

Development of Artificial Intelligence-Based Application Promoting SMCE and SME for Thailand Organic Valley

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Abstract

Thailand Organic Valley, spearheaded by government officials, is the country's first of its kind, serving as an agricultural template for the organic farmer's community located on Nong Bua Dang's plateau in Chaiyaphum. The community needs a way to promote and to move products digitally. Therefore, the authors have developed an e-commerce application to aid in selling and online marketing for the farmers-owned agricultural organic cooperative. The application also facilitates an artificial intelligence (AI) chatbot to ease the communication between the organic valley community and their buyers. The authors have also assessed the application's quality in serving online promotion. Finally, a customer satisfaction survey evaluates the platform's effectiveness. The population samples are drawn from three main target groups: regular website visitors, small and micro community enterprises (SMCE) and from small and medium enterprises (SME) in the Organic Valley area in the size of 325 people. The study utilizes the developed e-commerce platform, an application performance survey, and a satisfactory survey. Upon completion of the study, the application can be used as an e-commerce platform to connect customers with Organic Valley producers, utilizing a chatbot to ease communication according to the survey results. The assessment by experts has concluded that the application is very satisfactory (average of 4.37). The satisfactory survey conducted on representatives from SMCE and SME and visitors shows an average of 4.30.

Keywords: Development of artificial intelligent application, Digital marketing, Organic valley, Web application

1. Introduction

Thailand is an agricultural society and agriculture is still a way of life for most the Thai people. The agriculture sector is one of the main contributions to the country's economic growth. Small and Micro Community Enterprises (SMCE) and Small and Medium Enterprises (SME) are the main factors sustaining the economy (Ali Qalati, Li, Ahmed, Ali Mirani, & Khan, 2021). The SMCEs and SMEs in Nong Bua Dang, Chaiyaphum comprise many organic producers and farmers. The area has long been known for its rich soil and appropriate climate for cattle and plants. It has been proudly called the first "Organic Valley" of Thailand ever since. Despite its rich soil and suitable weather, the farmers do not succeed financially because of market reach. Fluctuations in demand often lead to lower profits. Most of the organic producers cannot afford branding, sorting, packing, and marketing. Middlemen in the agricultural sector

have an important role in bridging the gaps between farmers and the markets (Hatture & Naik, 2019). This also decreases money in the farmers' pockets. Technology in e-commerce applications has become an indispensable tool which enables the farmers to play middleman themselves. The application could do various things: public relation tasks (Jattamart & Kwangsawad, 2018; Suwannasri & Patcharatanaroach, 2018) and online marketing, for example, helping market expansion without the need for middlemen. It's also driving the local economy and creating jobs. There are studies about implementing chatbots to enhance customer services (Asadi & Hemadi, 2018; Vijayakumar, Bhuvaneshwari, Adith, & Deepika, 2019). The application would also help the day-to-day operations such as invoicing, taxing, and payroll utilizing the power of ERP (Elbahri et al., 2019; Mahraz, Benabbou, & Berrado, 2019).

Therefore, the study aims to build a workable e-commerce application with chatbot to

help the Nong Bua Dang Organic Valley's farmers. The researchers will then perform an accurate customer satisfaction analysis asking multiple target groups how satisfied they are. The application itself will also be measured.

2. Materials and Methods

The study comprises the following components: Application Development, Search Engine Optimization, Structured Questionnaire Survey, and Satisfactory Survey. The authors have decided to conduct this study using research and development strategy as outlined in Figure 1. Workflow of the Research: A 5-point Likert Scale is applied in all statistical analyses and categorized as Very satisfied (5.00 – 4.50), Satisfied (4.49 – 3.50), Neither (3.49 – 2.50), Dissatisfied (2.49 – 1.50), and Very dissatisfied (1.49 – 0.00). The questionnaire surveys have been categorized into two groups for separate assessors: experts in technology-related fields and representatives from SMCEs and SMEs including those assessing the application satisfaction.

1: Preparation

1.1 Study all information pertaining to the area of interest and associated parties such as SMCEs and SMEs.

1.2 Plan the meeting with government entities and interested parties for cooperation in application development to best suit the needs of the following groups:

1.2.1 One representative from each SMCE/SME by means of purposive sampling with a simple random sampling method using Krejcie and Morgan's table (Krejcie & Morgan, 1970: 608)

1.2.2 Government representatives such as the district chief and other officers responsible in SMCE /SME related tasks, in total 25 officers using a simple random sampling method and purposive sampling.

2: Analyzing existing workflow of the SMCE and SMEs (R1)

2.1 The largest possible number of parties to participate in the application development has been sought using Participatory Action Research (PAR) to collect data and to make assessments. The authors have facilitated a focus group discussion and conducted an interview with farmers along with relevant entities using structured questionnaire surveys.

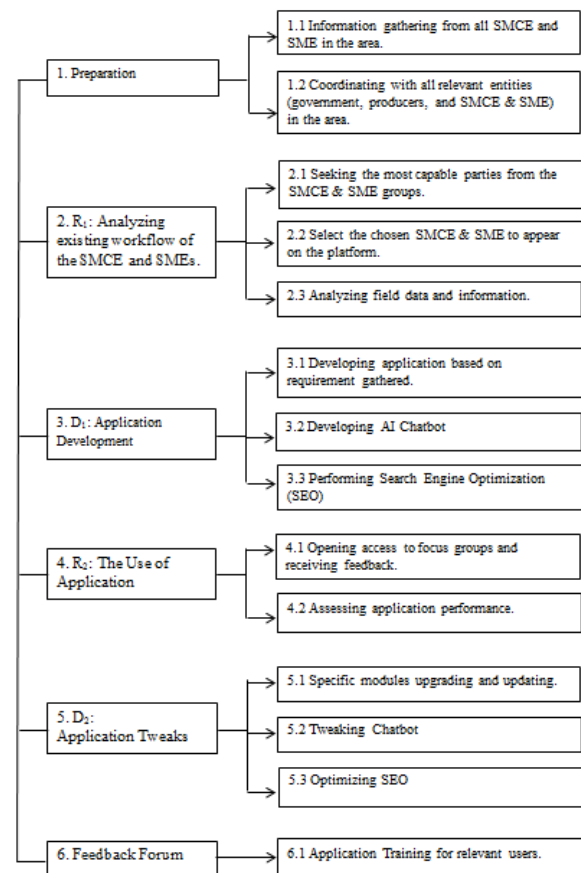


Figure 1. Workflow of the research.

2.2 Information is gathering information on items produced by the selected parties in the Organic Valley to appear in the application. The chosen products are considered as high quality and able to ship to customers immediately.

2.3 The field data is analyzed to use as a requirement of application development. The application comprises several modules tailored to meet the focus groups' expectations.

3: Application Development (D1)

3.1 The application comprises three main components: e-commerce website, application backend, and chatbot. The authors used PHP Laravel and Vue JS for the frontend and later decided to use Odoo Framework for both frontend and backend as a full replacement for easier single-codebase development. The domain name for this application is registered as ThailandOrganicValley.com.

3.1.1 Server:

The authors have utilized a cloud-based Ubuntu 18.04 server on DigitalOcean platform (4

GB Ram / 2 CPUs, 80 GB SSD storage disk, and 4 TB transfer monthly transfer rate limit) running Dockerized-containers with the following services:

- Dockerdoo contains Odoo version 12.0
- PostgreSQL runs a PostgreSQL database service version 11.0
- Tibco JasperServer Community Edition hosts the Java report engine server.
- Traefik helps reverse proxy and load balancing for the site which maps ports 8069, 8072, 5432, 8080 for Odoo, Odoo LongPolling, Postgres, and JasperServer, respectively. The reverse proxy service exposes ports 80 (HTTP) and 443 (HTTPS) to the Internet.

3.1.2 Application

The existing ‘web’ Odoo module has been installed for website frontend capability along with ‘website’ Odoo Community Association (OCA) modules such as ‘debrand’ and ‘logo’ for further aesthetic purposes. The ‘e-commerce’ module has also been utilized for online selling and purchasing. Furthermore, inventory management features have been used to track products on hand by installing a ‘stock’ module. The operations associated with human resources such as leaves, employee management, work scheduling, and expense reports are vital parts of most businesses; see Figure 2. The authors have decided to use existing Odoo apps with customized modifications to make the app relevant to the Thailand Organic Valley operation. However, the accounting of the business is a general chart of accounts (COA), see Figure 3, since the real operation is still in beta.

GraphQL, a query language for APIs and a runtime for fulfilling those queries with the existing data, is adopted to create, read, update, and delete (CRUD) for the application data. It is considered to be future-proof for further development in the future. The authors have developed a GraphQL schema to manipulate the application’s blog for faster and more efficient posting. Furthermore, a modern progressive JavaScript framework application, VueJS, has been created for interaction with the above-mentioned query language.

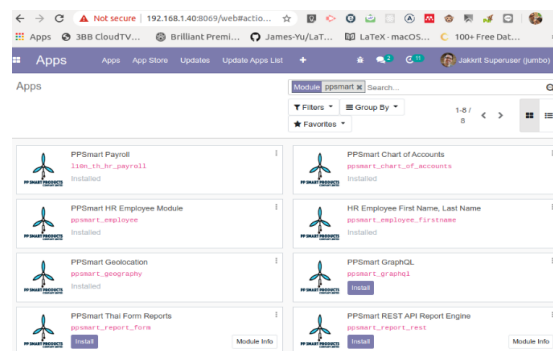


Figure 2. Custom modules.

1	<input type="checkbox"/>	100000	สินทรัพย์ -- สห1คุณ	Fixed Assets
10	<input type="checkbox"/>	110000	สินทรัพย์หมุนเวียน -- สห2คุณ	Current Assets
11	<input type="checkbox"/>	111000	เงินสดและเงินฝากธนาคาร -- สห3คุณ	Bank and Cash
12	<input type="checkbox"/>	111100	เงินสด -- สห4--	Bank and Cash
13	<input type="checkbox"/>	111101	Cash	Bank and Cash
14	<input type="checkbox"/>	111200	เงินฝากธนาคาร -- สห4คุณ	Bank and Cash
15	<input type="checkbox"/>	111201	Bank	Bank and Cash
2	<input type="checkbox"/>	111210	บัญชีเงินฝากกระแสรายวัน -- สห5--	Bank and Cash
20	<input type="checkbox"/>	111220	บัญชีเงินฝากออมทรัพย์ -- สห5--	Bank and Cash
21	<input type="checkbox"/>	111230	ธนาคาร -- สห5--	Bank and Cash
22	<input type="checkbox"/>	111300	รายการโอนระหว่างกัน -- สห4--	Bank and Cash
3	<input type="checkbox"/>	111301	Liquidity Transfer	Current Assets
30	<input type="checkbox"/>			

Figure 3. Chart of accounts.

3.1.3 Reports

The long-standing JasperReports developed by TIBCO based on Java has been around for at least a decade. It has been proven to be excellent at creating a complex report. The authors have planned to incorporate it into the ecosystem. Meanwhile, the JasperReports application is utilized to develop human resources- related tasks, e.g., a list of employees. We have written customized Python scripts to allow communication between the database and the Jasper Server.

3.1.4 Chatbot

An AI chatbot helps the business to answer client’s questions regarding the available products. The chatbot interacts with customers through the Line messaging platform due to its large local user base in Thailand. The bot is based on DialogFlow which is a user-friendly and intuitive platform developed by Google with powerful natural language processing (NLP); see Figure 4.

The algorithm can be described as follows.

- Users input query via Line Messenger or Odoo Chat.

- Odoo Chat or Line webhook forwards requests to Google DialogFlow to perform user's intent classification.

- The available intents are product search, quantity query, and price lookup.

- Once intent has been classified, database query returns result via Line or Odoo Chat.

The chatbot algorithm can be seen in Figure 5. The architecture diagram can be seen in Figure 6.

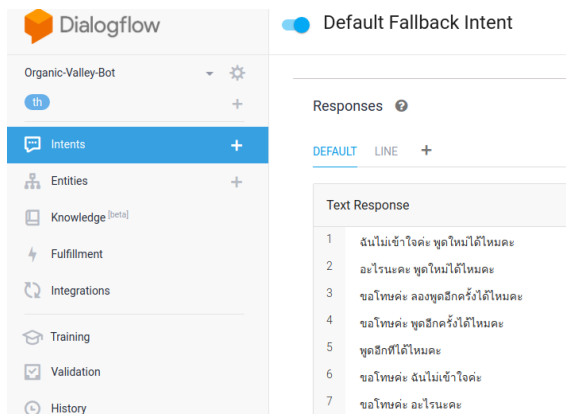


Figure 4. Dialog flow training example.

Algorithm 1: User interaction with chatbot

Input : Natural language *query* from user via Line Messenger or Odoo Chat

Output: Retrieved *productData* in JSON

```

1 do
2   query text forwarded to DialogFlow to extract keywords and
   classify intent
3   user's intent classification sent back to Server
4   for each product p in user intent do
5     lookup productData in Odoo database via product API
6     return productData
7   end
8 while user makes product inquiries;
    
```

Figure 5. Chatbot algorithm.

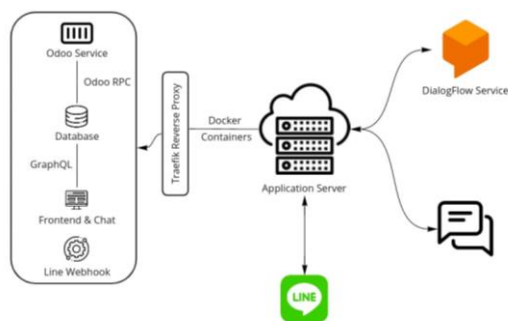


Figure 6. Architecture diagram.

3.1.5 Frontend

The frontend consists of two separate parts; administration and customers. The administrative part accommodates all previously mentioned features such as products, data entering etc. The customers have access to the e-commerce components through the website to buy and acquire information through contact form and Line Chatbot. They also received invoicing and receipt via email. The mail servers, both incoming and outgoing, are encrypted and based on Google GSuite services. The appearance of the platform can be seen in Figure 7 and 8.

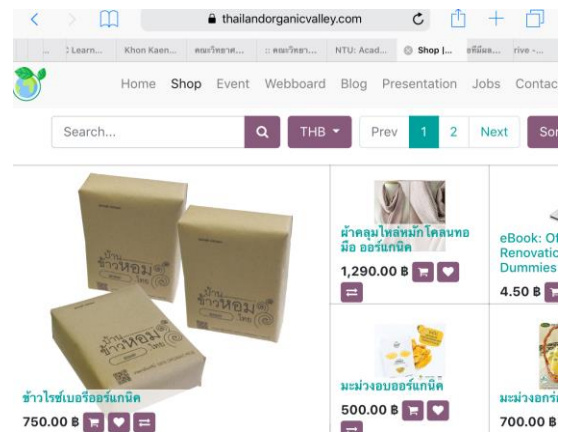


Figure 7. Product page.

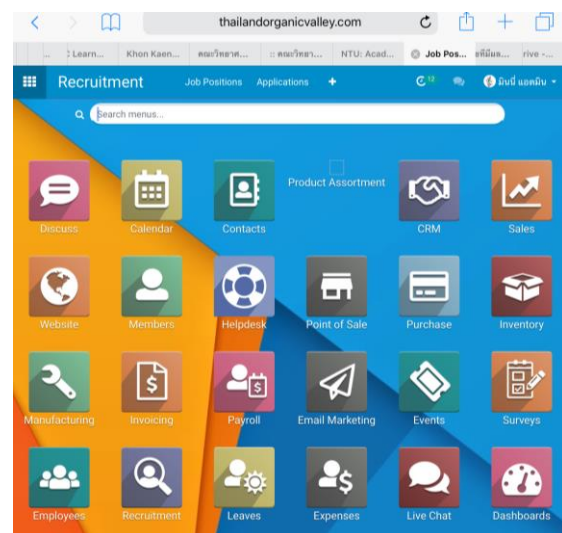


Figure 8. Admin page.

3.1.6 SEO

The authors have also developed forum and blog components to accommodate search engine

optimization (SEO) organically, as organic SEO will eventually mitigate the cost of advertising. The authors have utilized the web traffic of the major social platforms, i.e., Facebook, Instagram, Twitter, YouTube, Google Plus and Pantip, to generate leads back to our website. Tagging photos and videos is also one of the strategies to generate organic web traffic to the site.

4: The Use of Application (R2)

4.1 A qualitative research method, Focus Group Discussion (FGD) has been conducted with representatives from SMCE and SME and stakeholders in the area. The information collected from the FGD is then used in application improvements.

4.2 Application Performance Assessment

4.2.1 Opening application access to focus groups and receiving feedback has been performed utilizing a rating scale like Likert scale survey forms. The authors have surveyed two separate groups; experts in technology-related fields and regular visitors.

4.2.2 Reliability of survey: This study has used Cronbach's α coefficient to assess the internal consistency of the survey for experts' and visitor's assessments. The results were 0.84 and 0.86, respectively.

4.2.3 Sampling Method: Twelve experts and 325 regular visitors have been assessed for satisfaction after using the application. They are from various background including local farmers (SMEs and SMCEs), local government agencies, regular locals, self-employed, office workers, government officers, students, and teachers over 15 years of age using an unknown population technique, and

$$n = \frac{P(1-P)Z^2}{c^2}$$

where n = sampling size

Z = standard normal deviation

P = percentage picking a choice or response

c = confidence interval.

This study set $P = 0.3$, $c = 0.05$ and $Z = 1.96$ (at 95% confidence level)

4.2.4 Application Performance Assessment: The authors have used SPSS Version 15 to calculate the Likert-scale survey results.

3. Results and Discussions

The most-capable participants in manufacturing and producing high quality products selected from the SMCE and SME group are:

- Organic weaving (Figure 9)
- Organic Cavendish banana
- Organic Barracuda mango (Mamuang

Plang Yai Ban Loan Group, Mae Ban Thai Jaroen Group)

The selected groups have been in the market for some time and have the need to expand digitally without middlemen.

A few unselected participants could potentially grow in the near future, including mulberry woven thread export group (Ban Non Sri Sanga SMCE), beef cattle group (Ban Lad Wang Muang), and agritourism group (Kon Ton Nam Chee).



Figure 9. Ban Lad Wang Muang Group.

1. Application Interface

1.1 Frontend application: Visitors can browse the entire collection of products and local events. They can ask chatbot about products via the Line application and on the website forum. Guests can register to become a member of an app. Blogging is available to users. It is a big contribution to SEO as well.

1.2 Backend Application: Admins have access to all modules such as setting up products, managing inventory, scheduling employees, making transactions through POS (point of sale), payroll, campaigning sales and accounting as mentioned earlier.

2. Assessment of Satisfaction Surveys

2.1 Results from expert survey

Table 1 shows the application's quality survey result from experts in technology-related fields. The experienced users scored the application at an average of 4.37 (very satisfied). As can be seen in the Application Benefits category, it is agreeable that the application could be used in the real world, as it rated satisfied on all items.

2.2 Visitors

The results from the customer satisfaction survey show an average of 4.30, very satisfied. The customers are pleased with the application's user interface (UI) as shown in Table 2.

4. Conclusions

The application has been developed largely based on Odoo (the open-source ERP and CRM) serving to connect the Organic Valley with online buyers. An AI chatbot has also been created based upon Google Dialog Flow's NLP engine to intelligently chat with customers minimizing the workload in customer management tasks. The application also accommodates system users with several backend management jobs, from accounting to sales promotion, as previously mentioned. The authors have chosen to use Google DialogFlow as a starting point because it provides fast development and deployment at no cost. In the future version, we are aiming to train our own NLP model to achieve better performance.

Visitors can navigate the website and browse the organic products offered by Nong Bua Dang's SMCEs and SMEs. They can participate in the forum to interact with farmers directly. Farmers or government bodies can organize an event to attract people, which in turn boosts the local economy.

Administrators can incorporate new and custom modules to the system to best suit the nature of business. For example, when the SMCEs and SMEs decide to deliver products using their own fleet, a fleet service module can be created and integrated easily.

Maintenance of the computer server, networking, and system maintenance are essential to the business as well as upgrading existing modules or developing new ones. The application operators also need to perform SEO tasks to generate organic traffic to the website. Therefore, a person with computer literacy could be an asset to the whole operation.

The chatbot should be able to handle more advanced conversations with customers. It should be trained with more intents and follow-ups. Also, webhooks should be associated with more backend-related inquiries such as employee's work schedules, coupon notification, etc. Moreover, a bot fluent in Chinese could be very valuable to the farmers in Chaiyaphum.

Table 1. Results of the application satisfaction assessment by experts.

Content	Mean	SD	Level
[1] Design			
1. User interface is well-designed and looks modern.	4.75	0.45	Very satisfied
2. The application is not cluttered by menus.	4.17	0.44	Satisfied
3. Font size and background color are easy to look at.	4.38	0.51	Satisfied
4. Products shown on the website are attractive.	4.65	0.39	Very satisfied
Usage			
[2] Visitors			
1. Easy to navigate.	4.52	0.48	Very satisfied
2. Well categorized and easy to search.	4.33	0.61	Satisfied
3. Line chatbot is responsive.	4.14	0.43	Satisfied
4. Website chat box is responsive.	3.91	0.67	Satisfied

[3] Administrators

5. Easy to create products.	4.81	0.46	Very satisfied
6. Easy to edit products.	4.71	0.38	Very satisfied
7. Easy to manage inventory.	4.89	0.36	Very satisfied
8. Multiple languages can be added easily.	4.52	0.42	Very satisfied
9. Backend server is fast.	3.88	0.66	Satisfied

[4] Security

1. Application is encrypted using HTTPS.	3.99	0.53	Satisfied
2. Strong password requirement is hardened.	3.73	0.63	Satisfied

[5] Application Benefits

1. Application can be used for real transactions.	4.68	0.54	Very satisfied
2. Application can work with external peripherals like thermal printers, etc.	4.82	0.31	Very satisfied
3. Application makes it easier to connect the Organic Valley community with buyers.	4.61	0.45	Very satisfied
4. I'm satisfied with the application overall.	4.78	0.59	Very satisfied

Average ([1],[2],[3],[4],[5])	4.37		Satisfied
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Table 2. Results of the visitor satisfaction assessment.

Content	Mean	SD	Level
[1] Design			
1. User interface is well-designed and looks modern.	4.51	0.44	Very satisfied
2. The application is not in cluttered by menus.	4.24	0.65	Satisfied
3. Font size and background color are easy to look at.	4.41	0.53	Satisfied
4. Products shown on the website are attractive.	4.23	0.61	Satisfied
[2] Usage			
1. Easy to navigate.	4.34	0.56	Satisfied
2. Well categorized and easy to search.	4.67	0.65	Very satisfied
3. Line chatbot is responsive.	3.98	0.74	Satisfied
4. Website chat box is responsive.	3.95	0.68	Satisfied
[3] Usefulness			
1. Application can be used for real transactions.	4.26	0.52	Satisfied
2. Application can work with external peripherals like thermal printers, and etc.	4.12	0.54	Satisfied
3. Application makes it easier to connect the organic valley community with buyers.	4.35	0.67	Satisfied
4. I'm satisfied with the application overall.	4.48	0.59	Satisfied
Average ([1],[2],[3])	4.30		Satisfied

5. Acknowledgement

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Conflict of Interest

The authors do not report any financial or personal connections with other persons or organizations, which might negatively affect the contents of this publication and/or claim authorship rights to this publication.

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