Agri-Connect Energy Final Report

JESSICA CHER BAIJNATH
ST10277880
PROG7311: POE - PART 3
Mr. Junior Manganyi
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0. Resubmission Checklist:

Part 1:

I did receive positive feedback on my visual aids and my non-functional requirements. I do acknowledge that my academic tone, structure and the integration of design concepts lacked academically. I would enhance it with a more formal writing style throughout the report to meet the consistency of an academic tone and referencing. I would also enhance it to have a formal report structure by adding a correct cover page, page numbers, numbered sections as well as a table of contents to enhance the readability. I would also strengthen my answer about the integration of design and architecture patterns with the NFRs as it lacked more detail. I would explain how they work together to meet the goals of the Agri-Energy Connect platform.

Part 2:

My prototype for part 2 achieved its full functionality across features such as secure login, role-based access and product management. The lecturer's feedback did highlight areas that needed improvement such as consistent naming conventions across classes, methods and views to enhance maintainability; front-end styling to ensure consistent UI/UX across the pages. I would implement validation and error-handling to improve user feedback and prevent incomplete submissions. I would also do more user testing to identify and fix minor bugs.

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1. Performance Optimisation

The prototype that I developed in part 2 was functional and secure. The key features of it such as production filtering, user roles, secure authentication and login system worked as intended to. The performance was lacking when delivering large product lists or continuous product modifications.

1.1 Performance test summary:

- The form submissions and login response times were valid but could slow down under scaled conditions.
- The product filtering worked perfectly but lacked efficiency as components such as result caching could be enhanced.
- The UI was slower on repeated updates because of synchronous controller logic.

1.2 Bottlenecks:

- There was a lack of caching as data that was accessed frequently such as product lists and farmer records was retrieved again on every page request (Microsoft, 2024b).
- There was a lack of asynchronous I/O processing reason being all controller actions made use of synchronous logic which made the I/O operations slow (Microsoft, 2024c; Microsoft 2022).
- There was no load testing as the performance under multi-user simulation was not tested.

1.3 Proposed optimisation:

- Asynchronous controller actions will be added to improve the responsiveness for heavy data operations (Microsoft, 2024c; Microsoft, 2022).
- In-memory caching such as MemoryCache or Redis will be implemented for the dashboard product data and role information (Microsoft, 2024b; Microsoft, 2024d).
- Bundling and minification will be added to help reduce the size and number of CSS files by making use of tools such as WebOptimizer which will help in lowering the front end load times and improve the website performance (Microsoft, 2024a).
- Data indexing will be applied to frequently queried columns such as FarmerID, ProductionDate and Category which improves the SELECT query performance.

1.4 How it links to Agri-Connect Energy:

Many farmers accessing the platform could be doing so through mobile networks in rural areas which have limited connectivity. An unresponsive or slow application could discourage users or even hinder productivity especially when product submissions are time sensitive, for example before the harvest deadline. Therefore the proposed performance enhancement contributes to the practical usability for the farming community.

2. Recommended development methodology.

2.1 The selected methodology: Scrum (agile framework)

Scrum is known to be a simplified agile framework that encourages iterative and incremental software development (Scrum Guides, 2020).
Scrum is the best choice for Agri-Energy Connect as it encourages continuous improvement, stakeholder feedback as well as incremental delivery and all this is very important in an evolving agricultural technology context (Atlassian, 2025). It is also the best choice for projects that develop via collaboration between cross-functional teams and end users (State of Agile, 2025).

2.2 Why scrum suits the project:

- It has iterative releases as the development process of the prototype was split into mini-sprints where each one delivered a functional feature such as user authentication, product management, filtering feature and search function. This allowed for testing and refining functionality at each stage (Scrum Guides, 2020).
- It allows for rapid feedback as the agricultural stakeholders can give feedback during the beginning stages of the process which limits the risk of developing incorrect features (Scrum Guides, 2020).
- It allows for adaptability as farming is seasonal and variable. It enables the team to refine the features based on real time testing.
- It allows for collaboration as the scrum ceremonies make space for client input and team reflection which ensures alignment between business goals and development direction (Atlassian, 2025).

2.3 Potential risks/weaknesses and mitigation:

- The scrum teams can lose focus due to unclear sprint goals.
  -*Mitigation:* ensure each sprint has clear user stories and deliverables.

- The stakeholders may not always be available for testing or reviewing sprints.
  -*Mitigation:* collect feedback early and this should be documented as it can be used to refer back to when stakeholders are unavailable.

- Scrum ceremonies can be time consuming if not managed with efficiency.
  -*Mitigation:* time all meetings and use tools like Azure Boards to keep it directed at its purpose (Microsoft, 2025).

- Scope creep can occur if product ownership is not assigned meaning new features will be added causing issues (Wrike, 2024).
  -*Mitigation:* assign roles and appoint a product owner to manage the implementation of features and its times.

2.4 How this methodology ensure success for real stakeholders:

South African agriculture faces unpredictable issues such as weather events, funding issues or even sudden changes in policies. Therefore making use of scrums' iterative, feedback driven approach will help ensure that the Agri-Energy Connect system remains responsive and reliable (Scrum Guides, 2020). The scrum approach supports long term success as it delivers a solution that grows with the stakeholders as its iterative approach allows for issues to be fixed keeping the system useful and relevant rather than being outdated or problematic.

3. DevOps complements recommended methodology

DevOps is the combination of technical tools with collaborative culture to support the continuous process of planning, building, testing, deploying and monitoring (Microsoft, 2023a; RedHat, 2025). Implementing DevOps practices into the Agri-Energy Connect project will enhance the quality, speed and the stability. This complements the chosen development methodology Scrum.

3.1 DevOps practices that can be implemented:

- Continuous Integration/Continuous Delivery (CI/CD) allows for automated pipelines using GitHub Actions to build, test and deploy changes to different stages which reduces the need for manual input (Microsoft, 2023b; Microsoft, 2024f).
- implementing automated testing allows for unit tests, integration tests and UI tests.
- implementing application monitoring allows for using tools like Azure Monitor to monitor system usage and pick up on failures (Microsoft, 2024g).
- implementing security automation allows for the storage of sensitive login credentials using Azure Key Vault (Microsoft, 2024h).

3.2 Why it's suitable with Scrum:

With scrum the features are done in small increments. DevOps then handles the delivery and testing of these increments which ensures that each sprint produces stable, secure as well as usable software (Atlassian, 2025). It also allows for faster

recovery of critical issues which is important for when farmers rely on real time access to submit or view products.

3.3 How it links to Agri-Connect Energy:

Users from rural areas may not always report issues formally. Therefore making use of monitoring tools inside a DevOps pipeline will pick up on errors in advance which allows the teams to react before any complaints. This helps maintain the trust in the system's reliability (Microsoft, 2024g).

4. Enterprise frameworks

The recommended frameworks are a combined use of TOGAF (the open group architecture framework) and ITIL (information technology infrastructure library).

Reason being Agri-Energy Connect is a digital platform which means the success is dependent on the long term scalability, service delivery and governance. The integration of both of these frameworks can support the architectural and day to day operations.

4.1 TOGAF:

offers a general approach which is called the ADM cycle which helps to design, plan, build and manage the organisation's information systems (Ardoq, 2024; Visual Paradigm, 2025). It encourages breaking things into smaller parts and thinking long term.

4.1.1 How it's relevant to Agri-Connect Energy:

- It helps create a clear plan for growing a simple product portal into a full ecosystem.
- it supports future integrations such as mobile apps.
- ensures the alignment between the agricultural NGOs, farmers, energy providers and the developers.

4.2 ITIL:

addresses how well IT services are managed and delivered while highlighting the best practices for effective and high quality IT service management (ServiceNow, 2025).

How it's relevant to Agri-Connect Energy:
It offers a clear process for handling issues such as login errors, service requests and user support. It also supports ongoing reviews of feedback from users and the platform's performance to keep improving the system effectively.

4.2.2 How it links to Agri-Connect Energy:

Farmers need a platform they can trust and the government or partners who are donors need the assurance of sustainability and governance. The use of the combination of both of these frameworks deliver both strategic framework and operational efficiency.

5. Prototype description

5.1 A. Technical description (layman's terms)

Agri-Energy connect is a web-based system where farmers and employees can securely interact with each other. Farmers are able to login and upload products (their produce such as spinach, organic maize, etc.) and employees are able to filter through these listed items by product type or production date.

The system makes use of Microsoft technologies such as *ASP.NET Core MVC* for logic, *SQL server* for storing data and *Entity Framework* for database communication (Microsoft, 2024i). These technologies work smoothly on any modern device and with the help of login security it ensures that all users only see what they're allowed to.

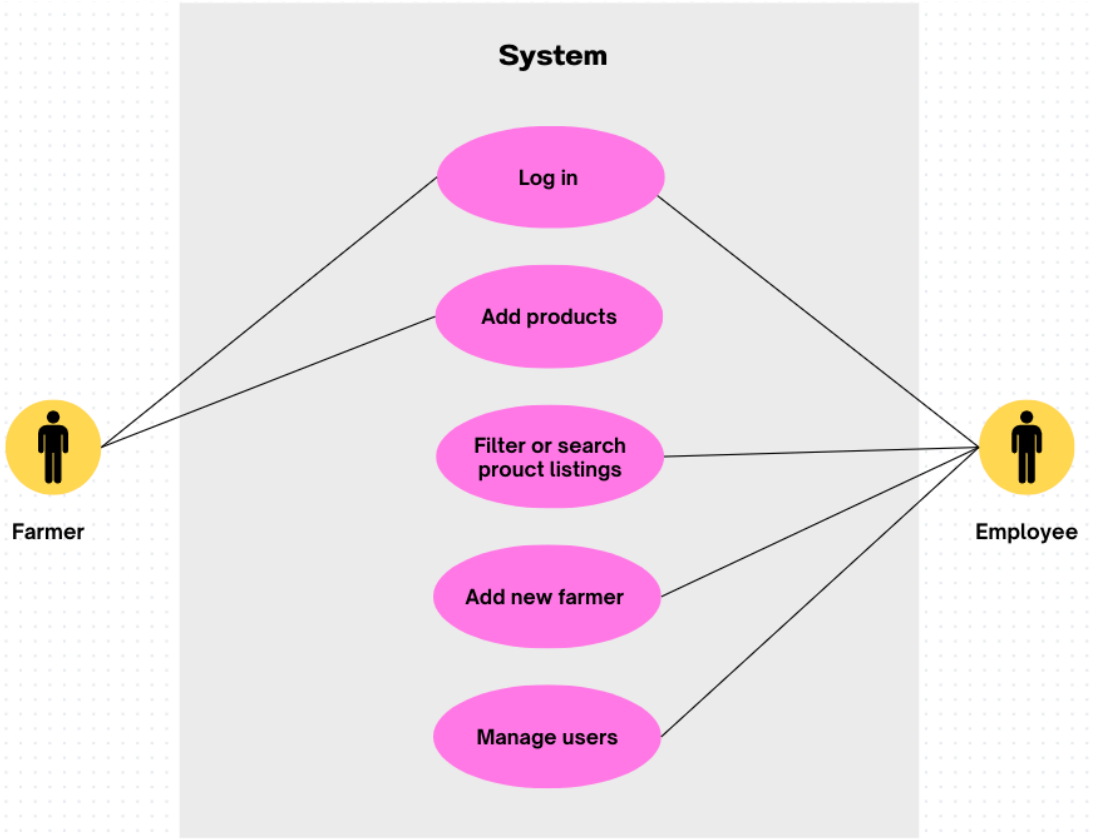

Figure 1: A System Use Case Diagram which shows the interaction between users and system functionalities. What farmers and employees can do within the system.

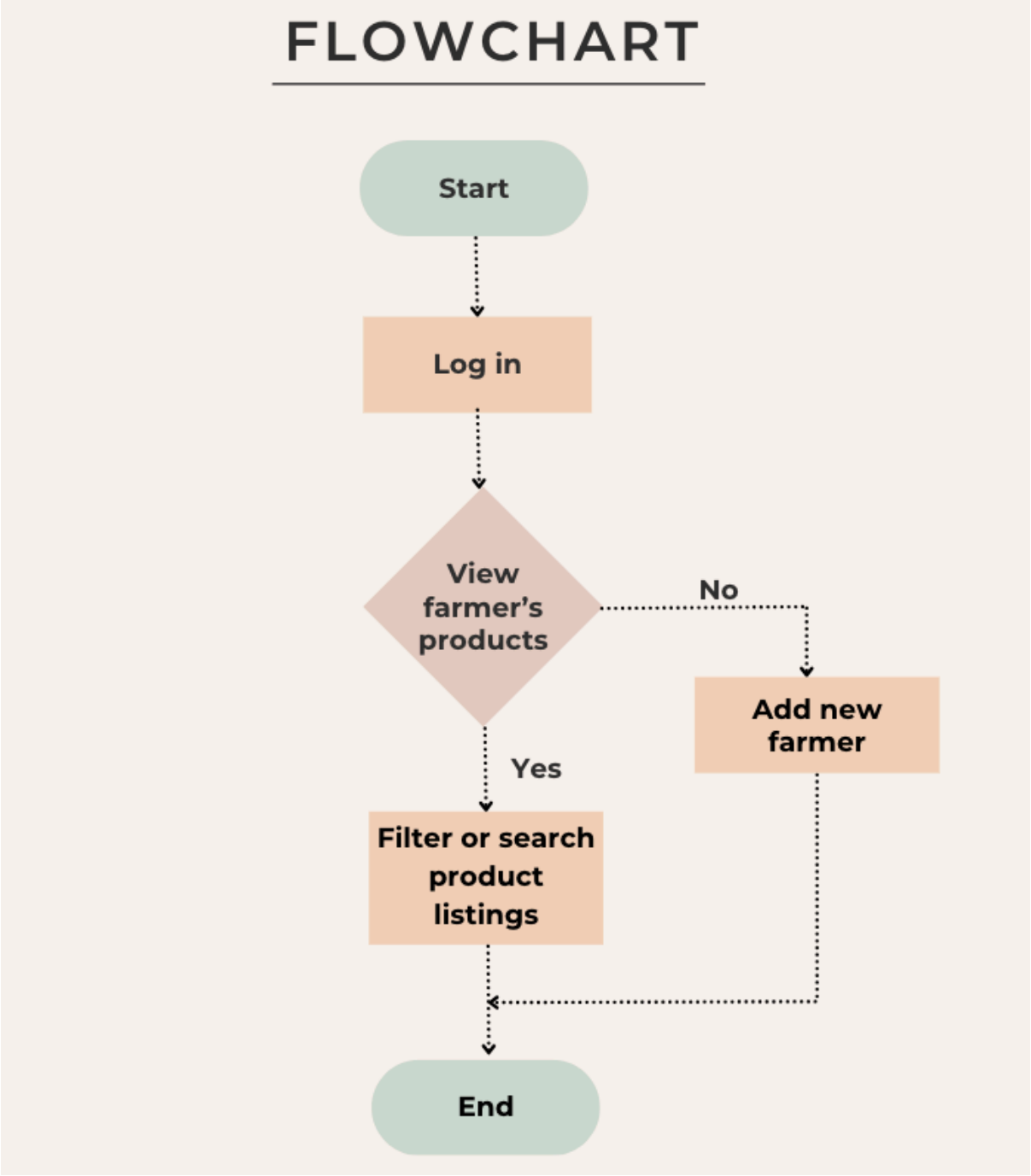

Figure 2: Product Management Flowchart (employee workflow). It shows the typical workflow an employee follows within the Agri-Energy Connect platform.

5.2 B. Business Value (marketing pitch)

Agri-Energy Connect is built with the everyday South African farmer in mind as it links sustainable farming with green energy partnerships. The platform has a simple interface, is user friendly and requires low data usage making it easy for small-scale South African farmers to make their operations digital with no technical skills needed. This platform provides an opportunity for farmers to digitise their operations and provides them access to green energy partners, funding opportunities and a safe and secure place for them to learn from one another. It's a practical tool that helps farmers grow their businesses stronger and more sustainable as they are able to learn about solar-powered irrigations or even farming practices such as improving their crop yields. Energy providers or funders are also given a chance to invest in something that can have a positive impact such as supporting food security in rural areas.

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7. AI Declaration:

I confirm that any use of AI in this report is limited to grammar, spelling, and academic tone improvements.

No AI tool was used to generate original ideas, structure content, or write sections of this assignment.