Digital Transformation of Agricultural Extension in Indonesia: A Comprehensive Analysis

Suswadi, Norbertus Citra Irawan

Agribusiness Department, Agriculture Faculty, Tunas Pembangunan University, Surakarta, Indonesia

Abstract

Digital transformation in the field of agricultural extension is quite essential for agriculture in the future. The problem is that not all extension workers understand the use of cyber extension. The research objective is to explore the relationship between individual motivation (IM), social capital (SC), digital extension adoption (CEA), knowledge sharing (KS), and agricultural extension performance (EP) in Indonesia. The research method used was explanatory, with purposive location selection and a population focused on agricultural extension workers. Sampling was carried out using quota techniques. Data analysis in this study used Structural Equation Modeling with Partial Least Squares (SEM-PLS). More specifically, IM and SC act as construct variables, while CEA and KS not only act as construct variables but also as mediators. Agricultural Extension (EP) performance is measured as a latent variable. The research results reveal that all construct variables, namely IM, SC, CEA, and KS, positively and significantly influence the EP. These findings demonstrate the importance of these factors in supporting digital transformation in agricultural extension in Indonesia and can provide valuable guidance for decision-makers and practitioners in efforts to increase the effectiveness of agricultural extension using digital technology.

Keywords

EU, Russian Federation, foreign trade, invasion, restrictive measures, sanctions.

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Introduction

Digitalization has changed agricultural extension communication and information services. To learn more about agriculture, extension workers must use digital tools. In terms of how to inform farmers effectively and efficiently about agriculture, digital consultation presents similar challenges. Next, extension workers cannot find reliable knowledge and information about the extension materials that farmers need to solve their farming problems. Extension workers cannot give farmers accurate information and make consulting services ineffective due to a lack of digital skills. Modern technology and media such as social media, mobile applications, and internet platforms can help farmers get the latest and most up-to-date information about farming and improve their skills. Extension workers must adapt to a quickly changing environment and learn digital skills to support farmers. Through the Ministry of Agriculture, the Indonesian government has implemented an agricultural information system by utilizing information and communication technology (ICT) to deal with one of the problems of disseminating agricultural information in the digital era. The Indonesian cyber extension (http://cybex.pertanian.go.id/) is an agricultural extension information system through internet media built to support the provision of extension materials and agricultural information for extension workers in facilitating the learning process of agribusiness extension workers, farmers, and entrepreneurs (Sabir et al., 2019).

Motivational and social capital problems may prevent Indonesian extension workers from adopting agricultural cyber extension technology (Pratiwi and Suzuki, 2017). The perceived usefulness, ease of use, and attitude of extension workers may significantly affect their willingness to adopt the technology (Saadé and Bahli, 2005). They may not adopt the technology if they are unsatisfied with it or find it helpful (Bermejo-Caja et al., 2019). Cyber extension technology adoption among extension workers may also be influenced by their social capital, which includes their network of contacts, their level of trust with one another, and the degree to which they share common beliefs and values (Delilah Roque et al., 2020). They may not adopt the technology if they lack peer trust or strong network ties (Freeman & Qin, 2020). Different norms and values between individuals who have accepted the technology and those who have not may also constrain adoption (Takahashi et al., 2020).

The motivation of extension workers is low, and they tend to be unwilling to adopt cyber agriculture extension (CE) technology, including a) Not having sufficient knowledge to operate the technology (Utami et al., 2019), b) Lack of motivation and support from local authorities (Norton and Alwang, 2020), c) Extension workers feel that they will not get good benefits from adopting the technology (Agussabti et al., 2022), d) Extension workers may not have enough money to adopt new technologies (Listiana et al., 2020), e) Extension workers may not receive sufficient assistance to understand and operate new technologies (Takahashi et al., 2020), f) Extension workers may have many other tasks to complete so they do not have sufficient time to adopt technologies cyber extensions (Kulikova, 2021).

There may be several obstacles in the way of extension workers in Indonesia adopting agricultural cyber extension technologies (Madonna et al., 2022). Cyber extension adoption depends on utilization, integration into work procedures, and technology proficiency (Cimini et al., 2020). Extension workers may not use the technology to its total capacity if they do not use it often or integrate it into their work routines (Steinke et al., 2021). Extension workers' knowledge-sharing frequency, quality, and reach may influence their performance (Wang et al., 2021). It may not improve extension performance if the information is given infrequently, inadequately, or to a small audience (Chandra-Mouli and Akwara, 2020). Thus, improving Indonesian extension workers' performance may require addressing these cyber extension adoptions and knowledge-sharing issues (Wijaya et al., 2019).

This article aims to find the nexus between individual motivation (IM), social capital (SC), cyber extension adoption (CEA), knowledge sharing (KS), and extension workers' performance (EP) as part of the digital transformation of agricultural extension in Indonesia through cyber extension.

Materials and methods

The basic research method used is explanatory, which is research that tests a theory or hypothesis. Explanatory research is chosen because the aim is to test theories or hypotheses, obtain information about things that are not yet known, gain a broad understanding of the topic, and produce new insights about phenomena. This method allows researchers to test existing hypotheses, obtain initial data, understand in depth the phenomenon being studied, and make a significant contribution to the development of knowledge about a topic.

The determination of research locations was purposive, namely in three provinces in Indonesia, which are food crop production centers, especially rice, and have implemented sustainable organic rice cultivation. Then, in each province, one regency was selected as the research location. The regency areas included Karawang (West Java Province), Sragen (Central Java Province), and Ngawi (East Java Province). This study uses five variables and 15 indicators described in Table 1.

The population in this study were field extension workers in the three selected regencies. Researchers have determined the number of samples in this study using quota sampling techniques with each regency of 50 people so that the total number of respondents was 150. The quota sampling method was chosen because it is easy to implement and manage, is suitable for research with time constraints, allows control of specific characteristics in the sample, can reduce research costs, and does not require absolute representativeness but rather the determination of cases or individuals based on specific reasons. The sampling technique in each regency uses simple random sampling.

Responses from respondents were arranged using a Likert scale where the values were 5 (strongly agree), 4 (agree), 3 (neutral), 2 (disagree), and 1 (strongly disagree). The use of the Likert scale was chosen because it is easy for respondents to understand, the data is easy to analyze and produces quantitative data, it can measure the level of intensity and variation in respondents' responses, and it is flexible to use in various types of questions and research topics.

The collected data were then analyzed using Structural Equation Modeling-Partial Least Square (SEM-PLS). Structural Equation Modeling-Partial Least Square (SEM-PLS) is a multivariate statistical analysis method that allows estimating complex cause-and-effect relationships in path models with latent variables. SEM-PLS uses a component

No	Variables and indicators		Explanations
1	*Individual Motivation (IM)*		
	IM1	Perceived usefulness	A belief that CE will work more efficiently and effectively (Ramayah and Lo, 2007)
	IM2	Perceived ease of use	Using CE is simple (Caffaro et al., 2020)
	IM3	Attitude towards techno-logy	Willingness to use CE technology, then understanding of its potential benefits and risks or related to an overall comfort level with its use (Tanveer et al., 2021)
2	*Social Capital (SC)*		
	SC1	Network ties	The extension worker's connections to other colleagues, farmers, and technology experts who can support the adoption and utilization of CE (Colussi et al., 2022)
	SC2	Trust	The extension worker's trust in their network and technology can impact their willingness to use CE (Fabregas et al., 2019)
	SC3	Shared norms and values	The extension workers and their networks promote integrity, respect for diversity, and lifelong learning, as well as quality client service, collaboration with other professions, and sustainable agricultural methods (Ertiaei et al., 2022)
3	*CE Adoption (CEA)*		
	CEA1	Usage behavior	They search for relevant content, participate in online forums and discussion boards, create and exchange files, and participate in virtual meetings to acquire information, share knowledge, and cooperate with other professionals (Bermejo-Caja et al., 2019)
	CEA2	Integration into work processes	The degree to which CE has been integrated into the extension worker's regular work processes and activities (Mapiye et al., 2021)
	CEA3	Level of proficiency	The level of skill and expertise the extension worker has in using CE can impact the effectiveness of their use of the technology (Maulu et al., 2021)
4	*Knowledge Sharing (KS)*		
	KS1	Frequency of sharing	The frequency at which extension workers share information, resources, and experiences related to the use of CE (Joshi and Dhaliwal, 2019)
	KS2	Quality of sharing	The extent to which the information and resources shared are relevant, accurate, and valuable to others in the network (Nayal et al., 2022)
	KS3	Reach of sharing	The extent to which the information and resources shared by extension workers are widely disseminated and used by others in the network, including other extension workers and farmers (Ortiz-Crespo et al., 2021)
5	*Extension Worker's Performance (EP)*		
	EP1	Efficiency	The time and effort needed to execute extension worker tasks and how cyber extension reduces these demands (Dharmawan et al., 2021)
	EP2	Effectiveness	The extension worker's ability to share information and resources with farmers and its effect on farmer knowledge and practices (Ayisi Nyar-ko and Kozári, 2021)
	EP3	Job satisfaction	How cyber extension affects extension worker job satisfaction (Listiana et al., 2019)

Source: Author

Table 1: Variables, indicators, and explanations.

approach that is different from the covariance-based approach in structural equation modeling, especially suitable for data that is not normally distributed and small sample sizes. It consists of a measurement model and a structural model and can be applied in various scientific disciplines. The software used in this research is SmartPLS.

The choice of IM and SC construct variables in research on the performance of extension workers using cyber extension mediated by CEA and KS has fundamental reasons. Individual Motivation helps understand the instructor's level of motivation in using technology such as cyber extension, while Social Capital reveals the influence of social interaction and social support on the use of this technology. The performance of extension workers is measured in terms of their effectiveness and efficiency in using cyber extension. Mediating variables such as CEA and KS help explain how individual motivation and social capital contribute

Direct Effect		Indirect Effect	
H1:	IM affects the CEA	H6:	IM affects the KS through CEA
H2:	SC affects the CEA	H7:	SC affects the KS through CEA
H3:	CEA affects the KS	H8:	IM affects the EP through CEA
H4:	CEA affects the EP	H9:	SC affects the EP through CEA
H5:	KS affects the EP	H10:	CEA affects the EP through KS
		H11:	IM affects the EP through CEA and KS
		H12:	SC affects the EP through CEA and KS

Source: Author

Table 2. The hypotheses.

to extension workers' performance through technology adoption and knowledge sharing. This mediation provides a more holistic understanding of the factors that influence extension workers' performance in adopting and utilizing cyber extensions.

Results and discussion

The relationship between individual motivation, social capital, cyber extension adoption, knowledge sharing, and extension performance can be analyzed using path analysis and partial least square (PLS) modeling output. PLS is a statistical method that can be used to examine the relationship between multiple variables (Purwanto and Sudargini, 2021) (Figure 1).

Path analysis will examine the relationships between individual motivation, social capital, cyber extension adoption, knowledge sharing, and extension performance. We were also determining how each variable affects the others. The output of the PLS model can then be used to estimate the strength and direction of these relationships and to identify the critical drivers of adopting and effectively using cyber extension by agricultural extension workers. The results of path analysis show the strength and direction of the relationship between IM, SC, CEA, KS, and EP variables. The results of all paths show positive numbers, meaning all relationships between IM, SC, CEA, KS, and EP, so the variables are positively related (Table 3). This relationship means positive feedback between the variables, where higher levels of one variable contribute to a higher level of the other and vice versa. This relationship can help support the extensive use and implementation of effective cyber extension by agricultural extension workers. It can lead to improved performance in using technology to support their work.

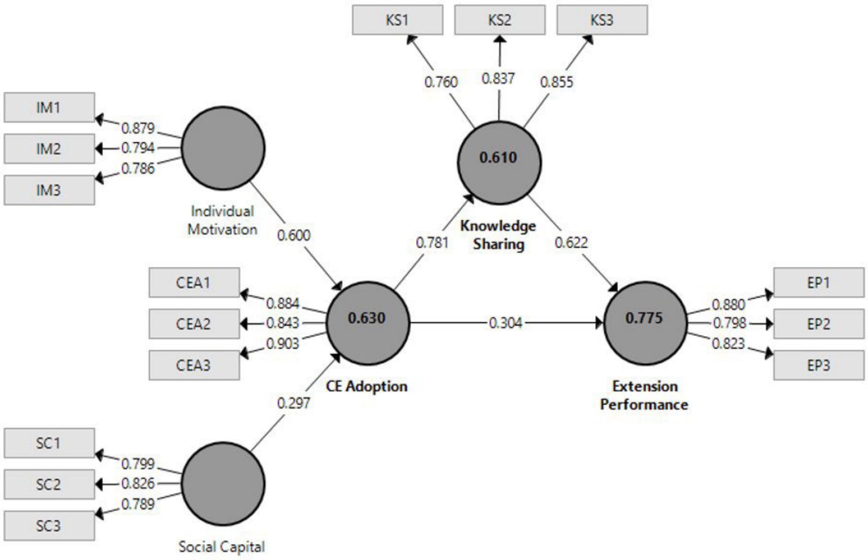
The construct's reliability, validity, and model accuracy must be tested to confirm the relationship between individual motivation, social capital, cyber extension adoption, knowledge sharing, and extension performance. Reliability can be verified by analyzing the consistency of the construct's results across time. At the same time, validity can be tested by comparing the results of the construct with existing theories and studies. Cross-validation, bootstrapping, and machine-learning algorithms can help researchers assess model accuracy. Interviews and surveys can be used to evaluate the construct's results. From the results of cross-loading, CA, rho_A, CR, AVE, and R Square, it is found that the relationship between these variables is quite strong (Table 4).

1. Individual motivation affects the agricultural cyber extension adoption

Based on Table 4, individual motivation elements like perceived usefulness, perceived ease of use, and attitude toward technology affect agricultural cyber extension adoption. Perceived usefulness means believing technology will improve job performance and make work easier. Agricultural cyber extensions can be used more if seen as beneficial. Perceived ease of use means technology is easy to use. Increased adoption of agricultural cyber extensions can also result from increased perceived ease of usage. Attitude toward technology is a person's overall positive or negative feelings toward technology. A positive attitude toward technology can boost the possibility of adopting agricultural cyber extensions.

2. Social capital affects the agricultural cyber extension adoption

Based on Table 4, social capital variables with indicators like network ties, trust, shared norms, and values affect agricultural cyber extension adoption. Network ties are people's connections and relationships with each other. An extensive social network can help disseminate information about emerging technology, such as cyber extensions for agriculture. Trust is the idea



Source: Author

Figure 1: Path model of the relationship between IM, SC, CEA, KS, and EP.

Var.	Ind.	Cross Loading					CA	rho_A	CR	AVE	R^2
		IM	SC	CEA	KS	EP					
IM	IM1	**0.879**	0.345	0.599	0.647	0.632	**0.756**	**0.755**	**0.861**	**0.673**	-
	IM2	**0.794**	0.354	0.633	0.570	0.665					
	IM3	**0.786**	0.544	0.612	0.681	0.546					
SC	SC1	0.395	**0.799**	0.401	0.424	0.438	**0.732**	**0.738**	**0.846**	**0.648**	-
	SC2	0.403	**0.826**	0.472	0.471	0.503					
	SC3	0.417	**0.789**	0.552	0.528	0.567					
CEA	CEA1	0.650	0.671	**0.884**	0.610	0.634	**0.850**	**0.850**	**0.909**	**0.769**	**0.630**
	CEA2	0.756	0.354	**0.843**	0.700	0.703					
	CEA3	0.569	0.563	**0.903**	0.739	0.736					
KS	KS1	0.559	0.525	0.598	**0.760**	0.565	**0.753**	**0.765**	**0.858**	**0.670**	**0.610**
	KS2	0.769	0.492	0.608	**0.837**	0.772					
	KS3	0.565	0.461	0.707	**0.855**	0.754					
EP	EP1	0.629	0.383	0.542	0.724	**0.880**	**0.781**	**0.781**	**0.873**	**0.696**	**0.775**
	EP2	0.581	0.696	0.788	0.740	**0.798**					
	EP3	0.671	0.480	0.623	0.677	**0.823**					

Test Type / Value	Value	Description
Cross-loading	If ≥ 0.7	Constructs have high validity and reliability
Cronbach's Alpha (CA)	If ≥ 0.7	Higher levels of coherence and consistency among items within a construct
rho_A	If ≥ 0.7	The construct accurately measures the latent construct, so it is reliable
Composite Reliability (CR)	If ≥ 0.7	The construct's items accurately and reliably measure the latent construct
Average Variance Extracted (AVE)	If ≥ 0.5	Observed variables measure latent constructs reliably and effectively
R Square	If ≥ 0.6	The independent variables effectively explain the variance in the dependent variable.

Source: Data processing

Table 3: Reliability and construct validity tests of IM, SC, CEA, KS, and EP variables.

that other people are reliable and can be counted on. People who trust each other may be more willing to share information and work together on adopting agricultural cyber extensions. In this context, "shared norms and values" are related to group members' accepted standards of behavior

Variable	Original Sample (O)	T Statistics	P Values	Sig.
Direct effect				
IM → CEA	0.600	7.387	**0.000**	***
SC → CEA	0.297	3.155	**0.002**	***
CEA → KS	0.781	27.986	**0.000**	***
CEA → EP	0.304	3.709	**0.000**	***
KS → EP	0.622	8.686	**0.000**	***
Indirect effect				
IM → CEA → KS	0.469	6.781	**0.000**	***
SC → CEA → KS	0.232	3.170	**0.002**	***
IM → CEA → EP	0.183	4.189	**0.000**	***
SC → CEA → EP	0.090	1.874	**0.062**	*
CEA → KS → EP	0.486	8.782	**0.000**	***
IM → CEA → KS → EP	0.292	4.759	**0.000**	***
SC → CEA → KS → EP	0.144	3.506	**0.000**	***

Note: Significance level: ***= 99%; **= 95%; *= 90%; ns = not significant
Source: Data processing output

Table 4. The direct-indirect effect path coefficient and hypothesis testing.

and attitudes. If everyone agrees on how important it is to use new technologies, like agricultural cyber extensions, that may make it more likely for them to be used.

3. Agricultural cyber extension adoption affects the knowledge-sharing

Table 4 shows how extension workers use and integrate cyber extension into their work can significantly affect how often, well, and widely they share knowledge. A high level of skill in cyber extension can lead to more efficient and effective information sharing, improving extension performance. Suppose cyber extensions are not popular. In that case, information exchange may be infrequent, low-quality, and reach only a tiny fraction of the community, which may reduce extension worker efficiency. Usage behavior, integration into work processes, and proficiency level can impact knowledge sharing among agricultural extension agents in Indonesia. Frequent sharing of information and best practices can increase awareness and understanding of the technology among individuals, leading to increased usage behavior and integration into work processes. As individuals adopt and become proficient in using technology, they can share their knowledge and experiences with others, leading to increased awareness, understanding, and adoption of technology in the broader network.

4. Agricultural cyber extension adoption affects the extension performance

Table 4 shows that agricultural extension workers' performance in Indonesia will likely affect their use of agricultural cyber extensions. How extension workers use these technologies, how well they fit into their work processes, and how well they know how to use them can improve their efficiency, effectiveness, and job satisfaction. For example, if they are better at using technology, they may be able to do their jobs more quickly. If they are better at integrating technology into their work, they may be able to do their jobs more effectively. Individuals proficient and confident in using technology are more likely to experience higher levels of job satisfaction, as they can perform their work more effectively and efficiently. Usage behavior, integration into work processes, and proficiency level can impact extension performance, including efficiency, effectiveness, and job satisfaction of agricultural extension agents in Indonesia. By adopting technology and increasing their proficiency, individuals can improve their efficiency, effectiveness, and job satisfaction, ultimately leading to a more prosperous and impactful extension program.

5. Knowledge sharing affects the extension performance

Based on Table 4, knowledge sharing, including frequency of sharing, quality of sharing, and reach of sharing, can impact extension performance, including efficiency, effectiveness, and job satisfaction of agricultural extension workers in Indonesia. Frequent sharing of information and best practices can increase awareness and understanding of essential concepts and strategies, leading to improved efficiency and effectiveness in extension work. High-quality knowledge sharing, with clear and concise information, can also increase an individual's confidence and ability to perform their work effectively. Extension work may be more efficient and effective if more people see and comprehend crucial information and tactics. Knowledge sharing provides high-quality information and best practices, which boosts workplace satisfaction and confidence. Sharing information and best practices improves efficiency, effectiveness, and work satisfaction, making extension programs more successful and influential.

6. Individual motivation affects knowledge sharing through agricultural cyber extension adoption

Based on Table 4, perceived usefulness, ease of use, and technological attitude can influence an individual's willingness and propensity to utilize and adopt cyber extensions in their work processes. This process can affect the frequency, quality, and reach of knowledge sharing between extension workers and other partners in the agricultural sector. The more motivated an extension worker is to use and adopt cyber extensions, the more likely they will share the knowledge they gain from using the technology with others in their network. Individuals becoming more proficient and integrating technology into their work processes may develop a more positive attitude towards technology, leading to improved extension performance. This convenience can make it easier for people to work together and share information, improving the extension worker's overall efficiency, effectiveness, and job satisfaction.

7. Social capital affects knowledge sharing through agricultural cyber extension adoption

Based on Table 4, "social capital" describes the strengths and opportunities that come from people's connections to and interactions with others. Social capital can play a role in influencing whether extension workers adopt and make use of agricultural cyber extensions. For example, strong network ties, a high level of trust, and shared norms and values can create a supportive environment that encourages the sharing of information and knowledge. Strong community networks and trust may help people adopt and use technology. People are more inclined to adopt technology if their community accepts and values it. On the other hand, insufficient social capital can make sharing knowledge harder to adopt and use agricultural cyber extensions effectively.

8. Individual motivation affects the extension performance through agricultural cyber extension adoption

Based on Table 4, an extension worker's decision to use agricultural cyber extensions can be affected by how helpful the technology is and how easy they think it is to use. Their productivity, effectiveness, and happiness on the job may all improve due to adopting this practice. For example, suppose an extension worker thinks a specific agricultural cyber extension is valuable and easy to use. In that case, they may be more likely to adopt and use it in their work. Technology users who have a positive attitude and see it as valuable and easy to use are more likely to adopt and employ it at work, improving productivity, effectiveness, and job satisfaction. Although intrinsic motivation is significant in determining extension success, other elements, such as technological expertise and how well it fits into existing work procedures, can also play a role. As people grow more adept and integrate technology into their work processes, they may become more positive towards technology, improving extension performance. After this integration, their work may become more efficient and effective, resulting in increased job satisfaction.

9. Social capital affects the extension performance through agricultural cyber extension adoption

Based on Table 4, social capital, which comprises network ties, trust, and shared norms and values, can significantly impact how extension workers in Indonesia adopt and use agricultural cyber extensions. Extension workers with more social capital may have more chances to get access to and make good use of these technologies. They may also be more likely to have a network of people who support them and can help them get through any problems they have with these technologies. Also, the network's shared norms and values can help build a culture of sharing knowledge and working together, making the extension workers more efficient and effective. Strong community relationships and trust may help people adapt and use technology, improving efficiency, effectiveness, and job satisfaction.

On the other hand, if social capital is low, it may be hard for extension workers to access and use these technologies, and it may be hard for them to share their knowledge, making them less efficient and effective. As people grow more skilled and integrate technology into their profession, they may create stronger network links and trust with others, increasing extension performance. Finally, social capital's impact on extension performance through agricultural cyber extensions depends on the situation and the social capital network's strengths and weaknesses.

10. Agricultural cyber extension affects the extension performance through knowledge sharing

Based on Table 4, when extension workers adopt agricultural cyber extension technology, they can access a broader range of information, resources, and tools to enhance their knowledge and skills. This increased knowledge can then be shared with farmers and other stakeholders through knowledge-sharing platforms like the agricultural cyber extension. Such platforms allow people in the agricultural industry to easily exchange ideas and practices and access information that can help increase agricultural productivity. Not only that, but they also provide resources accessed by extension workers to help farmers with everyday tasks, such as information, solutions, new techniques, and more. By exchanging data and information, these platforms used by extension workers can help farmers make better decisions, increase efficiency, and ultimately increase the profitability of their operations.

Through knowledge sharing, extension workers can improve the efficiency and effectiveness of their work, leading to better extension performance. For example, they can use the knowledge they have gained to design and deliver more targeted and relevant extension programs, leading to increased agricultural practices and technology adoption by farmers. This process can result in improved agricultural productivity, profitability, and sustainability, critical indicators of extension performance.

11. Individual motivation affects the extension performance through agricultural cyber extension adoption and knowledge sharing

Based on Table 4, the adoption of agricultural cyber extension can be influenced by several factors, including individual motivation, which can directly affect extension performance through usage behavior, integration into work procedures, and level of expertise with the technology. There is a correlation between the amount to which extension workers accept technology, how they feel about its effectiveness, and how easy they find it to use. Agricultural cyber extension, including usage behavior, integration into work processes, and proficiency level, can impact knowledge-sharing frequency, quality, and reach, impacting extension performance. Additionally, having a positive attitude about technology can motivate extension workers to become more competent in using the technology, which can contribute to improved overall performance. Individual motivation can also benefit extension performance by increasing the frequency, quality, and scope of information sharing among extension workers. Individuals who adopt and utilize technology may be more likely to engage in knowledge-sharing activities, leading to improved efficiency, effectiveness, and job satisfaction.

Technology can boost productivity, effectiveness, and job satisfaction if extension workers view it as valuable, easy to use, and have a good attitude toward it. As people grow more adept and incorporate technology into their work processes, they may regard it as more useful and easier to use, increasing motivation and extension performance. Technology can increase knowledge-sharing frequency, quality, and reach, improving efficiency, effectiveness, and job satisfaction.

12. Social capital affects the extension performance through agricultural cyber extension adoption and knowledge sharing

Based on Table 4, social capital can affect how effective those workers are at their jobs because of its effect on the use of agricultural cyber extensions and the spread of knowledge among extension workers. Strong network ties and high levels of trust within a community of extension workers might make it easier for information to be disseminated and exchanged, which can lead to an increase in the use of agricultural cyber extensions. Strong network relationships and trust can stimulate technology adoption and use, improving efficiency, effectiveness, and job satisfaction. Extension performance can increase if workers access more tools and resources more efficiently. However, the degree to which social capital influences extension performance may vary depending on factors such as the nature of the social capital in question (bonding, bridging, or linking) and the accessibility of other resources and technology. As people grow more adept and integrate technology into their work processes, they may build deeper network ties and trust with others in the extended community, improving extension performance. Technology can increase knowledge-sharing frequency, quality, and reach, improving efficiency, effectiveness, and job satisfaction. Frequent, high-quality social capital can improve knowledge sharing, efficiency, effectiveness, and job satisfaction.

Conclusion

In Indonesia, the success of agriculture extension workers is affected by various factors, including the workers' motivation and social capital levels, the adoption of cyber-based agricultural extension, and the sharing of relevant knowledge. There is a complex relation between individual motivation, social capital, adoption of agriculture cyber extension, sharing of knowledge, and performance of agriculture extension workers. Individual motivation and social capital are essential factors in adopting cyber agriculture extensions and their effects on agriculture extension workers in Indonesia. The adoption and utilization of agriculture cyber extensions can be affected by a person's level of motivation, such as the desire to improve skills and knowledge. Higher degrees of motivation were associated with better performance among agriculture extension workers; these workers were more likely to adopt cyber agriculture extension and contribute to knowledge sharing. Individuals with high levels of motivation are more likely to use cyber extensions and share their knowledge more actively, which can improve the performance of extension workers.

In the same way, the level of social capital, or the networks and trust between people, can also affect how these technologies are adopted and used. Substantial social capital, seen in network ties, trust, and shared norms and values, can also make it easier for people to use cyber extensions and share knowledge more often, better, and further. Also, social capital positively affected agriculture extension workers' performance. The consequences of this action are because those with higher levels of social capital were more likely to teach other farmers and use cyber agriculture extension.

Agriculture extension worker performance was linked to agriculture cyber extension and knowledge sharing. Those who used agriculture cyber extension and shared their knowledge were likelier to do well than those who did not. Adopting cyber agriculture extensions can significantly affect how people share information and how well extension workers do their jobs. When extension workers have access to and know how to use these technologies, they can share information with others in their network more efficiently and effectively. Improvements in productivity, output, and employee satisfaction can be attributed to these alterations for the extension workers. So, we can say that individual motivation, social capital, adoption of agriculture cyber extension, and sharing of knowledge are all linked to the performance of agriculture extension workers in Indonesia.

Research recommendation focuses on social capital because it is crucial to improving agricultural cyber extensions, information exchange, and agricultural extension worker performance in Indonesia. Social capital, or the resources and advantages of social networks, has been shown to boost the adoption of new technology and extension services. Extension workers can share information and build social capital by networking. This relationship can create a supportive workplace, motivating and engaging workers. Training programs for agricultural extension workers should focus on networks and social relationships to enhance social capital benefits. This relationship makes it easier for workers to work together, share information, and use new technology and best practices. By sharing information and the best ways to do things, Extension staff can learn about new technology and how to use it. This relationship fosters trust, a friendly environment, and employee engagement. By stressing social capital in agricultural extension and encouraging knowledge and resource sharing, Indonesian extension workers can adopt agricultural cyber extensions and perform better.

Future research based on individual motivation, social capital, agriculture cyber extension adoption, knowledge sharing, and agriculture extension worker performance in Indonesia, with an emphasis on social capital, includes: a) Studying how social capital, education, experience, and technology skills affect the adoption and usage of agricultural cyber extensions, b) Investigating social capital's role in agricultural innovation and extension worker performance, c) Investigating social capital's long-term impact on agricultural cyber extensions, and d) Assessing social capital-building and agricultural cyber extension strategies and programs. These opportunities for future research can give valuable information about the relationship between social capital, the adoption of agricultural cyber extensions, the sharing of knowledge, and the performance of extension workers. Research candidates can also help design policies and programs based on evidence to help Indonesian extension workers adopt and use agricultural cyber extensions.

Corresponding author:
Suswadi
Agribusiness Department, Agriculture Faculty, Tunas Pembangunan University
Surakarta Jalan Balekambang Lor No 1 Manahan Banjarsari 57139, Indonesia
E-mail: suswadi@lecture.utp.ac.id

References

[1] Agussabti, A., Rahmaddiansyah, R., Hamid, A. H., Zakaria, Z., Munawar, A. A. and Abu Bakar, B. (2022) "Farmers' perspectives on the adoption of smart farming technology to support food farming in Aceh Province, Indonesia", *Open Agriculture*, Vol. 7, No. 1, p. 857-870. E-ISSN 2391-9531. DOI 10.1515/opag-2022-0145.

[2] Ayisi Nyarko, D. and Kozári, J. (2021) "Information and communication technologies (ICTs) usage among agricultural extension officers and its impact on extension delivery in Ghana", *Journal of the Saudi Society of Agricultural Sciences*, Vol. 20, No. 3, pp. 164-172. ISSN 1658-077X. DOI 10.1016/j.jssas.2021.01.002.

[3] Bermejo-Caja, C. J., Koatz, D., Orrego, C., Perestelo-Pérez, L., González-González, A. I., Ballester, M., Pacheco-Huergo, V., Rey-Granado, Y. del, Muñoz-Balsa, M., Ramírez-Puerta, A. B., Yolanda Canellas-Criado, Pérez-Rivas, F. J., Toledo-Chávarri, A., Martínez-Marcos, M. and Group, E.-M. (2019) "Acceptability and feasibility of a virtual community of practice to primary care professionals regarding patient empowerment: a qualitative pilot study", *BMC Health Services Research*, Vol. 19, No. 1, pp. 1-10. ISSN 1472-6963. DOI 10.1186/s12913-019-4185-z.

[4] Caffaro, F., Cremasco, M. M., Roccato, M. and Cavallo, E. (2020) "Drivers of farmers' intention to adopt technological innovations in Italy: The role of information sources, perceived usefulness, and perceived ease of use", *Journal of Rural Studies*, Vol. 76, pp. 264-271. ISSN 0743-0167. DOI 10.1016/j.jrurstud.2020.04.028.

[5] Chandra-Mouli, V. and Akwara, E. (2020) "Improving access to and use of contraception by adolescents: what progress has been made, what lessons have been learnt, and what are the implications for action?", *Best Practice & Research Clinical Obstetrics & Gynaecology*, Vol. 66, pp. 107-118. ISSN 1521-6934. DOI 10.1016/j.bpobgyn.2020.04.003.

[6] Cimini, C., Boffelli, A., Lagorio, A., Kalchschmidt, M. and Pinto, R. (2020) "How do industry 4.0 technologies influence organisational change? An empirical analysis of Italian SMEs", *Journal of Manufacturing Technology Management*, Vol. 32, No. 3, pp. 695-721. ISSN 1741-038X. DOI 10.1108/JMTM-04-2019-0135.

[7] Colussi, J., Morgan, E. L., Schnitkey, G. D. and Padula, A. D. (2022) "How Communication Affects the Adoption of Digital Technologies in Soybean Production: A Survey in Brazil", *Agriculture*, Vol. 12, No. 5, 611 p. ISSN 2077-0472. DOI 10.3390/agriculture12050611.

[8] Dharmawan, L., Muljono, P., Hapsari, D. R. and Purwanto, B. P. (2021) "Digital information development in agriculture extension in facing new normal era during COVID-19 pandemics", *Journal of Hunan University Natural Sciences*, Vol. 47, No. 12. ISSN 1674-2974.

[9] Ertiaei, F., Rezvanfar, A., Hejazi, S. Y. and Alambaigi, A. (2022) "Developing an organizational health model for the agricultural extension structure of Iran", *The Journal of Agricultural Education and Extension*, Vol. 28, No. 1, p. 21-44. E-ISSN 1750-8622, ISSN 1389-224X. DOI 10.1080/1389224x.2021.1888758.

[10] Fabregas, R., Kremer, M. and Schilbach, F. (2019) "Realizing the potential of digital development: The case of agricultural advice", *Science,* Vol. 366, No. 6471, p. eaay3038. E-ISSN 1095-9203. ISSN 0036-8075. DOI 10.1126/science.aay3038.

[11] Freeman, K. and Qin, H. (2020) "The Role of Information and Interaction Processes in the Adoption of Agriculture Inputs in Uganda", *Agronomy*, Vol. 10, No. 2, 202 p. E- ISSN 2073-4395. DOI 10.3390/agronomy10020202.

[12] Joshi, D. and Dhaliwal, R. K. (2019) "Utilization of social media by farming community: A case from Punjab state", *Indian Journal of Extension Education*, Vol. 5, No. 1, pp. 47-52. E-ISSN 2454-552X, ISSN 0537-1996.

[13] Kulikova, A. (2021) "Cyber norms: technical extensions and technological challenges", *Journal of Cyber Policy*, Vol. 6, No. 3, pp. 340-359. ISSN 2373-8871. DOI 10.1080/23738871.2021.2020316.

[14] Listiana, I., Efendi, I., Rahmat, A. and others. (2019) "The behavior of extension agents in utilizing information and technology to improve the performance of extension agents in Lampung Province", *Journal of Physics: Conference Series*, Vol. 1155, No. 1, p. 12004. E-ISSN 1742-6596, ISSN 1742-6588. DOI 10.1088/1742-6596/1155/1/012004.

[15] Listiana, I., Hudoyo, A., Prayitno, R. T., Mutolib, A., Yanfika, H. and Rahmat, A. (2020) "Adoption Level of Environmentally Friendly Paddy Cultivated Innovation in Pringsewu District, Lampung Province, Indonesia", *Journal of Physics: Conference Series*, Vol. 1467, No. 1, p. 012025. E-ISSN 1742-6596, ISSN 1742-6588. DOI 10.1088/1742-6596/1467/1/012025.

[16] Madonna, M., Amanah, S., Sumardjo, S. and Anwas, E. O. M. (2022) "Mobilization of Cyber Extension Participants to Build Household Food Security", *Jurnal Penelitian Pendidikan IPA*, Vol. 8, Special Issue, pp. 67-75. E-ISSN 2407-795X, ISSN 2460-2582. DOI 10.29303/jppipa.v8iSpecialIssue.2479.

[17] Mapiye, O., Makombe, G., Molotsi, A., Dzama, K. and Mapiye, C. (2021) "Towards a revolutionized agricultural extension system for the sustainability of smallholder livestock production in developing countries: The potential role of icts", *Sustainability*, Vol. 13, No. 11, p. 5868. ISSN 2071-1050. DOI 10.3390/su13115868.

[18] Maulu, S., Hasimuna, O. J., Mutale, B., Mphande, J. and Siankwilimba, E. (2021) "Enhancing the role of rural agricultural extension programs in poverty alleviation: A review", *Cogent Food & Agriculture*, Vol. 7, No. 1, p. 1886663. ISSN 2331-1932. DOI 10.1080/23311932.2021.1886663.

[19] Nayal, K., Raut, R., Priyadarshinee, P., Narkhede, B. E., Kazancoglu, Y. and Narwane, V. (2022) "Exploring the role of artificial intelligence in managing agricultural supply chain risk to counter the impacts of the COVID-19 pandemic", *The International Journal of Logistics Management*, Vol. 33, No. 3, p. 744-772. ISSN 0957-4093. DOI 10.1108/ijlm-12-2020-0493.

[20] Norton, G. W. and Alwang, J. (2020) "Changes in Agricultural Extension and Implications for Farmer Adoption of New Practices", *Applied Economic Perspectives and Policy*, Vol. 42, No. 1, p. 8-20. ISSN 1058-7195. DOI 10.1002/aepp.13008.

[21] Ortiz-Crespo, B., Steinke, J., Quirós, C. F., van de Gevel, J., Daudi, H., Gaspar Mgimiloko, M. and van Etten, J. (2021) "User-centred design of a digital advisory service: enhancing public agricultural extension for sustainable intensification in Tanzania", *International Journal of Agricultural Sustainability*, Vol. 19, No. 5-6, pp. 566-582. E-ISSN 1747-762X, ISSN 1473-5903. DOI 10.1080/14735903.2020.1720474.

[22] Pratiwi, A. and Suzuki, A. (2017) "Effects of farmers' social networks on knowledge acquisition: Lessons from agricultural training in rural Indonesia", *Journal of Economic Structures*, Vol. 6, No. 1, pp. 1-23. ISSN 2193-2409. DOI 10.1186/s40008-017-0069-8.

[23] Purwanto, A. and Sudargini, Y. (2021) "Partial least squares structural squation modeling (PLS-SEM) analysis for social and management research: a literature review", *Journal of Industrial Engineering & Management Research*, Vol. 2, No. 4, pp. 114-123. ISSN 2722-8878.

[24] Ramayah, T. and Lo, M.- C. (2007) "Impact of shared beliefs on ´perceived usefulness´ and ´ease of use´ in the implementation of an enterprise resource planning system", *Management Research News*, Vol. 30, No. 6, pp. 420-431. ISSN 0140-9174. DOI 10.1108/01409170710751917.

[25] Roque, A. D., Pijawka, D. and Wutich, A. (2020) "The Role of Social Capital in Resiliency: Disaster Recovery in Puerto Rico. Risk", *Hazards & Crisis in Public Policy*, Vol. 11, No. 2, p. 204-235. ISSN 1944-4079. DOI /10.1002/rhc3.12187.

[26] Saadé, R. and Bahli, B. (2005) "The impact of cognitive absorption on perceived usefulness and perceived ease of use in online learning: an extension of the technology acceptance model", *Information & Management*, Vol. 42, No. 2, pp. 317-327. ISSN 0378-7206. DOI 10.1016/j.im.2003.12.013.

[27] Sabir, S., Sugiyanto, S., Sukesi, K. and Yuliati, Y. (2019) "The strategy for implementing agricultural extension based on cyber extension in Malang Raya Region", *Indonesia. Habitat*, Vol. 30, No. 1, pp. 8-15. ISSN 2338-2007. DOI 10.21776/ub.habitat.2019.030.1.2.

[28] Steinke, J., van Etten, J., Müller, A., Ortiz-Crespo, B., van de Gevel, J., Silvestri, S. and Priebe, J. (2021) "Tapping the full potential of the digital revolution for agricultural extension: an emerging innovation agenda", *International Journal of Agricultural Sustainability*, Vol. 19, No. 5-6, pp. 549-565. E-ISSN 1747-762X, ISSN 1473-5903. DOI 10.1080/14735903.2020.1738754.

[29] Takahashi, K., Muraoka, R. and Otsuka, K. (2020) "Technology adoption, impact, and extension in developing countries' agriculture: A review of the recent literature", *Agricultural Economics*, Vol. 51, No. 1, pp. 31-45. ISSN 1477-9552. DOI 10.1111/agec.12539.

[30] Tanveer, A., Zeng, S., Irfan, M. and Peng, R. (2021) "Do Perceived Risk, Perception of Self-Efficacy, and Openness to Technology Matter for Solar PV Adoption? An Application of the Extended Theory of Planned Behavior", *Energies*, Vol. 14, No. 16, p. 5008. ISSN 1996-1073. DOI 10.3390/en14165008.

[31] Utami, C. W., Indrianto, A. T. L. and Pratama, I. (2019) "Agricultural Technology Adoption in Indonesia: The Role of the Agriculture Extension Service, the Rural Financing and the Institutional Context of the Lender", *International Journal of Innovation, Creativity and Change*, Vol. 7, No. 7, pp. 258-276. E-ISSN 2201-1323.

[32] Wang, W., Kang, S.-W. and Choi, S. B. (2021) "Effects of Employee Well-Being and Self-Efficacy on the Relationship between Coaching Leadership and Knowledge Sharing Intention: A Study of UK and US Employees", *International Journal of Environmental Research and Public Health*, Vol. 18, No. 20, p. 10638. E-ISSN 1660-4601. DOI 10.3390/ijerph182010638.

[33] Wijaya, A. S., Sarwoprasodjo, S. and Febrina, D. (2019) "Cyber Extension: Penggunaan Media dan Kelancaran Pencarian Informasi di Kalangan Penyuluh Pertanian Kabupaten Bogor", *Jurnal Komunikasi Pembangunan*, Vol. 17, No. 2, pp. 114-123. E-ISSN 2442-4102, ISSN 1693-3699. DOI 10.46937/1720192684. (In Indonesian).