Five capitals framework: Understanding the use and adoption of e-extension by dairy extension workers in Tasmania, Australia and Punjab, Pakistan

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Abstract. In this study, the five capitals framework (natural, financial, human, physical, and social) are used to compare and understand the attitudes of dairy extension workers towards the use of information communication tools (ICTs) for extension services termed e-extension in Tasmania, Australia, and Punjab, Pakistan. Dairy extension workers were interviewed in both regions, and the data was analysed using thematic analysis. While extension workers in Tasmania and Punjab employed various ICTs, including social media platforms, it was discovered that social media was mostly used to connect with progressive farmers and corporate dairy farms in Punjab. Recent COVID-19 restrictions were among the most influential factors in increasing the adoption of ICTs among the respondents from both Tasmania and Punjab. Financial and physical capitals were the most influential capitals on E-extension adoption in both regions. This paper concludes with policy recommendations in terms of physical and financial capital through infrastructure improvements to increase internet access and the establishment of new and enhancement of existing online platforms to strengthen dairy extension services in Tasmania and Punjab.

Keywords: E-extension; Dairy extension; Information communication tools (ICTs); Technology Acceptance Model; Five capitals framework, COVID19

Introduction

Dairy farming involves milk production from farm animals. While dairy cows are mostly associated with the industry, other species that are milked commercially include sheep, goats, and buffalos. World milk production grew by 1.3% in 2019 to 852 million tonnes (Mt) and is expected to grow at 1.6% p.a. (to 997 Mt by 2029) (OECD/FAO 2020). This production growth is required to meet the increasing demand for dairy products.

Except for some peri-urban dairy farms, most of the dairy farming in Punjab, Pakistan is practised in mixed crop-livestock systems (Sarwar et al. 2002). Dairy systems in Punjab are categorised into five main milk production systems based on their location, herd size, and management level. These are smallholder subsistence, smallholder market-oriented, rural commercial, peri-urban, and large peri-urban. Characteristically, smallholding dairy farms with subsistence or market-oriented farming hold 90% of the share, followed by peri-urban or commercial farming (Tahir et al. 2019). The average smallholder subsistence dairy farm has from 3-7 animals. The main inputs to produce smallholder dairy products are often noncash resources, such as family-owned land and labour (Raja 2001; Malika et al. 2016). A study conducted in Punjab, Pakistan (Ajmal et al. 2015), revealed that most farmers had multiple animal breeds, the highest percentage of 47% for Nili Ravi buffalos, followed by Sahiwal cow (29%) and crossbred cows (20%).

In Tasmania, the dairy industry contributes over $1 billion per year to the state economy and creates wealth and jobs for regional communities (DairyAustralia 2016). Tasmanian milk production has increased by 32 per cent since 2010, mainly from existing farms with more cows, and increased per cow production (DairyAustralia 2016). The Tasmanian dairy industry offers several investment opportunities, including large-scale milk production, cheese manufacturing, and commercial-scale dairy processing (DairyAustralia 2020).

In contrast, Punjab often lacks market-oriented strategies for milk productivity, particularly in more isolated regions where up to 70% of farmers produce milk solely to feed their families (Wynn et al. 2017). Dairy farms act as a bank or insurance to meet essential family expenses such as the financing of weddings, funerals, and expensive medical care (Wynn et al. 2017). Dairy farming in Punjab is affected by decreased milk productivity due to the animals with low genetic potential and shortage of optimal feed, high disease incidence, and lack of an organised marketing system (Aujla & Hussain 2015; Lin et al. 2015).

Dairy extension aims to build capacity and enable dairy farmers to change so that they can adopt sustainable, profitable and better farming practices. It emphasises the applied aspect of education by broadening and transferring knowledge and problem-solving to individual and community concerns in the field of dairy farming (Fulton et al. 2003; Meena 2018). The dairy extension system is transforming from merely a platform for technology transfer to one that incorporates various participatory methods engaging different dairy stakeholders. This approach necessitates

awareness building through education, which must be tackled using various participatory extension methods (Ponnusamy et al. 2021). Several studies have indicated that only incorporating top-down extension approach does not necessarily result in successful information diffusion and technology transfer (Kaine 2004; Morse et al. 2006; Wauters & Mathijs 2010). Participatory approaches to agricultural extension recognise the active contribution of all dairy industry stakeholders including dairy farmers. These are based on partnerships between farmers and extension workers to learn from each other and contribute to their knowledge and skills. However, the concept of participation is intricate and resource intensive. All stakeholders involved in such a system can effectively accomplish their objectives by integrating information and communication tools (ICTs) (Kaddom 2020). ICTs can translate into an extension system that evolves into a method for exchanging knowledge rather than just transferring it (Blackstock et al. 2010), with facilitation delivered in a learning process (McCown 2002). To promote interactions that co-produce knowledge and create networks of creative individuals and organisations, it is necessary to employ a variety of online communication platforms. Through this approach, extension workers, entrepreneurs, and dairy farmers can work together and exchange knowledge in a way that opens up new opportunities for development and innovation (Chowdhury & Odame 2013). Further classifying and integrating these approaches into extension services using a variety of online tools, platforms, and the latest ICTs, which support networking, online interaction, and knowledge exchange, results in an extension system known as e-extension.

E-extension methods provide convenience, real-time information delivery, instant feedback, the ability to reach geographically dispersed audiences and reduced travel by audience or presenters (Rich et al. 2011; Afzal et al. 2016; Tetyana et al. 2016; Bhattacharyya et al. 2018). A dependable extension system strengthened by effective use of ICTs has the potential to significantly improve agricultural production and, ultimately, rural life (Arokoyo 2003). Recent advances in ICTs and innovations have created numerous new opportunities to improve veterinary practices (Bellet 2019), and increased the speed and accuracy with which data is collected and reported for disease surveillance and animal health monitoring (Holmstrom & Beckham 2017). By reducing personal visits and establishing frequent communication between farmers and extension workers, e-extension can increase farmers' access to timely information while addressing time and cost challenges (Cole & Fernando 2012; Afzal et al. 2016; Tetyana et al. 2016; Bhattacharyya et al. 2018).

Several studies have found challenges pertaining to the adoption of e-extension vary from lack of appropriate knowledge and skills regarding the use of online tools to unavailability of a reliable internet connection (Kale et al. 2015; Singh et al. 2015; Saidu et al. 2017). These challenges exist all across the world, but their manifestations are more diverse in developing nations (Saidu et al. 2017). Poor infrastructure, lack of experienced personnel, inadequate integration of ICTs into business operations, expensive ICTs equipment, and unfavourable government regulations were cited as major challenges (Gelb & Voet 2009; Munyua et al. 2009; Yimer 2015; Agwu & Uchechi 2019). Internet access has been heralded as a key facilitator of development, particularly in developing countries. Access to different ICTs, and online resources, in particular, can serve as a major development catalyst (Biggs 2015).

The Technology Acceptance Model (TAM) propounded by Davis (1989) is found to be useful for understanding these challenges and explaining how digital information resources are utilized and adopted. TAM is an information systems theory that models how users come to accept and use a technology (Davis 1989). The model suggests that when users are presented with a new technology, several factors influence their decision about how and when they will use it. These factors include but are not limited to behavioural intentions, attitude and perceived usefulness of the system, perceived ease of use of the system and individual intentions. TAM is the most influential extension of Ajzen and Fishbien's Theory of Reasoned Action (TRA). In this model, it was hypothesized that the attitude of a user toward a system was a major determinant of whether the user will use or reject the system (Figure 1). The attitude of the user, in turn, was considered to be influenced by two major beliefs perceived usefulness (U) and perceived ease of use (EOU), with the latter also having an influence on perceived usefulness (Davis 1989; Ajzen 2005).

Figure 1. Technology Acceptance Model
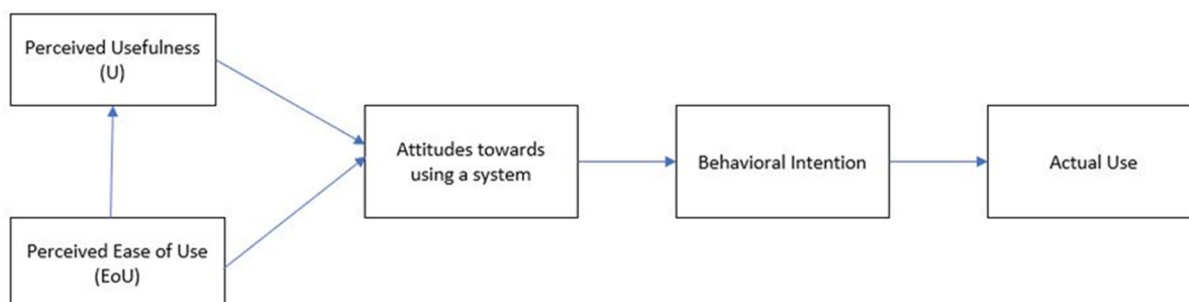
Source: (Fishbein & Ajzen 1975; Davis 1989)

In this study, the five capitals framework (FCF) was used to understand the influence of five capitals and related factors on the attitudes of dairy extension workers (Davis et al. 1989; Coleman 1990; Dhakal 2011). Different social studies have incorporated the concept of five capitals (financial, human, natural, physical and social capital) (Bourdieu 1987; Coleman 1990; Portes 1998), for developing frameworks to understand connections between social structure, life condition, and human behaviour (Lin 2002). Financial capital refers to monetary assets or wealth that help increase productivity. Human capital refers to people's health status, education, knowledge, and skills inherited or learned through education or training. Natural capital covers a range of natural assets (e.g., land, water, organisms) that help maintain a better environment through ecosystem services (e.g., forests, woodlands, water bodies) such as clean air and freshwater. Physical capital refers to man-made infrastructure and manufactured equipment such as highways, computer systems, and farm infrastructure. Finally, social capital refers to the network of relationships that enable individuals and groups to collaborate (Dhakal 2011; Cummings et al. 2022).

The five capitals framework was used in this study as an analytical tool to understand and compare the impact of different capitals on the use and adoption of e-extension methods by dairy extension workers of Tasmania and Punjab (Coleman 1990; Portes 1998; Lin 2002; Dhakal 2011; Hsieh et al. 2011; King et al. 2019). Understanding the importance of new tools and developing an attitude towards a change, like most human behaviours, is constrained by various factors including their usefulness and ease of use (Davis 1989; Coleman 1990). It is proposed that extension workers' use and adoption of e-extension methods in their daily tasks is influenced by their cultural, social, and material resources and can be categorized and compared using the FCF in two different study sites (Warschauer 2002; De Haan 2004; Kvasny & Keil 2006).

The following research questions were developed for this study:

- What types of ICTs are currently being used as part of e-extension in the dairy industry of Tasmania and Punjab and why?
- How and why do the five capitals affect the attitudes of dairy extension workers towards e-extension methods in Tasmania and Punjab?

Methods

The Tasmanian Institute of Agriculture and the Punjab Livestock and Dairy Development Department, respectively, provided a list of dairy extension staff. They were invited to take part in the study, and 12 extension workers from both study locations were interviewed, including six from Tasmania, Australia, and six from district Rahimyarkhan, Punjab, Pakistan. The selection of extension workers for this study was based on whether they could provide sufficient information. The participants were expected to be: (1) actively involved and engaged in dairy extension-related activities to have the necessary knowledge and experience of the phenomenon under study, and (2) show a willingness to participate in the study. Participants who met the above criteria were interviewed. Semi-structured interviews with dairy extension workers were conducted either face-to-face or over the phone or video call and lasted between 25 minutes to 1 hour. In Punjab, Pakistan, interviews were conducted in Urdu and later translated into English by the researcher who is native to Punjab and speaks English and Urdu languages. Each interview was recorded and transcribed for further analysis. The study's participants were from different public and commercial dairy organisations with dairy extension responsibilities in their respective regions. Participants from Punjab were veterinarians who also provided extension services as they were assigned to perform both duties by the Dairy Development Department of Punjab. To discuss study findings, study participants were represented as T1-T6 (Tasmania) and P1-P6 (Punjab), respectively. The research was conducted in line with University of Tasmania ethical guidelines

and received ethical approval from the University of Tasmania Human Research Ethics Committee (H0021920).

This research adopts case study methodology to compare the attitudes of dairy extension workers from two different study cases of Tasmania and Punjab. The researcher's experience and knowledge regarding the use of e-extension methods was integrated in the process of co-constructing knowledge with participants (Pham & Williamson 2021). Case study methodology enables the researcher to have holistic approach towards the research problem and participants' responses, while reducing bias and establishing a sound platform from which to explore the factors influencing the study in greater detail (George & Bennett 2005; Lindgreen et al. 2021).

All study participants were using different ICTs in their daily tasks and were well-versed in the concept of e-extension before their interview. Participants were questioned about their daily task-related ICTs usage experiences and the factors that influenced their choice of ICTs. They were questioned about the types of extension activities they were engaged in as well as the benefits, challenges or limitations they encountered when using ICTs. Using their personal experiences as guides, they discussed which combinations of ICTs and non-ICT based communication strategies work best. They were also questioned for their opinions on the current challenges and potential outcomes of e-extension in the dairy sector. Transcribed data were thematically coded and three general themes were identified, including: 1) E-extension adoption, 2) Traditional extension vs e-extension, 3) Challenges and prospects of e-extension explained using mind maps. Mind maps were constructed to represent interview data, identifying key statements and researchers' insights in relation to the interview, and to analyse the data to define study's key arguments and findings. Whilst technology is seen to make interpretation and analysis easier by using software for qualitative data analysis such as Atlas-Ti and NVivo (Faste & Lin 2012), where coding can be used on transcribed interviews, there is value in the researcher themselves engaging in the data and processing it to help map out what the key ideas or findings are, and how they relate to one another, rather than outsourcing transcription (Kitchin & Tate 2013). All mind maps were drawn based on researchers' insights for extracting codes identified from interview data and created in a presentable form with the help of NVivo software (Mueller & Oppenheimer 2014; Wiley & Rapp 2021). This qualitative study was thematically analysed to understand and differentiate attitudes of dairy extension workers in Tasmania and Punjab towards e-extension methods using five capitals framework in the light of available literature (Braun & Clarke 2006; Guest et al. 2011; Vaismoradi et al. 2013).

Results and Discussion

Extension workers in Tasmania indicated they were assigned to assist and support dairy farmers with farm management issues. They were conducting and managing heat detection and irrigation specific discussion groups, pasture training, field days like the annual dairy business of the year day and young stock management. They were also tasked with conducting silage management workshops focusing on silage production and quality, assisting farmers with sustainable dairy farming, feed management and farm business discussion groups. Extension workers in Punjab were also providing veterinary services to the dairy farmers in addition to farm management workshops and discussion groups. Their tasks ranged from providing treatment to livestock, vaccination, surgery, and feed solutions to the dairy farmers.

The following themes explain and address the first research question: What types of ICTs are currently being used as part of e-extension in the dairy industry of Tasmania and Punjab and why?
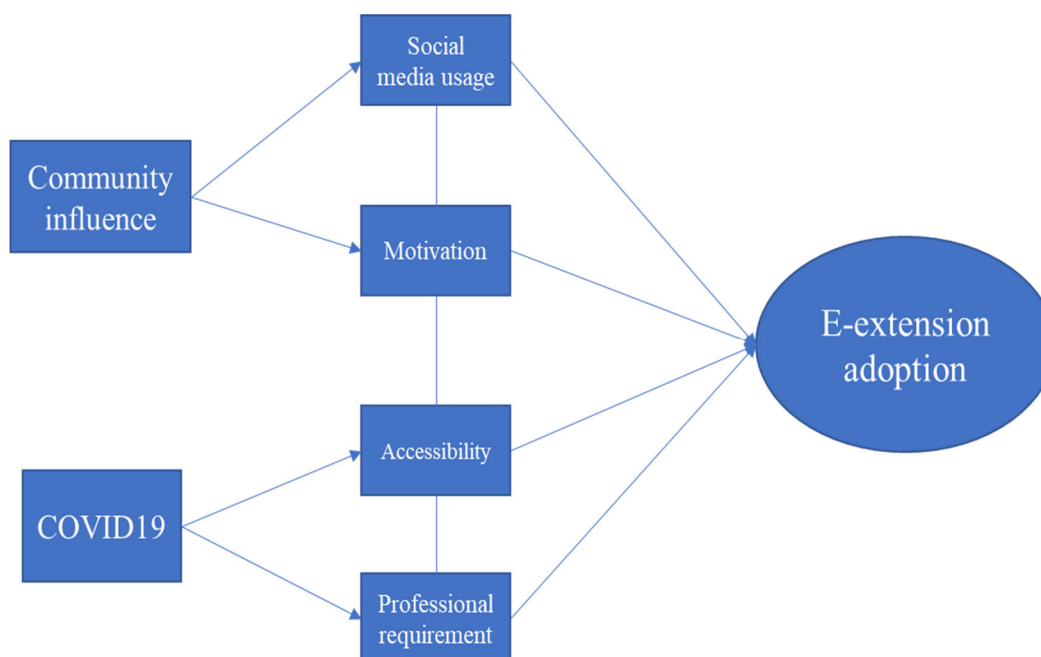
E-extension adoption

Some key factors related to e-extension adoption by extension workers identified during the thematic analysis are represented through a mind map in Figure 1. It was revealed that extension workers in Tasmania were motivated to use WhatsApp and Facebook messenger to communicate with farmers after realizing that dairy farmers were already using these tools. Two participants from Tasmania found social media apps helpful in their non-work-related activities and communication and were encouraged to adopt them in their extension tasks. According to a participant (T4):

> I realized a few years ago that farmers are using WhatsApp and Facebook messenger, so we also decided to keep it up.

Another participant (T5) said:

> 5-6 years ago, I came to know about a dairy support Facebook group at a dairy farm focused group discussion and found it an easy and effective tool of communication.

Figure 1. E-extension adoption (mind map)

Ease of access, low cost and providing support to extension activities during COVID19 restrictions were some of the benefits which led to the participants using social media apps as part of e-extension methods. The exceptional popularity and growth of social media in both Tasmania and Punjab can mostly be attributed to the common platform it provides to its users to share ideas and create new content (Bhattacharjee & Raj 2016). Its usage includes but is not limited to sharing texts, graphics, audio clips, or videos with affordability as all of these can be accessed without extra cost. The confluence of technologies and the evolution of multi-functional portable smart devices are some of the other reasons for expanding social media reach. The acceptance and prevalence of these social media platforms to a global audience is unprecedented, owing to the affordability of smartphones and the increased number of social media platforms (Dhiab et al. 2020).

Extension workers in Punjab were also using social media apps as they were encouraged to follow some progressive dairy farmers. According to them, COVID19 restrictions exponentially increased the use of ICTs as they were unable to visit dairy farms. All the participants from Punjab were using phone calls and text messages to assist and communicate with farmers. In addition, they were using an online platform named "Strengthening of performance management system" (SPMS), that was established and run by the Livestock and Dairy Development Department Punjab to assist farmers. Three Participants from Punjab found phone calls and text messages relatively easy and cost-effective ways to communicate. For example, participants (P1, P3, P4) said:

> Dairy farmers contact us directly on the phone to discuss their issues as a phone call is a cheap and reliable way of contact for both of us.

Three participants (P1, P5, P6) were particularly interested in using social media focusing on dairy farming. According to one participant (P2):

> I found some Facebook groups run by some progressive farmers and joined them as I wanted to be a part of a knowledge-sharing platform without spending much in terms of time and efforts.

All participants from Tasmania and Punjab found that COVID19 restrictions have exponentially increased the use of e-extension methods. Three Tasmania participants (T1, T2, T5) particularly mentioned that the use of zoom video calls, Twitter, and online webinars helped them remain in contact with farmers during COVID19 restrictions. One participant (P5) from Punjab found COVID19 restrictions as an opportunity to learn, saying:

> Switching to an online communication was challenging but helped me to change and adapt without compromising my responsibilities.

Traditional vs e-extension

All 12 participants from Tasmania and Punjab believed that a physical presence and face-to-face interaction for all extension activities is better than online only interaction, if they must choose

one. They also considered several technical and practical issues linked to e-extension methods; thus, their opinion was based on more than just their respective skill in conventional methods of extension. One participant (T5) from Tasmania said:

> I feel disconnected if I have not visited a dairy farm personally but also like using online tools as they save time and cost.

Another participant (T1) from Tasmania said:

> I found personal visits helpful in building relationships, better communication, and trust, but e-extension helped us remain in contact with current pandemic restrictions.

According to one participant (P3) from Punjab:

> With some extra responsibilities as a veterinary doctor, personal visits cannot be replaced completely with online communications; however, these do help us assisting farmers with farm management issues.

Figure 2, outlines extension workers' overall approach towards adopting a particular contact method. Although all the participants acknowledged the importance of e-extension methods, they also believed that the trust and influence part of communication could only be built with a face-to-face interaction. It was also revealed in a study that more than 60% of the social context of a situation in a person-to-person setting is communicated nonverbally. Most of the information in a person-to-person communication is acquired from nonverbal signals and components. Without enough support of nonverbal components, online communication cannot completely replace face-to-face communication (Winger 2005; Paul et al. 2016). In face-to-face communication, emotion exchange takes place without becoming aware of that exchange. These exchanges of emotions generate a sense of warmth, and 'human-ness' that are conducive to better understanding and relationship development between the communicating parties. The online communication cannot deliver the 'warmth' of face-to-face communication. Maintaining and building good relationships is essential to people's lives; it is a form of social capital that can help build or impede personal growth and well-being (Winger 2005; Zimmermann et al. 2008).

Figure 2. Traditional vs e-extension (Mind map)

However, face-to-face extension methods do not entirely outplay online communication. As expressed by the participants, online communication is inevitable in a fast-paced world. Most importantly, the COVID19 pandemic has highlighted the usefulness of ICTs. The use of ICTs during the COVID19 pandemic demonstrated both the constraints and opportunities for ICTs (Xie et al. 2020). Constraints include but are not limited to inadequate information for decision making, lack of informative public debate, insufficient and unreliable information to meet user's daily needs,

and the spread of fake news (Yang et al. 2020). Simultaneously, ICTs allow for quick responses by providing large-scale participation and increased collaborations across regions and national boundaries. It can be assumed from the responses that extension workers acknowledge the importance and effectiveness of using ICTs but oppose completely replacing face-to-face interactions. Perhaps, a tailored combination of both methods reinforcing each other could be a preferable package. It is observed in similar studies that when it comes to specific and detailed advice on farming issues, there is still a strong preference for the more traditional interpersonal communication methods that are face-to-face, i.e., farm visits, field days, and discussion groups (Byrne & Wims 2015; Mapiye et al. 2021).

Challenges and prospects of e-extension

Challenges and prospects identified by extension workers are presented through a mind map in Figure 3, while Table 1 summarises different factors influencing dairy extension workers' attitudes from Tasmania and Punjab by theme. In Punjab, it was revealed that an online dairy platform named SPMS was discontinued due to the lack of funding. Other challenges highlighted in Punjab were the availability of inaccurate and incomplete information through online channels. 'Sometimes, online sources spread wrong and incomplete information which affects animal health', said one of the interview participants (P3) from Punjab. Three participants (P1, P3, P4) expressed a concern saying:

> Lack of resources and poor internet connection is a big challenge for us to rely on an online communication method completely; however, this could be dealt with if a reliable online platform specific to dairy is established.

Figure 3: Challenges and prospects of e-extension (Mind map)
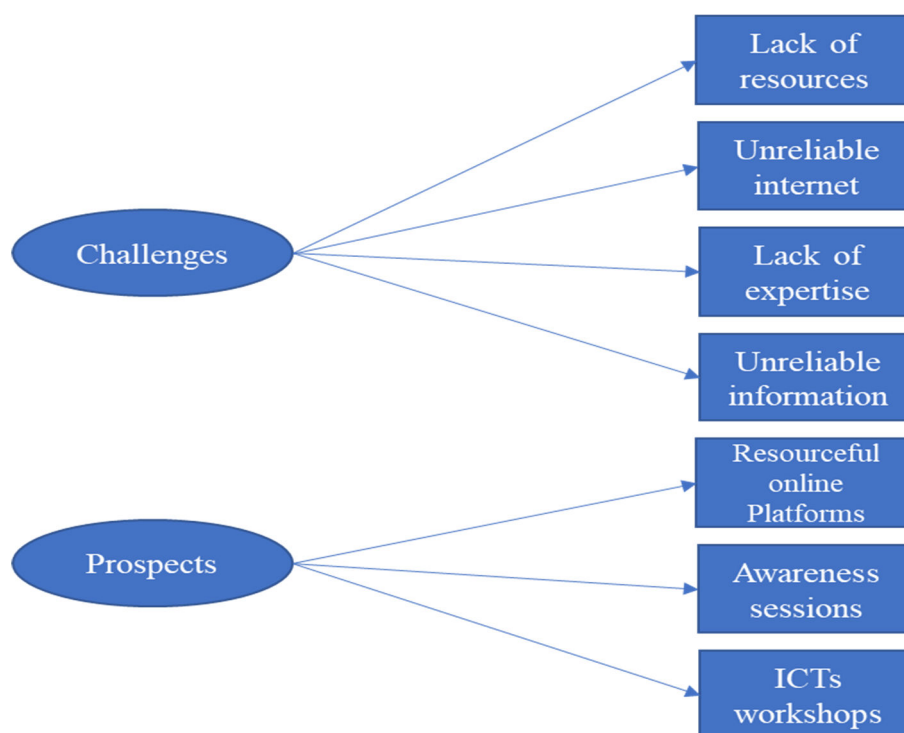
In Tasmania, extension workers were also facing challenges associated with different ICTs. These challenges included but were not limited to low quality and unreliable internet connection affecting webinars and video conferences and, in some instances inability of the users to use smart devices and tools. 'It (e-extension system) needs to be very simple, and more people should be familiarized with it to make it more helpful', said one of the participants (T6) from Tasmania. Participants (T1, T2, T3, T4), suggested not overloading farmers, ensuring that everyone involved is aware of technology and smart devices before being introduced to the e-extension system. Two participants (T5, T6) found 'ENLIGHT' (Dairy Australia's dairy farming related educational and training online platform) had great potential to enhance interaction and engagement between all stakeholders of the dairy industry. Technology limitations due to unskilled manpower, including ignorance of the ICTs potential and return on investment, have been the primary reasons for the slower adoption rate. Other challenges include lack of government support, being an expensive

initiative, risk, complex procedures, costs and benefits, security, legal aspects, business complexity, human capital deficiency and customer services (Duan et al. 2002; Hashim 2015).

Table 1. Extension workers' attitude towards e-extension

Themes	Tasmania	Punjab
E-extension adoption	Ease of access Accessibility Peer influence COVID19 restrictions	Cost and time effectiveness To keep up with progressive farmers COVID19 restrictions
Traditional vs e-extension	Preferred a combination of face-to-face and online communication. Trust and influence factor lacks in online communication.	Preferred a combination of face-to-face and online communication. Lack of resources and infrastructure to completely rely on online communication
Challenges and Prospects of e-extension	Unreliable internet connection affecting webinars and video conferences. Inability of all users to use smart devices and tools	Lack of funding to support online platforms. Unreliable information. Lack of knowledge to use smart devices.

Five capitals influencing the use and adoption of e-extension

This section explains how and why the five capitals affect the attitudes of dairy extension workers towards e-extension in Tasmania and Punjab. Table 2 explains differentiating attributes based on the available literature and respondents' feedback.

Table 2. Differentiating attributes of five capitals in Tasmania and Punjab.

Capitals	Tasmania	Punjab
Financial	Large corporate dairy farms. Frequently used ICTs included Webinars and Online seminars.	Small scale farmers with a diverse range of challenges need individual help. WhatsApp and phone calls.
Natural	More suitable weather for dairy farming. Only cows and similar farm management needs.	Harsh weather with different animals and breeds for dairy farming.
Human	Extension activities related to farm management.	Extension activities accompanied by veterinary services.
Physical	Better infrastructure and resources. Unreliable internet connection.	Lack of funding and resources causing a halt to a resourceful online platform. Unreliable internet connection.
Social	Peer influence and the dairy industry with mostly similar interests help join social media and online platforms.	Lack of mutual exchange of information. Only progressive farmers are using extended form of social media and online platforms.

Findings suggest that financial and natural capitals influenced the attitudes of dairy extension workers towards e-extension in both study sites. Due to varying financial and natural conditions in both regions, extension workers perceived the usefulness and ease of use of ICTs differently. Extension workers in Tasmania found webinars and online workshops to be one of the most effective ways of communication. This could be because most of the dairy farms in Tasmania are corporate and business-oriented with an optimal climate for pasture-based dairying, benefiting from an online group discussion to discuss similar issues (TasGov 2019). In Punjab, extension workers were using WhatsApp and phone calls more frequently to deal with a range of challenges being faced by dairy farmers. These challenges include but are not limited to different livestock needs (due to different animal breeds), harsh and less suitable weather conditions for dairy farming (natural capital) and contrasting farm management implications due to different farm sizes and needs (financial capital). With large and corporate dairy farms in Tasmania, the extension tasks are different compared to Punjab, where most small holder farmers are practicing dairy farming to meet household needs only. The most profitable aspect of any farm in Punjab is the cropping component, with the dairy enterprise very much a secondary concern (Wynn et al. 2017).

Table 3 describes five capitals and their implications for both study sites, as well as relevant recommendations to address associated challenges. As human capital describes people's knowledge and skills that are either inherited or learned through education or training, it directly

impacts the way of thinking and attitude towards a new concept (Dhakal 2011). The difference in the knowledge, skills, and capabilities between extension workers from both regions influenced their attitude towards the usefulness and ease of use of e-extension methods and consequently impacted their adoption. Education, qualification, and extension responsibilities influenced the types of ICTs being used in both regions. As stated by one of the participants (P3) from Punjab:

> With some extra responsibilities as a veterinary doctor, personal visits cannot be replaced completely with online communications"; however, these do help us assist farmers with farm management issues.

Table 3. Recommendations to address challenges associated with five capitals and their implications in Tasmania and Punjab.

Study sites	Capitals and their implications			Recommendations
	Positive	*Negative*	*Neutral*	
Tasmania	Financial Natural Social	Physical	Human	Infrastructure improvement is needed to support reliable internet availability. Establishment of new and making already available online platforms more resourceful.
Punjab	Social	Financial Natural Physical	Human	Investing financial and physical resources to help bring small scale dairy farmers into the online community. Infrastructure improvement to help increase internet accessibility. Developing and designing an online support platform helping farmers with varying weather and animal breeds related challenges.

In Tasmania the extension activities primarily focus on farm management related issues, including sustainable dairy farming, grazing management, farm business management, heat detection, young stock management and silage management. This helped them to remain in contact with dairy farmers even during the pandemic restrictions as one of the participants said:

> I found personal visits helpful in building relationships, better communication, and trust, but e-extension helped us remain in contact with current pandemic restrictions.

In Punjab, discussing physical capital, an online system named 'SPMS', which was providing a platform for dairy farmers and extension workers to get assistance and share knowledge, has been inactive due to lack of funding. Extension workers from Punjab found this platform very helpful and hoped for its resumption with some improvements in resourcefulness and accessibility. Some other challenges reported towards adopting e-extension methods included unreliable internet connectivity and misinformation, which are crucial for animal health.

Extension workers in Tasmania were mostly satisfied with the availability of resources. Two participants (T5, T6) particularly found an online platform, "Enlight" by Dairy Australia, a helpful tool with huge potential to make all dairy industry stakeholders communicate in a resourceful manner. However, some participants (T1, T2, T3) were concerned about the unreliable internet in some regions, and, in some instances, lack of expertise related to using online tools. Improved infrastructure as part of physical capital may improve the reliability of a system and help users attain better performance expectancy. Performance expectancy is the degree to which an individual believes that utilising or adopting the system would increase job performance (Venkatesh et al. 2003). In addition, performance expectancy is directly related to developing a positive attitude through perceived usefulness or benefits of a new system (Davis 1989). A technology that is perceived as aiding the better performance of tasks while offering cost benefits (in terms of time as well) will be expected to have a higher adoption rate (Venkatesh et al. 2003).

Social capital refers to the social relationships and structures that enable individuals and groups to collaborate (Ghorbanzadeh et al. 2023). Social capital impacts perceived expectations from family, relatives, peers, and friends for one to develop positive attitude towards using ICTs (Hsieh et al. 2011). Participants (T3, T5, T6) in Tasmania revealed that using social media platforms within friends and family networks and experiencing its benefits encouraged them to use these in extension tasks as well. It was revealed that the participant (T5) joined a dairy farming-based Facebook group by following the participants of a dairy support group discussion and found it useful. In Punjab, the participants (P3, P4, P6) were members of different social media groups managed by some progressive farmers. They were inclined to join those groups to remain in contact with the progressive dairy farming community because of their usefulness in terms of dairy related knowledge availability. The extent to which a person perceives that important others

think they should use the new system (Venkatesh et al. 2003) can also be defined as a social influence (Wang & Sun 2016). For instance, in the results obtained from a study in Guinea, social influence is the key determinant of cellular phones' use (Kaba et al. 2006). In addition, Social Influence has also been found to be a driver for developing a positive attitude towards using ICTs in different studies (Kante et al. 2016; Wang & Sun 2016).

Conclusion

Dairy extension workers from Tasmania, Australia and Punjab, Pakistan, were interviewed to understand their attitudes towards the use of e-extension methods. The five capitals framework was used as an analytical tool to understand and compare the impact of different capitals on the use and adoption of e-extension methods by dairy extension workers. COVID19 restrictions were among the most important factors influencing the adoption of e-extension methods in both regions, in addition to their cost and time effectiveness. The participants reported an exponential increase in the usage of social media platforms for extension services. However, depending on their needs, they used different tools and platforms. In Tasmania, the use of webinars and video conferencing was reported in addition to different other social media platforms. Most extension workers in Punjab were limited to WhatsApp groups, with some exceptions using Facebook groups to reflect different implications of financial and physical capitals. Although unreliable internet connections, lack of expertise, and inability to use smart devices were major concerns in both Tasmania and Punjab, they were more evident in Punjab. This could be one of the influencing factors developing different attitudes of extension workers towards e-extension methods in Punjab. They relied only on WhatsApp and other social media communication rather than opting for webinars and video chats requiring a reliable internet connection and more sophisticated equipment.

It was observed that Tasmania and Punjab hold different attributes of financial, natural, human, physical and social capitals, which directly influence the attitudes of extension workers towards e-extension methods. The findings of this study suggest that dairy extension system could be strengthened if we address the challenges associated with factors involving financial, natural, and, more specifically, physical capitals in both study sites. This research reflects the data obtained from the dairy extension workers only. Further research is needed to focus on dairy farmers as well, as their active participation is essential to establish an effective e-extension system.

Acknowledgements

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