERP system.

Agri-tech firm with a web team continuously monitoring the device and a team of IoT engineers who build the IoT devices in house and technician team who physically deploys in the field provides a holistic view of the supply chain that underlies modern precision-agriculture services. This report is built on NDL's supply chain — from the sourcing of sensors and components to building a smart innovative solution and final deployment, calibration and after sales service to the farmer level.

1.1 Background of the Report

This report has been prepared in fulfilment of the internship requirement, which mandates that an intern document and analyze the operations of the host organization. NDL was selected as the host organization because of its unique positioning at the intersection of hardware (IoT sensors and controllers), software (AI-based analytics, mobile/web dashboards), and last-mile agricultural service delivery. The internship spanned responsibilities in business and industry analysis, administrative and financial

documentation, ERP (Dolibarr) operations, procurement and logistics support, field operations (IoT deployment), training and field support, event coordination and stakeholder management, client interaction, and data collection and reporting — all of which feed directly into the supply chain perspective adopted in this report.

1.2 Objective

The general objective of this report is to study the supply chain of NDL, starting form sourcing the IoT components to all the way to the after sales service of E-irrigation and E-fisheries solutions The particular objectives includes:

1. To introduce an overview of the organization and its products; E-irrigation & E-fisheries, services and value proposition to the customers.
2. To state a clear image of the Agri-tech industry in Bangladesh and the driven competition of technological environment in which NDL operates.
3. Description of the deployment process of NDL's IoT based products and services to its clients, from the onboarding process to the installation and user training.
4. To track down the logistics chain of NDL, from procurement, inventory records, warehousing, transportation, deployment and training of farmers covering activities from the beginning sourcing to the end farmers.
5. To evaluate how NDL uses its ERP system (Dolibarr) to track vendors, clients and operational records with Third parties, Billing | Payment, HRM, Commerce, Tickets, and Documents module.
6. To identify the technical, operational and structural problems and challenges faced by NDL. To formulate recommendations and conclusions based on the internship experience.

1.3 Methodology

This report is developed using a qualitative and preliminary case study. The study's main source of data was gathered from personal experience and insights gained during the internship period. Besides that, the report consists secondary research information to complete the work. The methodology can be summarized as follows:

Primary Sources

- Participation in live field deployment activities as well as device installation process at Fishtech, Teknaf. and Go farmer sites in Rajshahi and Naogaon.
- Practical demonstration of the ERP software (Dolibarr) and it's different modules (Third parties, Commerce, Billing | Payment, HRM, Documents and Tickets)
- Active participation in procurement and reviewing internal documents like Cash Purchase Forms, Daily/Travel Allowance Forms, Expense Claim Forms.
- Conducted informal interviews and discussions with NDL's IoT engineers and Software engineers' team about various issues related to the devices and sensors used.
- Direct association in Stakeholder training and event coordination in Niyamatpur, Naogaon and Gujidaing, Rajshahi with NDL's management, Sajida Foundation, British Asian Trust and DASCHO Foundation.

Secondary Sources

- NDL's literature highlighting E-irrigation and E-fisheries product features.
- Publications regarding the IoT technology in agriculture, precision farming and the agri-tech industry in Bangladesh.
- Academic and white-paper literature on agri-tech supply chains and challenges in Bangladesh.

Data was collected from these channels and conceptually organized into this section of the report. The primary focus is identifying the constructive life cycle of NDL's device from sourcing components to final delivery of the product which includes stages as sourcing, procurement, inventory, transportation, deployment and after-sales service.

1.4 Limitations

The internship provided such valuable insights about NDL and its operation. But despite the practical exposure there are some limitations found during the period:

- The data were collected during a short-term internship period which only allowed capturing only activities of deployments and events that occurred within the period. Therefore, seasonal aspects of the supply chain may not be fully reflected in the study.
- Quantitative information about financial data for device costs, sensor price, procurement expenses, inventory levels were inaccessible due to confidentiality of NDL's internal records.
- Lack availability of Industry wide statistics about the agri-tech sector in Bangladesh.
- As an intern, there was some limitations to get exposure in certain functions (e.g. firmware engineering or backend server operations).
- Discoveries related to device failure are collected based on NDL's technical support team's field experience for the E-irrigation and E-fisheries product lines observed at the time of the internship. Thus, this might not fully represent the industry as a whole or subsequent hardware repetition.

CHAPTER 2: COMPANY AND INDUSTRY PROFILE

2.1 Company Overview

Nodes Digital Limited (NDL) is an agri-tech company founded in 2019 by a team of technology focused visionaries committed to making agriculture and aquaculture in Bangladesh and eventually globally more sustainable, intelligent, and data-driven. NDL's mission is to develop and market disruptive agri-tech solutions that combine IoT, AI, and machine learning with applied research to help the agricultural community improve productivity, efficiency, quality, traceability, and profitability. Their aim is to achieve sustainable agricultural solutions with innovative IoT devices by generating field level data-driven decision making.

Currently NDL offers two cutting edge solutions for precision agriculture: E-irrigation and E-fisheries. Both are built on a common technology stack of field sensors, IoT connectivity (cellular/SIM-based), cloud back-end processing, and AI-driven analytics, delivered to end users through a mobile application and web dashboard.

2.1.1 E-Irrigation

Figure 1

E-irrigation is NDL's flagship solution for optimizing irrigation in rice and other grain cultivation using IoT and AI. The system automates the Alternate Wetting and Drying (AWD) practice — a scientifically recognized water-saving method — and is offered in both fixed ("Smart AWD") and "Portable AWD" device formats. The company reports that through optimal agricultural operations based on real-time field data, their solutions boost production by 7 to 11% while optimizing resources and reducing irrigation costs by 25 to 30% and consequent energy savings. Additionally, the created integrated hardware and software system will optimize the use of various irrigation related inputs, minimize greenhouse gas emissions, and significantly reduce the amount of water used for irrigation. Additionally, e-irrigation contributes to the accomplishment of several agriculture related Sustainable Development Goals (SDGs), including water security (Goal 6), sustainable food (Goal 2), and climate action (GOAL 13).

Feature	Description
Precision Irrigation	Advanced sensors and real-time data analytics deliver precise irrigation management, ensuring crops receive the right amount of water and minimizing waste.
Energy Efficiency	Automated AWD practice minimizes manual intervention and can save up to 30% in energy/water cost.
Optimal Plant Growth	Generative AI models predict plant stress levels to optimize agricultural operations, reduce resource use, and increase yield.
Remote Access	Farmers can monitor and control irrigation systems remotely through a mobile app and web interface.

Table 1

2.1.1.1 Installation and Configuration Guide for Smart AWD (E-irrigation)

Site Selection > Prepare the AWD Pipe > Dig hole > Install the pipe > Install the sensor Unit > Power & Connectivity Setup > Calibration > System Activation & Monitoring

Figure 2

[Step: 01] Site Selection-

- The initial process starts with choosing the suitable rice field.
- Avoid highly elevated and low-lying spot.
- Maintain 1 meter distance from the field boundary.

[Step: 02] Construct the pipe of AWD-

- Make sure that the PVC for AWD is-30 cm in length and 7-10 cm in diameter.
- Drill holes on the lowerv15 cm of the PVC pipe.
- Make sure holes drilled have minimum 2 cm gap between each,
- Each hole should be 5 mm in diameter & holes need to be placed on all sides.

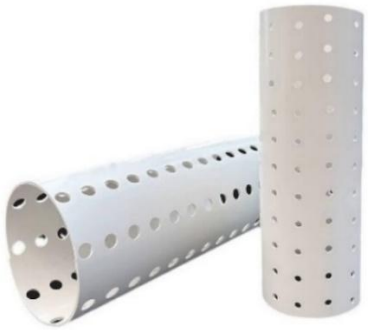

Figure 3

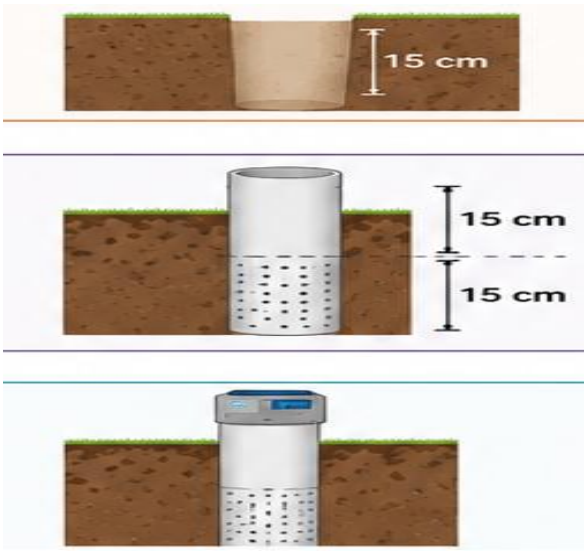

Figure 4

[Step: 03] Dig the Hole-

- Excavate a 15 cm deep hole.
- Excavated hole should be slightly larger than the diameter of the pipe.

[Step: 04] Install the Pipe-

- Assemble the pipe vertically.
- Maintain 15 cm of the pipe in the ground and remaining 15 cm pipe out in the paddy field.
- The pipe should be compacted with soil in the surrounding.

[Step: 05] Place the sensor unit-

- Place the water level sensor on the top of the PVC.
- The sensor should be directed downward inside of the pipe.
- To protect the sensor and to avoid damage make it water proof and fix securely.

[Step: 06] Power and Connectivity Setup-

- To power up the device connect it with battery or solar power supply.
- Set up the communication module to ensure constant network connectivity.

[Step: 07] Calibration-

- To test the device, fill up the field with normal water level.
- Read the output value generated by the sensor and compare with the actual measured value to make appropriate calibration.
- Adjust the calibration if needed.

Figure 5

[Step:08] System Activation and Monitoring-

- Activate the system and collecting data.
- Monitor the real-time data generated by the device on Mobile application or in the dashboard.
- Operate the AWD with the user manual provided by NDL to gain the maximum output from the device

2.1.1.2 SWOT Analysis for E-irrigation

Strength

- **Water Efficiency Optimization**
  It helps in ensuring that the amount of water used for irrigation is optimal, which assists with controlling the groundwater problem in Bangladesh.
- **Cost Reduction**
  It reduces extra use of fuels and electricity by farmers which helps them to save their resources.
- **Improves Yield**
  It helps the farmers into having a good yield of their crops.
- **Remote Access Monitoring**
  It ensures that farmers or other authorized personnel can monitor the farm activities from anywhere, ensuring maximum efficiency of the farm.
- **Climate-smart Agriculture**
  It supports sustainable farming practices which aligns with the Food and Agriculture Organization (FAO) and other Government climate smart initiatives.

Weakness

- **Low Usability**
  Due to lack of proper education, many farmers may find it difficult to interpret the **instruction on how to use the application.**
- **Requirement of Smartphone**
  The system depends on application which requires a smartphone to operate which is not very accessible to the rural farmers.

- **Maintenance Challenge**

  The sensors and other equipment used may need calibration and troubleshooting which may not be possible for the farmers to perform.
- **Initial High Cost**

  The initial installation costs may be high which may discourage the adoption of the technology.

Opportunities

- **Voice-Based Interface in Bangla**

  A voice translator could read instructions out loud to illiterate farmers, guiding them through the data collection process.
- **Government and NGO Partnerships**

  These organizations would be able to subsidize the cost for farmers and advocate for the service's adoption.
- **Water Scarcity Concerns**

  Water scarcity makes farmers more concerned with using the water they have as efficiently as possible.
- **Scalability Across Different Geographic Locations**

  The program could be deployed across different geographic locations because agricultural production is similar across the country.

Threats

- **Resistance to Technology Adoption**

  Farmers rely to their own traditional approaches rather than smart technologies.
- **Low Perceived ROI**

  If farmers do not see a short-term payoff, they will not adopt the technology.
- **Competition from Low-Cost Alternatives**

  Farmers can use manual AWD pipes, which are much cheaper than automated ones.
- **Poor Rural Connectivity**

  In rural areas of Bangladesh, the internet may have limited access which is necessary for proper functionality of IoT solutions.

2.1.2 E-Fisheries

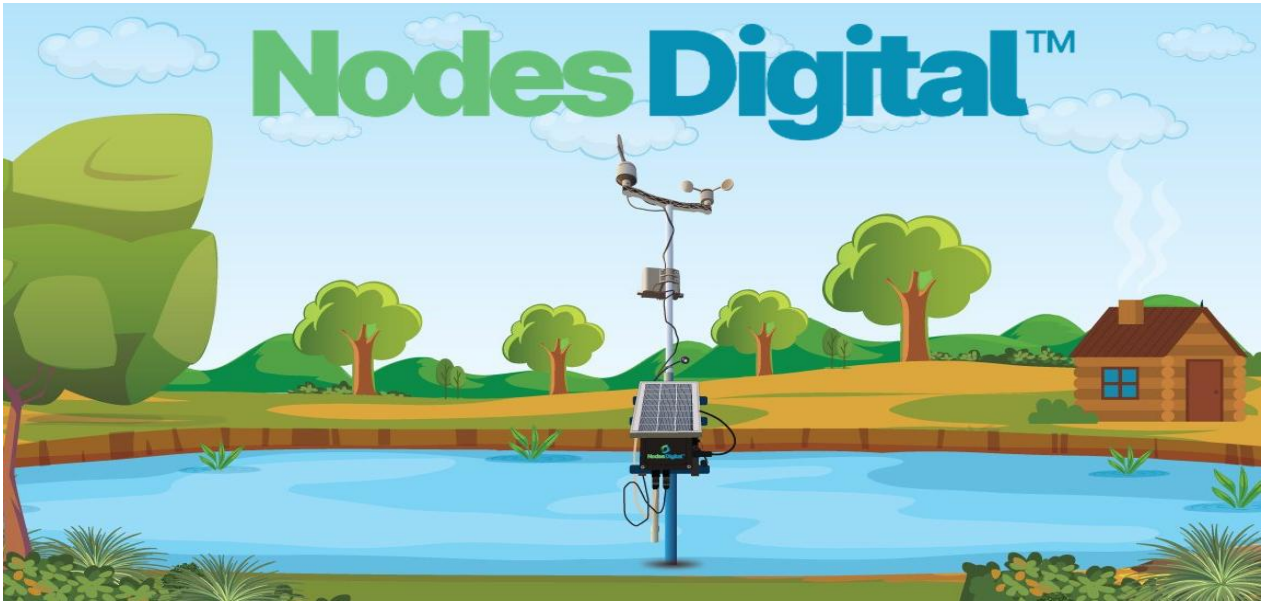

Figure 6

E-fisheries is another smart innovation for aquaculture management by NDL. It is designed to monitor pond health, integrating AI and IoT to automate fish farming. Their system concentrates on DO sensors (Dissolved Oxygen) and aerator automation by combining real time data. Their solution generates information on various metrics like water temperature, dissolved oxygen, ammonia and pH.

Feature	Description
Traceability	Real time monitoring of DO, ammonia, water temperature maintaining ideal environment for better yield.
Fish Habitat Management	Study fish habitual movements, detects abnormality and any stress sign which can be used to ease those problems.
Yield Optimization	Sensor based real time data and recommendations boost fish yield and maximize the harvesting efficiency and profitability.
Automated Aeration	To maintain a healthy fish stock, it monitors oxygen level continuously and detect fall. In such case it automatically turns on the aerator to avoid uncertainties.

Table 2

2.1.2.1 Installation and Configuration guide E-fisheries

Site Selection & Inspection > Sensor Installation > Control Box (IoT device) Setup > Aerator & Electrical Integration > Power Supply Setup > Network & System Configuration > Testing & Calibration > Final Check and Handover

[Step: 01] Site Selection & Inspection-

- Site visit for inspection and water circulation on the project.
- Check mobile network availability.
- Plan for sensor placement, control box and aerator.

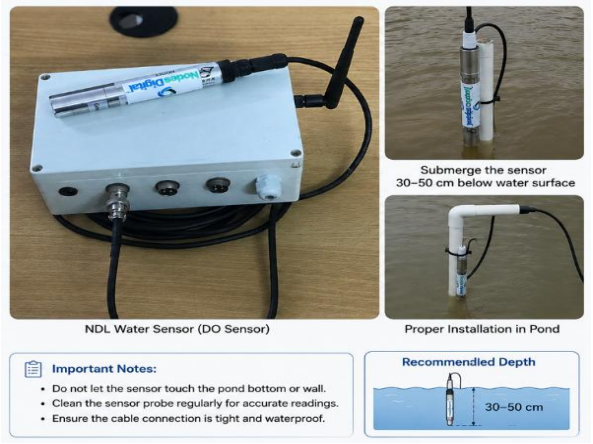

Figure 7

[Step:02] Sensor Installation-

- Install the DO sensor at the preferred location at a 30-50 cm depth of the water.
- To position the sensor, use PVC pipe or holder.
- Position the sensor ensuring it's not connecting with the bottom mud.

Figure 8

[Step: 03] Control Device (IoT Device) Setup-

- Install the waterproof control box above the water level.
- Inside the box connect:
  - TTGO Board, Converter, Relay Module, Backup PCB

[Step: 04] Aeration & Electronic Integration-

- Connect aerator motor to magnetic contactor.
- Connect contactor output to power supply via SMPS (Switched-Mode Power Supply).
- Relay output from IoT device.
- Use of operator for contactor coil input.

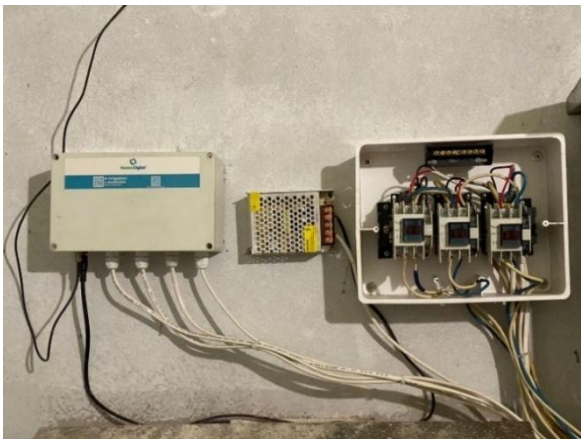

Figure 9

Figure 10

[Step: 05] Power Supply Setup-

- Connect SMPS to main power.
- Connect battery pack as backup.
- Ensure proper grounding and secure all connection.

[Step: 06] Testing & Calibration-

Calibration sensors using Hanna Test Kit and Desun Analyzer. (Used by NDL).

- Verify real-time data on Mobile app.
- Test aerator auto ON/OFF based on DO level

[Step: 07] Final check & Handover-

- Ensure all components are working properly.
- Give training to the farmers on Mobile usages, alerts and basic troubleshooting.
- Provide maintenance guidelines.

2.1.2.2 SWOT Analysis for E-fisheries

Strengths

- **Real-Time Water Quality Monitoring**
  The sensor used in their solutions can monitor parameters like the level of oxygen and temperature in the water which helps to prevent uncertain death of fishes.
- **Early Warning System**
  This feature allows farmers to be alerted before a situation becomes critical, which reduces risks.
- **Productivity Improvement**
  The application allows farmers to better pond management which leads to higher yield and quality of fishes.
- **Decision Making**
  The solution helps farmers make informed decisions instead of relying only on experience

Weaknesses

- **Limited Digital Literacy**
  Like the irrigation system, In E-fisheries there is same common barrier. The farmers may find it challenging interpreting the data as most of Bangladeshi rural farmers are uneducated.
- **High cost of Installation and Maintenance**
  The process of installing the model is expensive, and maintenance can be expensive.
- **Lack of Technical Knowledge**
  The farmer requires proper training on how to use the system correctly. Farmers can fail to monitor and charge the system appropriately without such skills and knowledge.
- **Limited Technical Support**
  Farmers may not have the resources to understand the features and functions of the system.

Opportunities

- **Voice Alert System in Bangla**
  A voice alert system can be added to the existing system to provide notifications in Bangla, where the farmers can know the massage only by tapping, making it easier for illiterate farmers to understand.
- **Export Quality**
  As value added Fish Products in Bangladesh is increasing rapidly therefore, farmers need the system to ensure there is quality production is meeting export standard.
- **Collaboration between Private and Public Organizations**
  NGO's and the government can collaborate to educate farmers on the best way to use the system.

Threats

- **Traditional Farming Practices**
  Farmers may be resilient to adopt the system and continue using years of experience in managing their ponds.
- **Low Costs of Conventional Approaches**
  As the solution is costly, farmers may prefer manual processes of checking water levels because it may cost them cheaper to hire workers.
- **Uncertain Environmental Conditions**
  The system need power to run the device, any uncertain environmental disaster like electricity failure can disrupt the whole process.
- **Infrastructure Limitations**
  If the project site has limited power supply or poor connectivity can hamper or reduce system's efficiency.

2.1.3 Company Operations

The daily operational processes of NDL are determined by a wide range of activities and cross functional responsibilities that were observed directly during the internship period-

- Industry and Business Analysis
- Administrative Documentation
- Financial Documentation
- Procurement and Logistics Handling
- Field Deployment and Installation
- Training and Field Support
- Event Coordination and Stakeholder management
- Data collection and Reporting

The listed functions represented above shows the operational framework that connects NDL's product design to its customers in the field and they linked with device deployment, installation, logistics, backend server, ERP system that followed by NDL.

2.1.4 SWOT Analysis for NDL

Strengths

- **Strong technological capability in IoT, AI, and Data Analytics**
  NDL's ability to provide precise and real-time agricultural analytics showing its technological capabilities. Such an approach allows farmers accessing the amount of guesswork and provide valuable insight to make better informed business decisions.
- **Integrated Solutions (E-Irrigation & E-Fisheries)**
  The company offers multiple solutions, reducing business risk as it is not solely depended on one solution. This strategy helps the company to target different areas in the agricultural sector that meet agricultural needs which provides diverse options to its clients.

- **Alignment with National Agendas**

  NDL offers solutions that promotes climate smart agriculture practices and digital innovations. This provides an advantage for the company to facilitate partnerships with government and NGO's. Additionally, their innovative solutions can attract investors and donors from across the world, which can help them to gain long term sustainability.
- **Cost and Productivity Benefits**

  NDL's smart solutions reduce costs for irrigation and energy consumption while increasing the yield and productivity consistently. Encouraging farmers to adopt their solutions to optimize farming efficiency.
- **First-movers Advantage**

  In smart farming technologies NDL has an advantage over other rival firms due to its early entry into the market. This allowed the firm to build up valuable field experience which facilitates the establishment of strong customer relationships and brand image.

Weaknesses

- **Reliance on Digital Literacy**

  Their solutions require users to understand their application and knowledge about digital technology. Many farmers lack understanding which makes it difficult for many farmers to use them creating resiliency as the literacy level among Bangladesh's farmers are low.
- **Limited Accessibility**

  The system they have developed is heavily text-based and visualization. Lack of user centric interface made a huge portion of target market excluded. As rural farmers are mostly uneducated, they struggle to interpret information which leads to underutilized and misuse of the technology.
- **Need for Technical Support**

  The devices require regular maintenance, including calibration and trouble shooting. Rural area farmers may find it difficult or they may not have the technical expertise perform these operations which increase the dependency on external

support teams leading rising costs both for the company and its users. Resulting slowing down the adaptation.

- **High Initial Cost**

  Sensors used in their devices are all imported which make the product initial installation quite expensive compared to traditional solution. Even though it is cost effective in the long run but the upfront expenses can be a deal-breaker for many farmers who are not financially stable. Small holder farmers are unable to afford the expense which remains a key problem.

- **Brand Invisibility**

  Farmer across the country relies more on traditional solutions available in rural markets rather than smart solutions meaning NDL's method is relatively unknown compared to conventional ways. And farmers are resilient using new technologies as they have to expertise, to boost the use of their solutions they should invest in marketing campaigns for the target audience to gain their trust on their inventions.

Opportunities

- **Growing Demand for Smart solutions**

  Scarcity of water, electricity power and labor shortage pushing farmers towards digital technology adaptation. This has become a necessity for farmers rather a basic need.

- **External Fundings**

  Government and NGO fundings can help minimizing the costs for a greater adaptation and wider use for rustic area smallholder farmers, increasing the availability of smart solutions.

- **Integration of Voice based system**

  Voice based system can be utilized in Bangla to mitigate the illiteracy problem. Farmers can get instructions or can interpret data via voice rather than reading instructions. In the way it can be more approachable and it will help in better adaptation and usage among farmers by creating confidence and inclusion.

- **Regional Market Expansion Potential**

The countries of South Asia have comparable agriculture issues where NDL's solutions (E-irrigation & E-fisheries) can be implemented. Which will allow the company to extend its geographical reach and at the same time it will boost their sales and profit.

Threats

- **Competition from Low-Cost Traditional Market**
  The main alternative of smart E-irrigation seems to be traditional AWD pipes, which are considerably cheaper compared NDL smart solutions. While not being as efficient, they are still popular among farmers due to their low price and simple design. Therefore, the relatively high cost of the equipment threatens to reduce its competitiveness on the market.
- **Rising New Agri-tech Competitors**
  The agri-tech industry is expanding with the entry of new entrants in the market. These entrants may provide alternative solutions that are easy to operate and have low-cost benefit. This trend could lead to increase market competition and which downward significantly the price impacting NDL's market share. In that case the company must focus on their continuous innovation to hold the competitive edge.
- **Resistance to Behavioral Change & Risk of Low Perceived Value**
  Farmers are used to rely heavily on their traditional methods and years of experience and knowledge. Therefore, they may disbelieve automated data driven decisions and farmers expects to see a short-time yield from modern solutions. if they do not see any quick results, they may lose interest. It may lead to a negative word-of-mouth in the farmer community which affects sales of the product and perceived values. Both shows why it can be an obstacle to technology adaptation.
- **Infrastructure Limitations**
  Internet of Things (IoT) system needs constant internet connection and electricity to run and generate information. The IoT systems are vulnerable because of lack of electricity and mobile network in rural areas of Bangladesh. This reduces the process effectiveness and decrease the demand as farmers lose trust due to the facts.

2.2.1 Industry Analysis

Bangladesh's agriculture sector is mainly dominated by the smallholder farmers which and face various issues which include low literacy among farmers, unpredictable climate change, insufficient supply chains. Smart IoT technologies with software and hardware can mitigate the problems, increase yield and resource efficiency. But Bangladesh's most of farmers have very low literacy rate and less technical knowledge which causes difficulty in adaptation of these modern solutions. Moreover, the upfront cost for IoT based solutions and it's maintaining cost are significantly higher demotivating farmers to apply.

The value chain of Bangladesh's agriculture sector is fragmented into several parts due to multi-stage intermediaries which reduces profit for the actual farmers but also provides opportunities for digital platform to improve market linkages and degree of transparency. Government support and private NGO initiatives has been taken to resolve the issues and help to develop a sustainable business environment for the farmers. Initiative like increasing availability of smartphones in rural areas, which opens the window of using modern agri-tech solutions. Slowly creating an environment focusing to the growth of the industry.

Several challenges are faced in the development process of Agri-tech innovations in Bangladesh. The agriculture sector is still underdeveloped and often farmers show resistance towards using new technologies over traditional methods. The main resistance comes from the limited finance, low technical knowledge and support, lack of user-centric designs, poor supply chain management limits the large-scale adoption of smart solutions. Technical support and training are needed as farmers do not have sufficient knowledge. The industry continues to expand with startups targeting on different financing schemes and advisory services, better supply chain and automations. Overall, the future of Bangladesh's agri-tech depends on making the solutions affordable, user-centric infrastructure and strong ecosystem collaborations.

CHAPTER 3: DEPLOYMENT

Deployment refers to the on-the-ground process by which an E-irrigation or E-fisheries device moves from a packaged unit to a fully functioning, data-generating installation at a client's farm or pond. During my internship, I was privileged to observed directly through two deployment cases: an E-fisheries DO-sensor installation at Fishtech, Teknaf, and an E-irrigation Smart/Portable AWD demonstration and training program at Go Farmer sites in Rajshahi and DASCOH Foundation in Naogaon.

3.1 General Deployment Workflow

Both product lines follow a general deployment process, the sequence can be shown as:

1. Pre-deployment site and data requirement assessment.
2. Procurement and dispatch of the required device/sensor unit to the field team.
3. Installation on site.
4. Functional verification confirming the device is transmitting accurate data to the server.
5. Handover challan receipt to the client's site representative.
6. User training on the mobile app, dashboard, and device controls.
7. Post-installation monitoring and feedback collection

3.2 Case 1 — E-Fisheries DO Sensor Deployment (Fishtech, Teknaf)

Figure 11

In case of E-fisheries, first it started with sourcing components for the device installation. After reaching the Fishtech site at Kharangkhali, Teknaf the IoT team began deployment

by examining the site and required data before installation. After that they proceed with the physical installation of the DO sensor. The installation phase involved testing data generated by the sensor and verify whether the device is sending accurate data. Once the installation is complete and confirmed functional, a challan receipt is issued to the Fishtech manager as proof of delivery.

A structured set of site information was collected during this process, following a defined sequence:

- Site & Pond Information
- Cell Layout
- Fish Culture Information
- Feeding Information
- Aeration Information
- Water Quality & DO Automation
- Geolocation Requirements

In addition, a set of specific technical and operational questions was answered for each site to enable correct sensor configuration and automation logic, including: the latest stocking date, expected harvest date, current cultivation day number, feed quantity per serving, GPS coordinates of the sensor point, GPS coordinates of the pond's four corners, the blower motor's horsepower/voltage/amperage rating, availability of internet on site, and the preferred auto-blower logic based on the DO setpoint. Once these were confirmed, the deployment concluded with hands-on training for the client on the app's user manual, aerator control from the app, and dashboard settings

3.3 Case 2 — E-Irrigation Training & Demonstration (Rajshahi & Naogaon)

The second deployment case combined live device demonstration with stakeholder training across a two-day program.

Day 1 — Gujidaing, Rajshahi (Go Farmer Site Visit)



Figure 12

Live testing and presentation of the Smart AWD and Portable AWD devices. A training session arranged for Go Farmer's farmer members. AWD pipe installation at the demonstration site. Live demonstration of correctly fitting the portable device cap to the AWD pipe for accurate data generation. Data screening directly from the device. Collection of feedback on a pre-installed Smart AWD device already in use under Go Farmer's ongoing project feedback received was positive.

Day 2 — Event Coordination (Niyamatpur, Naogaon to Gujidaing, Rajshahi)

The second day combined a stakeholder visit with a return to the field demonstration site, following the route: Rajshahi Airport → DASCOH, Niyamatpur → Gujidaing, Rajshahi → Rajshahi Airport. During the occasion, my role was Event coordination for day-long activities, covering the following activities:

- Arranging transport facilities for the day-long event.
- Arranging breakfast, lunch, and other logistical needs
- Receiving the Chairman and accompanying guests from the Sajida Foundation and the British Asian Trust at Shah Makhdum Airport, Rajshahi.

- Coordinating a brief one-hour session at the DASCHO foundation office, including formal interaction with DASCHO officials and local government officials from the agriculture administration.
- Briefing attendees on the impact and benefits of the Smart AWD device, its user manual, and its water-saving and cost-efficiency advantages.
- Explaining how the solution reduces labor input, increases yield, and supports sustainable farming.
- To make their service available they have introduced a new scheming system where one farmer or a group of farmers can rent their device for a whole session.
- Go farmer site inspection; A simple brief on Smart AWD device and collecting feedback from farmers if their solution is helping in farming practices and reducing cost for watering the field compared to old traditional method.
- Listing down farmers details who anticipated in the training session.
- Manual AWD pipe collection from Go Farmers project.

This case shows that the deployment process of NDL is not simply technical but has a strong connection with stakeholder relationship management, partnership coordination, and creating awareness among farmers for better adaptation and active use of their solution.

CHAPTER 4: LOGISTICS

This section provides end-to-end logistics of NDL based on its procurement, ERP vendor management and deployment functions during the internship. Starting from procurement of IoT components to final device deployment on site and after sales service.

4.1 Sourcing

NDL's IoT devices are a combination of hardware and software. Various sensors for DO, water level, microcontrollers, communication support based on cellular or sims, for calibration they use batteries, solar panels and voltage controllers and structural housings for agriculture and aquaculture facilities. Larger part of the procurement decisions is being made based on component reliability, price and software for calibration and sensor specific software tools provided the manufacturing company, those tools are used in the future by NDL's technical team to resolve any issue regarding sensor and calibration in the site.

4.2 Procurement

The procurement process is directly linked with administrative documentation activity. During my internship I got the privilege to source IoT components for Fishtech DO sensor deployment. Purchasing of different components lead to learn various documentation process of the company. Understanding the systematic of use of documents and forms to track expenses.

- Daily/Travel Allowance Claim form: Used for claiming expenses for field visits.
- Cash Purchase Form: Used for procurement, purchase of different components or services are recorded though this form.
- Expense Claim form: To claim operational expenses like patty cash purchases and other expenses made by stuffs and employees are recorded by using this form.
- Other important documentation including Salary, Utility expenses and vendor payments.

Vendor data is managed through NDL's ERP system's Third Parties module. That module specifically maintains records of vendors list with all necessary information.

4.3 Inventory, Warehousing, and Quality Verification

Sourced components and device sensor has to go through internal quality test ensuring the device readiness before leaving NDL’s premises for deployment.

Although detailed warehousing protocols were not directly accessible during the internship, the existence of post-installation diagnostic routines (e.g., checking sensor power, cleanliness, calibration, and connections detailed in Section 7) implies that devices are expected to be functionally verified before leaving NDL's premises, with field checks serving as a second layer of verification rather than the sole quality gate.

4.3 Transportation to Deployment Sites

NDL's transportation logistics must accommodate a geographically dispersed client base, spanning coastal aquaculture zones (e.g., Teknaf, Cox's Bazar district) and inland rice-growing regions. Field activities observed during the internship required multi travel for example, the Rajshahi/Naogaon program required coordinated transport between Rajshahi Airport, the DASCHO foundation office in Niyamatpur, Naogaon and the Go Farmer site in Gujidaing, Rajshahi. Transportation planning therefore covers both the movement of hardware/equipment and the movement of NDL's own technical, training, and coordination staff, often within tight single-day or multi-day schedules.

4.4 Site Assessment and Installation

On arrival at a site, the field team conducts a structured assessment before any installation, gathering the sequence of data described in Section 4.2 (site and pond information, cell layout, fish culture information, feeding information, aeration information, water quality and DO automation needs, and geolocation requirements). And for E-irrigation Smart AWD they have undergo similar installation requirements to install AWD pipe and fit the cap with sensor correctly for generating accurate field information.

4.5 Functional Verification and Handover

After finishing installation and checked device data accuracy form their server’s dashboard the deployment process is considered finished. Any abnormalities regarding data generation can be detected through the server and helps take necessary steps to resolve the issue. After successful installation NDL provides a Challan receipt as evidence

to the designated project's management personnel that the required service has been delivered.

4.6 Training and After-Sales Support

Use of logistics doesn't end after installation. They need to conduct training sessions on their mobile app and server dashboard user manuals to farmers based on different domain of their offerings. For E-irrigation they arrange sessions on water pump automation and on the other hand aerator automation process for E-fisheries solutions. These sessions provide an opportunity to collect feedback on their solutions directly from the end users where it creates a landscape to identify root causes comes from the device and improves after sales service from NDL's management end.

4.7 Reverse Logistics

In their operations they also a reserves logistics function. Devices or components sometimes need to be taken back to their office for repairing. As illustrated in Go Farmers site visit, manual AWD pipe and a portable AWD device were collected by NDL's stuff before leaving Rajshahi. This shows reverse logistics flow of NDL.

4.8 Logistics Chain Summary

Stage	Key Activities
Sourcing	Selection of IoT components, sensors, microcontrollers, connectivity modules, batteries/solar components and other operational housings from manufacturers/vendors.
Procurement	Cash Purchase Forms, Expense Claims, vendor list management via Dolibarr's Third Party module.
Inventory & QC	Pre-dispatch functional checks; sensor-manufacturer calibration software used as needed.
Transportation	Multi-leg movement of equipment and staff to coastal and inland sites.
Site Assessment	Structured data collection: site/pond info, cell layout, culture/feeding/aeration data, geolocation.

Stage	Key Activities
Installation	Physical placement of DO sensors / AWD pipes and device configuration.
Verification & Handover	Server-side data accuracy check; Challan receipt issued to client.
Training	App, dashboard, and device-control training for client staff/farmers.
After-Sales & Reverse Flow	Feedback collection; return of accessories/parts (e.g., manual AWD pipe).

Table 3

CHAPTER 5: Digital Platform Integration

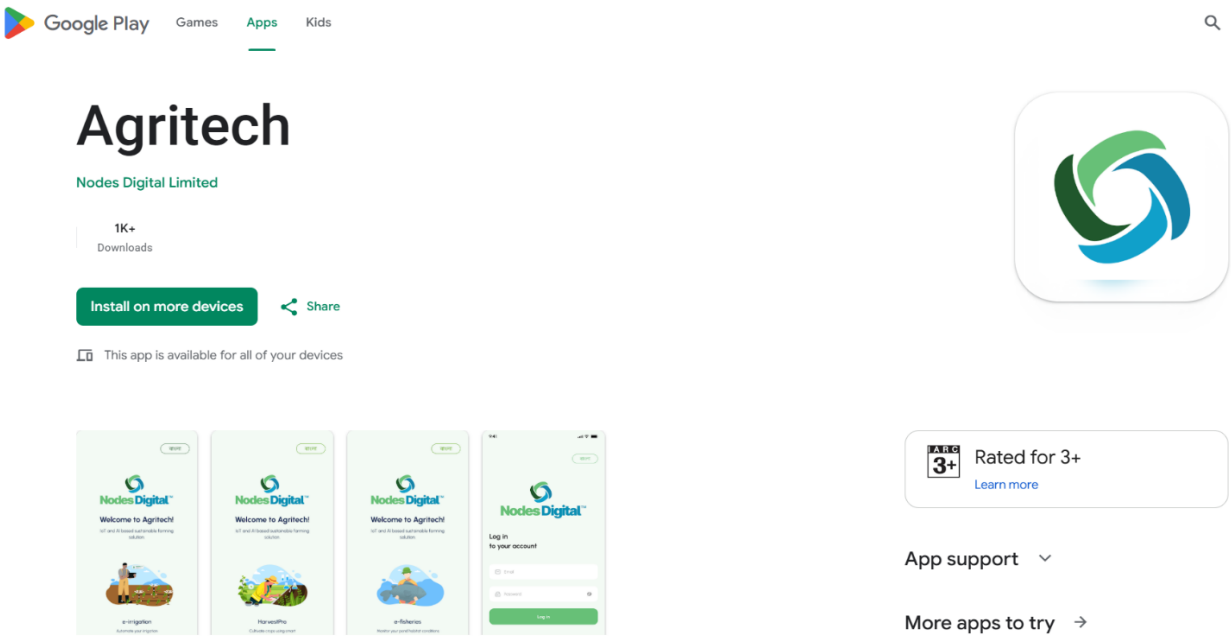

Figure 13

NDL's mobile application provides a centralized digital platform where farmers can get real time updates of their field or pond data that has been collected from their IoT devices. The application also sends instant alerts to unwanted situations which allows the farmers take necessary steps. This application lowers physical monitoring and reduces manual effort. Moreover, this enhances the productivity, reduces human labor input and use of resources in a more effective manner by giving more accurate information instead of prediction.

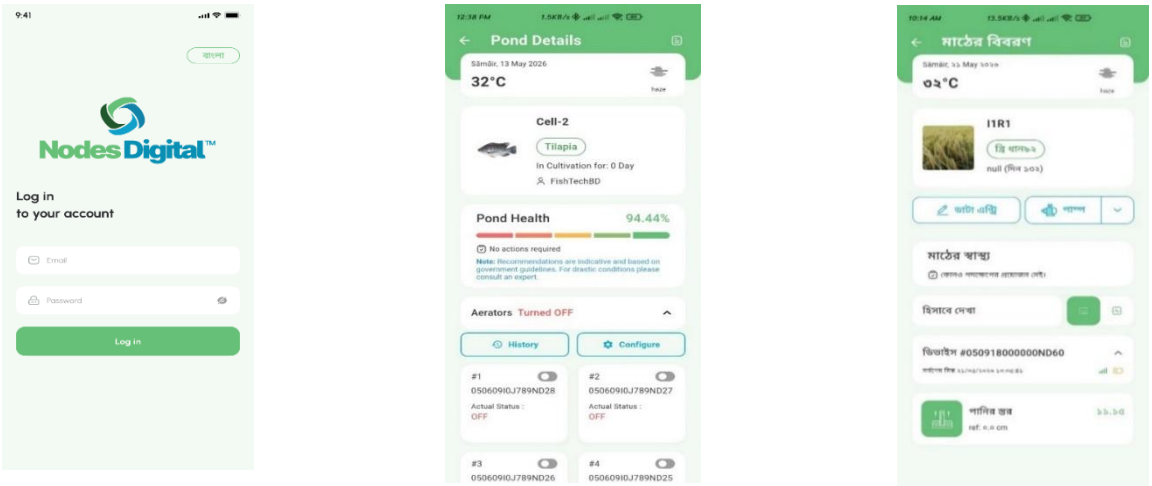

Figure 14

From this one application farmers can monitor both E-irrigation and E-fisheries solutions. After logging in into the Agritech mobile application, every farmer can get the information relevant to their farm, irrigation or pond. The app dashboard provides an interface which is easy to understand. Farmers can easily check information required.

Sensor installed in the projected site constantly collect real time data such as dissolved oxygen level (DO), moisture level in the soil and send it to the application. The information from IoT devices is being sent to a cloud server where it is synced with the mobile application.

🌙 **Nighttime Breakdown (18:00 - 06:00)**

Time Slot	Avg DO	Highest DO	Lowest DO	Status
18:00 - 21:00	5.54	7.47	1.52	🟠 Poor
21:00 - 00:00	5.10	6.94	0.42	🟠 Poor
00:00 - 03:00	4.28	7.14	0.32	🔴 Critical
03:00 - 06:00	**3.45**	6.46	**0.24**	💀 **Lethal**

☀️ **Daytime Breakdown (06:00 - 18:00)**

Time Slot	Avg DO	Highest DO	Lowest DO	Status
06:00 - 09:00	3.15	6.85	**0.27**	🔴 Critical
09:00 - 12:00	5.12	7.24	0.45	🟠 Poor
12:00 - 15:00	**6.58**	7.95	1.53	🟢 Healthy
15:00 - 18:00	6.62	**10.24**	1.96	🟢 Healthy

Figure 15

The application holds record of previous data sent from the device. As a result, Famers can easily interpret the forecasted data and effective measures. The application has an Alerts and Notification feature, it generates instant alerts to any irregular activity in their ponds or paddy fields. It also sends SMS to the farmer's mobile number in case of unavailability of smart phone.

CHAPTER 6: ERP IMPLEMENTATION

Nodes Digital Limited uses Dolibarr, an open-source Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) platform, as its primary system for managing internal administrative, vendor, and human-resource workflows. During the internship, a dedicated Dolibarr ERP account was opened and used to learn and operate several of its modules.

As an Intern, NDL allowed limited access into their ERP. I had access into Third parties, Commerce, Billing | Payment, HRM, Documents and Tickets

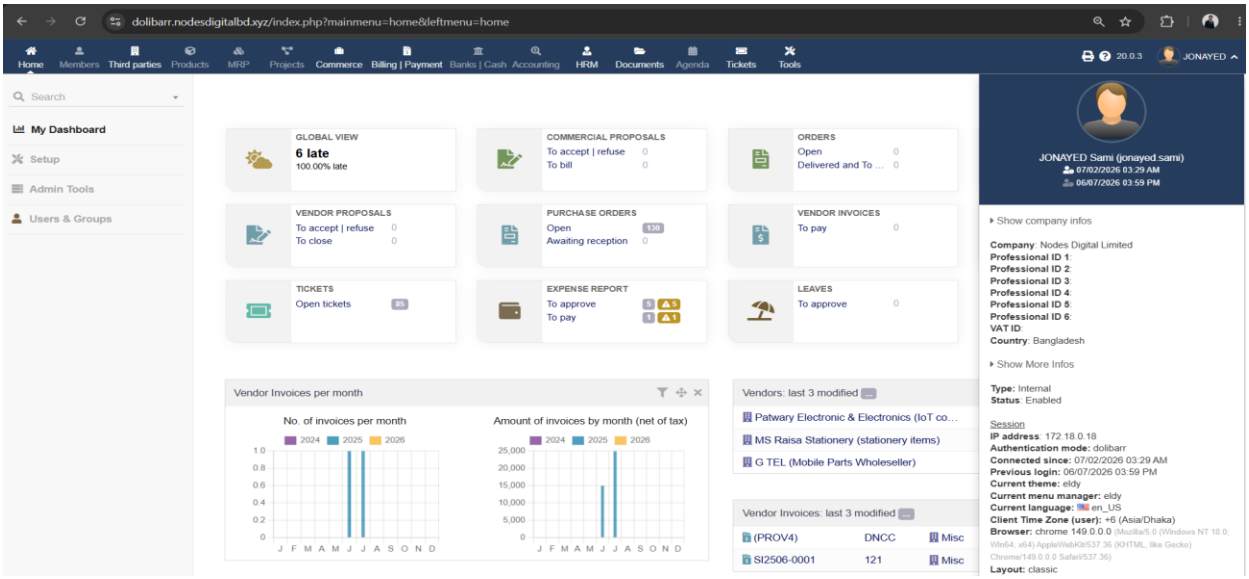

Figure 16

6.1 Modules Used

Module	Function Observed
Tickets	- Manage clients, suppliers, and partners. - Add and update customer/vendor information. - Store contact details (phone, email, address) and track transaction history with each party.
Commerce	- Create and manage quotations (proposals). - Convert proposals into sales orders.

Module	Function Observed
	- Track order status (pending, approved, delivered) and monitor sales activities.
Third Parties	- Create tickets for issues or tasks. - Assign tasks to team members. - Track progress (open, ongoing, closed). - Maintain communication related to problems.
Documents	- Upload and store important files. - Arranged documents by type of category and projects. - Limited Accessibility and sharing faciality among employees. - Retrievable files in need of emergency.
HRM	- Maintain employee information. - Track attendance and working hours. - Manage leave requests and approvals. - Track employee activity details and role in the organization.
Billing | Payment	- Record payments received. - Creates systematic receipts and invoices for clients. - Track due and unpaid amounts. - Manage supplier invoices and payments

Table 4

6.2 Role of ERP in the Supply Chain

NDL uses Dolibarr EPR as the administrative support system that integrates other functions to its system. It is used as a central hub where important functions like procurement, vendors, due and payment records and others important documents are in one place.

In Dolibarr's **Third Parties** module every purchased item with a details of vendor shop name, address number, vendor type (importer or reseller) are recorded accordingly and

that links with the procurement process directly. Every purchase and payments can be checked which ensures there are no informal or manual registry problems within the organization. In my time of internship, I was able to explore the module, I checked and updated the vendor list for last five months activity. The module helps in procurement decisions by keeping vendor data recorded in a structural manner.

Tickets module is specialized in resolving operations problems. In any kind of component requirement or device related problems on project can be rise in this module from where management can easily approve simultaneously keeping record of approval personnel. Which also provides a detailed record for administrative overhead costs like as an agri-tech company NDL's team are often away for device deployment or training sessions.

Dolibarr standardizes the HR workflow through **HRM** module. Through this module employees can rise leave request and other organizational needs to be approved later. Here employees can validate their request in case of cancelation of the event. Which helps employees reducing extra hustle while at work.

The **commerce module** is primarily used for assisting in the sales activity. To create professional proposals or quotes promptly for clients. This saves time as employees can directly make system generated proposals instead manual proposals. Order status can be monitored by this module, it provides if the order is pending or approved, or ready to deliver. Which improves their service quality by following up with their clients. Moreover, this module cut off manual work and helps to manage sales more efficiently.

Billing | Payment is a module from where employees can manage their every financial transaction. This module is used for creating invoices and billing receipt. Also, employees can monitor payments from clients or partners to know the status, which one is settled and which is unresolved along with the due date. It helps to identify those unresolved bills easily and work accordingly. Additionally, through this module remainders can be sent to clients and suppliers. Making the financial transaction transparent and fast.

Lastly the **Documents** module acts as a one central system where every important organizational file can be stored and retrieve any time. Instead of saving files in multiple places it allows employees to save it in one place and access to those files can be limited

by the system, which allows protecting files confidentiality. Employees can share documents among teams which improves the collaboration between team members and boost productivity.

6.3 Observed Benefits

- Centralization of all sales activities (quotations, orders) into one single system, reduces the resilience on manual paper works and dispersed records.
- Records of procurement, vendor information, payment history, expenses are kept in one place which lowers dependency on manual records with receipts and excel based spreadsheets.
- Records for administrative activities. Employee leave, Billing history, operational issues in one unified system. Which allows the employees to reduce time searching files kept in office shelf. Important file and data can be stored in the system allowing access limitation to secure confidentiality.
- Every document of payments, purchases and client details can be managed through its different modules. Employees can enhance their work effectiveness and reduce the risk of mistake by using the system efficiently.

6.4 Observed Limitations

- Dolibarr ERP system offers a wide range of modules targeting various departments. But however, during the internship I was allowed access only to Tickets, Third Parties, Commerce, Documents, HRM and Billing | Payment module.
- NDL still run their documentations outside the system modules, using various allowance forms (Daily/Travel allowance, Expense Claim form, Cash Purchase) reflecting the system is unutilized. Where the ERP provides integrated platform for administrative documentation work which opens an opportunity to automate financial workflows within the system.
- Device deployment details and project information are still recorded in different documents, not recording in the ERP system. Which shows a disparity between field operational documents and administrative works.

CHAPTER 7: PROBLEMS & CHALLENGES

This part of the report shows problems and challenges identified during the internship period. Device level technical issues and structural limitations collected from NDL's Software and IoT engineer team based on their experience and problems they faced.

7.1 Device-Level Technical Issues

NDL's technical team identifies IoT device issues primarily through two symptoms: (1) the system generating a zero value or an error code (9999) on the server/database indicating a sensor-related issue or (2) the complete absence of incoming data. The standard diagnostic sequence followed in the latter case is:

1. Check whether the SIM card used in the device is active or expired.
2. Check whether the SIM has an active internet package and validity.
3. Call the device's SIM directly to confirm whether the device is powered on; if not, reach out to the project's dedicated person.
4. Check whether the server, API, and backend systems are functioning correctly.

Once a sensor-related issue is suspected, the resolution sequence followed includes-

> Checking sensor power > confirming the sensor is clean and free of obstruction > verifying sensor calibration > using manufacturer provided sensor software (which varies by sensor company) to investigate > checking the MAX485 communication module > inspecting the sensor's physical connections.

7.2 Categorized Issue Landscape

Based on information gathered from NDL's software and IoT engineering team, device issues for the Smart AWD (E-irrigation) and E-fisheries product lines can be organized into seven categories,

Category	Problem Component	Elaboration
Network	Coverage Issues	Signal attenuation in remote, rural, or low-lying agricultural/aquaculture terrain causes intermittent connectivity.

Category	Problem Component	Elaboration
	Physical Damage (SIM)	SIM card degradation from oxidation, persistent moisture, or mechanical vibration in outdoor housing.
	Package Expiration	Unexpected suspension of data services due to expired prepaid plans or billing delays.
Calibration	Battery, solar or charging	Extreme heat causes reducing capacity of the device battery permanently. In addition, panel soling, dust and shades blocking sunlight negatively effects the solar panel reducing efficiency.
	BMS or Voltage Failure	Failure of the Battery Management System or voltage converters caused by moisture-induced shorts or electrical spikes.
Sensor	Damage & Fouling	Permanent degradation of sensor sensitivity due to biofouling (algae/barnacles) or chemical corrosion in water/soil.
	Physical Obstruction	Debris or wildlife activity (e.g., spiders nesting in AWD pipes) blocking ultrasonic signals or sensor ports.
	Connection Damage	Degradation of cabling insulation from UV exposure or physical damage from pests, leading to signal loss.
Firmware	Software Bugs	Memory leaks, buffer overflows or unoptimized logic causing system freezes or instability over long-term operation.
	Data Timing Issues	A period of temporary inactivity cause integration failure, the reason for not getting timely data through IoT solutions.

Category	Problem Component	Elaboration
	Communication Errors	Poor network coverage or corrupted data packets due to noisy environment disrupts focus and communication of IoT devices.
PCB	Component / Rust Damage	Electrochemical migration, rust, or condensation-induced short circuits on the circuit board within the enclosure.
Micro-controller	Processing Limitations	Insufficient RAM/Flash memory to handle real-time data tasks, leading to crashes or overheating errors.
	Peripheral Failure	Loss of I/O communication between the controller and external hardware modules due to voltage noise or faulty traces.
System/Back-end	Server/API Downtime	Service outages or API changes preventing ingestion of field-device data into the central platform.
	Algorithmic Issues	Flaws in back-end processing logic leading to corrupted data interpretation or faulty automated decisions.

Table 5

7.3 Frequency and Severity Observations

NDL's two products have separate patterns of failure. E-irrigation and E-fisheries are two dimensional solutions, one use for precision agriculture and other one is used for enhance aquaculture management. Both devices have different seasonal cycle, E-irrigation typically considers 3-4 month of period a season where E-fisheries season varies on types of fishes are producing (Tilapia, Coral, Shrimp) typically 6-8 months in a season. By interviewing NDL's technical team the following issues were identified:

Issue	Frequency	Severity / Note
Voltage converter damage	1–2 times per season	High severity; common across both E-irrigation and E-fisheries devices.
Sensor software crash	Rarely occurs	Low severity.
Methane sensor issue	2–3 times per season	Usually calibration issue.
Sensor cleaning requirement	Varies	Sensor must be cleaned per the NDL's recommended schedule.
Sensor calibration requirement	once per season	Routine maintenance item.
Power Calibration Issue	Once per season	Solved and diagnosed by NDL's technical team.
Aerator Automation issue	Once per season	Often raise from project's main power supply disruptions rather than the device.

Table 6

By following the failure pattern, it can be concluded that IoT solutions mostly occurs power calibration issue due to battery issue, voltage converter damage or solar issues. And sensor centric issues mostly occurred for environment driven causes or calibration issues which cannot be controlled by NDL. Failures like aerator automation, disrupted data from sensor are caused by the farmer's neglection for not following the user manual properly provided by the technical team pf NDL. Allover, this section highlights that there are some problems and issues in deployed field devices that the company cannot manage solely showing it requires both company and client cross functional collaboration.

7.4 Broader Industry and Structural Challenges

NDL run business into an industry with various problems and limitations regarding structure. By reviewing papers and articles related Bangladesh's agri-tech industry some challenges were identified:

- **Fragmented supply chains:** The supply chain for fish farming and crops consists of multiple middle man which negatively effects the farmers reducing profitability and value creation that was supposed to meant for the farmers.
- **Limited Financial Access:** IoT solutions are significantly costly which is unaffordable to many farmers as most farmers are smallholder farmers. As a rising agri-tech company, to make their products available for every farmer they have introduced rent free schemes for trial purpose. And a dependency on external fundings to boost the adaptation among rural area farmers.
- **Lack of Technical Knowledge and Trust:** Automated IoT based farming solutions has set it apart from the traditional practices. But farmers of Bangladesh focus on quick results where modern solutions increase their production over time as a result farmers loss trust and believe. And due to high illiteracy rate, they lack technical knowledge which reviews farmers need regular training support and user-centric design to shift from traditional farming practices.
- **Infrastructure and Connectivity issues:** In rural and coastal arears of Bangladesh where most farming and aquaculture activities takes place lack constant network availability, increasing difficulty to monitor remotely.
- **Environmental durability:** Bangladesh's weather is unpredictable, extreme humidity, over heat, insects and parasites and seasonal climates like monsoon rain causes raising expenses for components and frequency of maintenance. Ultimately, increasing device price.
- **Imported Components:** Hardware like sensors, microcontrollers, and different connectivity modules used in IoT devices shows a strong dependency on importing. Currency fluctuations, imports duties and lead time risk and which significantly increase cost for smart solutions, causes difficulties for small and medium sized farms to adopt the technology due to lack of financing and high upfront cost.

CHAPTER 8: RECOMMANDETIONS AND CONCLUSION

8.1 Recommendations

Based on my experience I gathered during the internship, the following recommendations would help NDL to improve their operations:

- **User-Centric Design**

  Users of NDL's IoT solutions are mostly illiterate, farmers face problem understanding device outputs resulting underutilized device potential. NDL can install a Bangla voice tap system where the system will read instructions for the clients reducing misinterpretation of information.

- **ERP Implementation**

  NDL uses Dolibarr ERP to various operational activities, but yet the system is not properly utilized. NDL still uses spreadsheet-based documentations for different project details, and manually creates proposals and allowance forms where the ERP system offers fully automated documentations and professional proposals with limited accessibility. NDL should use the system properly to save time for administerial paper works and enhance operational efficiency.

- **Frequent Training Session**

  As farmer lacks technical knowledge and low literacy rate which directly effects the adoption for modern solutions. NDL should increase the frequency of training sessions, which can help to deliver clear understanding about the features and advantages of using NDL's smart solutions. Additionally, to mitigate trust issues across the community.

- **Use Better M2M SIM Card**

  By using better IoT sims in NDL's solutions can slightly improve network coverage issues. As NDL's solutions has a board implication in coastal and rural areas. Poor network coverage creates disrupted data sent from their devices. Reducing device efficiency, NDL can switch to another SIM company with better network coverage.

8.2 Conclusion

This report has tried to study the Supply chain of Nodes Digital limited company and its current flagship IoT solutions E-irrigation and E-fisheries from initial sourcing to final deployment. Covering administrative documentation process, component procurement, role of ERP system, Field deployment and after-sales services for both devices.

There are a number of conclusions were made based on the learnings gathered during internship period. The supply chain of NDL is highly inter connected between each function. ERP based administrative, sourcing and procurement, installation and after sales support, stakeholder management, training sessions and feedback collection highlighting how strongly each activity influences one another. Even after successfully delivering the device their activity doesn't stop there. Their strong after sales support have Point NDL one of the promising agri-tech company in the agri-tech industry.

Using Dolibarr ERP as the central integrated hub for vendor management, Ticketing, Employee records, Billing and payment, and for admirative documentations provides an advantage mitigating operational errors and focus on other important concerns.

Technical error identification system. NDL has coded error identification system, in case of inappropriate data generation from devices the server shows 0 Value or 9999 on server. Which indicates to sensor related issues, helps identify the issue instantly and take effective measures to resolve it. More technical problems like lack of network coverage, connectivity issue, calibration issues, firmware failure, Microcontroller issue due to extreme weather. Which creates an opportunity to improve their product design and continuous innovation.

Agriculture sector of Bangladesh shows that the industry is facing savior challenges like multiple inter-mediaries, lack of education in farmer community, Limited financing, lack of user-friendly infrastructure which is directly affecting the adaptation of IoT technologies among the whole community. For a sustainable farming practice NDL is continuously arranging training sessions which creates awareness among farmers community. Partnership with Government projects and NGOs to raise external funds to help the farmers community. Introducing rent free schemes, the company is trying to reach out to those farmers who cannot afford the solution increasing availability of smart solutions.

In conclusion, the internship provided an opportunity to understand How a company operates its multiple functions simultaneously, a strong supply chain covering every aspect of the company from sourcing to last mile delivery. How ERP system strengthen company operation by integrating business functions (Documents, Billing | Payment, Third Parties, HRM). Field device performance monitoring and problem identification mechanism with a strong after-sales service states the company's strong presence in the industry and reliability of their E-irrigation and E-fisheries solution.

References

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