**Business Case**©

**For LabEMS**

**2025**

**Group Members:**

|  |  |  |
| --- | --- | --- |
| **Student Number** | **Name** | **Surname** |
| 34224874 | Tracy-Lee | Oberem |
| 44749082 | Schalk | Van Wyk |
| 40951499 | Janco | Pretorius |
| 37352598 | Johan | De Wet |
| 35093633 | Lethabo | Ratau |
| 47492058 | Ryno | Williamson |
| 41172493 | Mark | Kellerman |
| 39141004 | Tlou Given | Moreti |
| 45538093 | Ewald | Olivier |
| 43314392 | Murhangeri | Mashimbye |
| 44395027 | Lucky | Mkhatshwa |
| 41606205 | Stefan | Fourie |
| 38980274 | Jaco | Brits |

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# **1** **Executive Summary**

Universities and other Higher Education Institutions that provide access to laboratory equipment currently lack a defined, digital inventory system that can provide the necessary support needed by faculty and students to efficiently make use of the equipment. Booking of equipment, routine maintenance schedules and audit trails are all currently tracked by making use of physical paper trails, including notepads and whiteboards and occasionally e-mail chains. The proposed solution must implement a fully digital web application capable of keeping record of all the above and provide an efficient interface for users to make the most out of the laboratories.

Several solutions have been considered, including the current manual filing system, purchasing commercial off-the-shelf software from a third party, as well as a custom in-house build. After a thorough evaluation based on cost, feasibility and alignment with the business goals, the choice was made to develop LabEMS, a custom web application built in house to handle issues like bookings, service reminders, providing meaningful information to the universities in real time as well as returning reliable information back to the users.

The implementation will follow a structured, phased approach with a focus being given on developing and iterating prototypes as each phase progresses.

Four main phases will be followed:

(1) A Business Case and feasibility study will be conducted

(2) Functional and technical specifications will be implemented

(3) User Acceptance Testing will be conducted and lastly

(4) the system will be presented and implemented.

**2** **Business Problem**

## **2.1** **Environmental Analysis**

The North-West University is currently using email requests, paper logs, and spreadsheets to manage bookings as well as the maintenance of laboratory equipment. This outdated method has surfaced in a setting where:

* **Digital transformation is a national priority:** the adoption of centralized, automated systems and audit-ready, role-based compliance are key components of South Africa's Higher Education digital transformation plan.
* **Laboratory equipment is expensive and requires a lot of resources:** Optimizing usage, prolonging longevity, and cutting down on needless expenses all depend on proper tracking and maintenance.
* **Growing need for precise, up-to-date data:** For internal and external assessments, audit and compliance procedures need records that are accurate and quickly available.
* **Operational complexity has grown**: As a result of the facilities being used by several stakeholders, including students, laboratory personnel, and administrative staff. Manual processes result in inefficiencies, effort duplication, and a greater chance of misunderstandings.

## **2.2** **Problem Analysis**

**Business Problem**

The core business problem is that the NWU is currently using a manual laboratory equipment booking and maintenance system which is very inefficient.

**Why it exists:**

* They are still using old methods like emails, paper logs, and spreadsheets.
* They don’t have a centralized digital platform to coordinate requests, maintenance, and audit tracking.

**Impact on the business:**

* The students are unsure if there is equipment available to use which limits their ability to work efficiently.
* Laboratory staff has more administrative work and can also lead to double bookings and delayed maintenance.
* It is difficult to maintain accurate audit reports.

**Timeframe:**

* To minimize continuous resource waste, compliance risks, and inefficiencies, as well as to fit with South Africa's Higher Education digital transformation goal, immediate action is required.

**Business Opportunity**

By implementing a centralized digital laboratory equipment booking and maintenance system it creates an opportunity for the NWU to:

* Reduce downtime, enhance planning, and maximize equipment use by letting students reserve equipment in advance.
* Provide a single, integrated platform for scheduling maintenance and handling reservations to lessen the administrative burden on lab staff.
* Improve compliance by producing precise, audit-ready records in real time.
* Increase the longevity of equipment by recording maintenance and usage in a timely manner.

**Window of opportunity:**

* Short- to medium-term: By taking advantage of institutional preparedness and available financial sources, the project should be launched as soon as possible to coincide with the ongoing national digital transformation initiatives in higher education.

**Positive impact:**

* Improved effectiveness of operations.
* Lower expenses due to misplaced or badly maintained equipment.
* Improved compliance stance, preventing fines or damage to one's reputation.
* Improved student satisfaction and resource planning.

**3** **Alternative Solutions**

## **3.1** **Solution 1 - Manual Filing system**

3.1.1 Description

The pen and paper option is a manual filing system method for managing all laboratory equipment bookings for laboratory staff and students. The system relies on physical logbooks, printed calendars as well as paper-based booking sheets. Email communication is used to request bookings, which are then recorded manually upon confirmation. This informal and decentralized system depends heavily on individual discipline and is prone to human error, making it inefficient and not user-friendly.

3.1.2 Benefits

The primary benefit of the pen and paper approach is its affordability since it does not require any investment in software, hardware or technical training. Users are naturally already familiar and comfortable with the concept. It is simple to implement and easy to understand for all users, regardless of their technical ability.

|  |  |  |
| --- | --- | --- |
| **Benefit Category** | **Benefit Description** | **Benefit Value** |
| Affordability | System has no hardware, software or technical training required | This system eliminates initial investment costs which allows it to be more budget friendly. |
| Ease of Use | The process is familiar and requires minimum training | Saves time and resources on user training |

3.1.3 Costs

|  |  |  |
| --- | --- | --- |
| **Expense Category** | **Expense Description** | **Expense Value (Monthly)** |
| Stationery and laboratory supplies | Pens and paper | *R463* |
| Storage cost | Physical storage required to retain historical logs and records for auditing purposes | *R800* |
| Communication costs | Paying for bandwidth to have connection to the internet to access emails. | *R1500* |

3.1.4 Feasibility

This system is highly feasible since it is already in use in many environments. However it becomes far less feasible if upscaling of operations or users occurs. With an increasing number of students yearly this manual system will suffer if left without heavy manual intervention, due to this it cannot meet modern compliance standards.

|  |  |  |
| --- | --- | --- |
| **Solution component** | **Feasibility Rating** | **Assessment Method** |
| Manual booking and recording process | Medium | Process is simple but error-prone and inconsistent |
| Stationery and printing requirements | High | Supplies are readily available and inexpensive. |
| Email based communication for bookings | High | Email systems lack automation and tracking |
| Storage of physical records | Medium | Storage is feasible but space becomes a constraint over time |
| Scalability of the system | Low | Manual processes do not scale well. |

3.1.5 Risks

Due to the system relying heavily on physical resources, the system could be prone to human error such as lost/damaged/misplaced records or the overlooking bookings, causing double bookings/omissions to occur. Due to the main form of communication being emails, there is also a possibility that emails get lost which could lead to miscommunication. Moreover, the lack of traceability and audit logs makes the system unsuitable for regulated environments or institutions that must comply with digital standards.

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk Description** | **Risk Likelihood** | **Risk Impact** | **Risk Mitigating Actions** |
| Loss, damage or misplacement of physical records | High | High | Digitise the system and implement secure backup procedures for the records. |
| Human error in booking and maintenance logs | High | High | Implement checking procedures or digital validation. |
| Lack of accountability and traceability | High | Medium | Introduce user sign in on a digitised system. |
| Difficulty in locating historical data | Medium | Medium | Digitise all past records and data. |

3.1.6 Issues

|  |  |  |
| --- | --- | --- |
| **Issue Description** | **Issue Priority** | **Action Required to Resolve Issue** |
| Loss, damage or misplacement of records | High | Digitise the system and implement secure backup procedures for the records. |
| Double bookings and scheduling conflicts | High | Replace the manual calendar with an automated booking tool. |
| Difficulty sharing of records between departments | Medium | Centralise bookings onto a shared digital platform |
| Time-consuming updating and reporting techniques | Medium | Automate data entry and generate reports via a digitised system. |

3.1.7 Assumptions

* Staff and students will most likely fill in the manual reports without supervision
* All physical records will be stored in a safe, organised location and retrievable when needed.
* Lab operations will remain at a small and manageable scale that no automation is required.
* There will be enough administrative staff to manage the physical records.

## **3.2** **Solution 2 - Commercial off-the-shelf software (COTS)**

3.2.1 Description

The company-bought LabEMS is a commercial off the shelf software solution designed for managing laboratory equipment and bookings. This system integrates all the core functions, such as the tracking of the equipment and bookings into a single platform. This system relies on a stable internet connection and requires every student or staff to have a device to be able to interact with the system as it is a cloud-based application.

3.2.2 Benefits

The primary benefit of the Commercial off-the-shelf software solution is to digitize and automate the processes to reduce the inefficiencies and errors that come with manually entering logs.

|  |  |  |
| --- | --- | --- |
| **Benefit Category** | **Benefit Description** | **Benefit Value** |
| Operational Efficiency | Automation within the system makes tracking and scheduling much more efficient, reducing the chance of human error and delays in allocation/procurement of equipment | Increases efficiency and ensures compliance standards. |
| Data Accuracy | System allows for centralising of all data | Reduces the risk of inconsistencies or missing data |
| Time saving | Requesting of the equipment and to be able to see the availability of the equipment and digitally enter logs/reports | Don’t have to manually enter logs with a pen and paper saves time for students and staff. |

3.2.3 Costs

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Calculation** | **Cost ($)** | **Cost (R)** |
| **Base Academic plan (first 3 users)** | $49/month | $49 | R906.50 |
| **Additional User (197)** | 197 x $15/user/month | $2,955 | R54,667.50 |
| **Total Monthly Cost** | $49 + $2,955 | $3,004 | R55,574 |
| **Annual Cost** | $3,004 × 12 | $36,048 | R666,888 |
| **Total Estimated Cost Before VAT** | $36,048 × 5 | $180,240 | R3,334,440 |
| **VAT at 15%** | R3,334,440 × 0.15 |  | +R500,166 |
| **Total Estimated Cost After VAT** | **R3,334,440 + R500,166** |  | **R3,834,606** |

3.2.4 Feasibility

|  |  |  |
| --- | --- | --- |
| **Solution component** | **Feasibility Rating** | **Assessment Method** |
| Cloud-based deployment | High | Vendor confirms cloud hosting |
| Internet connectivity | Medium | Reliable in most areas, but there might arise problems for users who don’t have internet access |
| Device accessibility for staff and students | High | All staff and students need internet access on their devices |
| Vendor support and maintenance | High | Ensure ongoing technical support and updates to the system |
| Licensing and subscription cost | High | Cost falls within the budget for NWU’s IT budget |
| Equipment and booking integration | High | Pilot testing and core features must be demonstrated during demos |

3.2.5 Risks

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk Description** | **Risk Likelihood** | **Risk Impact** | **Risk Mitigating Actions** |
| Vendor discontinues support or service | Low | High | Negotiate exit clauses in the contract |
| Data privacy and security | Low | High | Enforce strict access controls and encryption |
| Unexpected costs | Medium | Medium | Monitor expenditures during implementation |
| Staff and students resistance to change from a manual system to automated system | Medium | Medium | Provide training and support for the students and staff |

3.2.6 Issues

|  |  |  |
| --- | --- | --- |
| **Issue Description** | **Issue Priority** | **Action Required to Resolve Issue** |
| Dependency on third-party support | High | Negotiate flexible contracts and ensure data export options |
| Limited customisation for NWU-specific processes | High | Choose a custom developed solution tailored to NWU’s specific requirements. |
| High training requirements due to an unfamiliar interface | Medium | Conduct proper user training and provide users with proper support documentation for the system. |
| Potential integration challenges with existing NWU systems | Medium | Choose a custom developed solution tailored to NWU’s specific requirements. |
| Costs could increase due to uncontrollable factors (price increase, upgrades, etc.) | Medium | Perform a full cost analysis study and complete contract review before purchasing the system. |

3.2.7 Assumptions

* The vendor will remain reliable and committed to long term support and updates.
* The solution will meet all of the university's system specifications and needs.
* It is assumed that all the laboratories, staff and students will have reliable internet connectivity to access the cloud-based LabEMS system
* It is assumed that all the staff and students have devices that can connect to the internet
* IT is assumed that sufficient funding has been secured to cover the setup, licensing and operating cost of the system
* It is assumed that adequate training sessions and user support will be provided.

## 

## **3.3** **Solution 3 - Custom Developed Solution**

3.3.1 Description

LabEms is a custom-developed, web-based application created by students for students, specifically for the North-West Universities laboratory environment for students studying biological and natural sciences. The program focuses on the booking of equipment, auditing of records, providing security and creating an easy-to-use interface for all the stakeholders involved. Being developed in-house the system can be changed and adapted over time to fit any new requirements or needs that may arise. The system will be developed to align with the universities compliance requirements while also assisting in supporting the move towards digital transformation within the institute.

3.3.2 Benefits

The custom system offers a tailored approach designed specifically for the universities laboratories, ensuring that the developed solution matches currently implemented workflows and compliance requirements. Due to it being a custom designed system, it will offer the university complete control over all features, requirements, security specifications and data storage without being dependent on external vendors or having costly licence fees.

|  |  |  |
| --- | --- | --- |
| **Benefit Category** | **Benefit Description** | **Benefit Value** |
| Operational Efficiency | Automation within the system makes tracking and scheduling much more efficient, reducing the chance of human error and delays in allocation/procurement of equipment | Increases efficiency and ensures compliance standards. |
| Data Accuracy | System allows for centralising of all data | Reduces the risk of inconsistencies or missing data |
| Time saving | Requesting of the equipment and to be able to see the availability of the equipment and digitally enter logs/reports | Don’t have to manually enter logs with a pen and paper saves time for students and staff. |
| Complete control | Due to the system being developed in-house, this allows for the university to have complete control over future updates and requirement changes | The system will be fully adaptable to the universities needs |
| Affordability | Due to the system being developed by students for students, the university will not be required to buy any licensing for the system. | Money saved on software and technical training. |

3.3.3 Costs

|  |  |  |
| --- | --- | --- |
| **Expense Category** | **Expense Description** | **Expense Value** |
| Development cost | Money provided to the student developers by NWU | *R0* |
| Server hosting | Cost for hosting the web application on university server | *Between R15 and R1600* |
| Maintenance and support | Bug fixes, updates and support after deploying and handed | *R0* |

3.3.4 Feasibility

|  |  |  |
| --- | --- | --- |
| **Solution component** | **Feasibility Rating** | **Assessment Method** |
| In-house development | High | Review of student developer teams, and supervision by a project manager, working with NWU’s faculty |
| Web-based Application Infrastructure | High | Assessment of university hosting capability and network performance |
| Equipment booking functionality | High | Requirements gathered from stakeholders must match the features being developed |
| User interface Design | High | Early prototyping, with stakeholder feedback to ensure ease of use |
| Adaptability for future requirements | High | Since it is in house-code ownership, (Owned and managed by the university) It is easy to update and add additional features if needed. |
| Training and support | Medium | Development of user manuals and documentation on the system. |

3.3.5 Risks

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk Description** | **Risk Likelihood** | **Risk Impact** | **Risk Mitigating Actions** |
| Developers may be too inexperienced to offer an accurate solution | Medium | High | Consider backup plans in case of such an event occurring. |
| Security vulnerabilities could occur due to developer inexperience | Medium | High | Conduct security assessments and apply most suitable practices to avoid such an event from occurring. |
| Delays in development phases | Medium | Medium | Make use of an agile methodology with strict deadlines in place and review dates. |
| Possible lack of long term maintenance | High | Medium | Plan to handover the system to the university's IT department. |
| Possible usability issues during launch | Medium | Medium | Perform pilot testing and gather user feedback for any bugs that may have been overlooked before initial launch. |

3.3.6 Issues

|  |  |  |
| --- | --- | --- |
| **Issue Description** | **Issue Priority** | **Action Required to Resolve Issue** |
| Possible project delays during development | Medium | Construct an initial clear development schedule and enforce punctuality within the team. |
| Developer turnover due to graduating students | High | Document the system efficiently and transfer maintenance to the university's IT department. |
| User resistance to change | Low | Provide a hands-on demo experience and training to users. |
| Long term sustainability and support concerns | High | Establish a support plan and document the system efficiently to allow the handover to go smoothly. |

3.3.7 Assumptions

* The development team will be able to deliver fully functional working solutions by the deadline.
* Users will be willing to adapt and accept the new system and the changes that may take place.
* The system will remain sustainable for a prolonged period through detailed documentation, assisting the handover to the universities IT department.
* The requirements of the university and its laboratory restraints will remain aligned to what the system is able to support.

# **4** **Recommended Solution**

## **4.1** **Solution Rating**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1. Manual Filing** | | | **2. COTS** | | | **3. Custom System** | | |
| **Criteria** | Score | Weight | Total | Score | Weight | Total | Score | Weight | Total |
| Economic Feasibility | 3 | 28% | 0,84 | 4 | 28% | 1,12 | 5 | 28% | 1,4 |
| System Benchmarking | 1 | 13% | 0,13 | 5 | 13% | 0,65 | 5 | 13% | 0,65 |
| SWOT Analysis | 1 | 13% | 0,13 | 2 | 13% | 0,26 | 2 | 13% | 0,26 |
| Technical Feasibility | 3 | 28% | 0,84 | 4 | 28% | 1,12 | 4 | 28% | 1,12 |
| Legal & Compliance | 2 | 18% | 0,36 | 4 | 18% | 0,72 | 4 | 18% | 0,72 |
| **Total Score** |  | **100%** | **2,30** |  | **100%** | **3.87** |  | **100%** | **4,15** |

## **4.2** **Recommended Solution**

Based on the assessment criteria and scoring in the table above, the LabEMS Custom Solution is recommended for implementation after scoring 4.15/5 on the assessment criteria. This option is recommended over the other two proposed solutions for the following key reasons:

* **Economic Feasibility:** The system offers a very attractive economic solution as there are almost no costs involved in developing LabEMS, as well as benefitting the university through reduced downtime and optimized workflow.
* **System Benchmarking:** The system will provide superior performance compared to the current workflow, as well as being optimizable if the needs ever change.
* **Technical feasibility:** High technical feasibility scores indicate that the system can be implemented securely and easily integrated with the current NWU environment.
* **Legal and Policy Compliance**: The system will fully comply with NWU policies, the POPIA act as well as OHSAS guideline, ensuring strict adherence to these regulations.

# **5** **Implementation Approach**

## **5.1** **Project Initiation**

North-West University's current method of managing laboratory equipment bookings and reports is outdated and inefficient. The method relies highly on emails, paper logs and physical spreadsheets, making it difficult to keep accurate audit records and creates an unnecessary amount of administrative work. This method also results in missed opportunities when equipment sits idle or booking miscommunications occur.

With the ever-growing demand for digital transformation in universities and the growing number of students accepted to study every year, a digitised solution is the way forward.

Objective:

To centralise laboratory bookings, maintenance, and usage analytics to replace the manual booking of the lab equipment. Provides data for audits and usage optimization.

Responsibilities of the team:

* Frontend development - UI design of the project, making sure it is user friendly.
* Backend development - handling of server-side logic and database integration.
* Database design and migration - setting up initial database for system
* Infrastructure setup - provisioning and deployment of Azure services

## **5.2** **Project Planning**

Scope:

* Booking functionality for students and staff to reserve equipment
* Role based access controls, this includes admin controls for the staff (ability to access reports for example) and normal roles for the students to make bookings and see the availability of the equipment
* Automated audit trails and record keeping features for administrative purposes
* Responsive and well-designed user interface for the stakeholders
* The system is created for the University by the students, which allows the code and features to be expanded upon when there is a need for it.
* Compliance with NWU’s data and system standards, which includes security policies

Stakeholders: This includes the North-West University staff and students which are studying biological and natural sciences. They will play a key role in providing feedback on the system to ensure it is continuously improved to better fit their needs.

Project schedule:

* Business case and feasibility study - 11 August 2025
* Functional and technical Spec - 1 September 2025
* UAT Presentations - 3 October 2025
* Present Artefact/system - 24 October 2025

Even though the developers are working on deadlines, prototyping throughout all the phases of the schedule will be done to ensure the best possible result before presenting the system.

Resource allocation:

This project follows a hierarchical structure, we have a Project manager whose purpose is to give direction to the developers(members of the project) and we have a Project lead whose purpose is to assign work to each developer based on the schedule and what deliverable is next.

Communication plan:

Discord will serve as the primary platform for project communication. In addition, Documents and weekly meetings will be held to discuss upcoming tasks and identify any potential improvements to work completed in the previous week.

GitHub will serve as version control hosting for the system during the development process.

## **5.3** **Project Execution**

1.Execution Planning

Verify that the client is aware of all requirements, success criteria, and deadlines by reviewing the project plan and scope. All the project members must be assigned in this phase. All the programs and services must be available to use before the initiation of the project

2. Design

There will be a design phase which includes drawing diagrams and creating tables. This also includes the design of GUI. The design will be simple and user friendly.

3. Development

The product will be constructed in compliance with the design and quality requirements. During and after the building phase there will be a quality checks to ensure everything is up to standard. During the build phase all changes including design changes must be documented.

4. Testing & Quality Control

All the deliverable functions are tested to see if it performs as planned. Any inconsistencies discovered during this phase will be fixed. Testing also points out the quality issues and can be improved.

Approval

The completed product will be presented to the customer. The customer will be allowed to test the program to see if the program is up to the customers standards. Any last-minute changes will be made according to what the customer suggested. A signed document will be given so that the customer can approve that all deliverables and specifications were met.

## **5.4** **Project Closure**

**Transfer Deliverables to the Business:**

Final Deliverables:

The completed product will be handed over to the client or the stakeholder.

Project closure document:

A formal sign-off document will be given stating that the project has been completed and its objectives met.

Post-Implementation:

An evaluation of the project’s performance and how effectively it delivered it objectives will be done.

Release staff:

The staff will attend a meeting where there will be given recognition to efforts and honour accomplishments.

**Terminate supplier contracts:**

1. There will be looked at any duties, penalties or termination clauses in contact’s terms.
2. Next all the deliverables will be checked.
3. Then all pending payments and unpaid invoices will be taken care of.
4. Lastly a formal written closure will be sent to the supplier.

## **5.5** **Project Management**

Time Management

The project will be divided into manageable pieces between the project members. Timelines will be mapped using project management tools. There will be frequent meetings so that all the progress can be discussed and new deadlines can be announced.

Cost Management

There will be a thorough cost estimate that accounts for personal, machinery and contingencies. There will be a report indicating clearly all the costs.

Quality Management:

There will be a specific quality criterion that must be followed to force good quality. Constant monitoring will take place. Any quality issues will be addressed and handled accordingly.

Change Management.

If there are any changes that must be made. It must first be formally submitted to be approved. GitHub will be used for approving changes.

Risk Management:

Risks will be stated at the beginning of the project. Each Risk will be noted in each weekly meeting. Risks will also be categorized from low to high priorities. High priorities will have contingency plans to reduce the impact on the project.

Issue Management

All Issues will be noted and assigned to respective project members. Each member will then also be given a deadline to resolve the issue. Issues will also be categorized from low to high issues with high priority issues given more attention to and might be handled by more than one member.

Procurement Management

All external goods and services will be acquired through the NWU or approved vendors. Each product will then be tested before implementation.

Communication Management

Weekly meetings will be held in discord. Progress and information will also be shared, meeting minutes will be taken each meeting, stating a summary of the meeting, progress of the project and what each member task that they will be assigned to. Discussions between team members will also be held in discord.

Acceptance Management

Project deliverables will be reviewed thoroughly making sure all internal and external requirements are met. User Acceptance Testing will be conducted. Final acceptance will be granted when all requirements are met.