DOI : 10.18843/rwjasc/v8i4/21
DOI URL : http://dx.doi.org/10.18843/rwjasc/v8i4/21

DEVELOPMENT OF CROP AND FARMER ACTIVITY INFORMATION SYSTEM

Rosa Delima,

Department of Informatics
Duta Wacana Christian University, Indonesia

Febrian Galih,

Department of Information System
Duta Wacana Christian University, Indonesia

Argo Wibowo,

Department of Information System
Duta Wacana Christian University, Indonesia

ABSTRACT

Agriculture is one of the important sectors for Indonesia. Implementation of Information Technology in agriculture is able to give supporting data and information for agriculture business actor. In this research, an information system for plant and farmer's activity is developed. This system is able to help a farmer in order to record every agriculture activity. Data which is saved in this system will help a farmer to monitor agriculture activity. This system is developed using Waterfall System Development Life Cycle (SDLC) approach. This method is chosen based on the number of the developer team. This method has four main processes such as crop data collection, planting calendar data collection, agriculture activity and Farmer activity, and agriculture product data collection. This system is able to give information about agriculture crop and plant, agriculture and Farmer activity in form of graphics and table. The next phase of this research is conducting usability testing to the application and conducting system implementation.

Keywords: Crop, Farmer Activity, Information System, System Development Life Cycle, SDLC.

INTRODUCTION:

Agriculture is one of the important sectors in Indonesia. This sector plays the main role in National food security. Thus, technology implementation in agriculture sector becomes one of the interesting and superior research topics. By researching in this topics, it can support quality and quantity improvement for agriculture sector result. Developing of Information System in Agriculture sector is one of information technology implementations. Agriculture information system has wide coverage for agriculture business process, starting from land preparation and pre-processing to agriculture finished product. Every process has coverage in specific activity and services. To process this activity, it needs specific information system for each activity.

This paper discusses the development of Crop and Farmer Activity Information System. This system specifically processes the data related to agriculture crop and activity which is conducted by farmers. Process coverage in this system includes agriculture crop data collection, planting calendar data collection, agriculture activity and Farmer activity, and agriculture product data collection.

This system is developed using System Development Life Cycle with a waterfall approach. Implementation of this model is based on the number of a team member. This system is developed by 3 team member. In order to be successful in the development of this system, it needs some steps to develop this system: planning, analysis, design, coding and implementation, and system testing.

This information system is able to give information to the user related to crop specification, planting calendar per regency, agriculture activity which is being conducted by farmers, and information about quantity and type of agriculture product during harvest time. Information produced in this system can be cascaded down based on regency. Through this system, it will bring some benefit to those needs some supporting data for agriculture sector decision making.

LITERATURE REVIEW:

SYSTEM DEVELOPMENT LIFE CYCLE:

System Development Life Cycle (SDLC) is one of the approaches to developing a software. This approach is developed based on the framework to develop and change a computer-based system. SDLC is a basis for other software engineering methodologies. There is 3 type of SDLCs: traditional system life cycle, life cycle using prototyping, and object-oriented system life cycle. SDLC has six main phases in system development: planning, analysis, design, implementation, testing, and maintenance (Muslihudin & Oktafianto, 2016).

Planning is a phase to identify and prioritize which information system will be developed, system goal and objective, development period, time, budget, and team member. An analysis is an activity to elaborate and break down an information system into small parts and components. The purpose of the analysis is to identify and evaluate problems, opportunities, obstacles, and system requirement. In this phase, it also needs improvement suggestions. Following the analysis, the phase is designed which focuses on how the system is developed to fulfill the requirements which are described and elaborated in the analysis phase. Design phase includes the following steps: system modeling, database design, user interface design, hardware and network analysis. After finishing the design, every component produced in design result will be coded and implemented. This phase is known as implementation phase. In this phase, all resources will be prepared for system construction, including software, hardware, rooms, networks, and other supporting resources and facilities. Implementation process can be conducted parallel with system testing. Testing is conducted by developers and system end users. For system sustainability, it needs system maintenance continuously. Maintenance is to guarantee the continuity of system usage and to identify system requirement for system improvement (Muslihudin & Oktafianto, 2016).

AGRICULTURE INFORMATION SYSTEM:

Agriculture information system is a computer-based system which is developed to support business process in agriculture. Based on farmer's perspective, agricultural system has 3 main cycles (Deloitte, 2012): (1) Pre-cultivation which include seed selection, land selection, agricultural calendar, access to credit, and many other processes; (2) Crop cultivation and harvesting which include land processing, seed spreading, cultivation management, water and fertilizer management, pest management, and many other processes; (3) Post-harvest, which includes marketing, transportation, packaging, product processing, and many other steps. Development of agriculture information system can be referenced to those three phases.

Implementation of Information System in Agriculture has been implemented in Kenya (Rees, Momanyi, Wekundah, Ndungu, & Odondi, 2000), Croatia (Renko, Nikalosevic, & Pavicic, 2002), China (Wen, Zetian,

Daoliang, Longyong, Jian, & Xiashuan, 2007). Table 1 shows some information system that is successfully developed in many countries.

Table 1: Some Examples successful agricultural information system implementation in many countries (Qiang, Kuek, Dymond, & Esselaar, 2011).

Information Technology Usage	Objective	Case Study
Access To Market Information	To help farmers find out about market prices. This helps them make decisions regarding when to harvest, how to negotiate with intermediaries, and so on. Often combined with other information such as weather forecasts.	• Esoko (various countries in sub-Saharan Africa) • e-Choupal and Reuters Market Light (India) • Manobi (Senegal) • Infotrade (Uganda) • Zambian National Farmers Union MIS (Zambia)
Distribution and Supply Chain Management and Traceability	To increase efficiency and credibility, reduce spoilage, and more. To record movements along the value chain, respond to quality standard requirements, and help large buyers track, manage, pay, and reward small producers.	• Application across dairy sector (Kenya) • Dunavant Cotton (Zambia) • Infosys system for horticulture (India) • EJAB (Bangladesh) • SourceTrace (Costa Rica, Mexico)
Farm Extension Services, Access to Sector Experience, Research, and Other Resource Information	Using ICT to deliver better farm extension services (utilization of best agriculture practices, research, weather, climate and more).	• Grameen AppLab Community • Knowledge Workers (Uganda) • Farmer Voice Radio Project (Kenya) • IFFCO/Kassan Sanchar (India) • Radio (Mali and many others in Africa)
Commodity Exchanges/ Warehouse Receipt Systems	To provide transparency in price discovery and to facilitate better prices and efficiencies between buyers and sellers. It avoids moving crops themselves, reducing spoilage, transportation, and transaction costs. Exercises temporal and spatial arbitrage.	• Ethiopia Commodity Exchange (ECX) • Uganda Commodity Exchange • (warehouse receipt system) • Zambian Commodity Exchange • (ZAMACE) • SAFEX (South Africa)

RESEARCH METHODOLOGY:

Crop and Agricultural activity Information System is to be developed using System Development Life Cycle approach. There are 5 phases which are implemented to develop Crop and Farmer Activity Information System: planning, analysis, design, implementation, and system testing.

Planning:

This activity which is conducted to develop Crop and Farmer Activity Information system defines the goal, objective, scope of the system development, defining technology priority, and application selection. The goal and objective of this system development are to support information for the end user (farmers and agriculture stakeholder) which is related to crop data processing and agricultural activity. The scope of this system development is morphology data processing, crop and plant species, harvest period and time estimation, and input agricultural activity which is conducted by farmers. The development of Crop and Farmer Activity Information System collected data from Special District of Yogyakarta Province.

Analysis:

Analysis phase to develop Crop and Farmer Activity is conducted based on the previous research. Crop and Farmer Activity is a part of Integrated Agricultural Information System (IAIS). Analysis step is based on Integrated

Agricultural Information System blueprint (Delima, Santoso, & Purwadi, 2016). Data analysis, function, and system services are conducted based on Integrated Agricultural Information System architecture. As analysis additional materials, literature study is done for a related system.
Based on the analysis, it is discovered that Crop and Farmer Activity Information System is a system which specifically processes crop morphology data, crop species, agricultural calendar, agricultural land, agricultural activity, and yields. Information which is produced by Crop and Farmer Activity Information System includes crop information, planting and agricultural calendar, and agricultural activity with its yields.

Design:
Following the analysis phase is system design. There are some design processes in order to develop the Crop and Farmer Activity Information System: Use Case Diagram, Data Flow Diagram, Entity Relationship Diagram, Flowchart, and Activity Diagram.

USE CASE DIAGRAM SYSTEM:

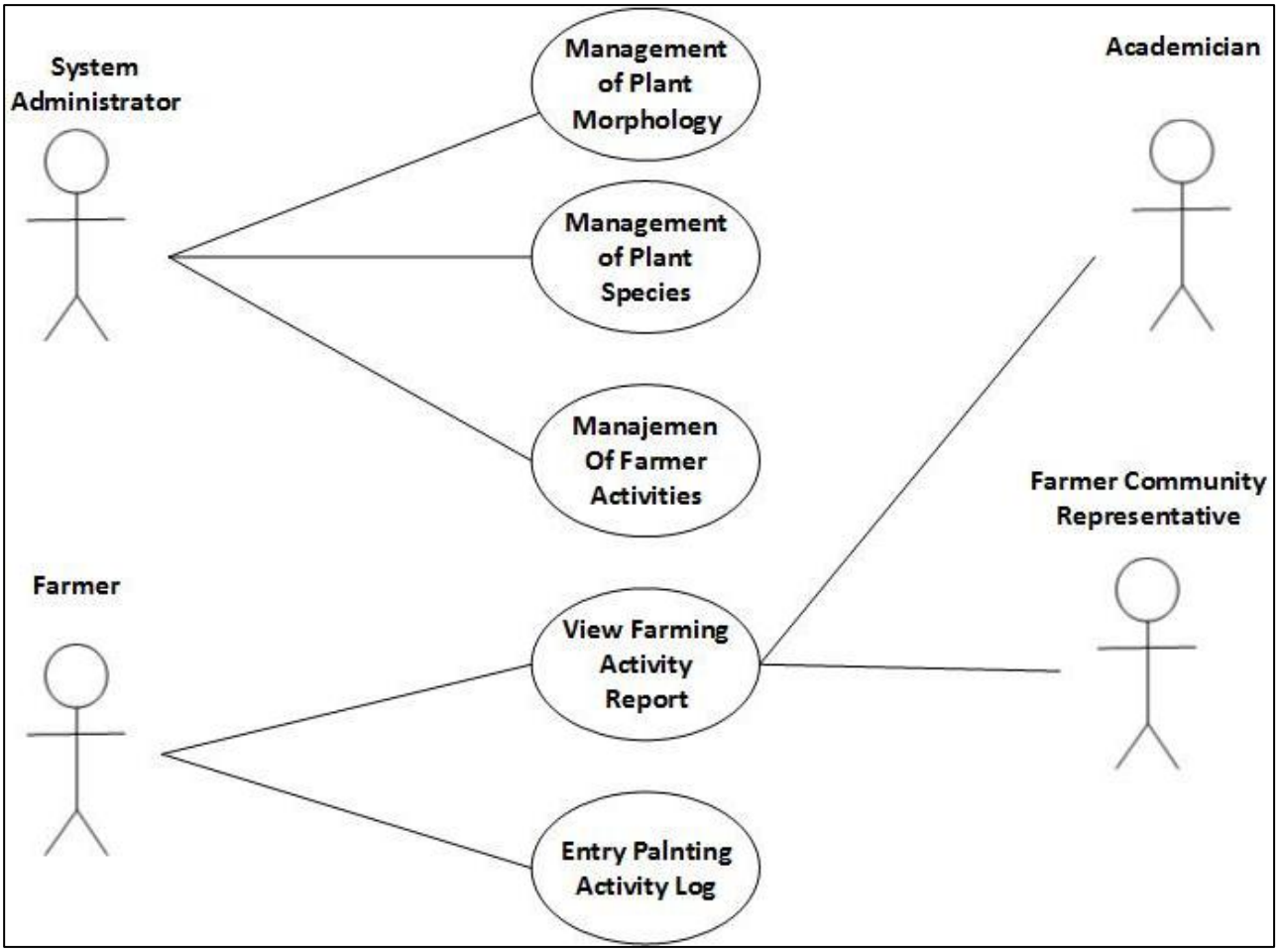

Figure 1: Use Case Diagram Crop and Farmer Activity Information System

Figure 1 shows Use Case diagram of the system. Use Case Diagram illustrates user system role and user system activity. Crop and Farmer Activity Information System has 4 users: System administrator, farmers, academician, and farmer community representative. Each user has different privilege. The system administrator is eligible to add, update, and delete morphology data, plant species, and farmer activity. Meanwhile, academician is eligible to add or delete invalid data. Farmer is eligible to get information about morphology and crop. Each farmer also should add Farmer activity. Farmer community representative can see its member activity log.

DATA FLOW DIAGRAM SYSTEM:

Data Flow Diagram (DFD) is a diagram that represents the relationship between the entity, process, and data in the system logically. Through Data Flow Diagram (DFD), it is able to see data flow, input, and output of the system. Development of DFD starting from level 0. It is known as Context Diagram. Level 1 in DFD is derived

from level 0. Level 1 shows entity, system main process, and the relationship between data and system process. Figure 2 shows DFD Level 1 for Crop and Farmer Activity Information System.

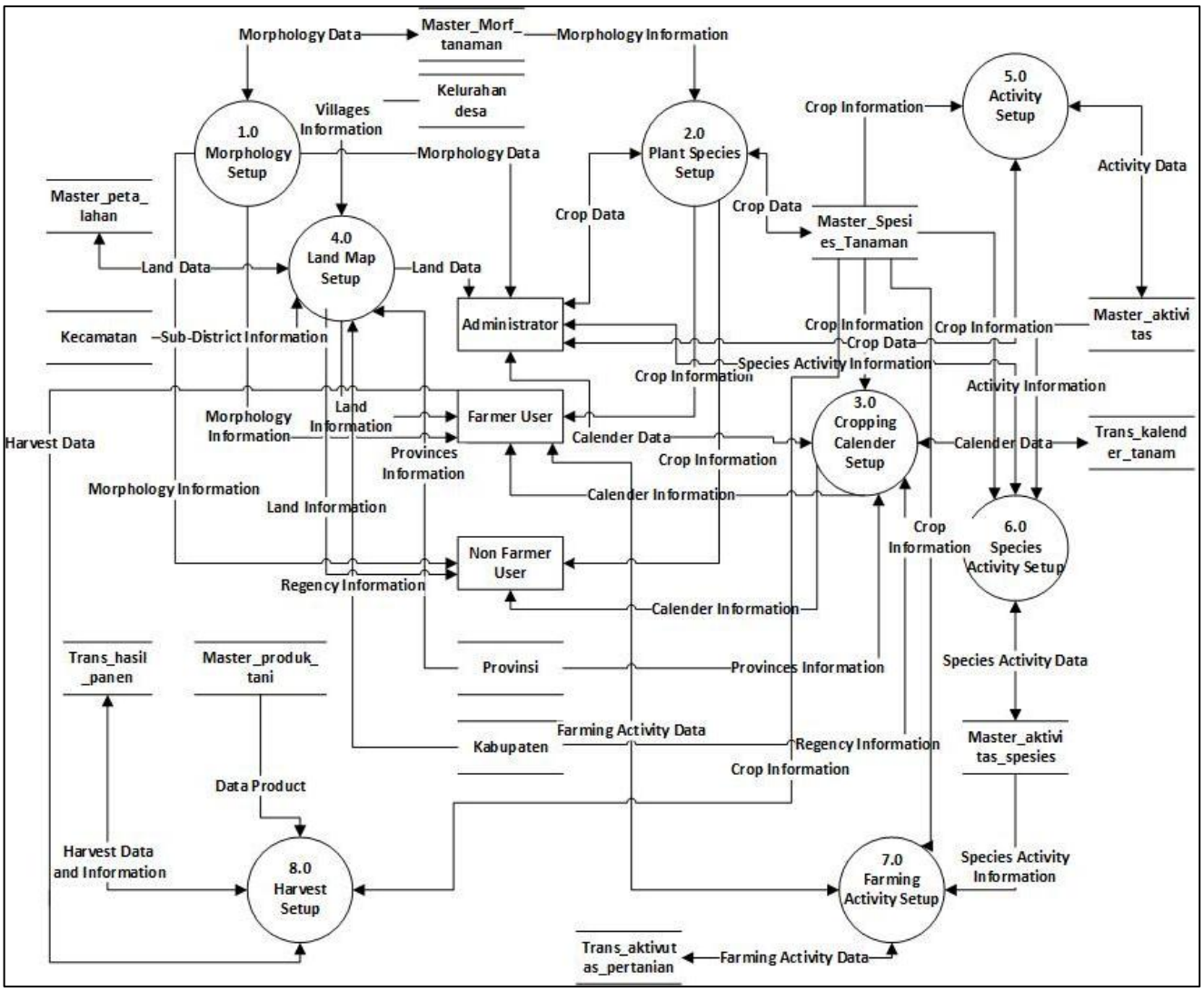

Figure 2: Data Flow Diagram Level 1 of the System

Figure 2 shows Data Flow Diagram for Crop and Farmer Activity Information System. Crop and Farmer Activity Information System has 3 entities: Farmers, General User (Academician and Farmer Community Representative), and System Administrator. There are 8 main processes: morphology setup, plant species setup, planting calendar setup, land map setup, activity setup, species activity setup, agricultural activity setup, and harvest product setup. Those main processes relate with 13 tables: master_morf_tanaman, kelurahan_desa, kecamatan, kabupaten, provinsi, master_peta_lahan, master_spesies_tanaman, master_aktivitas, master_aktivitas_spesies, trans_kalender_tanam, trans_aktivitas_pertanian, trans_hasil_panen.

ENTITY RELATIONSHIP DIAGRAM (ERD):

Entity Relationship Diagram (ERD) is a graphical representation of an information system that shows the relationship between people, objects, places, concepts or events within that system. An entity in this context is a component of data. In other words, ER diagrams illustrate the logical structure of databases. Figure 3 shows Entity Relationship Diagram for Crop and Farmer Activity Information System.

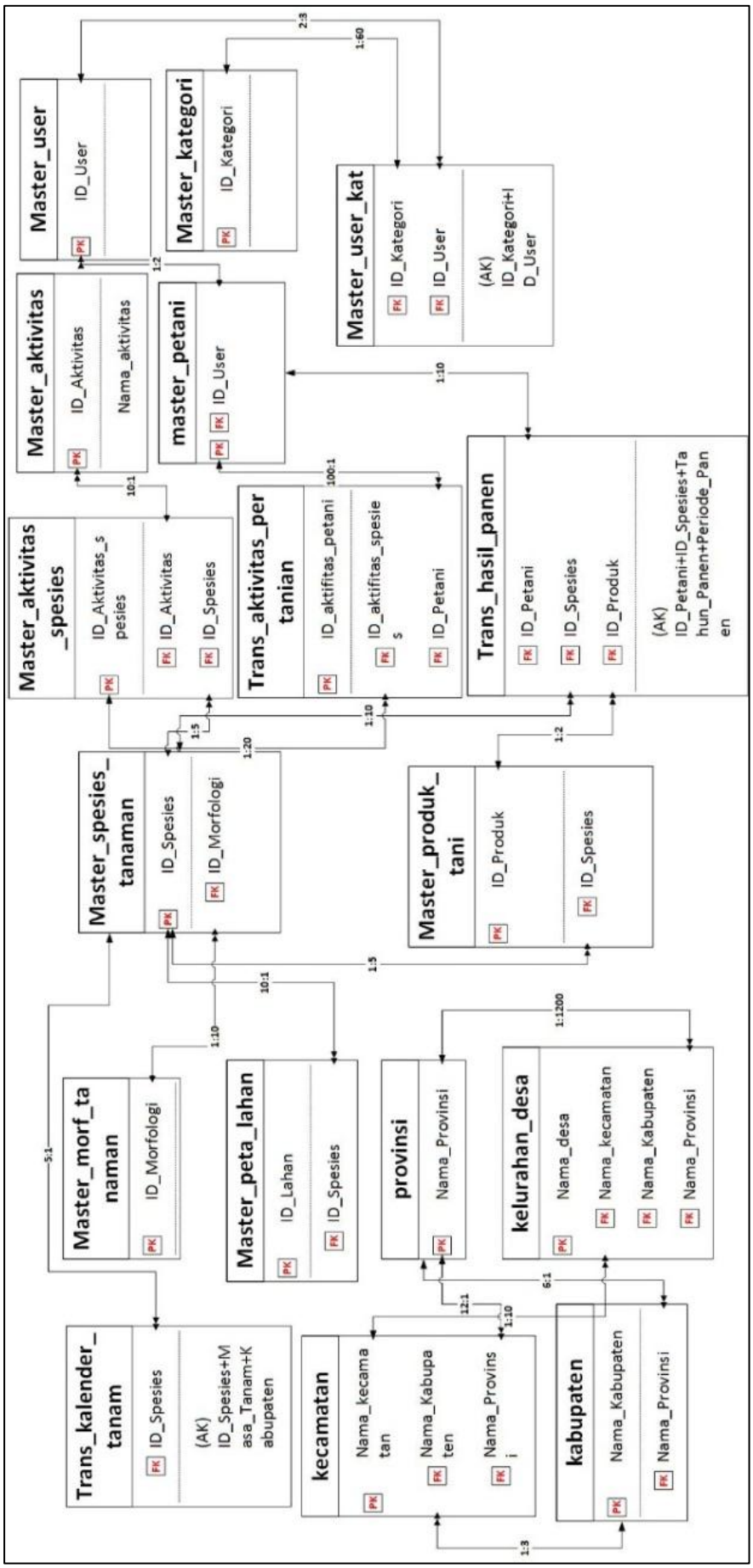

Figure 3: Entity Relationship Diagram Crop and Farmer Activity Information System.

Figure 3 shows the entity relationship diagram for Crop and Farmer Activity Information System. There are 17 entities for Crop and Farmer Activity Information System.

ANALYSIS AND DISCUSSION:

System Implementation:

Implementation is a phase to create the system. This phase is to implement the design into the technical matters. Implementation of this system uses PHP programming language and MySQL database management system. The result for this phase is an information system which is able to process crop and farmer activity data. The system has 2 main part. The first part is to collect and process crop data. The second part is to collect and process farmer activity. Crop data collection brings information for crop list and its detail characteristics. Figure 4 shows crop information.

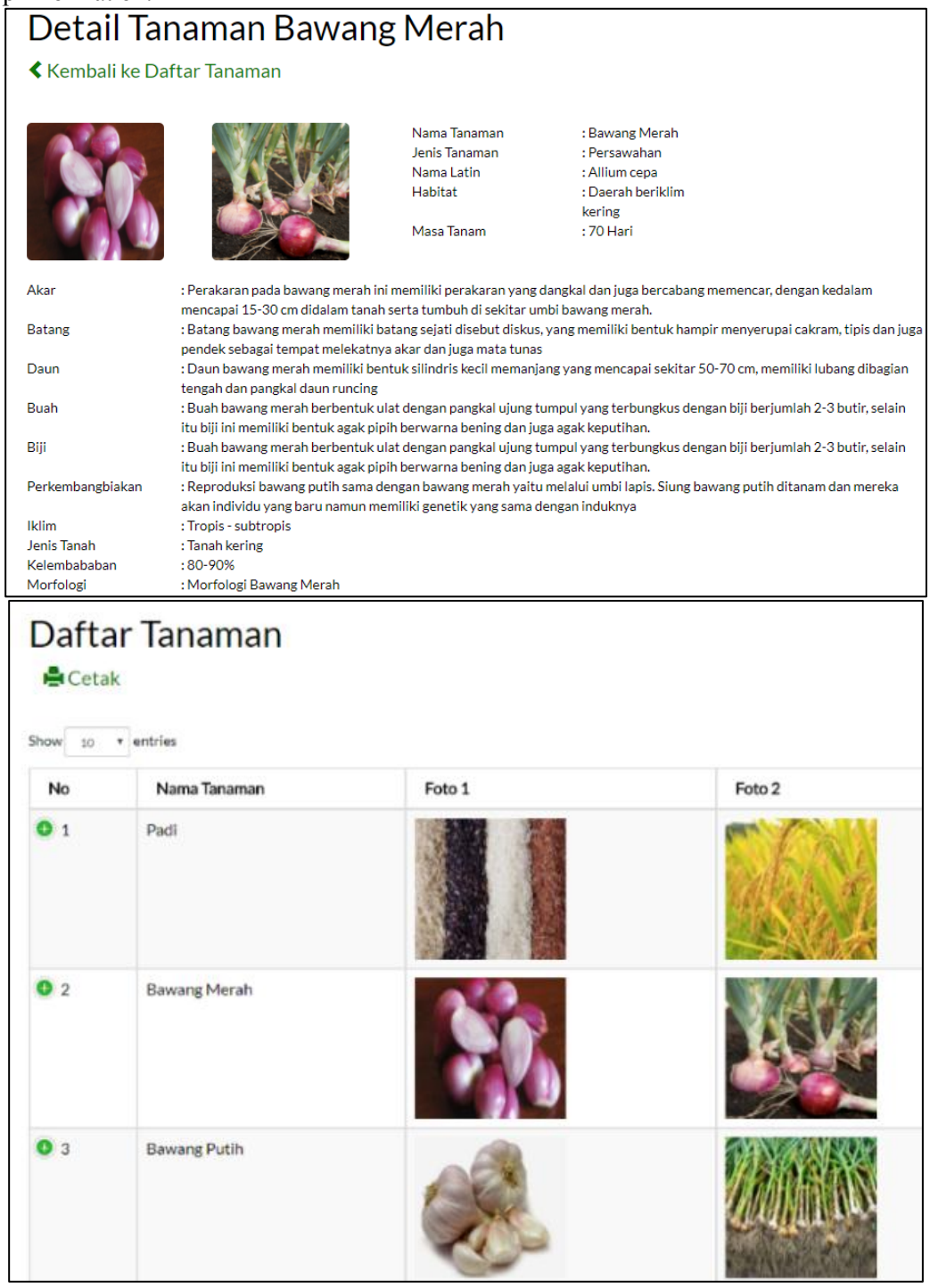

Figure 4: Crop Information and its detail characteristic.

Figure 4 shows a page to display information about the crop. Each crop has detail characteristics: root characteristics, trunk characteristic, leave characteristic, fruit characteristic, and seed characteristic.
The system administrator is able to enter this data. This data is shown for all users i.e., both farmers and general users (farmer community representative and academician).
Farmer activity data collection is another main function for this system. Farmer activity is related to crop. Farmer is able to enter activity related to cultivation. Based on this data, it brings some important information: information about the number of farmer activities based on district and crop (Figure 5) and yields based on crop and regency (Figure 6).

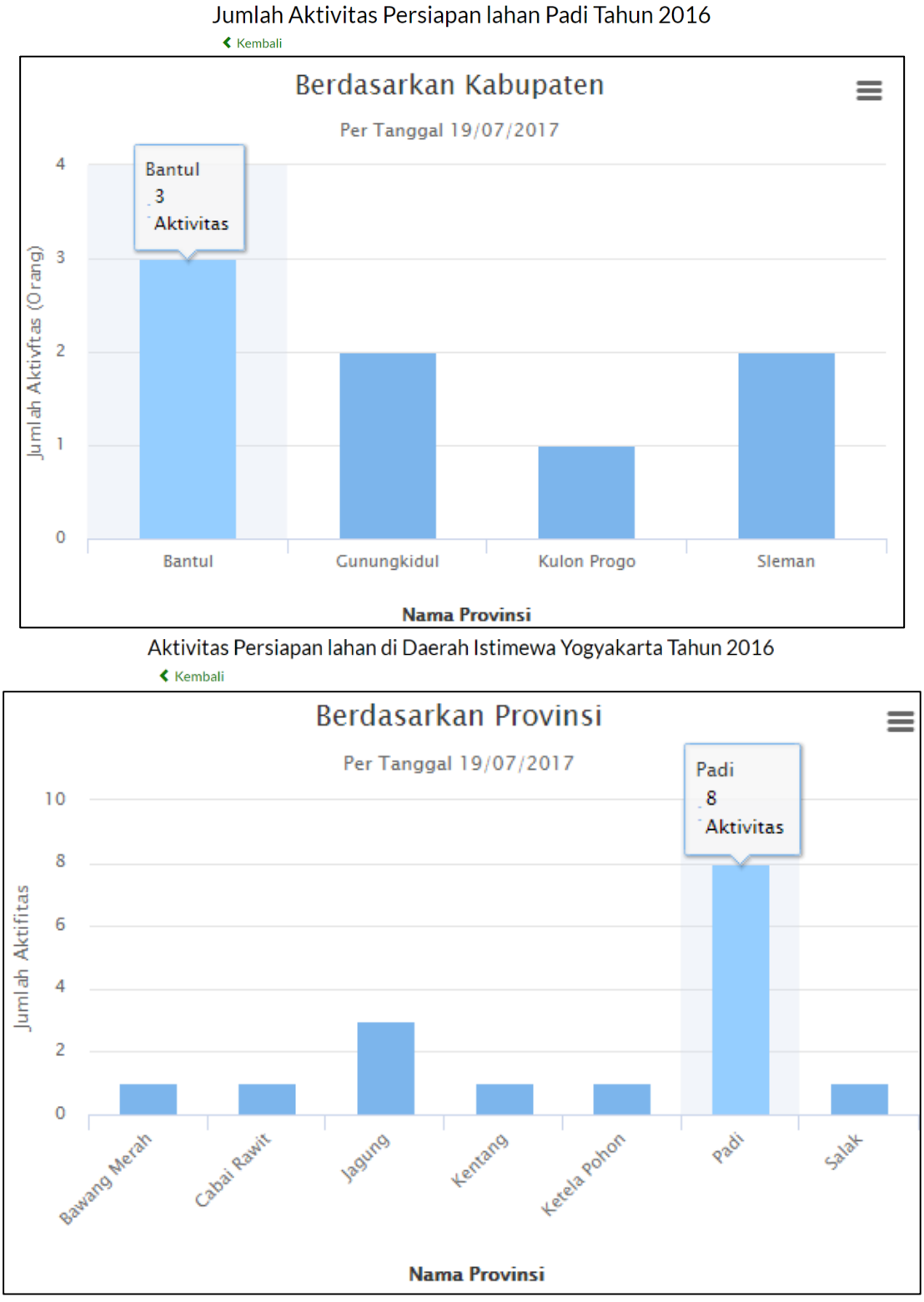

Figure 5: Farmer Activity Information

Summary Hasil Panen Tanaman Daerah Istimewa Yogyakarta 2016

Kembali Cetak

No	Nama Tanaman	Jumlah Panen (Kuintal)
1	Padi	140
2	Bawang Merah	15
3	Bawang Putih	
4	anggrek	
5	Jagung	30
6	Gandum	
7	Bayam	
8	Kentang	
9	Kedelai	
10	Ketela Pohon	20
11	Salak	50
12	Cabai Rawit	10
	Total	265

Informasi Panen Tanaman Padi 2016

Kembali

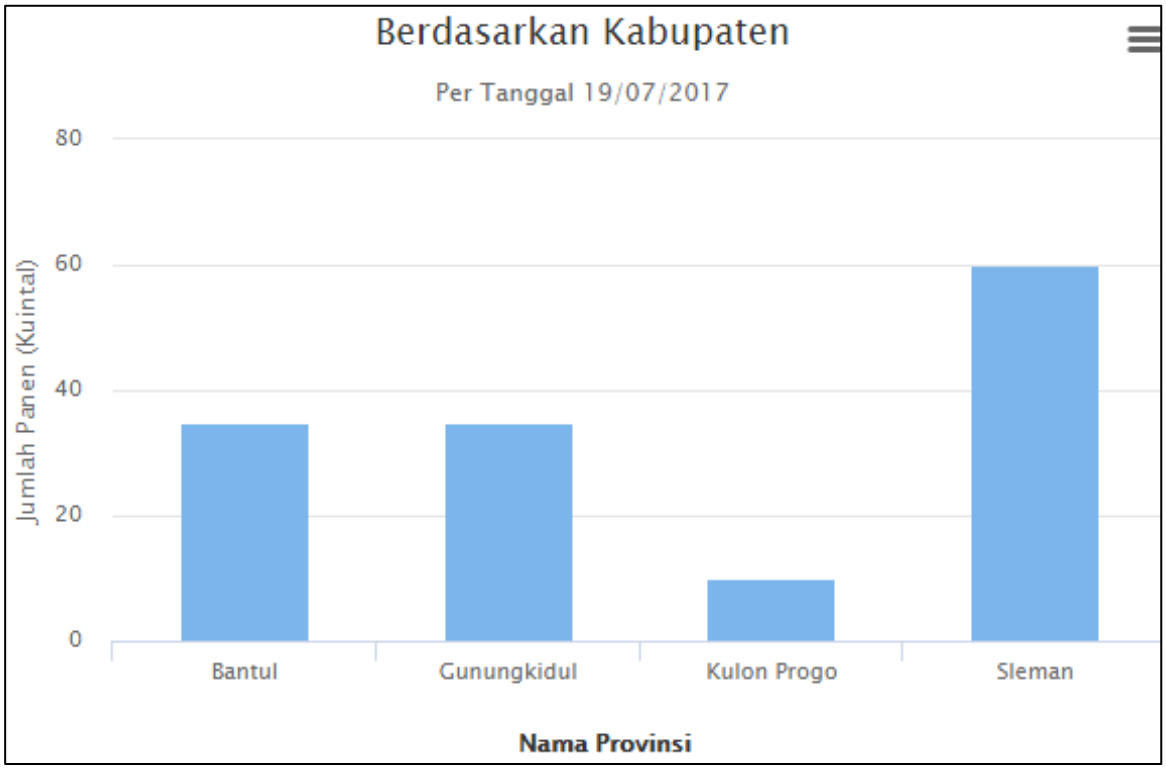

Figure 6: Yield Information

Figure 5 and 6 are the outputs for farmer activity function as a part of Crop and Farmer Activity Information System. The output is presented using a graph to ease the user to read. The graph is able to be cascade down into a smaller district.

SYSTEM ANALYSIS:

System analysis is conducted to analyze advantage and disadvantage of the system. Based on system testing and system pre-implementation, it is known that system has some advantages: (1) System is able to present information graphically to summarize data; (2) System is able to export report into excel file; (3) System is able to create report into excel based on data filter; (4) System is able to predict harvest time for farmer activity.
On the other part, the system has some disadvantages: (1) System is not able to notify harvest time for farmers; (2) Coordinate for land is entered manually; (3) Static graph only is used in this system.

CONCLUSION:

From the research, it can be concluded as follows:

1) Developing Plant and Farmer's Activity Information System is useful for a farmer to give supporting data and information about farmer's current activity.
2) Crop and Farmer Activity Information System is developed using System Development Life Cycle (SDLC) approach. Implementation of this approach is appropriate because the number of the team is limited to three persons.
3) Crop and Farmer Activity Information System is able to issue information about the crop, farmer activity, and yield in the form of graphs and tables.
4) Crop and Farmer Activity facilitates 4 users: farmer, academician, farmer community representative, and the system administrator.
5) Usability testing is needed in order to find the weakness of the system based on user perspective.
6) The next step is system implementation and developing internet of things (IOT) to detect the land condition and to monitor agriculture field. integration between IOT application and the system, and developing of knowledge-based system is needed to analyze condition and give a new knowledge to farmers and its community.

REFERENCES:

Delima, R., Santoso, H. B., & Purwadi, J. (2016). Pengembangan Blueprint Sistem Informasi Pertanian Terintegrasi dengan Pendekatan Enterprise Architecture dan Service Oriented Architecture. In L. A. Bersaing., *Kementerian Riset, Teknologi,*. Indonesia: dan Pendidikan Tinggi Republik.

Deloitte. (2012). *eTransform Africa: Agriculture Sector Study: Sector Assessment and Opportunities for ICT.* . Project Report.

Muslihudin, M., & Oktafianto. (2016). *Analisis dan Perancangan Sistem Informasi.* . Yogyakarta: Andi Offset.

Qiang, C., Kuek, S., Dymond, A., & Esselaar, S. (2011). *Mobile Applications for Agriculture and Rural Development,* . s.l. : The World Bank.

Rees, D., Momanyi, M., Wekundah, J., Ndungu, F., & Odondi, J. (2000). *Agricultural Knowledge and Information Systems in Kenya - Implication for Technology Dissemination and Development.* London: Agricultural Research and Extension Network.

Renko, N., Nikalosevic, S., & Pavicic, J. (2002). The Market Information System and State Support for the Market of Agricultural Products in Croatia. *British Food Journal, 104*(7), 543 - 571.

Wen, G., Zetian, F., Daoliang, L., Longyong, Y., Jian, X., & Xiashuan, Z. (2007). AgriInfo: an Agricultural Information System Based on a Call Center in China. *New Zealand Journal of Agricultural Research, 50*, 797 – 806.
