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A study on the acceptance of MARDI mobile apps

(Kajian penerimaan terhadap aplikasi mudah alih MARDI)

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Abstract

Agricultural mobile applications are able to disseminate rapidly new knowledge and technology to farmers compared to the conventional method through research officers or agriculture extension agents. These applications are knowledge platforms that shared new knowledge by adopting mobile technology especially for farmers and agricultural entrepreneurs at anytime and anywhere. Besides assessing the role of MARDI mobile applications among users, this study also aimed to evaluate the acceptability of the applications amongst those involved in smart agricultural environment. The survey was conducted using structured questionnaires which were distributed online to users (n = 132 respondents) who were classified according to their ages and educational backgrounds. Descriptive analysis methodology was used in this study which simplified data collection by combining descriptions in tabular form, graphic representations, charts and statistical reviews of the findings were presented in mean, frequency and percentage using SPSS statistical application. This study proved that there was an urgent need for MARDI mobile applications. Finally, the findings showed that users had adequate knowledge and awareness of using mobile technology and internet in their agricultural environment.

Introduction

Advancements in mobile technology are rapidly changing the nature of knowledge sharing by allowing flexible and instant access to rich digital content. Mobile apps can play a significant role in knowledge sharing and act as an information platform to share and disseminate efficiently the latest knowledge and technology in agriculture compared to the conventional method involving research officers and extension agents. Mobile apps are the next form of knowledge sharing using mobile technologies for rapid dissemination of information especially to modern farmers with access to internet. The potential benefits of mobile apps have been widely known including cost savings, worldwide communications, easy access, study aids, convenience and location-based services. Farmers can communicate and provide information on agriculture through text messages with other users. Mobile apps can be used as learning aids (e.g. pest and disease management or prevention for farmers) that can be accessed virtually by users from anywhere in the world. Despite the importance of adoption of mobile apps,

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very little research has been conducted concerning factors affecting the acceptance of mobile apps by users in a smart farming environment.

Mobile apps in agriculture

Farming is becoming a more time-critical and information-intense business. A push towards higher productivity will require an information-based decision-making agricultural system. Farmers must get accurate information at the right time and place, and should take full advantage to improve their livelihood by equipping themselves with appropriate knowledge. Related agencies must make efforts to improve knowledge management and inform farmers using existing facilities and tools especially via Information Communication Technology (ICT). The success and sustainability of government- or private-owned agricultural projects requires that the farm operators be very knowledgeable and well informed particularly in terms of on-farm decision-making (Bagheri et al. 2016). Thus, it is important to expose farm operators with updated information on agriculture. By doing this, it will enhance positive mindset or attitudes among farmers and the public towards agricultural activities (Naveen Kumar et al. 2019). Thus, the agriculture-related agencies have to choose the right channels to disseminate the valuable agricultural information to the respective farmers. At the moment, one of the most promising and futuristic channels available is through mobile applications.

Mobile application is one of the new highlights in ICT. Mobile apps was one of the top 10 strategic technology trends for 2014 and estimated that 139 billion apps will be downloaded worldwide (Cheon et al. 2012). With the rapid transformation of mobile technology and consumer behaviour, interaction with customers using mobile devices creates an opportunity for efficient delivery of knowledge to users. Smart phones are no longer simple communication devices, but rather real-time information delivery channels that address the needs and support decision-making. For this purpose, IT specialists in agriculture must have a distinct mobile strategy that focused on business challenges, improved efficiency and customer satisfaction. It is important to incorporate mobile strategy into an organisation's business strategy and choose the right technology, focus on the right problems, and deliver the apps on time.

Initially MARDI has decided to use e-learning content to enrich and enhance knowledge among farmers by using mobile applications. E-learning is defined as learning aids and experiences to support individual learning with various types of computer technology (Tavangarian et al. 2014). Thus, mobile apps embrace many features of e-learning such as multimedia contents and communications with other users but it is unique in terms of flexibility of time and location (Muslimin et al. 2017). The mobile devices can be categorized into three different areas:

a) Portability: mobile devices can be taken to different locations.
b) Instant connectivity: mobile devices provide instant connectivity to access a variety of information without logistic and time constraints.
c) Context sensitivity: mobile devices can be used to find and gather real or simulated data.

Mobile application learning in smart farming

Mobile apps have the potential to support all forms of agriculture. Smart farming is particularly an appropriate venue for the integration of mobile apps because almost all farmers have mobile devices (Walter et al. 2017).Various attempts to utilise mobile apps have been applied in smart farming environment. For example, farmers can receive early warning notification and sent feedback using mobile devices (Cheon et al. 2012). Watering and fertiliser application schedules can be checked using mobile devices. Implementing mobile apps

in a smart farming environment is still challenging because of social, cultural and organisational factors (Cheon et al. 2012).

A few researchers have studied on the adoptability and usability of mobile apps among smart farmers. These researchers mainly focused on user's acceptance of mobile apps. Qiang and Kuek (2012) observed that people were able to accept new knowledge and technology that were perceived useful. The technology acceptance models used in previous studies focused on user's perception towards the functionality and characteristics of mobile apps technology (Dugar et al. 2010). These researchers were particularly interested in investigating the effectiveness and usefulness of mobile learning apps in the learning process.

Mobile apps features

Mobile apps have several features that made them popular among users which comprised the following as suggested by Fenu and Pau (2015):

a) Reduce the time barrier, place and distance. They provide a platform for individuals to grasp knowledge at their own time and pace.
b) Mobile technology enhances the user's learning experience by providing a new look and feel that differs from desktop and laptop technologies.
c) Mobility experience is a primary component of mobile technologies which benefits and enhances the user's experience.
d) Users are able to access a variety of mobile learning platforms that are available on the market through mobile phones which have access to Internet.
e) Enabling mobile services and providing competitive rates among mobile operators will be the most important key elements.
f) Most citizens of developing countries reside in rural areas which have limited access to new knowledge, i.e. attending public courses or going to the library. Adopting the use of mobile phones will allow them to gain new knowledge right from the tip of their hands.
g) The rapid growth and evolution of connected wireless mobile devices lead to positive growth of mobile learning apps.
h) The readiness of advanced mobile system will overcome the limitations of mobile devices and together with the implementation of a rich client interface makes a booming market for mobile learning applications development.
i) The demand for mobile applications is not only focused on agricultural environment users but also by other individuals from various disciplines (autonomous farmers) which focused on special learning objectives, i.e. agricultural domain, pest and disease experts, etc.

Limitations of mobile apps

The limitation of mobile apps services is one of the issues that should be look into thoroughly. Scholars have noted that mobile devices and apps have some limitations such as memory size, battery life, high line cost, and small screen (Qiang and Kuek 2012). Another study highlighted the need to consider the range of limitations of wireless technologies, issues such as safety and security, as well as training when exploring the adoption of mobile apps (Abolfazli et al. 2014). However, these limitations are now reduced with the enhancement of new technologies and mobile phone capabilities. Recent developments in technology provided new facilities and interfaces for learners to explore a new paradigm of learning.

Research problems

MARDI has abundant knowledge and expertise in agriculture that would be very beneficial and valuable if converted into e-learning and transmitted online. However, before making this areality, MARDI needs to first ensure that this approach will generally be accepted by learners or users.

Smallholder farmers/learners realised the power of good and reliable information which can improve their income by elevating farm productivity. MARDI realised that it has the technical competencies to generate, develop and deliver new knowledge and technologies to their clients in order to improve farm productivity. By doing so, a public R&D institute will significantly contribute and support the transformation of agriculture and bio-based industry into a commercially viable industry (Ommani and Chizari 2008).

Evaluation of the mobile technology will help MARDI in providing good and effective information to target groups. It was suggested that each organisation which used e-learning as one of the ways to disseminate knowledge should evaluate the effectiveness of their programmes systematically (Idrish et al. 2017). This was to ensure that users/ learners used the knowledge and skills that they had acquired. It was important to evaluate the learning programmes based on a student's satisfaction because satisfaction was a major driver for the success or failure of such a medium (Levy 2007).

Objectives

The objective of this study was to investigate the acceptance of MARDI mobile apps among the current users. The acceptance of the programmes will be used as guidelinesfor future development of mobile apps in MARDI.

The specific objectives were:

i. To measure farmers' awareness, experiences and expectations regarding the mobile-based applications in agriculture and farming practices.
ii. To explore farmers' adoption of the technology based on their awareness of the existence of such technology and it properties.

Materials and methods

Users can download MARDI mobile apps from the app store. After the apps have been downloaded, each user must register as a MARDI apps user. They are required to provide information such as full name, identity card number, age, telephone number, set their password and email address which will be registered as their username. Users are required to register only once, and in future they can use their username and password to download and explore other MARDI apps available in the app store. The registered information will be stored in MARDI apps database.

An online questionnaire was developed to study the acceptance of MARDI apps by users. This online questionnaire was distributed to the existing registered users through their e-mail addresses. They are required to submit their feedback within 3 weeks. This study received 200 replies from respondents but only 132 respondents with complete answers were considered in the study. The structured online questionnaire was developed to identify the effectiveness of MARDI mobile applications and measure the level of user's satisfaction. It was divided into four sections: demographic information, application system, understanding the problem statements and suggestions. The respondents were required to answer multiple choices, like scales and open ended questions.

The descriptive analysis method was used to describe the data obtained in the present study. In descriptive statistics, the type of data analysis often involves bivariate analysis with only one variable. Generally, descriptive statistics is a method of analysing data by percentage and frequency using the measure of central tendency (MCT) such as average, mod and median. This method summarises data groups through a combination of table-shaped descriptions, graphical descriptions and charts and statistical reviews of the findings (Jaggi 2012). Descriptive analysis is one of the statistical data analysis techniques

performed prior to conducting any statistical tests. It is applied to summarise the data by describing and characterizing them besides identifying user's tendency and perception of MARDI apps.

Results and discussion

Profile of respondents

As shown in *Table 1,* most of the respondents who downloaded the MARDI apps were male at 87.9% and the remaining 12.1% were female. The respondents in the 31 – 40 years old age group were 35.6% followed by 20 – 30 year-old at 27.3%. Furthermore, 18.9% of the respondents were in the age group of 41 – 50 years old and the least age group was 51 – 60 years at 14.4%. These data indicate that the findings represented opinions of different levels, age and disciplines of respondents.

Majority of the respondents were university graduates (82.6%) with employment in regular jobs with minimum wages. From race clustering point of view the Malays holds the most respondents at 84.7%, followed by Chinese at 6.1%, Indians at 3.8% and the rest from other races at 5.3%. The promotion of MARDI apps should be expanded and intensified to be more comprehensive. In order for these apps to be widely used, language barrier should be overcome by developing the apps in dual language mediums (Bahasa Malaysia and English).

Table 1. Demographic profiles of the respondents

Profile	Classification	Total n = 132 cumulative	Percentage
Age group	20 – 30	36	27.3
	31 – 40	47	35.6
	41 – 50	25	18.9
	51 – 60	19	14.4
	>61	5	3.8
Gender	Male	116	87.9
	Female	16	12.1
Designation	Salaries/wages fixed	66	50.0
	Self-employed	55	41.7
	Students	4	3.0
	Housewife	1	0.8
	Others	6	4.5
	Pensioner	4	1.3
	Jobless	2	7
Education	Primary school	1	0.8
	Secondary school	22	16.7
	University/college	109	82.6
Race	Malay	111	84.7
	Chinese	8	6.1
	Indian	5	3.8
	Others	7	5.3
Religion	Islam	115	88.5
	Buddha	7	5.4
	Hindu	4	3.1
	Christian	4	3.1

Knowledge about MARDI's apps

There are two main mobile operating systems available in the market, i.e. the Android and the Apple operating system. Each of this operating system has their own store to publish the developed apps. *Figure 1* shows that 29% of Android smart phone users knew about MARDI mobile apps from Play Store, 23% Apple smart phone users from App Store, 17% users from friends, 7% from other co-workers and the remaining 4% from family members. Play Store seems to offer the best platform according to users requirements and needs. In addition, Play Store is also more sociable and gives its customers a personal insight on which apps to purchase.

Duration of using mobile apps

Most of mobile learning apps which are available in the market usually gets connected and often executed via the Internet. The duration on the frequency these apps were accessed by the respondents is shown in *Figure 2*. About 7% used the application for 1 – 2 hours per day, 4% for 3 – 5 hours per day while 34% used it once a week and the remaining 38% at least once a month.

Usability of MARDI apps

Currently, mobile learning apps are the in-things from which users seek help in research and update their knowledge interactively. Most of the respondents (56.8%) used MARDI Lebah Kelulut apps as shown in *Table 2*. Increasing awareness among farmers on sustainable agricultural management and natural conservation of the environment were some of the factors that contributed to the immense interest on stingless bees. Generally, stingless bees assist in crop pollination.

Table 2 also shows the percentage of respondents having access to a list of MARDI mobile apps, namely MARDI

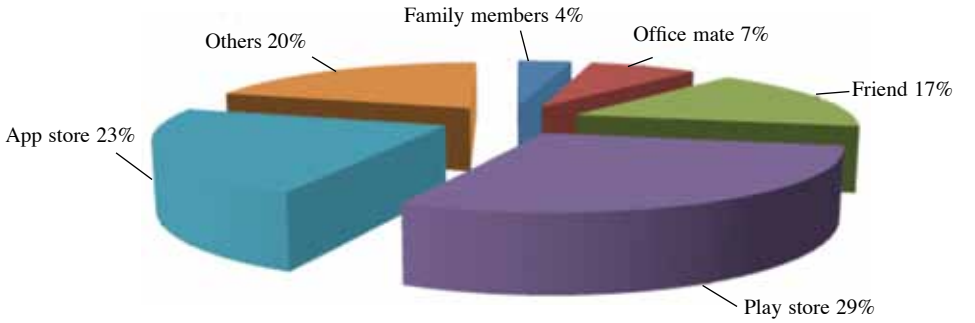

Figure 1. Sources of information about MARDI apps

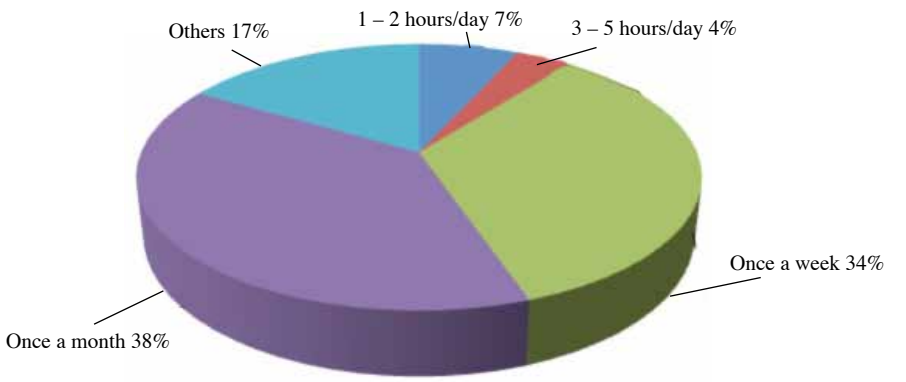

Figure 2. Frequency of users' access to MARDI apps

Lebah Kelulut (56.8%), MARDI Penternakan Ayam Kampung (30.3%), MARDI Fertigasi Cili (25%), MARDI DoktorCili (24.2%), MARDI Teknologi Kambing Pedaging (16.7%), MARDI Penanaman Cendawan Tiram Kelabu (14.4%), Cendawan Tiram Kelabu (13.6%), MARDI Fertigasi Melon (13.6%), MARDI Direktori Usahawan (12.1%), MARDI Green Pharmacy (9.1%), MARDI Fertigasi Tomato (9.1%), MARDI Hidroponik Salad (8.3%) and MARDI Padiaerob (5.3%). Besides MARDI Lebah Kelulut, the MARDI Penternakan Ayam Kampung Mobile apps had the next highest frequency of access by users. The lowest percentage was MARDI Padiaerob application which was accessed by 5.3% of respondents.

Users perception of MARDI mobile apps

Figure 3 shows that most users agreed that MARDI apps (*Figure 4*) were user friendly (68.3%), had informative contents (59%), very effective displays (58.3%) and attractive displays (56.8%). A total of 61.9% of the respondents were satisfied with the time duration to access MARDI apps. Users also observed that the information presented were complete and easy to understand. These findings indicated good acceptance among users. Promotion should be enhanced so that the MARDI Mobile apps are

Table 2. Percentage of users accessing the different types of MARDI apps

Types of MARDI apps	Frequency	Percent (%)
MARDI Lebah Kelulut	75	56.8
MARDI Penternakan Ayam Kampung	40	30.3
MARDI Fertigasi Cili	33	25
MARDI Doktor Cili	32	24.2
MARDI Teknologi Kambing Pedaging	22	16.7
MARDI Penanaman Cendawan Tiram Kelabu	19	14.4
MARDI Fertigasi Melon	18	13.6
Cendawan Tiram Kelabu	18	13.6
MARDI Direktori Usahawan	16	12.1
MARDI Green Pharmacy	12	9.1
MARDI Fertigasi Tomato	12	9.1
MARDI Hidroponik Salad	11	8.3
MARDI Padiaerob	7	5.3

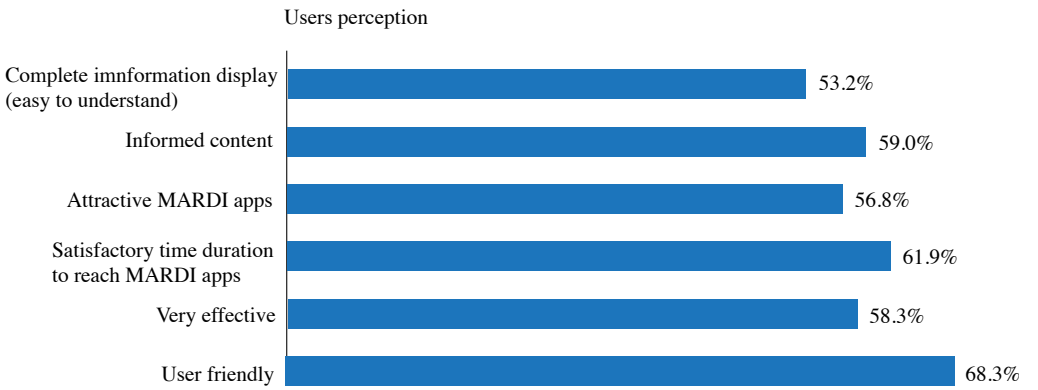

Figure 3. Perception of users regarding MARDI apps

Figure 4. List of MARDI mobile apps

adopted by more farmers and agricultural entrepreneurs in Malaysia.

Understanding MARDI apps

Table 3 shows that a majority of the respondents agreed on a score of 3 that the MARDI mobile apps increased their knowledge which help to facilitate their activities in related fields as well as improved their work performance. The mean values of each response, which ranged between 2.88 – 3.24 seemed to indicate that most respondents were agreeable with all the items and had a good understanding of the benefits of MARDI apps. A high percentage of respondents at 72.7% and 65.9% agreed that MARDI mobile apps respectively enhanced their cultivation techniques and

Table 3. Understanding MARDI apps

Items	Percentage (%)	Frequency	Median	Mean
Enhancecultivation techniques/business	72.7	96	3.0	3.05
Improve the quality of life	65.9	87	3.0	2.97
Gain knowledge	62.1	82	3.0	3.28
This application can help improvethe outcomes to meet the existing standards.	65.2	86	3.0	3.04
This application can reduce workload	62.9	83	3.0	2.88
This application is compatible/related to my work	59.8	79	3.0	2.94
This application can ease the work	74.2	98	3.0	3.02
Can improve my career performance	62.9	83	3.0	3.07
Provide useful information and knowledge	61.4	81	3.0	3.16
Reduce time	65.9	87	3.0	3.08
Reduce energy	64.4	85	3.0	3.08
Reduce cost	63.6	84	3.0	3.03
This application is very useful	64.4	85	3.0	3.17
Generally, I am very interested in using MARDI's mobile application.	50.8	67	3.0	3.24
Overall, MARDI's mobile applications is very satisfying.	62.1	82	3.0	2.95
MARDI applications provide me the opportunity to expand the network	60.0	80	3.0	2.88

business, and improved their quality of lives. Overall, 62.1% of respondents were satisfied with MARDI Mobile apps and thought that the apps were beneficial to their livelihood.

Conclusions

The findings of this study indicated that the MARDI mobile apps were very useful in a smart farming environment. Furthermore, the results showed that users had adequate knowledge and awareness on the usage of mobile technology and internet in agriculture. MARDI mobile apps provide users with new knowledge and information that helped increase their income. Besides, the mobile learning apps can be used effectively in institutions of higher learning and smart farming environments. Finally, the positive perceptions given by respondents in the study should serve as a basis for fostering the adoption of newer technologies and facilitates the transfer of knowledge towards Industrial Revolution 4.0.

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Abstrak

Aplikasi mudah alih dalam bidang pertanian dapat menyebarkan pengetahuan dan teknologi dengan lebih pantas kepada pengguna berbanding dengan kaedah konvensional yang menggunakan pegawai penyelidik atau pegawai pengembangan. Aplikasi ini adalah platform maklumat yang merupakan satu kaedah perkongsian ilmu terkini yang mengadaptasi teknologi mudah alih untuk kemudahan pengguna terutamanya petani dan usahawan tani pada bila-bila masa dan di mana sahaja mereka berada. Di samping menilai peranan aplikasi mudah alih dalam kalangan penggunanya, kajian ini juga bertujuan untuk menilai penerimaan aplikasi mudah alih MARDI oleh pengguna yang terlibat dalam persekitaran pertanian pintar. Kajian soal selidik berstruktur telah diedar secara dalam talian kepada pengguna (n = 132 responden) yang mempunyai pelbagai latar belakang pendidikan dan umur. Kaedah analisis deskriptif telah digunakan dalam kajian ini untuk meringkaskan pengumpulan data melalui gabungan deskripsi berbentuk jadual, penerangan grafik, carta dan ulasan statistik hasil penemuan disediakan dalam bentuk nilai purata (min), frekuensi, dan peratusan dengan menggunakan perisian statistik SPSS. Kajian ini membuktikan wujudnya keperluan yang mendesak terhadap aplikasi mudah alih MARDI. Selain itu, kajian ini menunjukkan pengguna mempunyai pengetahuan dan kesedaran yang memadai untuk menggunakan teknologi mudah alih dan internet dalam persekitaran pertanian mereka.