ASIA AND THE PACIFIC
FOOD SECURITY FORUM 2024
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Rural and Agricultural Development in the Digital Age

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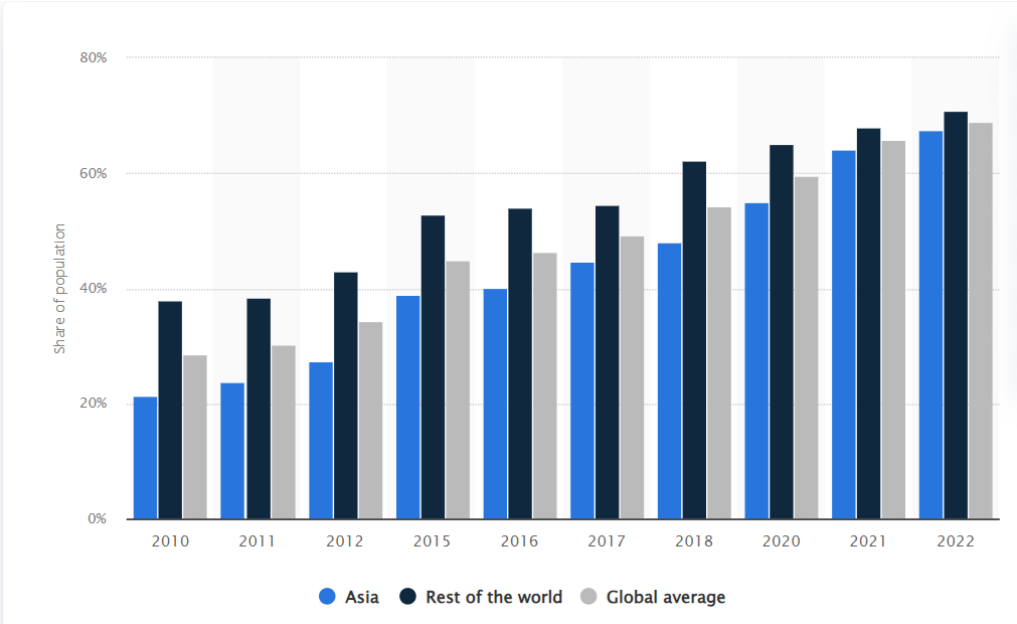
- Information and communication technologies (ICTs) – broadly defined as the internet, phones, computers, tablets, platforms, networks, software applications, and databases – are ubiquitous and influence our day-to-day lives.

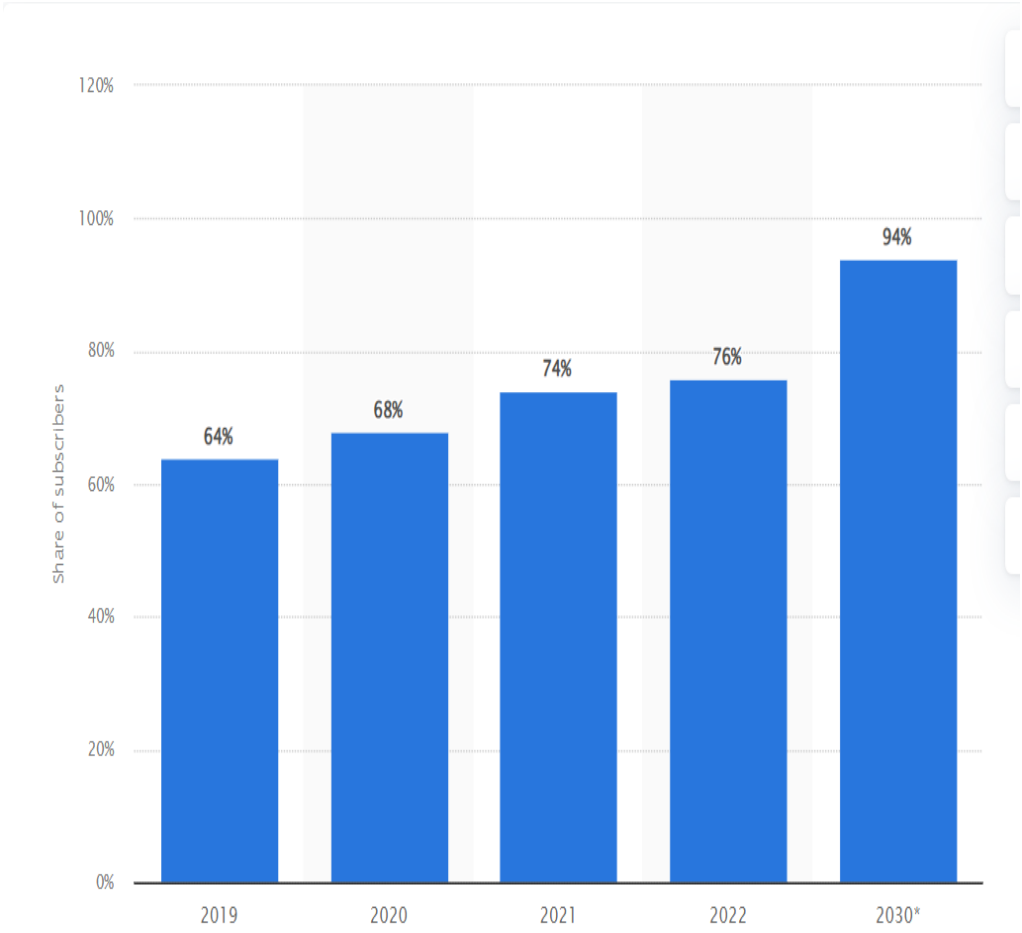
- The proliferation of ICTs has transformed markets, governments, and households.

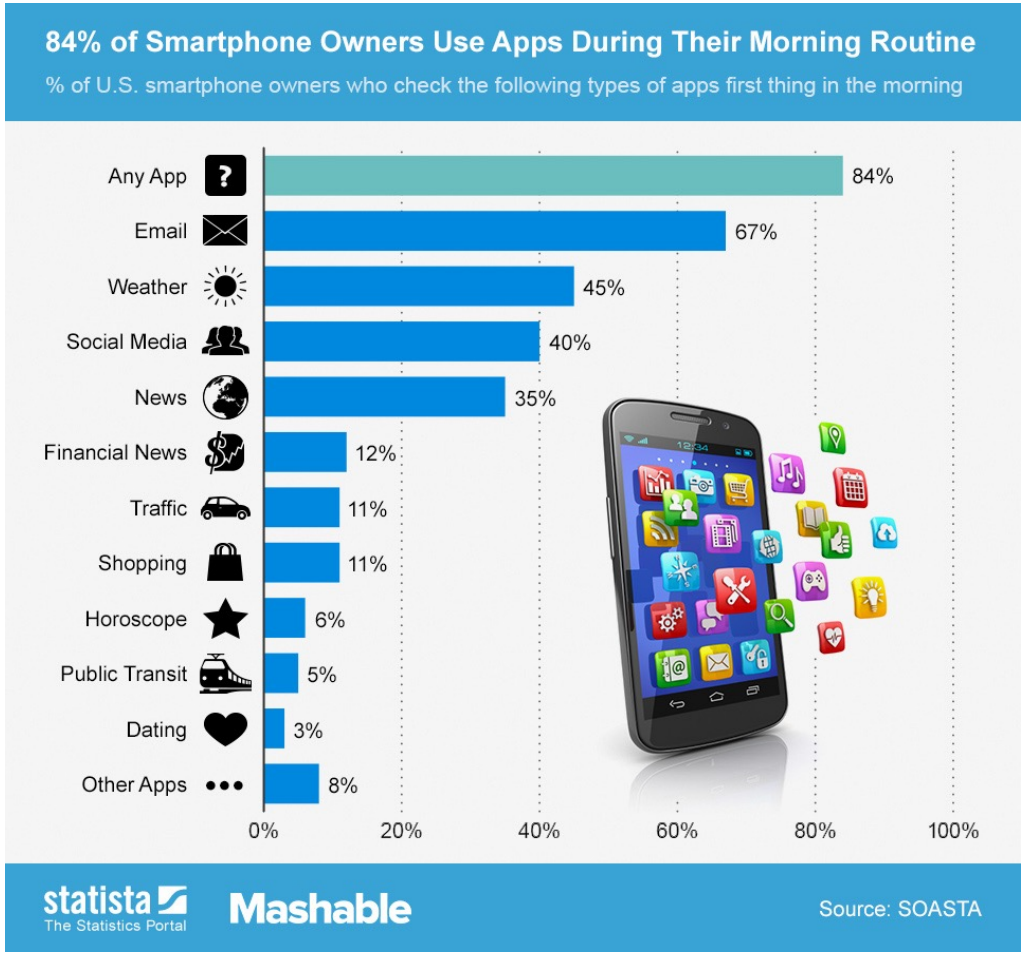
- Access to and use of ICTs has increased considerably in recent decades in rural areas of developing and transition countries.



Source: Statista 2024

Figure 1 Internet penetration rate in Asia compared to the global penetration rate from 2010 to 2022





Source: Statista 2024

Figure 2 Adoption rate of smartphones in the Asia-Pacific region from 2019 to 2022, with a forecast for 2030

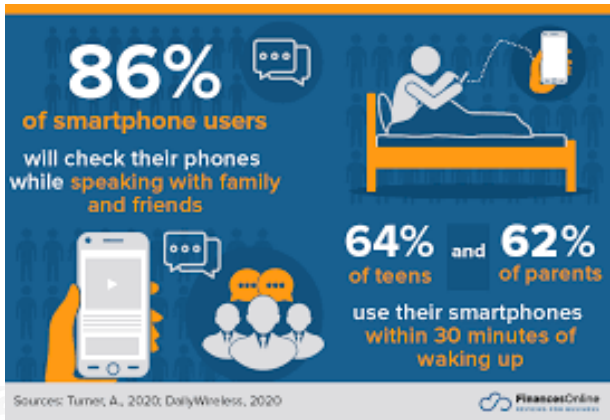
ICTs have impacts on rural and agricultural development

internet use

- stimulates farmers' adoption of agricultural technologies and practices (Ma and Wang, 2020; Yuan et al., 2021; Zhou et al., 2023);
- increases farm productivity and technical efficiency of crop production (Kaila and Tarp, 2019; Zheng et al., 2021);
- improves food and nutrition security (Ankrah Twumasi et al., 2021);
- reduces rural poverty (Mora-Rivera and García-Mora, 2021; Nguyen et al., 2022).

The usage of smartphones and apps

- promotes rural labour mobility (Hartje and Hübler, 2017);
- increases gains obtained from agricultural production and marketing (Bounkham et al., 2022; Zheng and Ma, 2023);
- improves rural farmers' subjective well-being (Nie et al., 2021);
- facilitates rural economic transformation (Min et al., 2020).



ICTs have impacts on rural and agricultural development

ICT adoption

- contributes to the achievement of the Sustainable Development Goals of the United Nations (Andersson and Hatakka, 2023; Prieto-Egido et al., 2023);
- helps diversify rural income (Leng et al., 2020);
- Improves the psychological health of rural farmers (Zhu et al., 2020);
- stimulates rural entrepreneurship (Barnett et al., 2019; Geng and Xue, 2023);
- smoothens rural consumption expenditure (Zhu et al., 2022);
- promotes environmental sustainability (Shobande and Ogbeifun, 2022).

Research Gaps

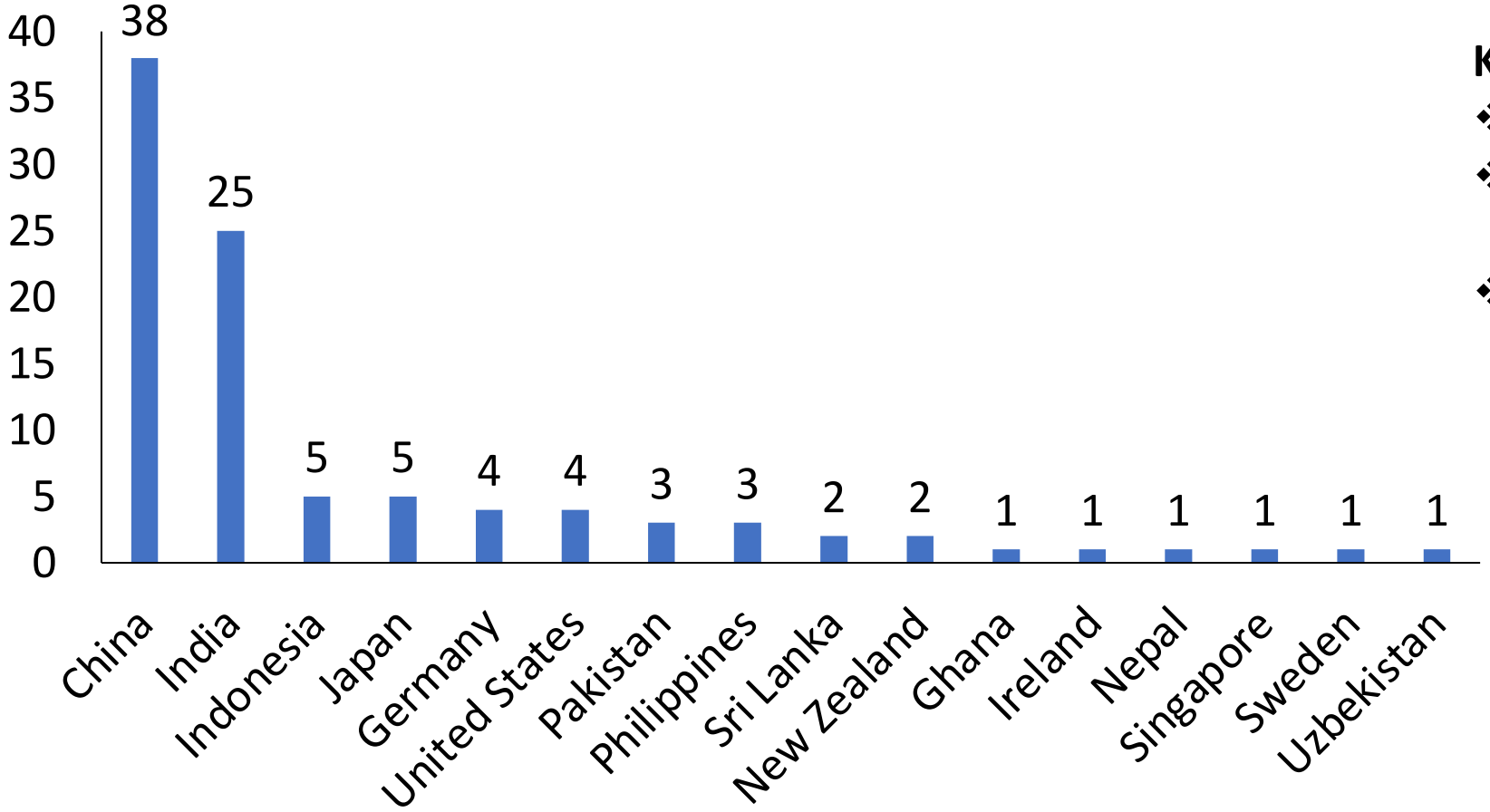
Examples:

1) It is unclear whether smartphone use can make a difference in empowering rural women in low- and middle-income countries
2) Little is known about the effects of smartphone-based extension services on agricultural development.
3) It is unclear how internet use influences rural household consumption diversity and farm productivity and how ICT adoption affects the poverty of vulnerable rural households.
4) No previous studies have attempted to understand the association between ICT adoption and farmers' participation in high-value chains.

Journal Special Issue (Review of Development Economics) in 2022: Rural and Agricultural Development in the Digital Age

Collaborators: ADBI; Lincoln University (New Zealand); University of Sussex (UK)

Guest editors: WanglinMa; Andy McKay; Dil Rahut; Tetsushi Sonobe



Key information:

- 97 manuscripts
- 16 countries (10 Asian countries)
- 65% from China and India

Figure 3 Distributions of 97 received manuscripts by submitting authors' countries

Virtual International Conference: Rural and Agricultural Development in the Digital Age

Dates: 8-10 and 12 August 2022

The topics of the selected papers:

- Internet use
- Smartphone use
- ICT adoption
- E-commerce adoption

Key information:

- 28 manuscripts
- 11 countries (6 Asian countries)
- Three outstanding keynote speakers
  - Prof. Michael Robert Kremer (University of Chicago)
  - Prof. Jikun Huang (Peking University)
  - Prof. Edward Barbier (Colorado State University)

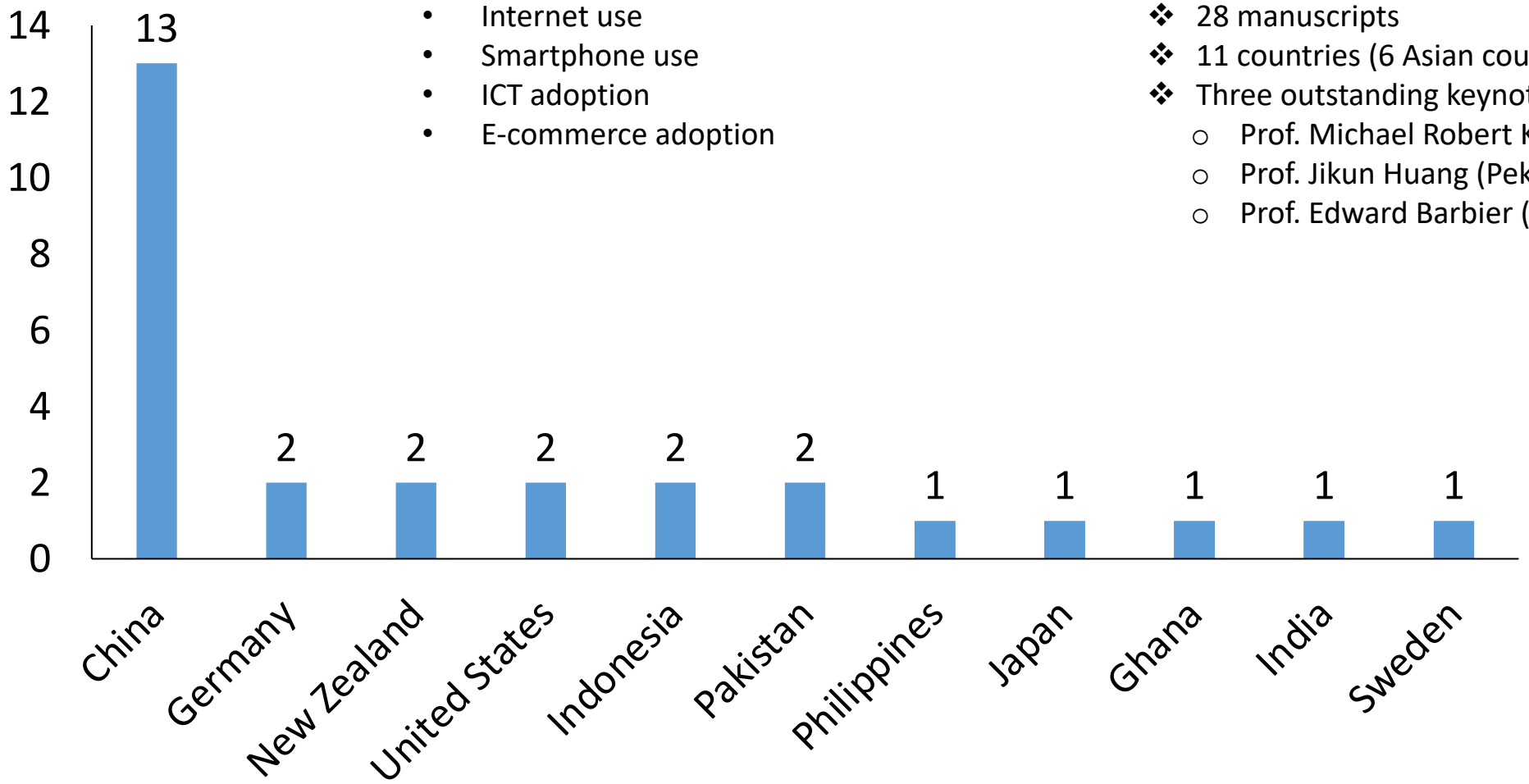


Figure 4 Distributions of 28 selected conference papers by corresponding authors' countries

Key findings of the Special Issue (9 papers)

(1) Internet use increases rural consumption diversity and agricultural productivity;

(2) Smartphone use empowers rural women in household decision-making and off-farm work participation;

(3) Smartphone-based agricultural extension services boost rural income growth;

(4) A lack of ICT infrastructure and inadequate skills to use digital technologies are two key factors that lead to digital poverty traps for smallholder rural farmers;

(5) ICT adoption increases the probability of rural households' access to credit and empowers rural women and farm households in relatively less developed regions to access credit;

(6) Digital financial inclusion reduces farmers' vulnerability to poverty;

(7) E-commerce adoption increases both sales prices and marketing costs, but the magnitude of increasing the former is higher than the magnitude of increasing the latter, which finally contributes to a higher gross return.

Rural Development in the Digital Age: Does ICT Adoption Contribute to Credit Access and Income Growth in Rural China

Wanglin Ma[1], Huanguang Qiu[2] and Dil Rahut [3]

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Research objectives

- To analyse the impact of ICT adoption on access to credit;
- To assess the joint effects of ICT adoption and access to credit on household income;

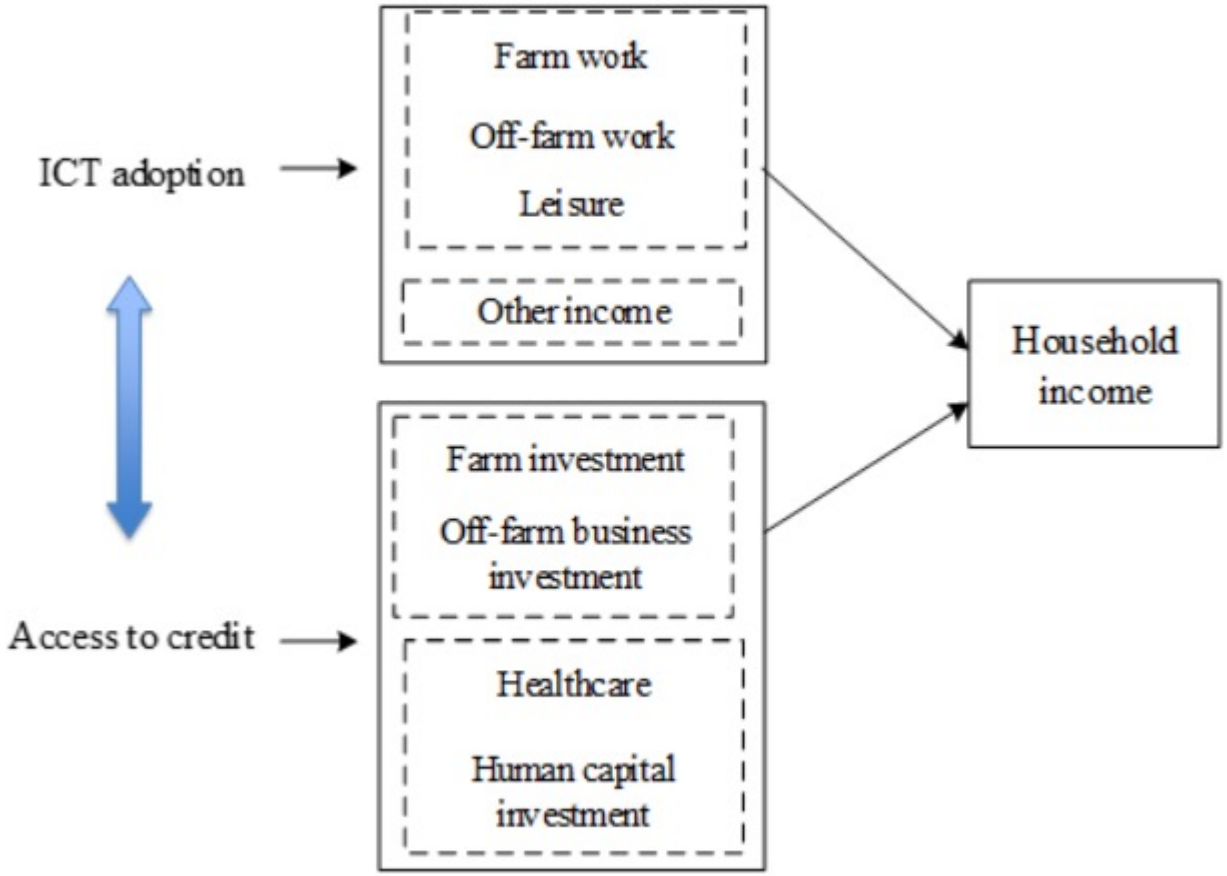


Figure 5 Potential relationship between ICT adoption, access to credit, and household income

Objective 1:
To estimate the impact of ICT adoption on access to credit

Recursive bivariate probit (RBP) model

The RBP model estimates two equations:

ICT adoption equation: $I_i^* = \eta_i X_i + \xi_i Z_i + \tau_i, I_i = \begin{cases} 1, & if\ I_i^* > 0 \\ 0, & \text{otherwise} \end{cases}$ (1)

Access to credit equation: $C_i^* = \alpha_i I_i + \beta_i X_i + \varepsilon_i, C_i = \begin{cases} 1, & if\ C_i^* > 0 \\ 0, & \text{otherwise} \end{cases}$ (2)

Objective 2:
To estimate the joint effects of ICT adoption and access to credit on household income

We assume that household income is a function of the ICT adoption variable, access to credit variable, and a vector of explanatory variables as follows:

$$Y_i = \gamma_i I_i + \delta_i C_i + \varphi_i X_i + \varpi_i \quad (3)$$

Endogeneity issues of ICT adoption variable (I_i) and access to credit variable (C_i).

A two-stage selectivity-corrected OLS model is used.

Stage 1: Estimating a seemingly unrelated bivariate probit (SUBP) model

ICT adoption equation: $I_i^* = \eta_i X_i + \xi_i Z_i + \tau_i \quad (4a)$

Access to credit equation: $C_i^* = \beta_i X_i + \vartheta_i M_i + \upsilon_i \quad (4b)$

Stage 2: Replacing endogenous variables in equation (3) with the predicted values obtained from stage 1

$$Y_i = \zeta_i I_i' + \lambda_i C_i' + \psi_i X_i + \omega_i \quad (5)$$

Table 1 Marginal effects of ICT adoption on access to credit

	RBP model		Probit model
Variables	ICT adoption	Access to credit	Access to credit
ICT adoption		0.128 (0.033)***	0.033 (0.012)***
Age	-0.004 (0.002)*	0.009 (0.002)***	0.008 (0.002)***
Age squared	-0.000 (0.000)*	-0.000 (0.000)***	-0.000 (0.000)***
Gender	-0.053 (0.010)***	0.005 (0.011)	-0.001 (0.011)
Primary school	0.040 (0.014)***	-0.016 (0.015)	-0.011 (0.015)
Middle-level school	0.123 (0.014)***	-0.050 (0.017)***	-0.035 (0.016)**
College and above	0.186 (0.036)***	-0.106 (0.035)***	-0.088 (0.035)**
Farm labor	0.018 (0.005)***	0.022 (0.005)***	0.023 (0.005)***
Car ownership	0.210 (0.014)***	-0.044 (0.017)***	-0.020 (0.015)
Indoor toilet	0.092 (0.010)***	-0.001 (0.012)	0.011 (0.011)
Pension	-0.060 (0.018)***	-0.067 (0.020)***	-0.072 (0.020)***
Soil quality	-0.036 (0.009)***	-0.008 (0.011)	-0.014 (0.011)
Specialization	0.057 (0.020)***	0.044 (0.022)**	0.051 (0.022)**
Central	0.022 (0.012)*	-0.046 (0.014)***	-0.044 (0.014)***
East	0.028 (0.012)**	-0.153 (0.013)***	-0.142 (0.013)***
IV	0.601 (0.022)***		
Observations	7,771		7,771

Standard errors in parentheses; $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$; The reference region is west. The reference education level is illiteracy.

Table 2 Disaggregated marginal effects of ICT adoption on access to credit by gender and geographic locations

	Category	Observations	Marginal effects
Gender	Male	4,435	0.130 (0.041)***
	Female	3,336	0.146 (0.056)***
Geographic locations	West (underdeveloped)	2,410	0.318 (0.088)***
	Central (middle-income region)	2,091	0.202 (0.061)***
	East (developed)	3,270	0.031 (0.062)

Standard errors in parentheses; * $p < 0.1$, *** $p < 0.01$

Two-stage selectivity-corrected OLS model

Table 3 SUBP model estimation (Stage 1)

Variables	ICT adoption (Coefficients)	Access to credit (Coefficients)
Age	-0.013 (0.007)*	0.023 (0.006)***
Age squared	-0.000 (0.000)*	-0.000 (0.000)***
Gender	-0.188 (0.035)***	-0.007 (0.032)
Primary school	0.143 (0.049)***	-0.029 (0.045)
Middle-level school	0.431 (0.051)***	-0.087 (0.047)*
College and above	0.655 (0.126)***	-0.243 (0.101)**
Farm labor	0.060 (0.016)***	0.068 (0.016)***
Car ownership	0.729 (0.049)***	-0.036 (0.044)
Indoor toilet	0.317 (0.034)***	0.045 (0.032)
Pension	-0.209 (0.062)***	-0.213 (0.059)***
Soil quality	-0.122 (0.033)***	-0.048 (0.031)
Specialization	0.200 (0.070)***	0.154 (0.063)**
Location dummies	Yes	Yes
IV1 (average number of other adopters)	2.077 (0.087)***	
IV2 (Gift money)		-0.001 (0.000)*
Constant	-0.493 (0.184)***	-0.399 (0.157)**
$\rho'_{\tau\varepsilon}$	0.037(0.022)*	
Wald test of $\rho'_{\tau\varepsilon}$=0	2.957, Prob>chi2=0.086	
Observations	7,771	

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; The reference region is west. The reference education level is illiteracy.

Table 4 Joint effects of ICT adoption and access to credit on household income (stage 2)

Variables	Selectivity-corrected OLS
ICT adoption (predicted)	2.907 (0.358)***
Access to credit (predicted)	-8.976 (3.971)**
Age	0.324 (0.109)***
Age squared	-0.004 (0.002)***
Gender	0.374 (0.312)
Primary school	-1.157 (0.433)***
Middle-level school	-0.880 (0.584)
College and above	2.400 (1.344)*
Farm labor	-0.628 (0.302)**
Car ownership	4.984 (0.521)***
Indoor toilet	2.046 (0.376)***
Pension	-0.189 (0.986)
Soil quality	-0.438 (0.353)
Specialization	2.974 (0.872)***
Location dummies	Yes
Constant	1.581 (2.184)
Observations	7,771

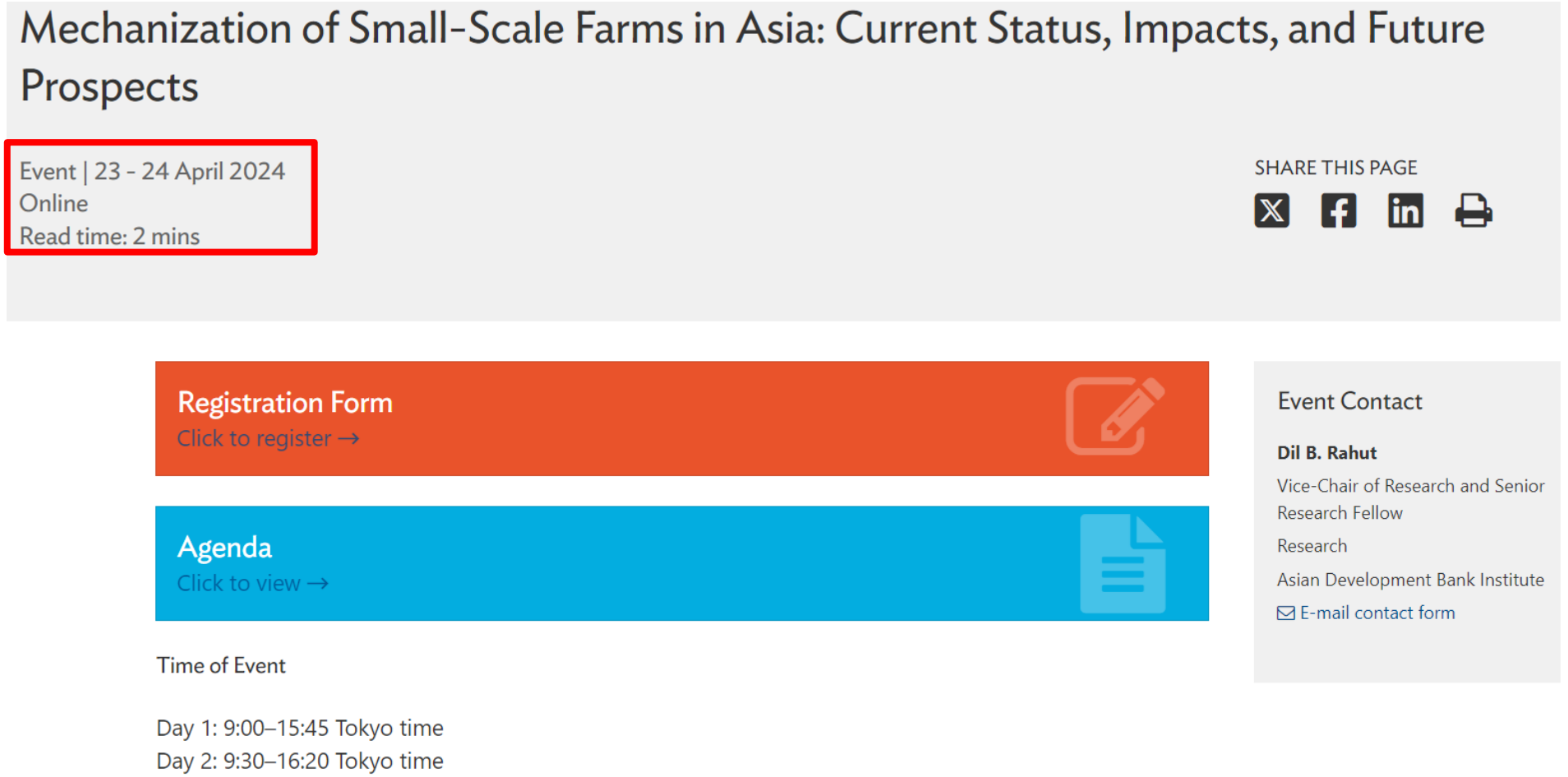
Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; The reference region is west; The dependent variable refers to household income, which is measured at 1,000 Yuan/capita. The reference education level is illiteracy.

Main findings

- ICT adoption increases the probability of credit access by 13%.
- ICT adoption empowers rural women and farm households in the relatively less developed regions to access to credit
- ICT adoption significantly increases household income, but access to credit significantly decreases it.

Forthcoming Conference: All welcome!

Guest editors: Wanglin Ma; Dil Rahut; Tetsushi Sonobe
Collaborators: ADBI and Lincoln University (New Zealand)
Outcome: ADBI-edited book



Forthcoming Special Issues and Conferences: Looking forward to your submissions

Theme 1 (posted online): E-Commerce for Rural and Agricultural Development
Journal: Electronic Commerce Research (IF=3.9; Q1)
Guest editors: Wanglin Ma and Dil Rahut
Collaborators: ADBI; Lincoln University (New Zealand)
Deadline: 25 July 2024
Conference type: Virtual

Theme 2 (coming online soon): Inequality and Development in Rural Asia
Journal: Review of Development Economics (IF=1.6; Q2)
Guest editors: Wanglin Ma; Andy McKay; Dil Rahut; Aya Suzuki; Tetsushi Sonobe
Collaborators: ADBI; Lincoln University (New Zealand); University of Sussex (UK); University of Tokyo (Japan)
Conference type: Hybrid; tentatively in Tokyo

Theme 3 (coming online soon): Circular Bioeconomy for Sustainable Agriculture and Agri-food Systems in Asia
Journal: Australian Journal of Agricultural and Resource Economics (IF=3.2; Q1)
Guest editors: Wanglin Ma; Johannes Sauer; Dil Rahut; Tetsushi Sonobe
Collaborators: ADBI; Lincoln University (New Zealand); University of Munich (Germany)
Conference type: Hybrid; tentatively in Tokyo

Thank you!