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THE WHY AND WHO FACETS OF STRATEGIC HORTICULTURE ENTERPRISE SYSTEMS

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Abstract: Actual Indonesia's inflation rate is higher than the government's inflation target. One of the reasons is that the dataset for calculating food group inflation is asymmetric due to incomplete supply and demand data. This study tries to overcome asymmetric data constraints by providing an enterprise system for strategic horticultural commodities (SHES). The research method used the first three Zachman Framework perspectives: the executive perspective contextual view, the business management perspective conceptual view, and the architect's perspective physical view, each evaluated using the Why and Who facets. Respectively, the result of the Why facet is about business drivers and motivation intention: vision, mission, and goals; strategic goals and the SHES model's entity goals/objectives; and system development rules, requirements, and functionality representation. The Who facets results are associated with responsibility assignments of farmers, merchants, sub-district data collectors, District Agriculture offices, developers, users, and managers (tested using high-fidelity prototypes/mockups). With SHES, data and information collection becomes systematic and holistic, immediately in the form of real-time data from farmers and traders. Access to SHES uses the farmer's/trader's mobile phone. Thus, data recapitulation, from village to sub-district, district, to provincial and national, will likely be based on reality/data facts in the field.

Keywords: Why and Who facets, real-time data, strategic horticultural commodities, high-fidelity prototype, Zachman framework

Abstrak: *Tingkat Inflasi riil di Indonesia masih lebih besar dibandingkan dengan target inflasi yang ditargetkan pemerintah. Salah satu penyebabnya adalah data penghitungan inflasi kelompok pangan tidak simetris karena data supply dan demand tidak lengkap. Penelitian ini mencoba mengatasi kendala data asimetris dengan menyediakan sistem enterprise untuk komoditas hortikultura strategis (SHES). Metode studi menggunakan tiga perspektif pertama dari Zachman Framework: perspektif kontekstual pandangan eksekutif, pandangan konseptual perspektif manajemen bisnis, dan pandangan fisik perspektif arsitek, masing-masing dievaluasi menggunakan aspek Why dan Who. Hasil dari aspek Why adalah tentang pendorong bisnis dan motivasi niat: visi, misi, dan tujuan; sasaran strategis dan sasaran/sasaran entitas model SHES; dan aturan pengembangan sistem, persyaratan, dan representasi fungsionalitas. Hasil aspek Who berkaitan dengan pembebanan tanggung jawab kepada petani, pedagang, pengumpul data kecamatan, Dinas Pertanian Kabupaten, pengembang, pengguna, dan pengelola (diuji menggunakan prototipe/mockup dengan ketelitian tinggi). Dengan SHES, pengumpulan data dan informasi menjadi sistematis dan holistik, langsung berupa data real-time dari petani dan pedagang. Akses terhadap SHES menggunakan telepon genggam petani/pedagang. Dengan demikian, rekapitulasi data, mulai dari desa hingga kelurahan, kabupaten, hingga provinsi dan nasional, kemungkinan besar akan didasarkan pada kenyataan/fakta data di lapangan.*

Kata kunci: *aspek Why dan Who, data real-time, komoditas hortikultura strategis, prototipe high-fidelity, Zachman framework*

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INTRODUCTION

Several horticultural commodities calculate Indonesia's inflation within the food group. Indonesia's inflation in June-July 2015 was 7.26%, whereas inflation in July 2022 was 4.94%, and in August 2022 was 4.69%. The inflation in July and August 2022 exceeded the 2022 inflation target of 3.00% with a deviation of ±1% (PMK No. 101/PMK.010/2021 dated 28 July 2021). These horticultural commodities are further referred to as strategic horticultural commodities (Suroso et al. 2022). These are red chili, curly red chili, cayenne peppers, shallot, and garlic. The paper discusses red chili, curly red chili, and cayenne peppers.

Price stability is the determining factor in achieving inflation stability, requiring the corresponding supply and demand balance. However, a balance of supply and demand is difficult to achieve. The production of strategic horticulture is affected by the season (Mariyono, 2017) and the margins of transportation and trade (Lin et al. 2015; Marpaung et al. 2019; Armenta et al. 2016). Also, it involves many elements, such as the array of producers, widespread supply chain actors, and diverse stakeholders and government regulators (Rachmaniah et al. 2021). The supply and demand models could support the development of the intelligent enterprise system; however, this requires a complete dataset gathered from all the relevant institutions and actors (Rachmaniah et al. 2022b). Hence, an enterprise architecture framework is required for collecting all variables within the dataset of the strategic horticulture enterprise system.

Different enterprise architecture frameworks (EAF) possess different EAF characteristics. Some EA frameworks frequently used are the Zachman Framework, the Open Group Architecture Enterprise (TOGAF) Architecture Development Method (ADM), the Federal Enterprise Architecture Framework (FEAF), the Department of Defense Architecture Framework (DoDAF), the Ministry of Defense Architecture Framework (MODAF), Adaptive Enterprise Architecture Framework (AEAF), and EA3 Cube Framework. In essence, the development of many EA Frameworks uses the Zachman Framework as its foundation (Rachmaniah et al. 2022a). The research of Sessions and DeVadoss (2014), Dorohyl et al. (2017), Bondar et al. (2017), and Mokone et al. (2019) specified that the Zachman Framework has various advantages. Dorohyl et al. (2017) study on critical IT infrastructure concludes that the Zachman framework has the highest usage percentage compared to SOA, TOGAF, DODAF, FEAF, British MODAF, Nato Architecture Framework (NAF), Gartner EAF, and ISO Open Distributed Processing-Reference Model (RM-ODP). For the Systems-of-Systems architecture study, the TOGAF, FEAF, and Zachman frameworks are suitable, yet Bondar et al. (2017) chose the Zachman Framework. The study of Mokone et al. (2019) used the analytical hierarchy process and showed that the Zachman framework has the highest ranking compared to FEAF, TOGAF, and TEAF.

Of the many available frameworks, the Zachman framework - The Ontology, gives more offerings (Rachmaniah et al. 2022a). The Zachman Framework for Enterprise Architecture (ZFEA) is a descriptive and holistic representation of an enterprise to provide insight and understanding (Gerber et al. 2020). The Zachman Framework defines pre-structured views and layers to represent information technology enterprises and does not define a specific process or methodology. It focuses more on role involvement and assigning objects viewed from different perspectives. Therefore, the Zachman Framework can provide comprehensive support to consider relevant aspects from all perspectives to design and develop enterprise systems for strategic horticultural commodities.

The strategic horticultural enterprise system (SHES) collects structured horticultural data variables independently from various institutions, including the Ministry of Agriculture (Kementan), the Central Statistics Agency (BPS), and the Bank of Indonesia. These three government institutions have many applications, both for internal administration purposes and to fulfill the requirements of various e-Government indicators within the Electronic-Based Government Systems known as Sistem Pemerintahan Berbasis Elektronik (SPBE). These applications also provide specific data and information according to the duties and functions of their institutions.

This study applies ZFEA to strategic horticultural commodities reviewed from the Why and Who facets applied for the first three perspectives of ZFEA. The hypotheses are that the Why facet is the main reason for the development and the Who facet is an enabler that ensures the use of the SHES. The resulting application is expected to be available to the lowest-level actors, Indonesian farmers, and merchants, hoping to help the sub-district data collectors provide symmetric data. The potential for forming the SHES is to answer the research question: How to develop the SHES using the ZFEA? Thus, the research objectives (research objectives/RO) are: (1) Identify and explore the executive perspective and scope context model, the business management perspective and business concept model, and the system logic perspective and system logic model for the SHES development. Each perspective and model is identified and analyzed according to the Why and the Who facets. (2) Producing SHES model artifacts following the Why and Who facets of the Zachman Framework - The Enterprise Ontology version 3.0.

The benefit of this research is to overcome the problem of controlling the price of strategic horticulture commodities to maintain inflation stability ascending from these commodities. This research has several contributions, including: Strategic horticultural production centers can monitor production, consumption, and prices according to the main patterns of commodity trading systems applied in their locations; The resulting SHES can be used as a surveillance tool and reference mechanism for data collection reporting and obtaining the structure of actors to obtain a complete and holistic dataset; The resulting artifacts become the foundation for a systematic and holistic horticultural data collection approach based on the reality of data in the field.

METHODS

The Zachman framework is an enterprise system ontological frame that considers different sequential audience perspectives (stakeholders): (i) executive perspective (business context planner), (ii) business management perspective (business concept owner), (iii) architect perspective (business logic designer), (iv) engineer perspective (business physics builders), (v) technician perspective (business component implementers), and (iv) enterprise perspective/ the enterprise (users). Each audience perspective consecutively formed model names: (i) scope context, (ii) business concepts, (iii) system logic, (iv) technology physics, (v) tool components, and (vi) operations instances. Initially, these audience perspectives and model names elaborated using six facets: (i) What, (ii) How, (iii) Where, (iv) Who, (v) When, and (vi) Why. We advance the SHES using the first three audience perspectives and the Why and the Who facets to demonstrate the ontological approach of the Zachman framework applied to the Indonesia horticulture strategic commodities (Figure 1). The first facet is the Why (motivation intention): the column identifying why we chose the final solution and the motivation behind the initiative or project. The second facet is the Who (responsibility assignment): the column to identify the key stakeholders and determine all the relevant personnel for the project. The data source used various Ministry of Agriculture documents, Sleman District Agriculture Office, and respondents tested the high fidelity mockups. The selected respondents for the responsibility assignment were farmers, traders, and data managers in Bogor, Garut, Sukabumi, and Sleman. Here, we use software engineering model approaches for the three audience perspectives and the two selected facets.

RESULTS

The Why Facet

1. Executive Perspective (Business Context Planner) and Scope Context (Scope Identification List)

The executive perspective mainly focused on the external side. Future executives will face the challenge of guiding the enterprise through a world full of complexity and uncertainty (Lapalme et al. 2016). In this study, the executive perspective (scope of context) directed to pay attention to efforts to control the strategic horticulture commodities prices to maintain the stability of inflation. In resilient agricultural development, an agribusiness approach must be applied holistically (Suroso et al. 2016). The artifacts from this cell are about the vision, mission, and goals of SHES as follows:

Vision: An advanced, independent, modern strategic horticulture agrosystem for realizing a sovereign, independent, personal, and sustainable agrosystem based on cooperation.

Mission : 1) Increase the availability of quality strategic horticulture commodities; 2) Increasing the added value and competitiveness of strategic horticulture farmers; 3) Implementing accountable, effective, and trustworthy strategic horticulture agrosystem management.

Goals:1) Increasing the welfare of strategic horticultural commodity farmers; 2) Increased added value and competitiveness of strategic horticultural commodity farmers; 3) Provide statistical data on fresh chilies for farmers, traders, and horticultural data managers as the foundation for making strategic horticultural commodity agrosystem policies; 4) Increased collaboration, integration, synchronization, and standardization of the implementation of strategic horticultural commodity agrosystem statistics.

2. Business Management Perspective (Business Concept Owner) and Business Concept (Business Definition Model)

The second audience perspective, a business management perspective, mainly focuses on the internal side (Lapalme et al. 2016). Similar to executives, future managers will face the challenge of guiding the workforce in their environment. Complexity and uncertainty in the enterprise will reflect the complexity and uncertainty of the environment. According to Donaldson et al. (2015) every organization and corporate architect must determine the best approach for their organization. Thus, the business management perspective (business concept) describes the SHES within which information systems should function. Analysis from this perspective reveals which parts of the SHES can be automated. The business management perspective is the place to identify the business needs and resources needed to execute the plan.

The artifact produced in this cell is a list of business goals aligned with the vision, mission, and goals set. These artifacts are compiled by the business concept owner into a business definition model. Table 1 shows a list of the strategic targets resulted. It is in line with Morales-Trujillo et al. (2018), who filled this cell with a list of business strategies. The difference is that Morales-Trujillo et al. (2018) rearranged the artifacts by combining this cell with business goals in a business context planner.

Efforts to increase farmers' added value and competitiveness face considerable challenges, especially when farmers need help calculating the profit or loss of their marketing results. Chili plants include seasonal vegetables harvested many times within each harvesting season. The chili harvesting age varies depending on the type and variety. Based on discussions with chili farmers in Garut, Sukabumi, and Sleman, generally, fresh chilies are harvested (picked) almost twice a week until the plants are no longer productive or it is not economical to harvest. It means that farmers need tools to record production, prices, and area harvested twice a week, considering that the price of chilies per day generally fluctuates. The development of statistical-estimation models and integrated or hierarchical supply chain planning will be a critical research area because it fully exploits the information opportunities presented by real-time sources (Villalobos et al. 2019).

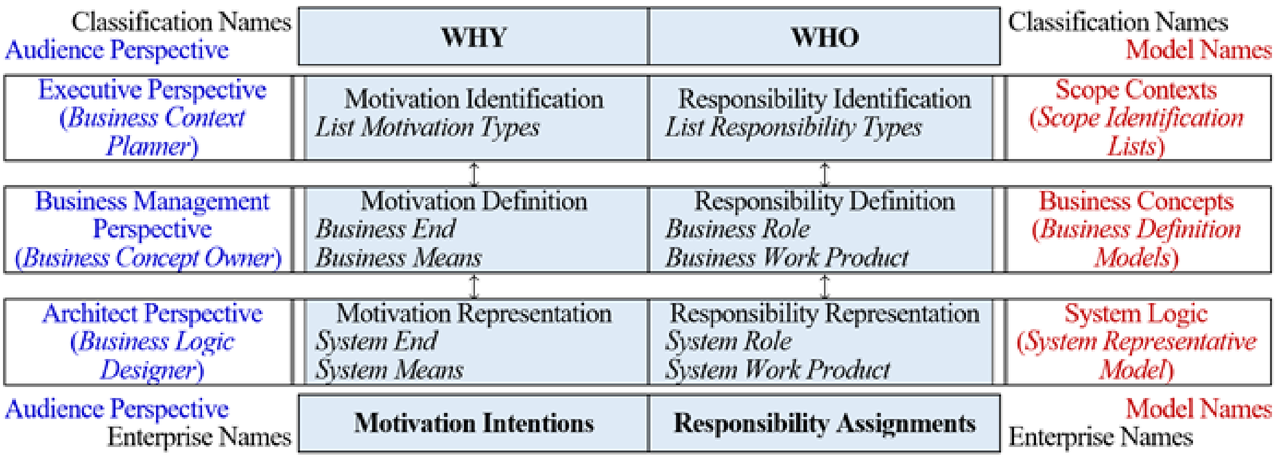


Figure 1. The Why and Who facets applied for strategic horticultural enterprise systems

Table 1. Artifacts of business concept owner's view (business concept)

Goals (business context planner view)	Strategic Goals (business concept owner view)
Increasing the welfare of strategic horticultural commodity farmers.	- Increasing the availability of strategic horticultural commodities considering supply and demand. - Availability of tools to record expenditure transactions and receipt of strategic horticultural commodity agrosystems.
Increasing added value and competitiveness of strategic horticultural commodity farmers.	- Increasing farmer exchange rates (NTP) continuously and sustainably. - Availability of strategic horticultural commodity agrosystem facilities and infrastructure as needed.
Providing statistical data on fresh chilies for use by farmers, traders, and horticultural data managers as the foundation for making strategic horticultural commodity agrosystem policies.	- Providing data collection tools from the farmer level at the village/sub-district level, the district agricultural office, to the national level. - Availability of strategic horticultural commodity datasets for supply and demand models. - Increasing utilization of quality holistic strategic horticultural commodity datasets.
Increasing collaboration, integration, synchronization, and standardization of the implementation of strategic horticultural commodity agrosystem statistics.	Increasing and strengthening holistic dataset of cross-agency statistics on climate, monetary, population, and exports and imports, starting from the district/city to the central level.

The number of rural residents who have cell phones is 54.31% of the rural population (BPS, 2021). It means that around 54.31% of rural farmers have the potential to automate data collection via their cell phones, but they need direction. The research results of Suroso et al. (2022) show a positive and significant global influence from internet users, fixed broadband subscriptions, and secure internet servers on the performance of the agricultural sector. Chili farmers need tools to record expenses and receipts for fresh chili farming. For this reason, a web-based application system must apply the progressive web app (PWA) concept. In this way, the farmers access the application from their mobile phones without the need to install the application on the farmer's cell phone. Progressive Web App (PWA) combines the best web and mobile apps, acts like an app, and is not required to be installed like a native app (Tandel and Jamadar, 2018).

Increased strengthening of statistics, including climate, monetary, population, as well as exports and imports, is carried out in a sectoral manner across agencies at the district/city level up to the central level in a holistic manner. Data collection using the sampling method and manual data recording will affect the accuracy of the data. In order to obtain more accurate statistical data, we require the creation of artifacts, as shown in Figure 2 (below the red dotted line), to fill in the SPH-SBS blank collected with an additional 11 variables from the supply and demand model It is in accordance with the need for data variables in the supply and demand model study, the discrepancy in the location of the smallest data unit (district), and the irregular frequency of data collection times (Rachmaniah et al. 2022b).

Thus, it is necessary to make a strategic horticulture enterprise system (SHES) application that local farmers and merchants can access. Thus it requires commitment and common perception of all parties involved in the strategic horticulture agrosystem. Strategic horticultural advocating and data collection are managed by the Directorate General of Horticulture (DGH) of the Ministry of Agriculture (Kementan) starting from the central level down to the district level, thereby forming a SHES (Figure 2). The dotted red line box depicted additional data requirement on district population, climate, and commodities' price.

3. Architect Perspective (Business Logic Designer) and System Logic (System Representative Model)

The third audience perspective, the architect's perspective, applies the business definition model from the perspective of business management (owner of the business concept) and translates/transforms (or reforms) it into enterprise building blocks. According to Lapalme et al. (2016b), the architectural perspective is primarily concerned with understanding enterprise components and the relationships between components. The architect's perspective contains the logical building blocks for an enterprise. The technology that supports the business model derives from the architect's perspective. In this perspective, business-information technology (IT) alignment will be a concern, especially if IT is the technology of choice (Lapalme et al. 2016b). In SHES, the architect's perspective (system logic) outlines how the system will meet SHES's information needs. The architect's perspective (system logic) representation is independent of solution-specific aspects or production-specific constraints. The architect's perspective identifies how the plan will meet business requirements. The architect's perspective is similar to the work done by systems analysts dealing with data, process flows, and business process functions. Artifacts relating to service-oriented architectures are primarily on the third line (architect perspective) (Sessions and DeVadoss, 2014).

Based on discussions with chili farmers in the Sukabumi, Garut, and Sleman districts, chili harvesting is every 3-5 days. It is different from shallot and garlic, where the harvest is simultaneous. In Figure 2, with the dotted red line, the actors in charge are represented by the dotted line arrows for cooperation and coordination and the solid line arrows for reporting. Apart from land owners (farmers/companies/other sources), the actors involved are Data Collection Officers (called PPD), Field Supervisory Officers (called PPL), and the Agricultural Supervisory Agency (called BPP). Even though economic motives have the highest ranking weight, farmers choose chili-based agribusiness mainly because of profit orientation (Mariyono and Sumarno, 2015). However, landowners, especially farmers, refrain from actively participating in inputting data. Therefore, farmers are the most minor units of data collection objects that need intervention. Farmers need help to use their cell phones to input data independently so that data is always complete and up to date. Remember that PPD are officers in a structural work unit with a work area of one sub-district, while PPL and BPP are non-structural work units with one or several sub-districts. To avoid data duplication, collaboration or division of areas between PPD PPL and BPP is required, for example, tasks by village.

The view of the business logic designer (system logic) is the rules (Figure 3) and access applied to SHES (Table 2). This regulatory artifact aims at the District/City Agriculture Office level, which is the primary data source requiring monitoring for accuracy and timeliness. Accurate, complete, and timely data at the District Agriculture Office level contributes to the Provincial and National Agriculture Office levels (Ministry of Agriculture). On the other hand, SHES helps farmers become actors who actively store their farming data. Data recording includes the use of capital, production, and recording of transactions between farmers and merchants. Essential records such as expenses and income on transactions will be stored safely and accessed at any time for the benefit of financial reports to banks.

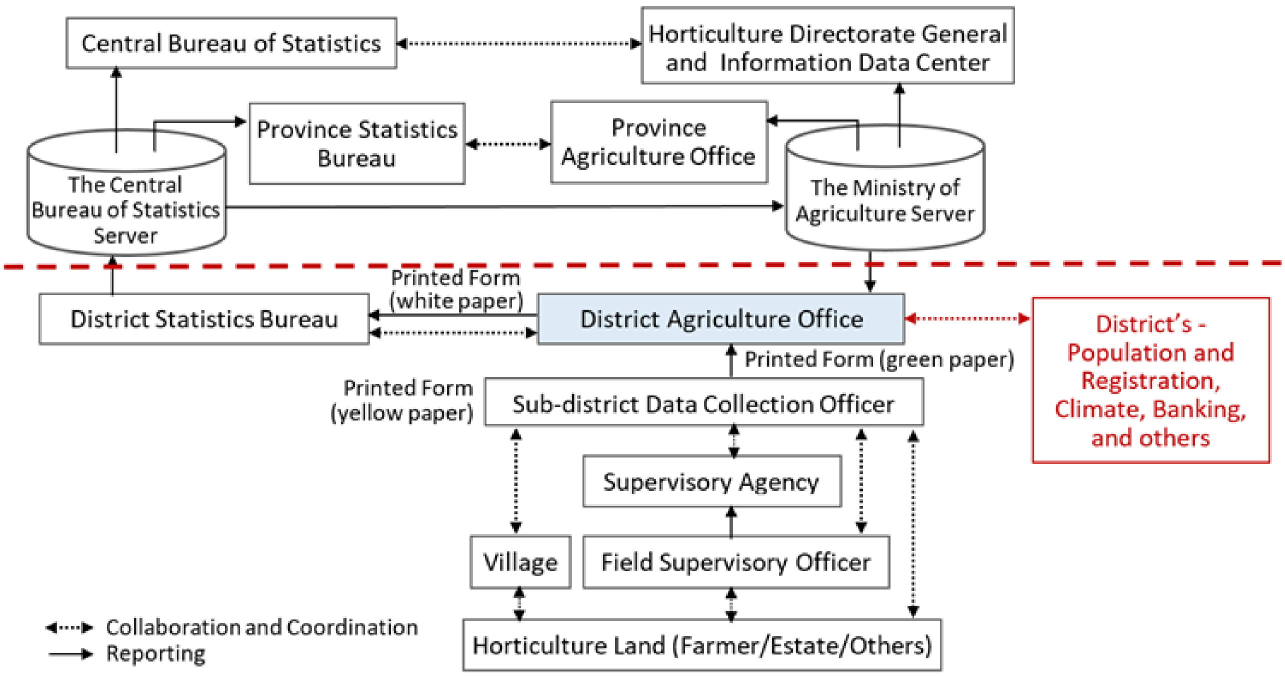


Figure 2. Intervention of the DJH reporting flow at the District Agriculture Office level (modified from BPS and DJH Ministry of Agriculture, 2020)

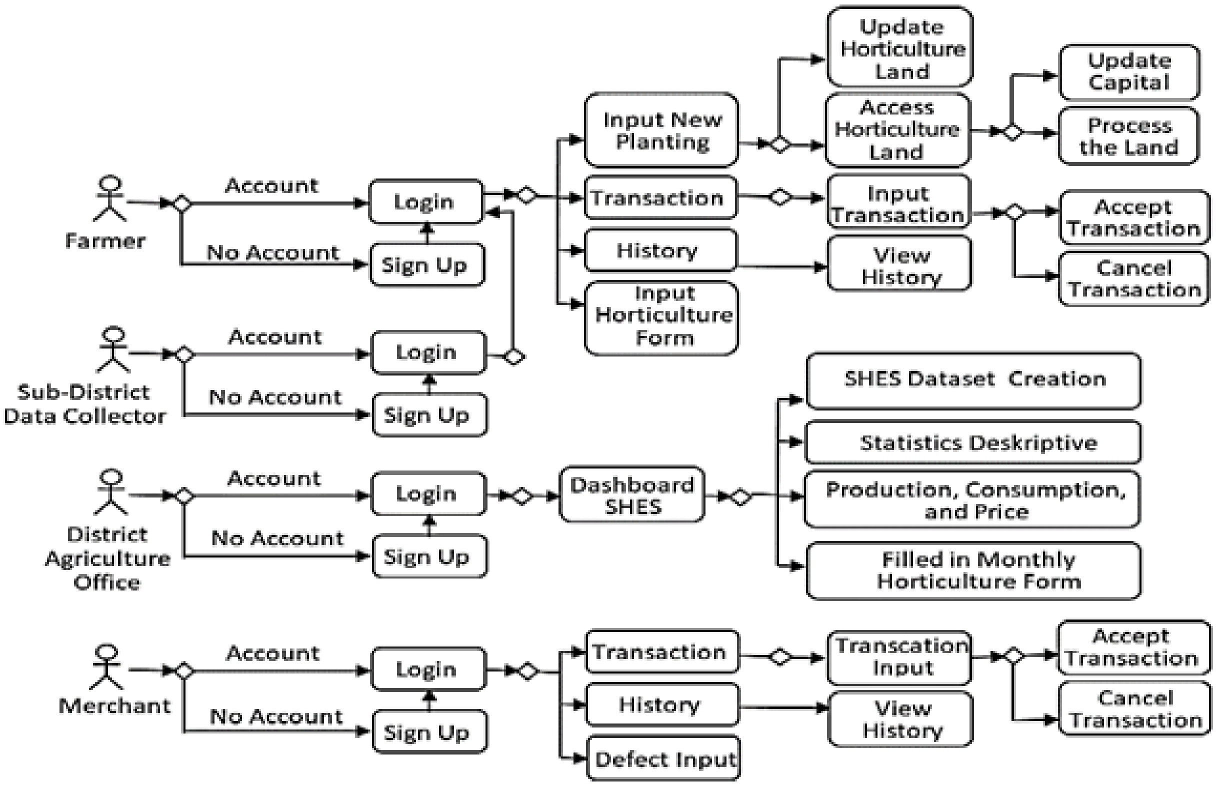


Figure 3. General user flow of strategic horticultural enterprise system (SHES)

Table 2. The level of user access rights for each SHES feature

SHES Features	User Access Rights				
	Farmer	Merchant	Data Collector	District Agriculture Office	District BPS
Input new planting	√		√	√	
Update horticulture land	√		√	√	
Update Capital	√		√	√	
Transaction	√	√	√	√	
Product Defect input		√		√	
Transaction History	√	√	√	√	
Input horticulture form	√		√	√	√
Supervision			√	√	
Profile	√	√	√	√	
Dashboard SHES				√	

The previous discussion on the Why facet of the SHES development using the first three Zachman framework perspectives supports the reasoning hypothesis of the SHES development. As Lange et al. (2016) recommended, it includes implementing enterprise architecture management (EAM) principles: determining EAM infrastructure, creating stakeholder awareness, providing high-quality EA products and services, and ensuring stakeholder commitment. Further, the study of Villalobos et al. (2019) explains real-time fresh product logistics and suggests the development of joint statistical estimation models and integrated or hierarchical supply chain planning. The Asravor et al. (2016) study in Ghana revealed that chili farming is 65.76% economically efficient, 70.9% technically efficient, and 92.65% allocationally efficient. However, the findings of Asravor et al. (2016) also revealed that chili farming showed decreasing returns to scale. It is partly due to the influence of the farmer’s age, experience, and gender, which significantly influence technical efficiency in Ghana, which also happens in Indonesia.

The Who Facet

The Who facet is the organizational stakeholders and horticulture actors, including their separate roles and responsibilities. A factor that contributes to increasing complexity in organizations is the increasing workforce heterogeneity. Current trends that will continue include more and less educated workers (due to the growing digital divide), professionalization of work, increasing numbers of retirees, and a rapidly changing and growing workforce with greater cultural and generational diversity (Lapalme et al. 2016).

1. Executive Perspective (Business Context Planner) and Scope Context (Scope Identification List)

Contextually, the Executive Perspective (business context planner) and Scope Context (Scope Identification List) cell identify the organizational units and their respective roles. In this cell, the artifacts produced are responsible institutions and agrosystem actors who play a role in SHES from the district to the central level. From an executive perspective, institutional and actor entities in horticulture agrosystems have unique characteristics, structured and unstructured (Table 3). Structured institutions have a formal organizational structure, such as Ministries in central provinces down to districts. On the other hand, the unstructured institutions are farmers (producers), various types of merchants, and consumers residing at the district level. The duties and responsibilities of actors in structured and unstructured entities comprise three categories: data providers, data managers, and data users. The data providers are actors that provide horticulture agrosystem data. Examples of data providers include farmers or producers (the supply side) or product collectors as buyers (the demand side). The data users utilize data from the SHES. An example of a data user is a regional government (district/city/province) that uses data for decision-making. Lastly, the data managers are actors who collect, analyze, and provide access to the SHES. The table shows the data management up to the district level.

The Role of Actors in the Unstructured Entities

The roles of unstructured entities differ in character compared to the duties and functions of the structured entities that follow their organizational hierarchy. In SHES, farmers' roles are producing strategic horticulture and reporting real-time production and sales. Farmers are responsible for producing sustainable, good-quality products. Farmers must adopt innovations, especially horticulture technology, to produce good quality products according to market needs. Meanwhile, the horticulture merchants are business actors (traders) who purchase strategic horticulture products from the farmers or other merchant actors—the traders who have direct contact with the farmers also report their real-time transactions to the SHES.

Table 3. SHES Actors and their relationships as data providers, users, and managers

SHES Actors	Data Provider	Data User	Data Manager
Unstructured Entities			
Farmer	√	√	
Horticulture merchants: distributor, agent, collector, wholesaler, and retailer	√	√	
End consumer		√	
Structured Entities			
Data Collector and Supervision:			
- Sub-district Data Collector (PPD)	√	√	√
- District Statistic Agency Data Collector	√	√	√
- District Field Supervisory Staff	√	√	
District Offices:			
- Agriculture Office	√	√	√
- Supervisory Agency (BPP)	√	√	
- Meteorology, Climatology, and Geophysics	√		
- Office of Population and Civil Registration	√		
- Local Government		√	√

The Role of Actors in the Structured Entities

The actors' role in the structured entities is in line with the duties and functions of their institution. It means that the structured entity actors in Table 3 have duties and responsibilities inherent according to the formal hierarchy of their organization. The difference is the integration between institutions, which considers the supply and demand sides as a basis for making decisions on agrosystems for horticultural crops. The target focus is also on the sub-district and district/city levels, which are the minor units of data collection objects for SHES.

2. Business Management Perspective (Business Concept Owner) and Business Concept (Business Definition Model)

In this cell, the Business Concepts (Business/ Conceptual Definition Model) are definitions and roles of actors and work products produced by related actors. Work products can be in the form of models, documents, activity logs, forms, lists (lists), or the form descriptions of activity customization and tasks defined by the process (Pressman and Maxim, 2020). Table 4 lists SHES work products and their definitions at the district level. The work products for the province and national level follow the existing application.

Table 4. SHES work products and its definition

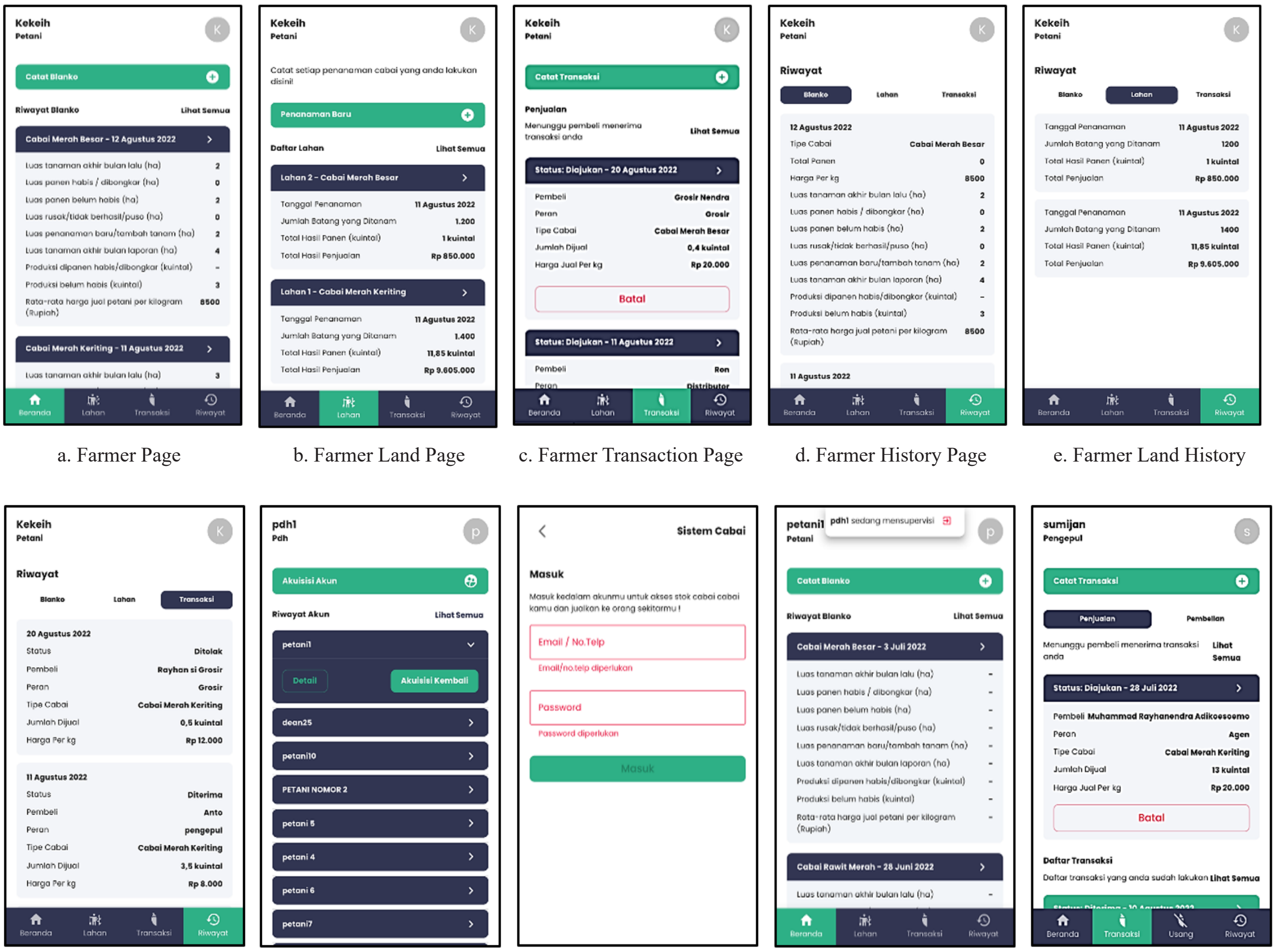
SHES Actors	Work Products
Unstructured Entities	
Farmer	- Real-time production, finance, and sales transaction data recording via the SHES mobile application
	- Notification for the Sub-District Data Collector (PPD) to assist farmer data recording process
	- Harvest history and sales transaction data for financial reports to fulfill banking requirements
Horticulture merchants:	- Stock receipts validation received from farmers and other merchants
	- Sales record to other types of traders or final consumers
	- Record the volume quantity of product defects prior to selling
Structured Entities	
Data Collector and Supervision:	
- Sub-district Data Collector (PPD)	- Socialize and educate farmers with cell phones to implement the SHES mobile application.
	- Monitor sub-district farmers' completion of SHES application data recording
	- Assist sub-district farmers and provide supervision on data recording (when farmers' ICT literacy is inadequate)
	- Supervise horticultural farmers to input their data into the SHES application
- District Data Collector	- Receive and review the completeness of sub-district data collection
	- Recapitulate sub-district data into district-level data
	- Transfer/export softcopy of district horticultural data to the District Statistic Agency Data Collector
- District Statistic Agency Data Collector	- Editing and coding, as well as checking data completeness
	- Monitor and import district/city data into the SIMSPH-Online application. The server for SPH-Online data is the BPS RI server
	- Collaborate with the District Data Collector in collecting strategic horticultural data
	- Import data from the SHES application into SPH-Online
- District Field Supervisory Staff	- Utilizing ICT facilities at Kostratani for real-time data collection and further sharing the data with the District Agriculture Office
	- Coordinate with the Sub-District Data Collector to avoid farmers duplication (overlapping) of strategic horticultural data collection
	- Educate and support the farmers to use farmers' cell phones for strategic horticultural data input
Other District Offices	District Meteorology, Climatology, and Geophysics Office shares dry/rainy season
	The District Population and Civil Registration Office shares sub-district population data

3. Architect Perspective (Business Logic Designer) and System Logic (System Representative Model)

This cell depicts the roles of system developers, system managers, and system users, as well as the allocation of human resources. In this cell, what is meant by the system is the SHES application used at the district level. The strategic horticulture commodities have potential for other horticultural commodities (seasonal fruit vegetables).

SHES application developer

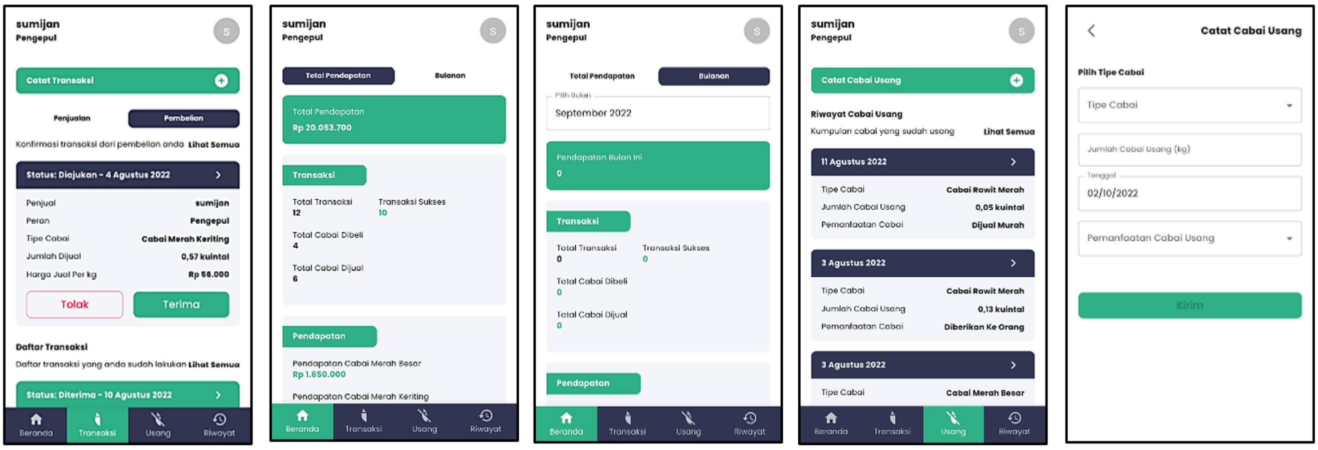
To develop SHES applications, we allocate personnel of user interface (UI) and user experience (UX) designers, UX researchers, and front-end and back-end programmers. The architect's perspective in this cell is SHES application development's analysis and design stage. Therefore, this cell does not cover the roles of front-end and back-end programmers UI and UX design geared towards mobile phone devices. The results of the user interface (UI) design will be the basis for the construction/implementation phase of the SHES application by implementing a progressive web app (PWA). PWA combines mobile and web apps so that website access is faster on mobile phones. Implementing PWA is very important, considering that the devices owned by most users are cell phones. The UI designer provides the workflow of the district-level SHES, represented through high-fidelity UI design (Figure 4). The UX researcher plays a role in researching target users to determine the target user's response to the design and feasibility of the UI and the resulting District SHES workflow. It is in line with the results of Bancin and Rachmaniah (2022) study requesting application access via mobile phones, which respondents are already familiar with, compared to using applications on laptops.



a. Farmer Page b. Farmer Land Page c. Farmer Transaction Page d. Farmer History Page e. Farmer Land History

f. Farmer Transaction History g. Sub-district Data Collector h. Create Farmer Account i. Suprivision Page j. Merchant Transaction

Figure 4. Results of high fidelity UI design for users: farmers (a to d, f), horticulture data collectors (PPD) (g to d, i), and merchants (j to d, o)



k. Merchant Purchase Transaction Page | l. Merchant Total Revenue | m. Merchant Monthly Income | n. Product Defect Quantity | o. Input Product Defect

Figure 4. Results of high fidelity UI design for users: farmers (a to d, f), horticulture data collectors (PPD) (g to d, i), and merchants (j to d, o) (continue)

Users and Data Managers

Users will use the District SHES application as a medium for recording/collecting data from the individual objects. The target users are farmers, horticultural data collectors (PPD), and traders. However, the results of the interviews show that the main target of this research is farmers because by focusing the distribution process on farmers, the data distribution is more accurate and complete. Meanwhile, District Agriculture will receive processed data in the form of blanks filled in per month according to the automation results, and the user can choose the sub-district or recapitulation from which they want to withdraw the data.

Farmers fill in the complete data needed in the process of automation of SPH-SBM forms by the system (Figure 4a – 4f). Farmer activities such as recording blanks, creating new land, updating capital, and recording transactions will produce data that will be recorded in the system and help the system automate blanks according to the data entered. Farmers who fill in data independently will produce more accurate data because it is filled in directly from the primary source of information, namely farmers. In this condition, the District Horticulture PPD does not need to fill in the form manually anymore because the form is already available at the District SHES (Figures 4.g to 4.i). If farmers cannot fill in independently, the District Horticulture PPD will assist with filling. In this case, the District Horticulture PPD plays a role in supervising and monitoring farmers who need help filling in data. At district SHES, PPD Horticulture and the Department of Agriculture also played a role as data managers.

The role of merchants is as buyers via transactions carried out with farmers. The presence of merchants in the SHES District will create an online business environment that can operate daily by carrying out transactions between traders or farmers (Figures 4j to 4o). With transactions with traders, farmers obtain financial reports from the Farmer Transaction History page (Figure 4f). The roles of these three users will considerably influence the flow created in District SHES because they will create a large environment that can complement each other online. High-fidelity UI SHES has been tested in Sukabumi Regency and has met the expectations of its users.

The resulting user interface design becomes a reference in determining each user's role. District SHES has six user roles: farmers, District Horticulture PPD, and merchant groups consisting of collectors, retailers, distributors, agents, and wholesalers. New users who will register for the application will choose roles according to their respective roles. Access rights limit each role according to its role (Figure 5). The farmer can access user features, land, transactions, and SPH-SBS form. The District Horticulture PPD Role has access to user and supervision features. The merchant can access user, transaction, stock, and product defect features. For example, a merchant role cannot access the SPH-SBS form feature because this feature is limited only to farmer roles and vice versa. The results of this artifact will be a reference for the engineer's perspective (business physics builder/technology specification model).

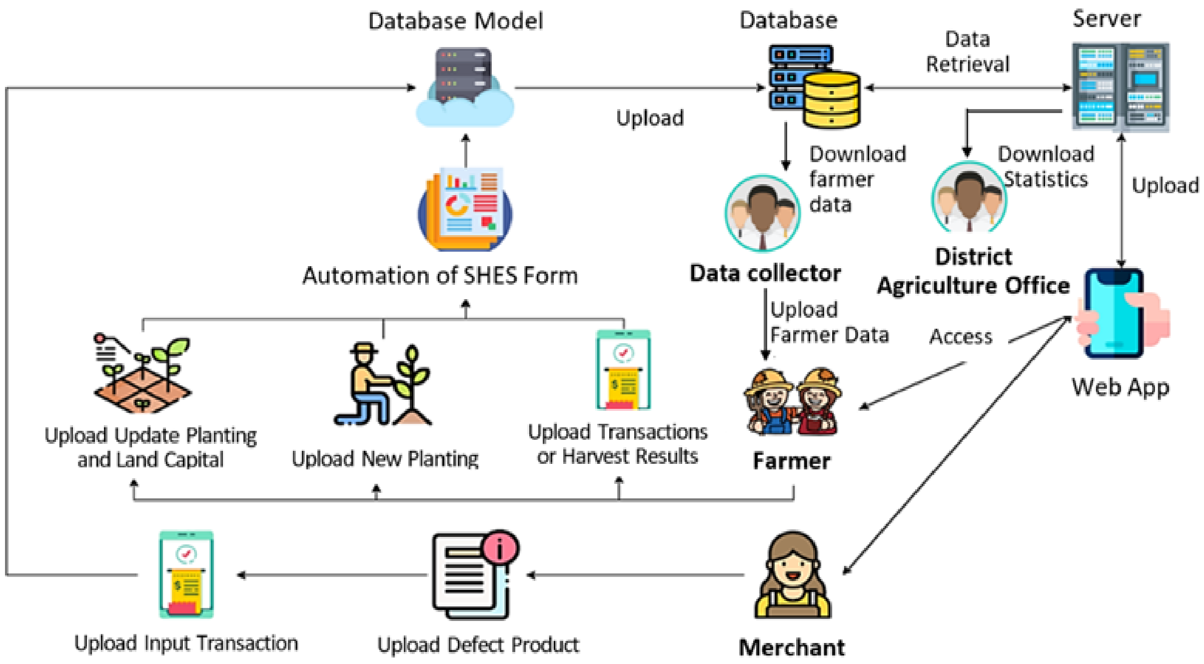


Figure 5. Distribution of feature access rights according to user roles

The responsibilities assignment of the Who facet based on the executive, business management, and architecture perspectives described above support the hypothesis as an enabler of the SHES development and usage. Also, our research results on the Who facet are in line with (Danny et al. 2019)observation, and field studies are combined with the literature and knowledge to do this research. The result of this research of Zachman Framework is an enterprise architecture using cloud reporting tools (BI, which uses the Zachman Framework as an architecture enterprise to align the vision and objectives between management and system development for the crude palm oil (CPO) business with plantation centers in Sulawesi and Bengkulu and the Head Office in Jakarta. The WHO facet emphasizes human resources according to the company's organizational structure. Incoming data to interested parties will be used and processed into reports displayed for upper management via cloud reporting tools. In our case, it is via the existing servers at the national level.

Managerial Implications

This research studies the ontology for strategic horticultural enterprise. Ontology studies concepts directly related to existence, especially incarnation, existence, and reality, as well as the basic categories of existence and their relationships. Ontology concerns what entities exist or can be said to exist and how these entities are grouped, related in a hierarchy, and divided according to similarities and differences. The results of this scientific research are valid for all time and disseminated to all districts/cities throughout Indonesia. On the other hand, the results of consulting work are by order work, which is more concerned with achieving milestones determined based on the time and budget agreed upon by the ordering party and the consultant.

Research on the strategic horticultural enterprise system (SHES) employed part of the Zachman Framework for Enterprise Architecture – The Enterprise Ontology version 3.0. We used three sequential rows of audience perspective and two interrogative columns (Why and Who). The audience perspectives must be sequential, while the interrogative is arbitrary. The researcher believes that the Why interrogative is the basis for the need for subsequent interrogatives to become a harmonized composite integration. On the other hand, the three columns of audience perspective must be sequential, from the executive perspective, the business management perspective, and the architect's perspective sequentially. It aims to make the alignment transformation between the audience's perspectives according to the interrogative more clearly visible. The artifacts produced become the foundation for three remaining audience perspectives: the engineer's, technician's, and enterprise perspectives.

SHES planning, analysis, and design for users from the sub-district level to the district/city level and then integrated with the Sipedas online application. In this way, the collection of data and information becomes systematic and holistic, directly in the form of real-time data from farmers and traders. SHES access is using a farmer's/trader's cell phone. Thus, the recapitulation of data, from villages per sub-district to districts/cities to provinces and nationally, is expected to be based on the reality/facts of data in the field. The implication is that it is time for farmers and merchants to utilize their cell phones to record their farming activities. As an incentive, it will be easier for farmers to have a financial report feature that results from recording harvest history features and sales transactions. Farmers need financial reports to meet the requirements for submitting subsidized fertilizers or bank funds.

At the district level, SHES data at the sub-district and district levels become a reference for providing counseling and guidance to farmers. For example, in Sleman Regency, the strategy applied is "building awareness in togetherness." The district coached the farmers in the Sleman to plant chili out of season to prevent overproduction. During the rainy season, farmers must raise the beds (to avoid excess water) and adjust the spacing. Another strategy is to give farmers an alternative to growing other horticultural crops to control chili prices. Also, the district provides Farmer Gathering Points in each sub-district to facilitate the auction market to accommodate all farmers' production. In this way, there is certainty that the market can absorb all farmers' horticultural products.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Inflation commodity requests a continuation of automated data collection starting from the data source from the very bottom locus. Each government institution must do this together because the implications for the cost of data collection surveys in total are very high. Therefore, we need collaboration and active participation from multiple government institutions, producers, and consumers of strategic commodities data sources. Strategic horticultural commodity agrosystems often encounter supply and demand mismatch, causing prices to fluctuate and volatile because farmers have difficulty meeting the quality and quantity demanded by the market in a timely. At certain times, production is abundant, but at other times, production must meet the volume of market demand. Demand occurs in almost all districts/cities, but not all districts are production centers, creating production flows from production centers to non-production centers. This production flow results in price disparities due to differences in transportation and trade margins and the number of trading actors involved. Supply and demand mismatch conditions require data and information management to apply multiple operations, business processes, organizations, stakeholders, and policies. Thus, strategic horticultural commodity agrosystem management with SHES is suitable to minimize the supply and demand mismatch. The application of the three perspectives of the Zachman Framework, the ontology to the Why and Who facets, shows that SHES development can be elaborated in more detail for other perspectives and facets up to the implementation phase. The Why facet provides the foundation for the next stage, while the Who facet clarifies who does what in the next stage. It supports that the chosen hypothesis is correct. It is also in line with the results of previous researchers. The Zachman Framework for Enterprise Architecture (ZFEA) is a descriptive and holistic representation of an enterprise to provide insight and understanding. The Zachman Framework defines pre-structured views and layers to represent information technology enterprises and does not define a specific process or methodology. It focuses more on role involvement and assigning objects viewed from different perspectives. Therefore, the Zachman Framework can provide comprehensive support to consider relevant aspects from all perspectives to design and develop enterprise systems for strategic horticultural commodities.

Recommendations

SHES has the potential to support Indonesia's ideals for One Indonesian Data. The SHES approach applies proactive collaboration and participation from each institution and all horticultural agrosystem players. Data sources that spread widely across institutions and actors from the minor units in villages/districts to the center have the potential realization. With SHES, completeness of data and information, which is an essential factor, can be achieved, thereby reducing the mismatch between supply and demand because information is balanced.

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