COS10025

Technology in an Indigenous Context Project

Business Case and Project reflection report

Project Title: Information System for Vocational Training among Ethnic Minorities in Vietnam

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Declaration

I declare that this report is my individual work. I have not copied from any other student's work or from any other source except where due acknowledgment is made explicitly in the text, nor has any part of this submission been written for me by another person.

Signature: Ta Quang Tung

Part A: Business case

Executive Summary

Lying to the Southwest of Phu Tho province, Vietnam, Tan Son is a mountainous district that is home to a significant proportion of ethnic minorities in Vietnam. It is a poor district with a large number of households living in poverty. Despite this, Tan Son features abundant agricultural opportunities thanks to its extensive area of land suitable for farming and forestry. This project aims to help the ethnic minorities in Tan Son take advantage of their surrounding agricultural opportunities by tapping into their regional knowledge base and leveraging the latest developments in information technology and STEM. More specifically, it sets out to develop an information system for agricultural vocational training targeted at these minorities where users can contribute and share knowledge and skills. This information system is designed to be user-friendly and intuitive to use for ethnic minorities, who might lack experience with more advanced information systems. Features including training personalization, voice recognition search engine, content auto-translation, farmer-and-business connection, and content verification will make the information system a reliable, practical, and accessible tool for ethnic minorities in Tan Son. Although this solution might be a little costly to implement, it will greatly benefit the district.

Introduction (Project Description & Motivation)

Tan Son is a mountainous district situated in the Southwest of Phu Tho province, Vietnam. As of 2019, this district is home to over 85 thousand people (General Statistics Office, 2020), 82.3% of whom are ethnic minorities such as the Muong, Dao, and Hmong (Tan Son District Portal, n.d.). Among the industries that make up the economy of this district, agriculture, forestry, and fishing contribute almost 50%. The area of farmland in this district is nearly 5300 hectares, while the figure for forestry land is over 50,000 hectares (Tan Son District Portal, n.d.). Despite these opportunities, however, Tan Son is still a poor district with many households struggling to sustain themselves. In 2016, the proportion of poor households in this region stood at 26.38% (Dang, 2017).

Factors contributing to this poverty include lifestyle, education level, and limitations in their farming practices.

To alleviate poverty in Tan Son, vocational training may be the solution. Research by Do et al. (2020) finds that vocational training can provide better income opportunities for ethnic minorities. Investigating the status of vocational training in Northwestern regions of Vietnam, Hong and Giang (2022) also conclude that trained ethnic workers have access to better jobs and income. They recommend that training programs should be congruent with the key economic sectors of the place in which these programs take place. Given that the key industry in Tan Son is agriculture, the obvious solution that comes to mind is to host agricultural training programs there to boost income. However, implementing successful vocational training programs, especially ones targeted at ethnic minorities, is difficult. Looking at the current training practices in Vietnam, Do et al. (2020) discover that not many ethnic workers are willing to participate in training. This is due to their unwillingness to learn new skills, dedicate time to training, and forgo small but immediate income. Many ethnic workers fail to see the value of vocational training and consider it a waste of time. Geographical barriers are also to blame for low participation levels, as many Vietnamese ethnic minorities live in mountainous regions where direct access to physical classrooms is difficult due to poor and unsafe road infrastructure.

Aware of the current poverty problem in Tan Son and the potential solutions to it, this project sets out to develop a vocational training solution that exploits the latest developments in information technology while also making use of local knowledge bases. To be specific, this project will construct an information system for agricultural training that can be accessed by any ethnic user. Aside from perusing quality training information provided by professionals, users can also contribute their own knowledge to the platform, enriching the information repository and allowing local knowledge to be disseminated. This project's scope is limited to ethnic minorities living in Tan Son, Phu Tho, and the features will be designed around their situation. However, users from other regions can also access this system if they want to. Considering the current challenges in vocational training mentioned in the above section and the characteristics of

the target audience, this project will set out a number of requirements to ensure its maximum effectiveness. First, the content served by the information system should be personalized to address the needs of users, making the system more attractive and engaging. Second, the information system should connect ethnic farmers with private enterprises to bring it more practical value. Third, given the low literacy of some ethnic farmers, the system should let them look for information using voice queries instead of text. Fourth, the system should cater to many ethnic languages as not all ethnic users might be proficient in the Vietnamese language. Finally, the system should be able to verify uploaded information so that it can be a safe and trustworthy platform for local knowledge exchange.

Summary of project budget (all design ideas)

This project features five design ideas to address the above requirements. The following section briefly explains each design idea and summarizes its cost, providing justifications for key costs.

Design idea 1 constructs a recommendation system for training personalization. This system gives farmers recommendations based on data collected by IoT sensors and farmers themselves. The design benefits farmers by providing them with details on the plants and animals that are best suited to their land, allowing them to make the most of their resources. It also recommends farmers what to do daily to ensure their plants and animals are in the best condition. This concept will be implemented on the cloud. Since it requires machine learning, it will need to use more expensive EC2, ECS, and SageMaker configurations for speed. Additional investment in IoT sensors are also necessary.

Cost type	Item	Amount	Monthly cost (AUD)
Equipment	Cloud architecture (EC2, ECS, and SageMaker)	Specified on AWS	623.68
	IoT sensor	50	2288.51

Labor	Cloud Architect	1	1789.26
	IoT engineer	1	805
	Data analyst	1	632.30
	Manager	1	2167.94
	Machine learning engineer	1	1790
	Office (100m^2, with electricity and Wi-Fi coverage)	1	7381.54
Total			17478.23

Table 1: Cost summary for design idea 1.

Design idea 2 features a mis/disinformation detector with deep learning to prevent misleading content from being uploaded and circulated on the information system. When content is uploaded to the system, it first goes through the detector for analysis. Misleading uploads are rejected while non-misleading ones are saved to the database. It benefits users by allowing the platform to be a safe and reliable place to exchange local knowledge and skills. This lets local knowledge bases flourish and disseminate. This concept will be implemented on the cloud. Since it requires machine learning, it will need to use more expensive EC2, ECS, and SageMaker configurations for speed.

Cost type	Item	Amount	Monthly cost (AUD)
Equipment	Cloud architecture (EC2, ECS, and SageMaker)	Specified on AWS	623.68
Labor	Cloud Architect	1	1789.26
	Manager	1	2167.94
	Machine learning engineer	2	3580

	Office (100m², with electricity and Wi-Fi coverage)	1	7381.54
Total			15542.42

Table 2: Cost summary for design idea 2.

Design idea 3 allows the auto-translation of information with the transformer model. It benefits users by providing them knowledge in languages they are proficient in, therefore overcoming the language barrier. This concept will be implemented on the cloud. Since it requires machine learning, it will need to use more expensive EC2, ECS, and SageMaker configurations for speed. Additional GPUs are needed to speed up machine-learning tasks because auto-translation is a lengthy process.

Cost type	Item	Amount	Monthly cost (AUD)
Equipment	Cloud architecture (EC2, ECS, and SageMaker)	Specified on AWS	623.68
	GPU Tesla T4	5	8757.05
Labor	Cloud Architect	1	1789.26
	Manager	1	2167.94
	Machine learning engineer	1	1790
	Office (100m², with electricity and Wi-Fi coverage)	1	7381.54
Total			22449.47

Table 3: Cost summary for design idea 3.

Design idea 4 equips the information system with a voice search engine using the BIMASR framework. It benefits ethnic users by allowing those with low

literacy to easily search for information on the system with their voices. This concept will be implemented on the cloud. Since it requires machine learning, it will need to use more expensive EC2, ECS, and SageMaker configurations for speed.

Cost type	Item	Amount	Monthly cost (AUD)
Equipment	Cloud architecture (EC2, ECS, and SageMaker)	Specified on AWS	623.68
Labor	Cloud Architect	1	1789.26
	Manager	1	2167.94
	Machine learning engineer	1	1790
	Data engineer	1	2152.21
	Office (100m^2, with electricity and Wi-Fi coverage)	1	7381.54
Total			15904.63

Table 4: Cost summary for design idea 4.

Design idea 5 implements a blockchain system for farmer and business connections. Businesses will submit product orders to the system while farmers select suitable orders and sign contracts that are put into the blockchain system. This discourages either party from breaching the contract as they will be permanently recorded by the system, marring their reputation. Farmers can be provided with additional guidance from businesses to fulfill their contracts. The concept benefits ethnic users by connecting them to businesses and helping them build their reputations. The information system thus is more practical and attractive. This concept will be implemented on the cloud. Since it requires machine learning, it will need to use more expensive EC2, ECS, and SageMaker configurations for speed.

Cost type	Item	Amount	Monthly cost (AUD)
Equipment	Cloud architecture (EC2, ECS, and SageMaker)	Specified on AWS	623.68
Labor	Cloud Architect	1	1789.26
	Blockchain engineer	1	922.92
	Manager	1	2167.94
	Machine learning engineer	1	1790
	IT security	1	1356.51
	Office (100m^2, with electricity and Wi-Fi coverage)	1	7381.54
Total			16031.85

Table 5: Cost summary for design idea 5.

Recommended option to proceed

While all of the above design concepts fulfill the requirements in their own creative ways, design concept 5 – implementing a blockchain system for farmer-business connections, is the most suitable for further development in Tan Son.

This design adds the most practical value to the system by bridging ethnic farmers in Tan Son with private businesses, giving the former an incentive to use the system. As pointed out by Do et al. (2020), one reason why ethnic workers are unwilling to participate in training is that they do not want to abandon small jobs that provide an immediate but small income. By connecting farmers with private businesses that can supply them with larger pay, there is a bigger incentive to use the training system.

Aside from simply greater salaries, this system will also give the ethnic farmers in Tan Son involved greater visibility in the market. The blockchain system records their contract fulfillment and discourages farmers from breaching them. If farmers follow their contracts consistently and legitimately, all of their progress can be captured into a clean track record. This helps farmers build their reputations and give them greater exposure to private businesses. This is particularly useful because Tan Son is a mountainous region where the challenging terrain makes it difficult for ethnic farmers to be discovered by private businesses.

Additionally, this system also helps ethnic farmers in Tan Son receive training and guidance from private businesses. Farmers that are signed to contracts can receive further support to help fulfill their contracts, thus boosting their knowledge and skills. The support they get can be in the form of either new technological applications or new production techniques. This helps enlighten the farming community of the district, which is already behind in education and practice.

Ethnic farmers in Tan Son are not the only beneficiaries of this solution. Private businesses also reap the benefits through their potential exposure to skilled ethnic farmers of the region that may not have found a suitable platform to promote themselves. These farmers can work at a lower cost while outputting products of high standards. Private businesses can also come into contact with farmers that cultivate specialties of the region such as special glutinous rice crops (Phu Tho News, 2009). In this way, the value provided by this solution is shared by both parties.

Part B: Project reflection

Group Work Reflection

1. Describe the group work strategies/processes that worked for your team.

   At the beginning of each task in this unit, the first thing my team did was to organize an online meeting on Discord so that everyone could discuss what we had to do. Then, the team divided the workload into roughly equal portions and let members select the part they wanted. This strategy worked well because it ensured fairness and allowed everyone to know their specific responsibilities. Some tasks were allocated by the leader, Hoang, based on abilities so everyone could do their work well.

2. Describe the group work strategies/processes that did not work for your team.

   Unfortunately, even though a meeting was organized at the start of each task, the team sometimes did not communicate the requirements of tasks to members very well. For example, in task 3 where the team had to design the presentation slides, the entire design task was allocated to Quang. Hoang did not inform Quang of the exact requirements, so the slides ended up missing some details. Thankfully, Hoang and I were able to amend the slides before the presentation. The team should have communicated with each other more closely through texts and supplementary meetings to ensure everyone is adequately informed.

3. Describe what could be improved on next time you work in a group. This should be from your individual perspective, e.g., "not working with person X" is not something **you** can change.

   My team should have communicated the requirements of each task better and had frequent progress checks to make sure everyone was going in the right direction. By leaving members to work alone with a vague understanding of tasks until their deadlines, my team sometimes

had to redo everything from the start. This happened to me in the innovation concept task, when I had to redo my part because I misunderstood the task requirement. Thankfully, I received support from the team leader to finish my part before the Canvas submission.

4. Describe an event/action in your team (i.e., not just from you) that you think was outstanding with respect to each of:

   a. Team organization

   Hoang, the team leader, organized the team's work carefully into Google Drive folders to keep the team's output in the same place. This makes locating a member's work much easier and more effective. Tasks were allocated fairly to each team member. The team had a GANTT chart to keep track of important deadlines and manage time.

   b. Meetings

   To ensure constant communication within the team, Messenger and Discord groups were created for chats, meetings, file exchanges, and important announcements. The Messenger group was mainly used for quick chatting, while the Discord group was used for group meetings. The team had weekly meetings on Wednesday evenings and additional meetings in person or online when needed. These communication channels allowed the team to contact each other at any time.

   c. Delivery of the project design ideas/budget

   The team discussed and agreed on project design ideas before allocating one to each member for research and writing. All ideas were finalized by Hoang before being added to the report. For the budget, which was hard to estimate, the team worked together to decide on the most sensible expenses.

   d. Delivery of the Innovation concept

The team clearly defined writing responsibilities for the innovation concept report. The project overview and requirements were handled by everyone. Each design concept was written by one member as designated in the ideation phase. References from each part were compiled and listed by Hoang at the end of the report. The team supported each other during writing to make sure all ideas are communicated effectively.

e. Delivery of the final presentation

Before the day of the presentation, the team agreed on what to say in each part and who would be responsible for each part. For every design concept, the team agreed to follow the structure of issue – concept – benefit – cost, making the presentation easy to follow. Members were also instructed to prepare transitions into the following parts. Hoang handled the presentation's introduction and conclusion with grace.

Individual Work Reflection

- Project tasks
  - Describe your tasks in the group project in each phase of the project
    - Phase 1 – Problem identification and identifying learning issue

      For the problem identification phase, I worked closely with my team to select a problem to work on. After careful deliberation, the team decided that the most appropriate problem would be agricultural training for ethnic minorities in Tan Son. I then read papers on the current situation of training in Tan Son, in Vietnam, and around the world to

obtain a comprehensive view of the problem. Finally, I found that misinformation in training was an interesting learning issue to address.

- Phase 2 – Develop design ideas using diagrammatic tools

    After identifying my learning issue, I browsed the Internet for papers on how to address it. I found an interesting article on a misinformation detection framework used to identify misleading videos on social media. Using this article as inspiration for my design idea, I worked on the diagram of the solution. Initially, I chose Figma to be my diagram-drawing software; however, I moved to draw.io because it integrates more closely with Google Drive where the team's work is stored.

- Phase 3 – Estimation of cost (budgeting)

    In order to calculate the costs of my design idea, I first considered where it would be implemented. I chose AWS Cloud as it provides a reliable infrastructure for me to deploy my solution. The costs of equipment are therefore the costs of the services I use on AWS Cloud, which are EC2, ECS, and SageMaker. I then estimated the costs using the AWS Pricing Calculator. I also considered labor costs such as project managers, machine learning engineers, offices, etc., and used the Internet for estimation.

- Phase 4 – Analysing the benefits of each solution in accordance with the telecommunication guidelines

    To evaluate the benefits of my team's solutions, I had to understand what features they provided. This meant I had

to work closely with my teammates so that they could explain in detail their solutions. After my team enlarged on their ideas, I listed each of their features and benefits and compared them to the needs of the township.

- Contributions to the group
  - Describe how your efforts contributed to the whole group

    As a responsible team member, I made sure that I submitted all of my work on time so that my team would not fall behind schedule. Being the perfectionist in the group, I helped my team proofread reports and adjust the layout of our presentation slides so that the team's output would be of the highest quality.

  - Describe how you were involved in the teamwork environment

    I attended all meetings and kept up with all messages and announcements to stay updated on tasks assigned by our leader Hoang. I communicated frequently with Hoang to see if Hoang needed any help with the tasks. During the second and third tasks, I helped Hoang perfect the submission to ease the workload. I also communicated with the other team members to know their progress.

- Conclusion and recommendation
  - Conclude your achievement in accordance with the culturally suitable solution (you can pick either 1 or 2 solutions that suit well)

    My design solution, which involves implementing a misinformation detector to ensure the integrity of the information system, is suitable for the project's target audience. Since many ethnic minorities in Tan Son have poor educational backgrounds, they have trouble distinguishing between reliable and misleading

information. This design ensures that users of our system will not be deceived by malicious misinformation. The solution is implemented on the cloud, eliminating the need for managing physical servers and connectivity infrastructure and the associated disturbance and pollution.

o Recommend how you could further improve your design ideas within a team environment

Since I mostly worked alone on my design idea, I was not able to use much of my team's input to improve it. My design idea has the limitation of only being able to process video content. However, in an information system, content may be uploaded in many forms, including text, audio, and image. If my teammates could work on the design idea with me, it would be able to process many other forms of uploaded content, making the information system even more robust.

Part C: Unit Learning Outcomes (ULOs)

1. Locate Indigenous knowledge systems and consider how they story the long history of technology, science, and engineering.
    a. Understanding and exploring Indigenous knowledge systems
    Indigenous communities have existed for hundreds of years and accumulated a rich knowledge base. Unfortunately, this knowledge is slowly being pushed out due to the introduction of Western knowledge and practices. It is important to consider Indigenous knowledge bases while designing a solution to make sure it integrates seamlessly with the community. This project considers Indigenous knowledge as part of its solution, therefore showing respect to the community.
    b. Ensure the project was undertaken in accordance with locating Indigenous knowledge systems (Technology)
    While designing the solution, the team had to consider how to locate and integrate Indigenous knowledge systems into the information system. As we are outsiders with little access to the knowledge base kept inside the target community, the team had to find a way to allow the community itself to share knowledge. The team achieved this by allowing ethnic users to contribute their knowledge and skills to the information system, exposing their knowledge base to the outside world and allowing it to be disseminated.

2. Apply relevant knowledge of emerging technologies to a project within an Indigenous context taking into consideration and acknowledging Indigenous histories, worldviews, standpoints, and cultures.
    a. Analysing the challenges and needs of communication technologies and services for the remote Indigenous community
    Connecting Indigenous communities is an aspect that is considered by this project. Our system needs to somehow connect ethnic users with the outside. By considering the need to

connect to the private sector, this project's design solution connects ethnic farmers with private businesses, rendering remoteness and geographical barriers meaningless.

b. Explore user access, affordability, appropriateness in relation to the communication infrastructure

Access, affordability, and appropriateness are important factors that determine the success of the project. This project takes all these factors into account while designing a solution. By opening access to all users and hosting its service on the cloud, this project's information system allows easy and cheap access to the platform while also avoiding the disturbance and pollution that comes with setting up physical servers and connections in the target community.

3. Function as an effective team member using project management tools and demonstrating professionalism and ethical behavior.

a. Attended team meetings, facilitator meetings, and workshops

In this unit, my team had meetings every Wednesday evening and workshops every Tuesday morning. These meetings and workshops were different each time so I made a point of attending all these events. I took notes of key points in each meeting and workshop and communicated with my tutor and teammates to know what to do.

b. Assisted in planning for the team

At the beginning of each task, my team would divide and allocate work to all team members. As a member of the team, I had to select the task that fitted my abilities and inform the team's schedule. After I received a task and read through its requirements, I would report back to the leader how much time I needed to finish it, allowing the leader to organize the team's schedule and manage time.

c. Delivered work on time for the team

After being allocated work, the team would begin working according to the schedule. In order to prevent the team from falling behind, I completed my work one or two days prior to the deadline to have it checked by the leader for any necessary revisions. Thanks to this, I had spare time to help the other team members.

4. Communicate within teams, stakeholders using appropriate verbal, written, and technological approaches.

   a. Contributed to team meetings

   My team had meetings every Wednesday evening on Discord. In each meeting, members were expected to discuss upcoming assignments and report their progress. I contributed to meetings by offering my understanding and perspectives on upcoming tasks so that the team could decide on the most suitable approach.

   b. Engaged with facilitator meetings

   My team had facilitator meetings every Tuesday morning after the lectures. In these meetings, the team had to work with the facilitator to report progress and clear any confusion about upcoming tasks. I always prepared questions beforehand so I could ask my facilitator, making sessions more productive.

   c. Proficient in verbal communication, both presentations and conversation

   This unit required verbal communication to effectively work in teams and deliver a satisfactory presentation. It meant that I had to express myself well during group work and presentations. During in-class meetings, I clearly communicated with my team about my current progress and difficulties, allowing me to get the assistance I needed. For the presentation, I was able to effectively deliver my design idea to the audience by following a clear speech structure.

d. Proficient in written communication, both reports and online interaction

Aside from verbal communication, written communication is also required to excel in this subject. I had to clearly express myself in written reports and messages to my teammates on communication channels. I was able to write my reports quite well by following a clear structure and using correct vocabulary, grammar, and punctuation. I was also able to communicate with my teammates through text messages, allowing me to work with them more easily.

e. Made use of other tools (e.g., online brainstorming tools) to interact with others

I had to make use of a number of drawing diagrams in this unit to express my ideas. One of the tasks I needed to do was to convey my design concept to the team leader. For this, I learned how to use draw.io to construct a diagram showing my solution. Thanks to this, I was able to effectively explain my design to the leader.

5. Appreciate emerging technologies in a local, global and sustainable context.

a. Considered a culturally appropriate design solution

A good design should take into consideration the cultural context in which it is situated. For this project, I had to design a solution that would fit the cultural, economic, and educational contexts of Tan Son, Phu Tho. By carefully considering each of these factors, I was able to construct a solution that is appropriate to the educational and social situation of this district.

b. Explored sustainable livelihoods in relation to the digital connectivity infrastructure

Designing a technological solution that enables sustainable livelihoods is an important goal. One of the solutions the team worked on in this project involved developing a blockchain system to connect ethnic farmers with private businesses. This system

allowed farmers to have a high income by receiving farming jobs from businesses. In this way, ethnic communities can focus on money-making farming jobs instead of other harmful and unsustainable activities.

(Word count: 4531)

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