

The Development of Farm Management Information System for Smallholder Farmers in Malaysia

Mohd Shahrul Nizam bin Mohd Danuri, Mohd Sazili bin Shahibi

*Faculty of Information Management, Universiti Teknologi MARA
No. 1, Jalan Pulau Angsa AU10/A,
40150 Section U10, Shah Alam, Selangor Darul Ehsan*

msnizam.mdanuri@gmail.com, mohdsazili@salam.uitm.edu.my

Abstract. This paper introduces the process of developing web application of farm management information system (FMIS) for smallholder farmers in Malaysia by using rapid application development (RAD) prototyping methodology in information system research design. The web application requirement determined through extraction process using physical data-driven design system from Malaysia Good Agriculture Practise (MyGAP) physical forms. Additionally, the functions and features of the system were determined through several questionnaires which were distributed to 209 smallholder farmers located in Taman Kekal Pengeluaran Makanan (TKPM) in Selangor. Selangor agricultural area together with smallholders farmers were chosen as respondent because Selangor is the highest internet penetration state in Malaysia. Subsequently, the design and analysis of FMIS are constructed by us including the database design, data flow design, system flow design and software development which was validated by two other experienced system analysts. The software development process were using PHP web development tool called Scriptcase version 8 which were taking less than 2 months to be completed. Furthermore, we also made a comparative study of an existing system available in the market to give additional competitive value to the new development of FMIS in Malaysia. The final developed FMIS is accessible through the official MyAgris website.

Keywords: Farm Management Information System, Prototype Development, Application Requirement, Good Agricultural Practice.

INTRODUCTION

Malaysia agriculture industry has been driven by rubber and oil palm sub-sector since before the Independence until these days. The high return of investment in the industry sub-sector made all small to large scale of farmers interested to involve in the cultivation. Since the industry is more a commodity, it is operated by large-scale farmer with high capital investment like Federal Land Development Authority (FELDA). Their structured agriculture business and partnership model with a set of policies and criteria in place for many small-scale farmers known as smallholder farmers that sometimes are family type of farmers with less and limited resources such capital and land [1]. Despite this, many smallholder farmers also cultivate rubber and oil palm by themselves not limited to the

sub-sector but move to less capital investment and risk such cash crop and agro-food sub-sector.

Under Agricultural Development Plan in Rancangan Malaysia ke-8 (RMK-8), the Malaysia government initiates many agriculture infrastructures across the country such Taman Kekal Pengeluaran Makanan (TKPM) and Taman Pertanian Modern (TPM). The initiatives allowed smallholder farmers to cultivate more crops and support the agricultural supply chain for ensuring the future national food security [2]. They begin to improve their livelihood and become more competitive under the plan. Nevertheless, Malaysian smallholder farmers still need shifting to new agriculture practice and paradigm in order to sustain in the dynamic agriculture environment challenge in context of farm management practices and systems. Nowadays, managing farm is not as easy as before and they are also need to comply with many new regulations such as Malaysia good agricultural practice (MyGAP).

One of the components in MyGAP is managing farm information. The farm information consist all the main farm activity logs such land preparation, seedling, irrigating, harvesting, and others [3]. Currently, the information is recorded manually in booklet. Furthermore, the information will be transferring into computer spreadsheet such Microsoft Excel in order to transform it into more valuable information. Managing information becomes more tedious once the data grow bigger. Due to this limitation, we proposed to the Malaysia smallholder farmers with Farm Management Information System (FMIS) to support their traditional way of keeping farm information that comply with MyGAP requirement.

FMIS is widely used by large scale of farmer in order to manage their farm information in daily operational. FMIS also known as 'system' or 'software' that enable large scale farmers to manage farm information and enhance their ability to make further decision in their business [4]. The system enabled them to analyze and transform big data into useful information for further decision making. In context of smallholder farmers, usually they have lesser data due to their small farm project. However, as the data growth, it is still useful for them to make future forecast and decision making. Furthermore, the system will assist them to improve their productivity and readiness before scale up their farm in future.

Existing System Comparative

There are several software companies offering FMIS in the market. In comparison, the software is not very well known in Malaysia. Most of the software are too robust and not suite to Malaysian smallholder farmers daily operation needs. We made initial comparison study from several existing software available in the market categories by simple system modules and features.

TABLE 1: Farm Management Information System Comparison in the Market

Item	MyAgris	FarmLogic	AgSquared	FarmWorks	FarmLogs
Web/Mobile Availability	Yes	Yes	Yes	No	Yes
Device Accessibility	Yes	Yes	Yes	Yes	Yes
Login Accountability	Yes	Yes	Yes	No	Yes
User Authority	Yes	Yes	Yes	No	Yes
Upload features	Yes	Yes	Yes	Yes	Yes
MyGAP Reporting features	Yes	No	No	No	No
Searching features	Yes	Yes	Yes	Yes	Yes
Analysis features	Yes	Yes	Yes	Yes	Yes

Objectives

The overall objectives of this research are to create MyAgris web application system known as Farm Management Information System (FMIS) for smallholder farmers in Malaysia. The system is considered as software to manage smallholder farmers to comply with MyGAP regulation in Malaysia. As general, the system development process can be categories as below:-

1. To create database structure for storing farm information.
2. To create web application as user interface that will interact with database.
3. To ensure overall system is comply with the initial literature and software comparative study.

MATERIALS AND METHODS

In order to propose FMIS to smallholder farmers in Malaysia, the system must easy to be used and not too complex because their age are more than 40 years old and less system literacy [5]. Therefore, we proposed new custom made and simple FMIS prototype called MyAgris that suitable to smallholder farmers use in daily farm operation and comply with MyGAP requirement. The system development was using rapid application development (RAD), one of the established information system methodology in research design [6] . Meanwhile, the system requirement and analysis was determined using questionnaires distributed to 209 farmers in Taman Kekal Pengeluaran Makanan (TKPM) in Selangor. Since most of the smallholder farmers literacy in information system is not high, we choose other IS expert in information technology and agricultural field to assist the development process in prototyping cycle. This will also increase the reliability and validity of the development process.

RAPID APPLICATION DEVELOPMENT (RAD)

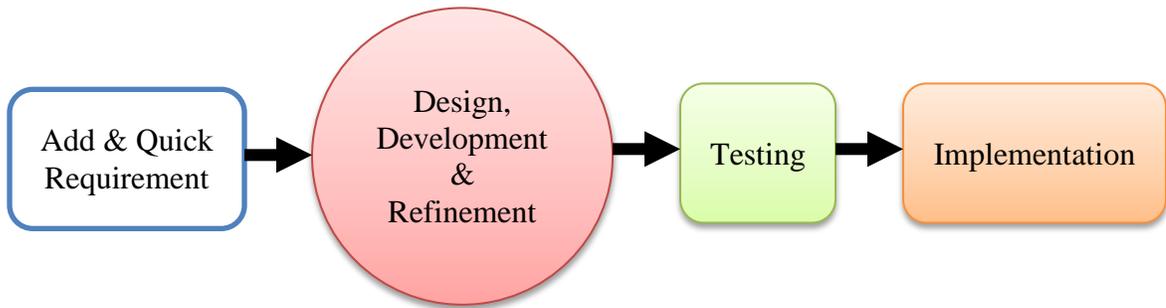


FIGURE 1: Rapid Application Development Methodology [6]

RAD was introduced and evolved in software development process since early 90's. It is a development concept for a software prototype to be developed faster with high quality through several process of gathering information from user [7]. The methodology is also known as Joint Application Development (JAD) as it involves interaction with user while gathering the requirement, design and analysis [8]. It gives flexibility in development cycle to be revised and refined until the end of software development process. Recently, most of advance and complex system use RAD evolution method also known as Agile Development Methodology.

Analysis and Quick Requirement

The analysis and requirement gathering during MyAgris development process was using two main sources to achieve system development objective. The main source is from the MyGAP physical forms provided by Department of Agriculture Malaysia (DOA). The physical forms translated to become main database structured and design for storing information using data-driven model [9], [10]. The second source was using the information gathering from questionnaires distributed to 209 smallholder farmers from all TKPMs in Selangor. Furthermore, we also choose questionnaires distribution because it were less time consume, many respondents and much cheaper compare to interviewing [11]. The questionnaires was constructed with 10 simple and general questions gathered from literature review and initial existing FMIS comparative study in the market to ensure the smallholder farmers understand and able to answer it because most of them have lower information system literacy. Both sources were analyzed and validated together with the IS expertise selected from research agency consist by experienced software analyst and agriculture research officer.

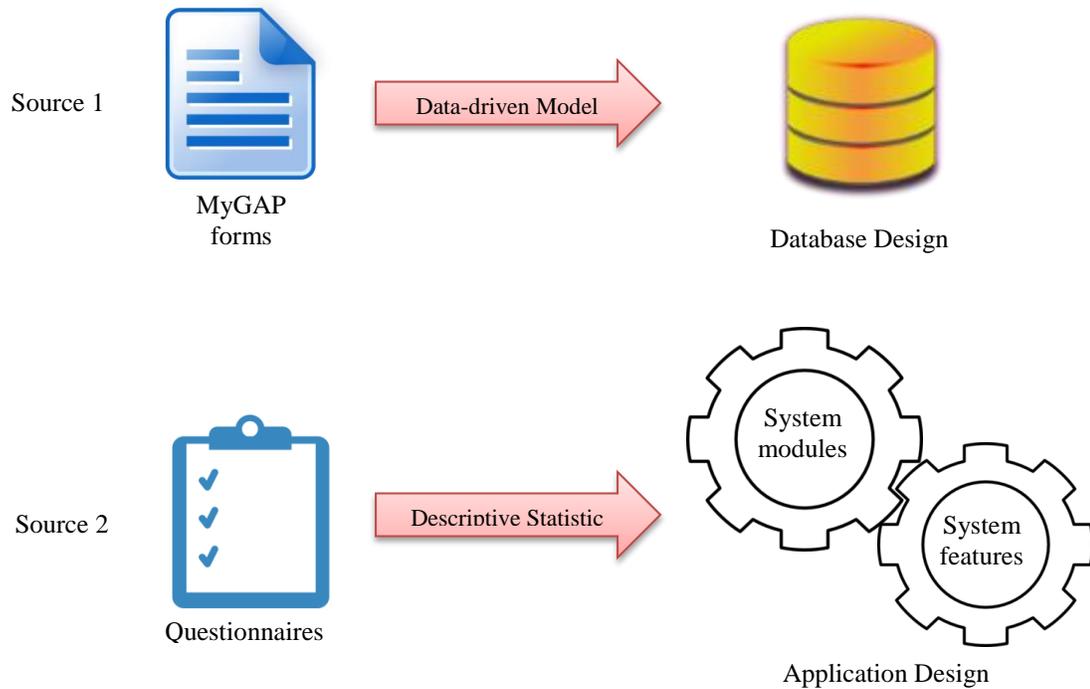


FIGURE 2: Analysis and Quick Requirement Gathering

There are many system development methodologies that may apply towards the development process. However, it depends on the total size of the development projects and resources that needed [7]. FutureFarm is a very big development project in Europe to identify a suitable FMIS for large farmers with high resource availability. The project utilizing soft system methodology with interviewing process to four different type of farmers in Europe which focusing on managerial level in farm management [12]. In addition, the method is suitable for the project with rich data gathering in qualitative way. However, it consumed very high time and resources. In contrast, the method used for this research is different which is more focusing on quantitative survey method for system features determination and database modeling using data-driven model system extracted from physical MyGAP forms.

Design, Development and Refinement

Most of the process will be in the cycle of repetition and refinement in software development. Therefore, it is important for the users to involve during the development of the software. The actual users which are the smallholder farmers is highly Information Communication and Technology (ICT) literate but they are poorly IS literate [13]. For that reason, we select other users to assist, evaluate and validate the system during development process. The users were selected from research agency because they are experiences and uses to IS. They are also having a background in software analysis and agriculture development.

Data-driven Modeling

Data-driven model has been used during the development of database design. Subsequently, we also use it in system development during refinement of the database as well as the application system. We also used Scriptcase version 8 as software development tools to construct web the application system. Scriptcase is widely used as RAD tools in software development.

TABLE 2: Comparison Software Development Tools

No	Features	Scriptcase	PhpStorm	NuSphere PhpED	RapidPHP Editor
1	Installation	<ul style="list-style-type: none"> Installation program package from digital downloaded program from internet 	<ul style="list-style-type: none"> Installation program package from digital downloaded program from internet 	<ul style="list-style-type: none"> Installation program package from digital downloaded program from internet 	<ul style="list-style-type: none"> Installation program package from digital downloaded program from internet
2	Web/Mobile Design	<ul style="list-style-type: none"> Support both 	<ul style="list-style-type: none"> Support both 	<ul style="list-style-type: none"> Support both 	<ul style="list-style-type: none"> Support both
3	Cost	<ul style="list-style-type: none"> Competitive 	<ul style="list-style-type: none"> Competitive 	<ul style="list-style-type: none"> Competitive 	<ul style="list-style-type: none"> Competitive
4	Application Development	<ul style="list-style-type: none"> It is a fastest PHP IDE development Include several application templates Very less time spending to write code Focus on logical design. 	<ul style="list-style-type: none"> Robust PHP IDE development Include several Javascript code templates Really focus on coding. 	<ul style="list-style-type: none"> Fast PHP IDE development Include several CSS code templates Less time is spent to write code. Focus on logical design. 	<ul style="list-style-type: none"> Fast PHP IDE development Include several CSS code templates Less time is spent to write code. Focus on logical design.
5	Technical Support	<ul style="list-style-type: none"> Included with the purchase 20-days free private support Use of support forum, knowledge base, blog, and ticketing system 	<ul style="list-style-type: none"> Included with the purchase Use of support forum, knowledge base, and ticketing system 	<ul style="list-style-type: none"> Included with the purchase Use of support forum, knowledge base, email and ticketing system 	<ul style="list-style-type: none"> Included with the purchase Use of support forum, knowledge base, email and ticketing system
6	User Experience	<ul style="list-style-type: none"> Suitable for beginner user 	<ul style="list-style-type: none"> Suitable for expert user 	<ul style="list-style-type: none"> Suitable for expert user 	<ul style="list-style-type: none"> Suitable for beginner to novice user
7	Rapid Development	<ul style="list-style-type: none"> The fastest IDE to develop application using framework and data-driven model 	<ul style="list-style-type: none"> Fast to develop an application with several type framework 	<ul style="list-style-type: none"> Fast to develop an application with several type framework 	<ul style="list-style-type: none"> Fast to develop an application with several type framework

System Modeling

The system modeling in FMIS development was used to specify system flow (SF) and data flow design (DFD). The final SF design has been outlined by system analysts with the Scriptcase built-in feature and the result as show below:-

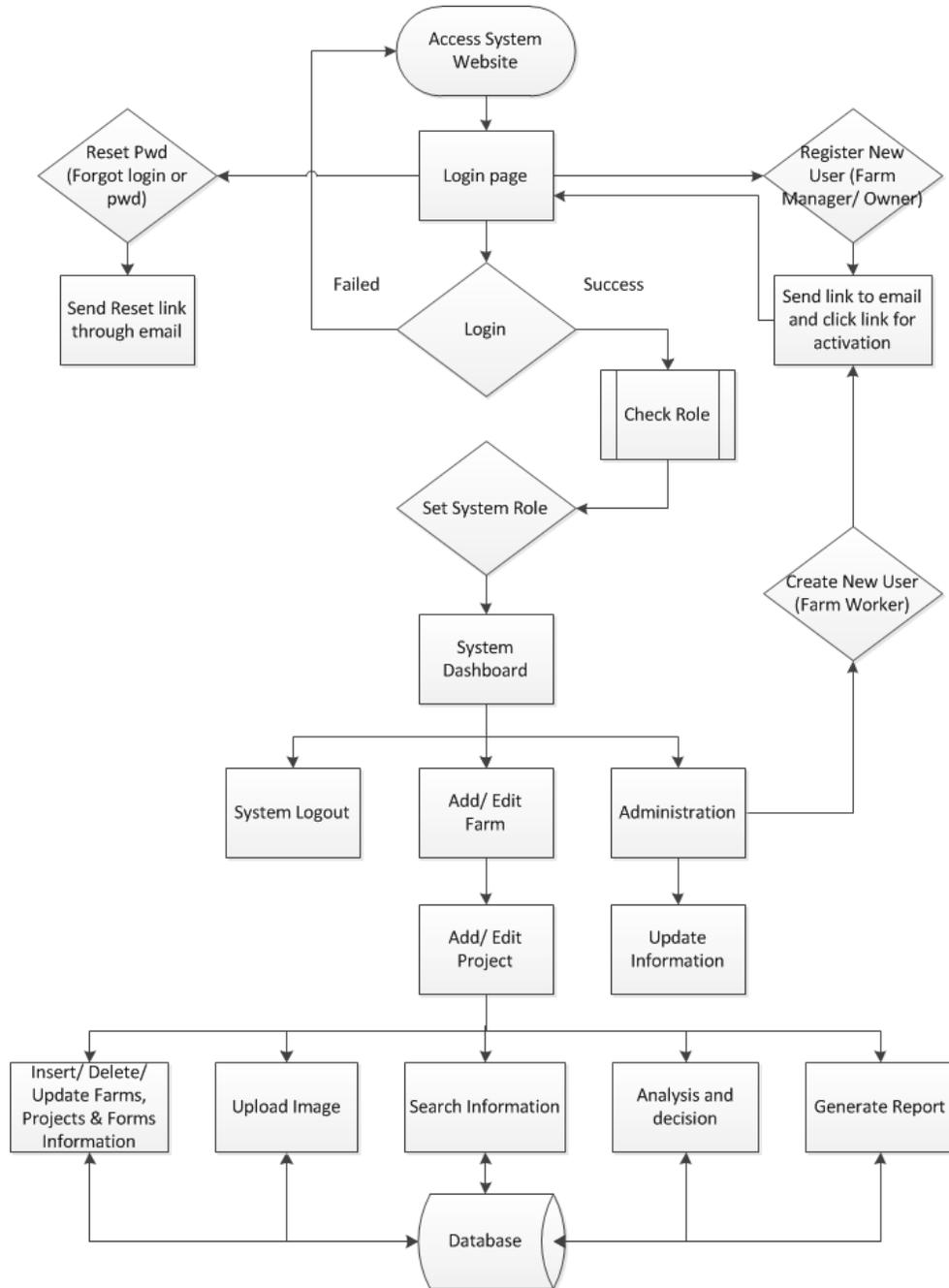


FIGURE 3: MyAgris System Flow Design

From the first landing page, the MyAgris will show the login page for the system. From there, users may login into the system using their username and password. They may also retrieve their forgotten password using their email address. Besides that, they are also able to make new user registration whereby they will be later identified as farm owner or manager in the system. The registration will use user email for authentication and activation before using the system as security purposes. After the activation, user will be able to login and use the system as usual.

From the login page, successful user login will be redirected to the system dashboard base on the system role checking in the system. There are only two roles available in the system which is the farm manager and farm worker. Farm worker role have limitation features while using the system. Meanwhile, the unsuccessful login will be redirect back to the main login page.

From the main dashboard, only farm manager role able to add new users and farms as well as projects in the system. They are able to add farm workers and assign them to their existing farms and projects created. Meanwhile, farm workers are allowed to edit and insert data in existing farm and project accounts created by their farm manager. All farms and projects are exclusive for each farm managers and farm workers account. Furthermore, in each of sub-modules, they are able to upload image, search information, analysis for decision making and generate report which comply with MyGAP.

The screenshot shows the login interface for the 'Farm Management Information System'. The header is green with the title 'Farm Management Information System'. The main content area is white and features the 'My Agris' logo in green, which includes a stylized leaf icon. To the right of the logo are two text input fields labeled 'Username *' and 'Password *'. Below the password field, there are two blue links: 'New user' and 'Retrieve password'. A green 'Login' button is positioned at the bottom right of the form area. At the bottom left, there is a small logo for 'UNIVERSITI TEKNOLOGI MARA'. At the bottom right, a line of text reads 'This project is under research conducted by Universiti Teknologi MARA'. A red asterisk and the text '* Required field' are visible on the left side of the form.

FIGURE 4: MyAgris login page

Testing and Implementation

The system test has been done using User Acceptance Test (UAT) by the same selected user during development. The application ported into the official website at <http://www.myagris.com>. The result is accepted and the system sufficient for the actual testing in production environment with the actual users which are the smallholder farmers after series of training.

Contribution and Research Limitations

The contribution of this research paper is to produce a new development of FMIS for smallholder farmers in Malaysia. The research used RAD as the IS development methodology due to the time constraints and decided to give more flexibility during the development process. Despite of the result of the actual system developed, the study should extend up to the acceptance of the system developed and impact evaluation of the system after fully implementation.

CONCLUSION

This paper attempts to propose an essential process of FMIS development using RAD methodology and several software tools. The process and development of FMIS has been stated in this paper and the final system has been implemented. The final system need to be further tested and verified by actual users especially the smallholder farmers. The system is useful for future integration with precision agriculture, farm automation and mechanization.

The actual system developed in this study is accessible throughout the website <http://www.myagris.com>. It allowed any farmers in Malaysia to register and use the system for storing farm information followed with MyGAP compliance. Furthermore, the system also should be extended to be used by other type of users such DOA's officer, researchers and other agencies to make use the information stored in the system.

This research has shown the benefit of using dedicated information system development methodologies and several software tools produced new FMIS for smallholder farmers compared to other system analysis and design methods. It has been essential guide to derive more technology in agriculture which improved nation economic scale in the future.

ACKNOWLEDGMENTS

We would like to acknowledge people and organization from the university and industry for giving such inputs in order to develop this paper. We would like to thanks the Kolej Universiti Islam Antarabangsa Selangor (KUIS) for giving opportunity to present this paper in the International Conference on Information Technology & Society 2015. Many thanks to smallholder farmers in Taman Kekal Pengeluaran Makanan (TKPM) in Selangor for giving such advice and respond to this research.

REFERENCES

- [1] S. Vermeulen and L. Cotula, *Making the most of agricultural investment: A survey of business models that provide opportunities for smallholders*. 2010.
- [2] MOA, “Dasar Agromakanan Negara 2011-2020,” in *Dasar Agromakanan Negara 2011-2020*, 2011.
- [3] Department of Agriculture, “Rekod Ladang dan Panduan Mengisi Rekod Ladang: MyGAP (Malaysian Good Agricultural Practice),” 2013.
- [4] T. Lewis, “Evolution of farm management information systems,” *Comput. Electron. Agric.*, vol. 19, pp. 233–248, 1998.
- [5] PEMANDU, “Transitioning from Agriculture to Agribusiness,” in *Economic Transformation Programme: A Roadmap For Malaysia*, Performance Management and Delivery Unit (PEMANDU), 2011, pp. 512–550.
- [6] J. Martin, *Rapid Application Development*. Macmillan Publishing Company, 1991.
- [7] D. E. Avison and G. Fitzgerald, *Information Systems Development: Methodologies, Techniques and Tools*. 1995.
- [8] P. Rob and C. Coronel, *Database Systems: Design, Implementation, and Management*, 7th ed. 2007.
- [9] M. Denne and J. Cleland-Huang, “The Incremental Funding Method - A Data Driven Approach to Software Development,” *IEEE Softw.*, vol. 21, no. 3, pp. 39–47, 2004.
- [10] M. A. Mahmood, “System Development Comparative Investigation,” *MIS Q.*, vol. 11, no. 3, pp. 293–311, 1987.
- [11] J. A. Hoffer, J. F. George, and J. S. Valacich, *Modern Systems Analysis and Design*, 2nd ed. 1999.
- [12] C. G. Sørensen, S. Fountas, E. Nash, L. Pesonen, D. Bochtis, S. M. Pedersen, B. Basso, and S. B. Blackmore, “Conceptual model of a future farm management information system,” *Comput. Electron. Agric.*, vol. 72, no. 1, pp. 37–47, Jun. 2010.
- [13] N. Uphoff, “Empowerment of Farmers through ICT,” no. 1980, pp. 1–19, 2012.