FARMER APP ADOPTION IS INFLUENCED BY AGE, USE OF ADVISORS AND FARMER NETWORKS

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SUMMARY

No peer-reviewed information is available on the adoption of mobile applications (apps) by Australian farmers, despite the increase in number and usage. An online survey of 400 sheep industry participants found that age, use of advisors and farmer network participation had a significant influence on the level of farmer app adoption. However, when surveyed, farmers ranked networks and advisors of low importance when deciding to use an agricultural app. Older age brackets had lower levels of app adoption but the actual level of adoption was high compared with common perceptions. Age should not be viewed as a barrier to adoption or overlooked in R&D and marketing.

INTRODUCTION

Mobile apps (computer applications for mobile devices) have the potential to revolutionise the way farmers undertake training, extension, and support more informed decision making. Despite the increased number and use of agricultural apps, there is no peer-reviewed information on the adoption of apps by Australian farmers and their role in extension, training and decision making. Therefore, online surveys were conducted to examine the extent to which existing technology adoption models are relevant for the adoption of app technology for the sheep industry, as well as identify factors of importance to farmers for app adoption.

MATERIALS AND METHODS

An initial online survey was conducted in 2017 utilising the Sheep CRC communications database, which consisted of predominantly sheep farmers but also included service providers, researchers and others. The survey was completed by 400 respondents with 79% being sheep farmers and the majority of the remainder being industry service providers. A subsequent survey was conducted using the Sheep CRC RamSelect app user database (n=54) to examine factors affecting adoption from a targeted app user group. RamSelect, (viz. RamSelect Plus), is a web-based application, www.ramselect.com.au, viewable on mobile devices rather than downloaded, allowing ram buyers to find and rank sale rams based on Australian Sheep Breeding Values (ASBVs) for their flock.

Both surveys were voluntary participation and conducted via SurveyMonkey, an online survey builder website, via industry email invite. Participants included those that did and did not use apps. Survey questions were based upon aspects of the technology adoption model Diffusion of Innovations (DOI) theory (Rogers 2003), as well as derivatives from the Technology Acceptance Model (TAM) (Davis *et al.* 1989), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.* 2003), and the ADOPT tool (Kuehne *et al.* 2011). These models encompass widely accepted principles for technology adoption (e.g. DOI), plus new considerations from more modern adoption theories such as ADOPT.

Survey participants ranked the importance of app attributes in relation to their actual use of apps and indicated if the attributes were very important, important, somewhat important or not important in deciding whether they were going to use an agricultural app. These rankings were then scored 4 (very important) to 1 (not important). Within the survey, participants were also asked if they owned

a smartphone or tablet, if they used mobile apps (in general) and if they used agricultural apps. They indicated their age bracket, whether they participated in a farmer group or network and whether they used farm advisors.

Statistical analysis. App attribute importance ranking was analysed using a repeated measures ANOVA, with a Greenhouse-Geisser correction, determining if the mean scores for app attribute importance were significantly different. Post hoc tests were conducted, using Bonferroni correction, to reveal if any attribute importance score means were significantly different from each other through a pairwise comparison. A Chi-square test was used to investigate if there was a relationship between age and levels of smartphone/tablet ownership, mobile app use and agricultural app use. The Chi-square test was also used to test the same adoption relationship with use of advisors and farmer network participation. A one-way ANOVA with Tukey post hoc test was also conducted to determine if the level of adoption for each technology was different between each age brackets but full results not reported here. All test assumptions were checked and validated. Survey data was analysed using IBM SPSS version 25.

RESULTS AND DISCUSSION

Of the respondents to the Sheep CRC database survey, 91.9% owned a smartphone or tablet, 83.4% used mobile applications and 63.3% used agricultural applications. Similarly, of the respondents to the RamSelect app user survey, 92.6% owned a smartphone or tablet, 85.2% used mobile apps and 70.4% used agricultural apps. Note that RamSelect can be accessed without a mobile device and hence some users would define its use not to be that of an app.

App attribute importance. The three most important app attributes identified from the Sheep CRC database survey were usefulness, ease-of-use, and providing a better way of doing something the user already does. The three least important factors related to farmer networks, fellow farmer use and advisor recommendations, which all ranked not important to somewhat important. Attributes of compatibility, interest in the subject, quickness to see benefits, complexity, trialability and price, were identified as a group of medium importance factors influencing farmer app use. Survey data analysis determined that the mean scores for app attribute importance were significantly different ($F(7.866, 2352.003) = 279.879$, $p<0.0005$). Post hoc tests revealed that several attribute importance score means were significantly different from each other, which led to the segregation of the groups of attributes with high, medium and low importance.

It is evident that the fundamental principles affecting technology adoption, such as usefulness and ease-of-use, remain vital to technology adoption, including apps. Providing a better way of doing something the user already does was also of high importance. This should be of particular interest to developers working on tools that provide information or methods the user has not previously considered, as they may have an additional barrier to adoption. The three lower importance factors had been hypothesised by the authors to be of higher importance. Therefore, further analysis of the survey data was undertaken, revealing that those who were part of a farmer network or used advisors had significantly higher levels of agricultural app adoption.

Farmer networks. Respondents from the Sheep CRC database survey who were part of a farmer group or network had significantly higher levels of app use (Table 1). Figure 1 illustrates a significant finding that is the proportion of survey participants who used agricultural apps ranged from 70.4% for those involved in farmer networks to 44.6% for those who were not.

Table 1. Percentage of smartphone/tablet ownership, mobile app and agricultural app use within age bracket, farmer network and advisor use categories in the Sheep CRC database survey (percentage and number of respondents in each category are shown)

	Smartphone/tablet			Mobile app use			Agricultural app use		
	n	Yes	*p*-value*	n	Yes	*p*-value*	n	Yes	*p*-value*
Age bracket									
18-40 years	64	98.4%^	<.001	64	96.9%^	<.001	63	85.7%	<.001
41-55 years	138	94.9%^		138	88.4%^		135	68.9%	
56-70 years	119	90.8%^		119	78.2%		116	51.7%^	
≥ 71 years	32	68.8%		31	51.6%		31	35.5%^	
Farmer network									
Yes	237	92.6%	.564	220	85.9%	.076	178	70.4%	<.001
No	88	90.7%		75	78.1%		41	44.6%	
Use of advisors									
Yes	88	96.6%	.053	88	90.9%	.022	88	73.9%	.012
No	260	90.0%		259	80.3%		252	58.7%	

* Significance level *p*-value ≤ 0.05. ^ Post hoc tests were conducted finding these age brackets not being significantly different from each other.

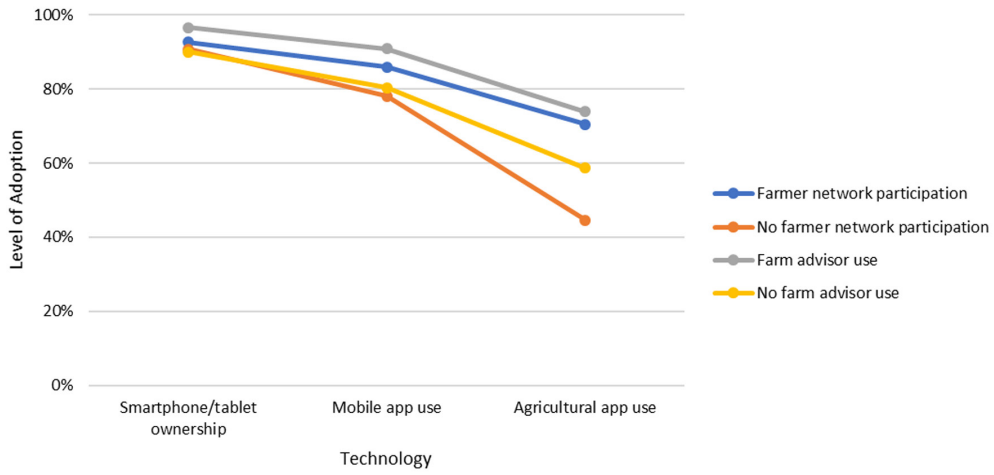

Figure 1. Percentage of technology adoption between farmer network participation (n=354) and farm advisor use (n=348) from Sheep CRC database survey respondents

A similar association between farmer network involvement and app adoption was evident in the RamSelect app user survey. The proportion of participants who used mobile apps ranged from 90.9% for those involved in farmer networks to 55.6% for those who were not with the difference being highly significant ($\chi 2(1) = 7.287$, p = .007). Furthermore, the proportion of participants who used agricultural apps ranged from 81.4% for those involved in farmer networks or groups to 33.3% for those who were not, with the difference being significant ($\chi^2(2) = 8.821$, p = .012).

Use of advisors. In the Sheep CRC database survey, the highest proportion of mobile app use was in those who used advisors but the more significant association was between advisor use and agricultural app use with 73.9% using agricultural apps compared with 58.7% (Table 1, Figure 1).

Rather than being a contradiction to attributes of importance for app adoption, this inconsistency

between farmers' ranking of what is important to their agricultural app adoption and the clear difference in app adoption between farmer networks and advisor use, it is likely due to farmer adopter category (e.g. early adopter). Therefore, those who participate in farmer networks or use advisors, are potentially an excellent target market for agricultural app developers due to their high level of adoption.

Age. Results from the Sheep CRC database survey showed that age had a significant influence on smartphone or tablet ownership but only when compared with the oldest age bracket of 71 years or older (Table 1). Age also had a significant influence on mobile app use when comparing those 55 years and younger with those in two older age brackets. The most significant influence of age was on agricultural app adoption where there was a significant difference between the main three age brackets where 85.7% of 18-40 year olds used agricultural apps, 68.9% in the 41-55 years bracket used agricultural apps but this dropped to 51.7% in the 56-70 years group, although this is still over half of that age group (Table 1). No significant difference was found between those 56-70 years to those 71 or older for agricultural app use.

A similar significant effect of age was found in the RamSelect app user survey where smartphone or tablet ownership ranged from 100% to 83.3% ($\chi^2(2) = 6.183$, $p = .045$) the use of mobile apps ranged from 100% to 63.2% ($\chi^2(2) = 11.461$, $p = .003$). There was a large range between age groups for the use of agricultural apps (81.3% to 55.6%) but the variation was not found to be significant ($\chi^2(4) = 4.187$, $p = .381$) possibly due to smaller sample size.

From this we can deduce that there is a significant effect of age on the level of smartphone or tablet ownership, mobile app and agricultural app use. However, it is valuable for app developers and marketers to note that the level of smartphone ownership and app use was still high across most age brackets compared to anecdotal evidence that few "older" people are using apps.

CONCLUSIONS

This study shows that while some principles from existing technology adoption models are relevant for the adoption of app technology, there are some that are not so important and farmers have identified their factors of importance to app adoption. The level of agricultural app adoption was significantly higher amongst respondents using advisors and farmer networks, yet farmers did not rank advisors or networks as important to their app uptake. Therefore, an alternative model may be needed specific to the adoption of apps for agriculture. The level of general app use was high amongst survey respondents but the level of agricultural app use was lower suggesting there is a lack of relevant or useful apps in the marketplace and/or inadequate marketing. While age did have a significant effect on app adoption, the level of app use amongst most age brackets was high and age should not be viewed as a barrier to adoption.

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