



Social system to support innovation adoption on dairy farming in Indonesia

Ibnu Budiman, Marjolein Derks, Sahara, Eko Cahyadi, Annemarie Wagemakers

Wageningen University and Research, IPB

Ibnu.Budiman@wur.nl

Background

- Many related studies are often concentrated on **individual** adoption **determinants** (Klerkx, Jakku, & Labarthe, 2019), and rely only on a predictive association, in Europe, North America, Australia, NZ (Caffaro, Roccato, Micheletti Cremasco, & Cavallo, 2019; Pierpaoli et al., 2013). > lack of answer to **How and Why**...and of studies in Southeast Asia (with different socio-cultural factors)
- There was a **lack of consideration for non-individual determinants and systemic (socio-institutional) issues** such as the role of (rural) stakeholders' networks and context of **interactions among adoption factors**.
 - Processes of (technology) innovation adoption are not linear and generally include a series of **feedback-loops/mechanisms** in the (social) system (Pathak et al., 2019).
- In Southeast Asia, limited resources on majority **small farmers** tend to make them often having less social interaction...

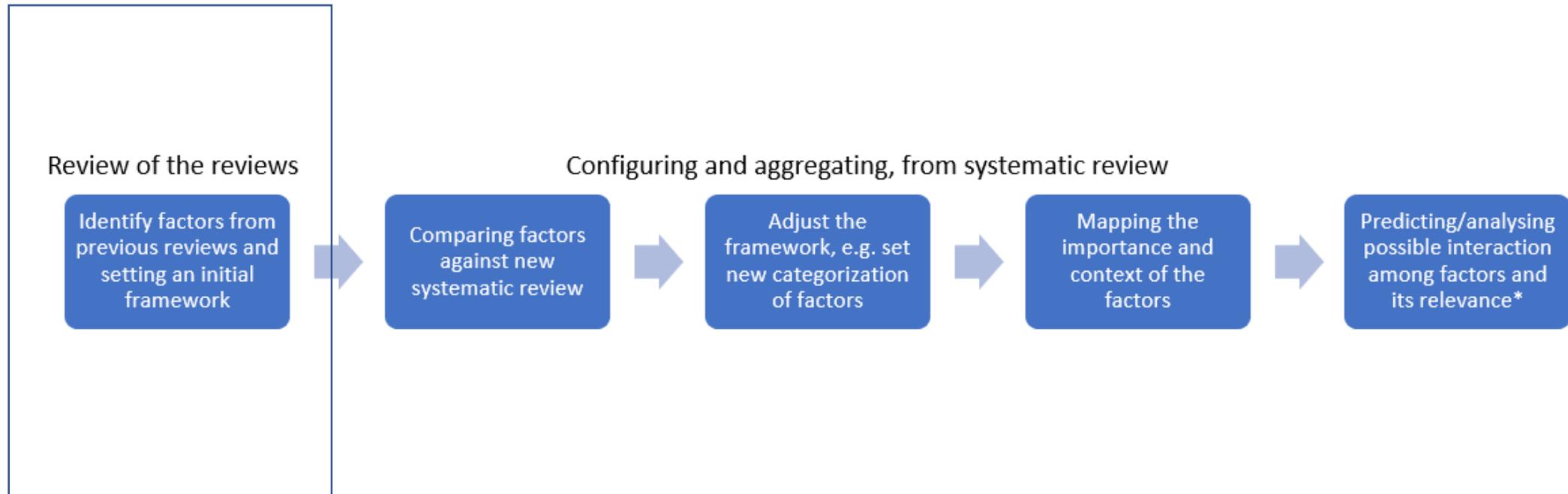


Review questions

What are socio-institutional factors/system that influence innovation adoption on (small) animal farms in Southeast Asia?

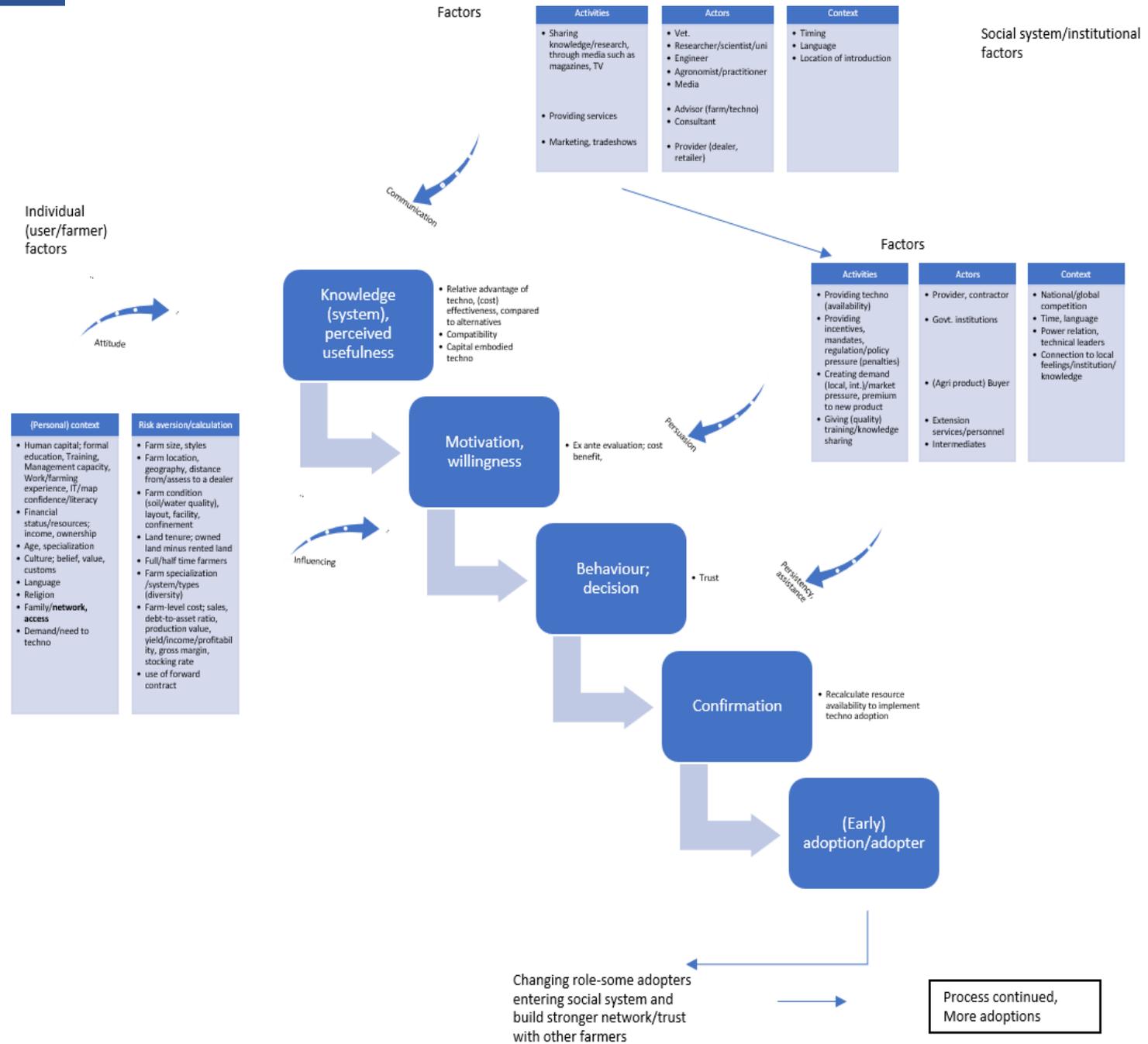
What is known about the interaction between factors?

Methods: Review processes



From 5 global review papers

Initial framework



Twenty-five factors - framework synthesis

Individual factors

- Human capital; formal education, Training, Management capacity, Work/farming experience, IT/map confidence/literacy
- Financial status/resources; income, ownership
- Age, specialization
- Culture; belief, value, customs
- Language
- Religion
- Family/network, access
- Demand/need to technology
- Farm size, styles
- Farm location, geography, distance from/assess to a dealer
- Farm condition; soil/water quality, layout, facility, confinement
- Land tenure; owned land minus rented land
- Job status; Full/half time farmers
- Farm specialization /system/types (diversity)
- Farm-level cost; sales, debt-to-asset ratio, production value, yield/income/profitability, gross margin, stocking rate
- Use of forward contract

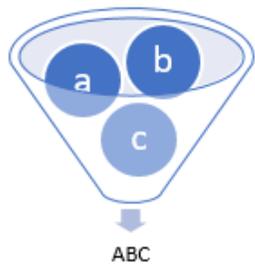
Socio-institutional factors

- Sharing knowledge/research, through media such as magazines, TV
- Providing (consultancy) services
- Marketing, tradeshow
- Provision of technology, availability, ease of use
- Providing incentives, mandates, regulation/policy pressure (penalties)
- Creating demand (local, international)/market pressure, premium price to new product
- Giving (quality) training/knowledge sharing
- Actor networks/interaction; cooperation/conflict, change agents

Methods: Systematic review

Review of the reviews

Identify factors from previous reviews and setting a framework



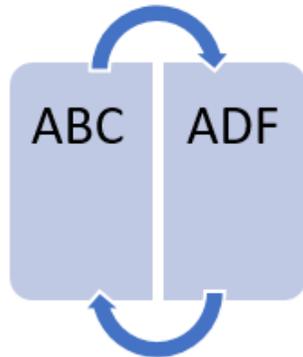
Configuring and aggregating, from systematic review

Comparing factors against new systematic review

Adjust the framework, e.g. set new categorization of factors

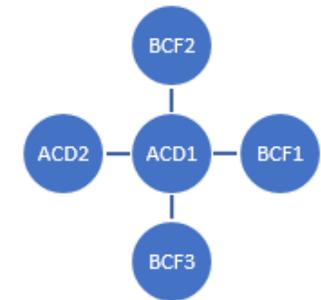
Mapping the importance and context of the factors

Predicting/analysing possible interaction among factors and its relevance*



ACD	BCF	CDG
•1	•1	•1
•2	•2	•2

	Level of importance	Country /techno /treatability
ACD	1	A, b
BCF	2	B, c



Systematic review to Southeast Asian cases

1 AND

- a. Livestock farming OR
- b. Inland fishery
- c. Dairy farming
- d. Livestock agriculture
- e. Livestock production
- f. Animal production

2 AND

- a. Technology adoption OR
- b. Technology uptake
- c. Technology transfer
- d. Technology diffusion
- e. Technology dissemination
- f. Adoption barriers
- g. Adoption factors
- h. Uptake barriers
- i. Uptake factors
- j. Innovation adoption

3

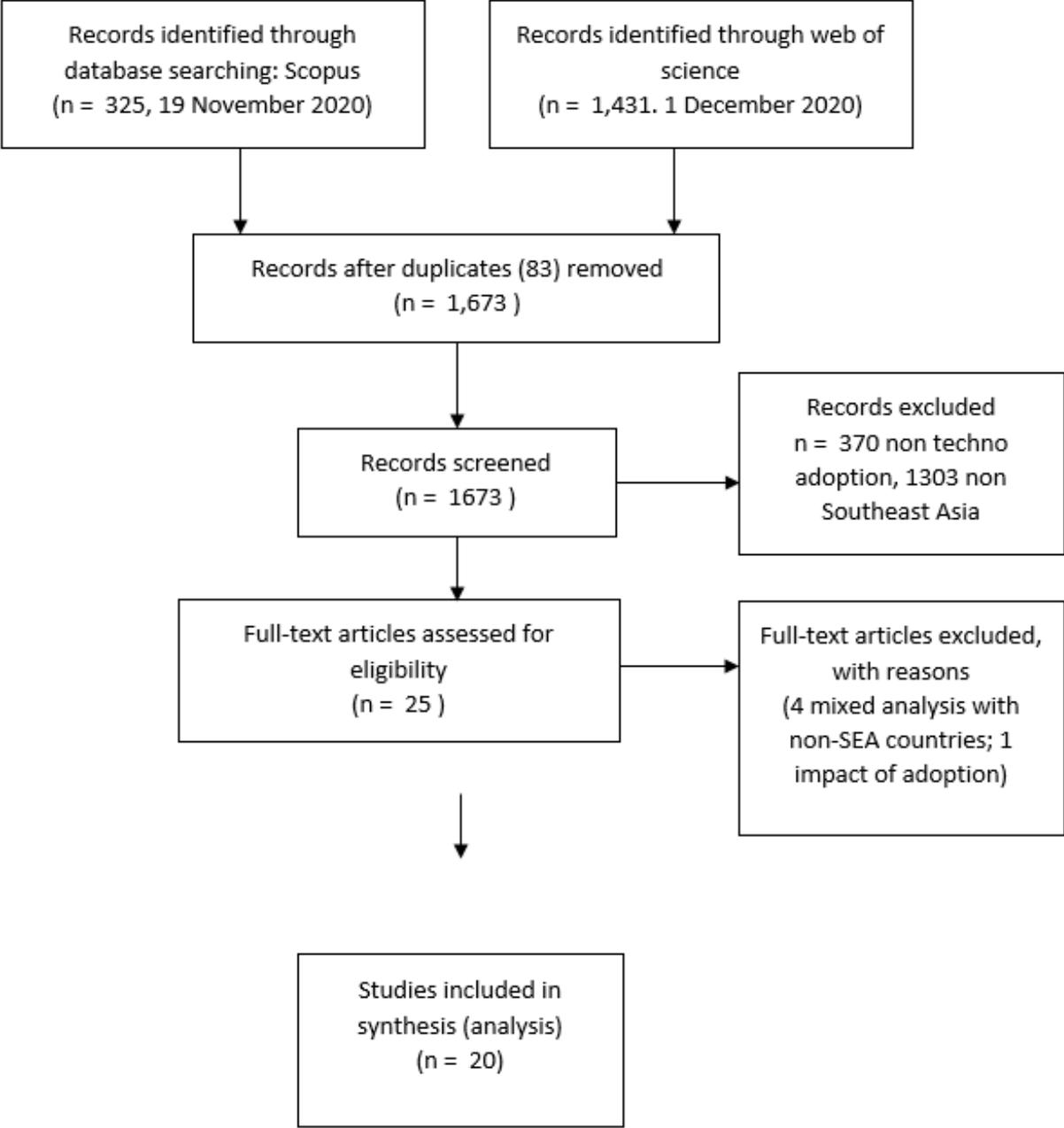
- a. Institution OR
- b. Mechanism
- c. Organization
- d. Actors
- e. Stakeholders
- f. Farmers
- g. Peasant
- h. Farmers behaviour
- i. Socio technical system/transition

1 (a OR b OR...) AND 2 (c OR d OR) AND 3 (e OR f OR)

Database (peer reviewed journal articles)	Search in	Return results
Scopus	Title, Abstract ,Keywords	325 , search done in 19 November 2020
Web of science	Title, Abstract ,Keywords/subject	1,431, done in 1 December 2020

Systematic review

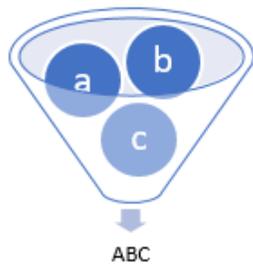
- Included if**
- Population: livestock farmers, smallholders, rural/livestock stakeholders
- Intervention: Setting/context of papers are on technology adoption/diffusion/dissemination (including its knowledge exchange) in livestock farming
- Comparison: adoption barriers/factors by farmers and/or social theories such as/related to social practice, stakeholders/farmers behaviour/behaviour change, systemic approach etc.
- Empirical papers with case studies located in South east Asia
- Year of publication after 2000



Data analysis

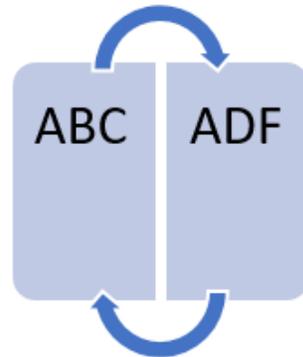
Review of the reviews

Identify factors from previous reviews and setting a framework



Configuring and aggregating, from systematic review

Comparing factors against new systematic review



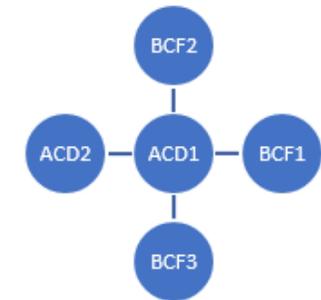
Adjust the framework, e.g. set new categorization of factors

ACD	BCF	CDG
•1	•1	•1
•2	•2	•2

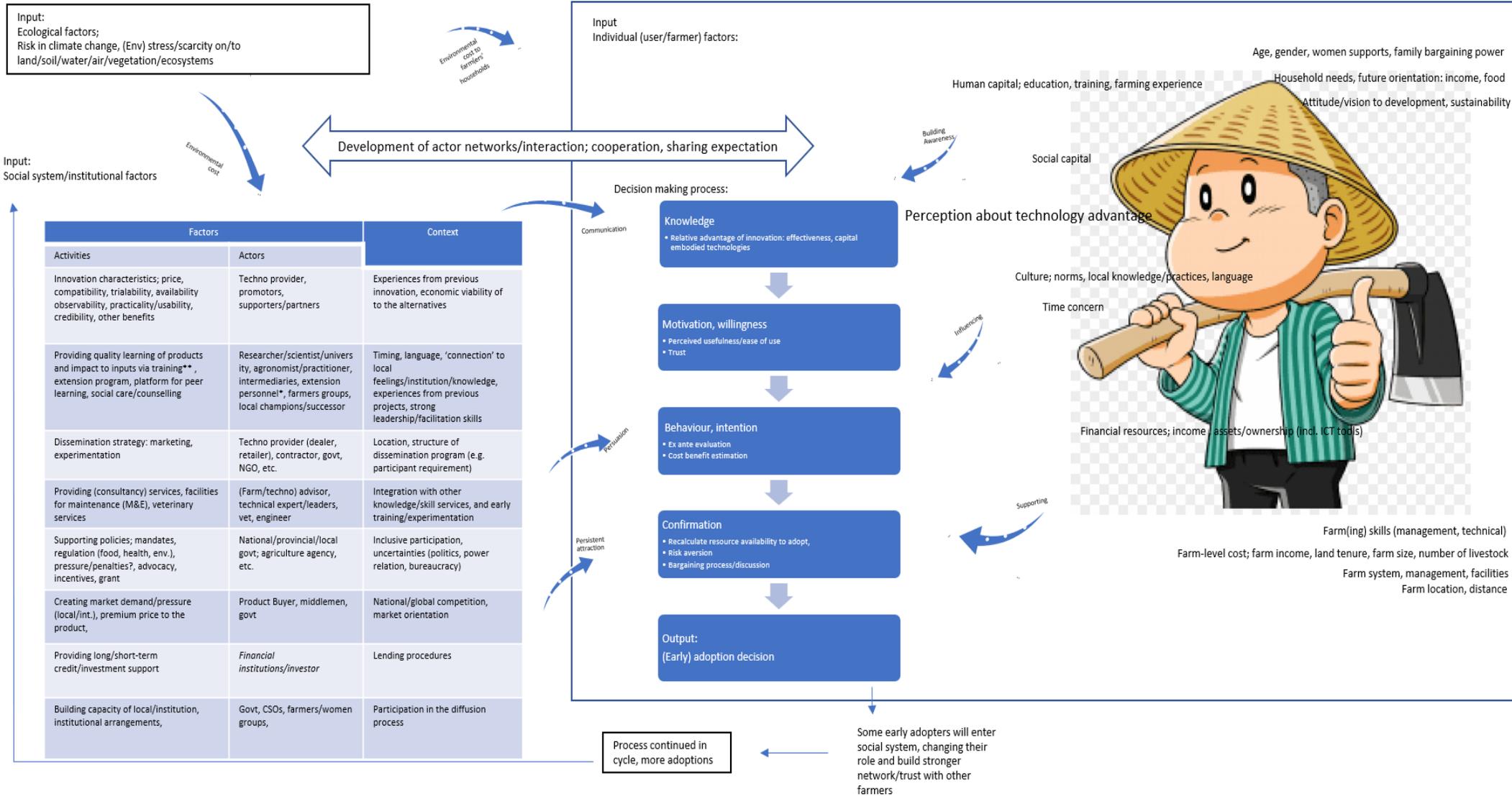
Mapping the importance and context of the factors

	Level of importance	Country /techno /treatability
ACD	1	A, b
BCF	2	B, c

Predicting/analysing possible interaction among factors and its relevance*

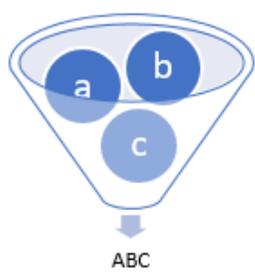


Results: 22 factors



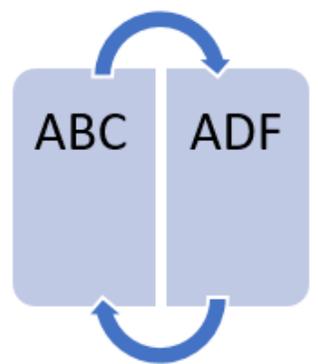
Review of the reviews

Identify factors from previous reviews and setting a framework



Configuring and aggregating, from systematic review

Comparing factors against new systematic review



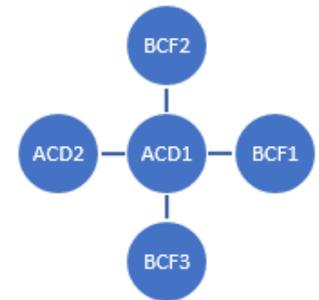
Adjust the framework, e.g. set new categorization of factors

ACD	BCF	CDG
•1	•1	•1
•2	•2	•2

Mapping the importance and context of the factors

	Level of importance	Country /techno /treatability
ACD	1	A, b
BCF	2	B, c

Predicting/analysing possible interaction among factors and its relevance*



Ecological determinants; climate risk,
Pressures to land/soil/water/air/species/ecosystems

Institutional factors

Environmental cost to farm(ers' households)

Development of actor networks/interaction; cooperation, sharing expectation

Environmental cost

Innovation characteristics Price, compatibility, practicality, credibility, benefits
• Techno providers, promoters

Learning platforms Extension program, peer group, experimentation, M-E
• Extension personnel, farmers groups/cooperatives, successor,

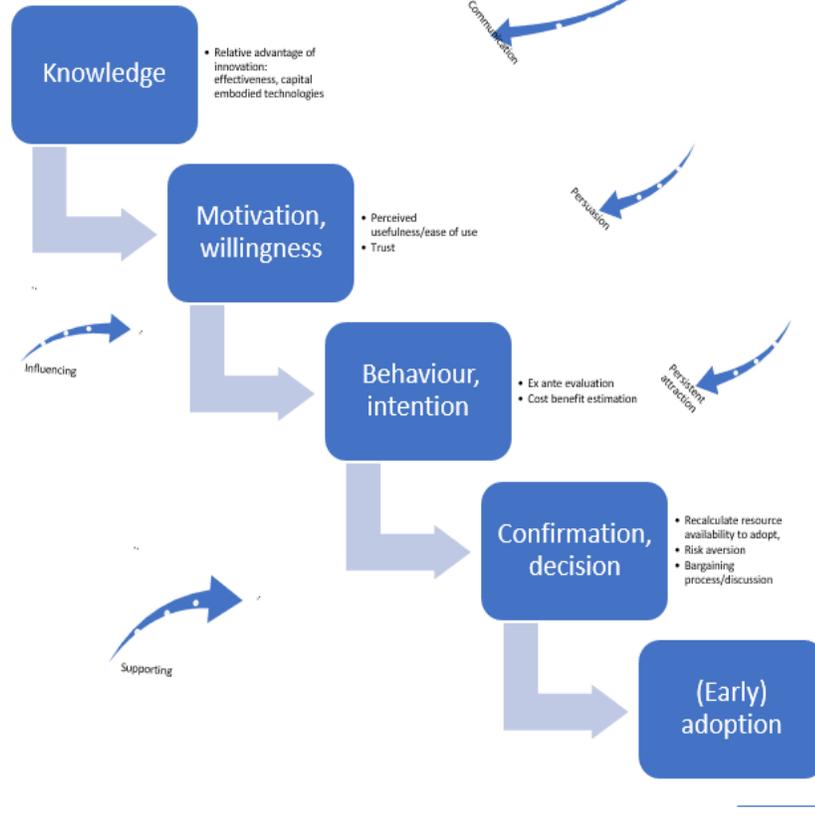
Market Demand, premium price
• Buyer, companies, govt

Policy and governance Regulation, incentive, dissemination strategy
• National and local govt, food industries

Farmer

Individual (user) factors

- Perception on innovation**
 - Education, age, experience
 - Social capital
- Vision to development**
 - Culture
 - Local practices
- Farm size, productivity**
 - Income
 - Farming system



Some stop adoption due to inconsistency in some determinants

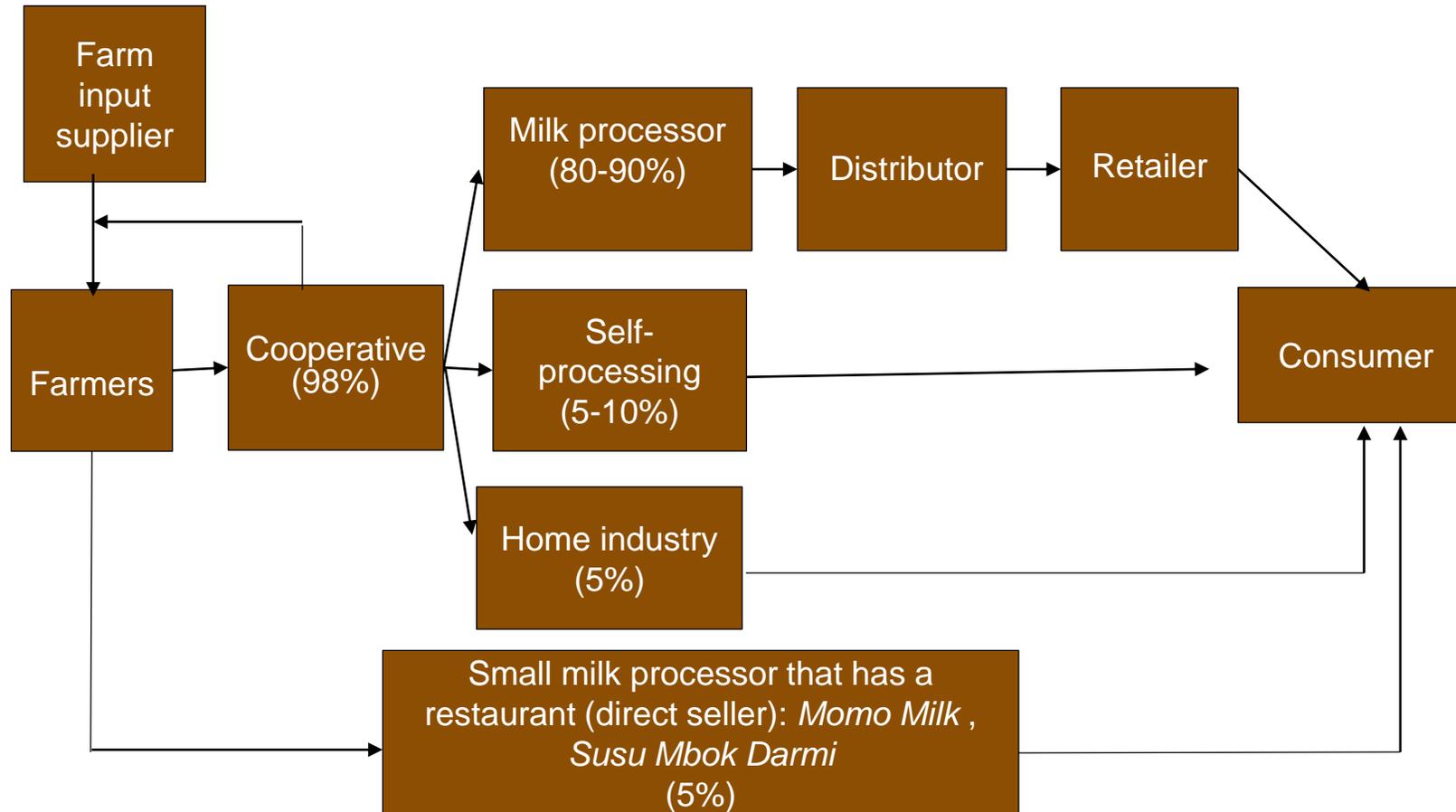
Some early adopters will enter social system, changing their role and build stronger network/trust with other farmers

Process continued in cycle, more adoptions

Problem statements

- Awareness does not always lead to permanent adoption. Discontinuation of agricultural technology adoption by farmers often happens.
- Dis-adoption is not only the farmers' failure (pseudo adopter behavior), but it is a system failure

Social system affecting farmers' adopter behavior: Actors along the value chain

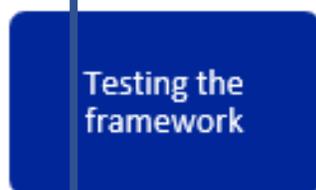


The general objective of the thesis

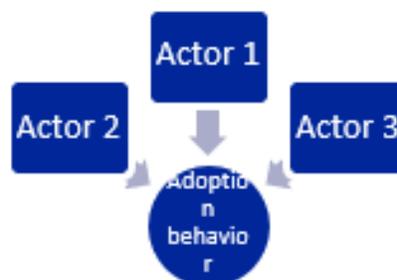
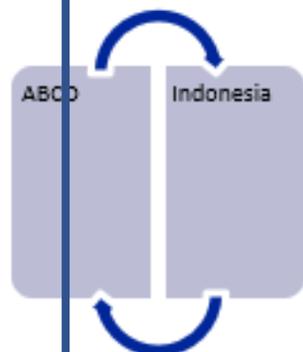
- To build a social system framework as a decision support [tool](#) for technology adoption.
- This framework will generate **social requirements for transition pathways for the uptake of novel smart farming systems** in Indonesia.
- The tool will be based on **social factors, social system behaviour, and actors' interaction** in supporting technology adoption.
 - Adoption factors, their interaction, and their feedback loops/mechanisms will be analyzed in (social) system dynamics.
 - This includes the systemic reason that leads to temporary and pseudo adopter behavior by farmers and how to deal with them



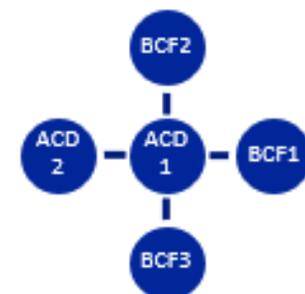
Develop a contextual framework



A case study in Indonesia



	Factors	Actors
Transition strategy	AB	1, 2



Research topics	Data collection	Data analysis	Location scope
Social system framework for technology adoption	Systematic literature review (SLR)	Framework synthesis	Indonesia
Interaction between different factors in the social system	Policy/document review (ISHS data Indodairy), (auto)ethnography	Social system framework; content analysis with AtlasTi; System dynamics	2 dairy cooperatives area; 200 farm households
Farmers behaviour and social network	Interviews	Social network	1 cooperative area, 50-80 households
Enabling factors and transition pathways	Co-creation/FGD	Backcasting	1 cooperative area

Interdisciplinarity and collaboration

- (Auto)ethnography through joint field visit with Achmad:
 - Adoption of MOSS
- Joint FGD with Ngakan:
 - Stakeholders' preference on digital system infrastructure > enabling factors and transition pathways

Thank you!

Feedback?



Relevance; the use of the framework

- To select specific locations and strategy for promoting agriculture technologies/innovation
- Further development; To predict adoption rate of innovation



Appendix

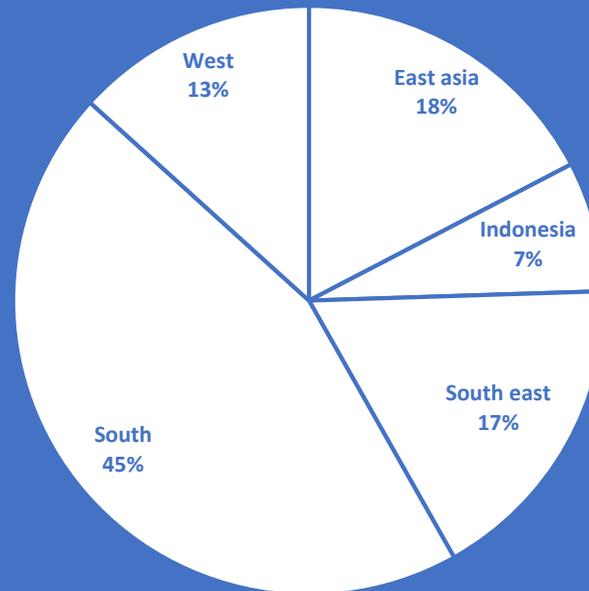


SLR, screening, collaboration for other review?

Trash	(84)
My Groups	
crop agri and/or ...	(49)
excluded africa	(282)
excluded aussie-...	(51)
excluded europe	(161)
excluded north a...	(81)
excluded pharm...	(345)
excluded-before 2...	(1)
excluded-latin a...	(102)

included per region	
east asia-china-ja...	(34)
indonesia	(8)
SEA-SG-MY2-VN...	(15)
south asia-india-...	(88)
west asia-turkey-i...	(26)

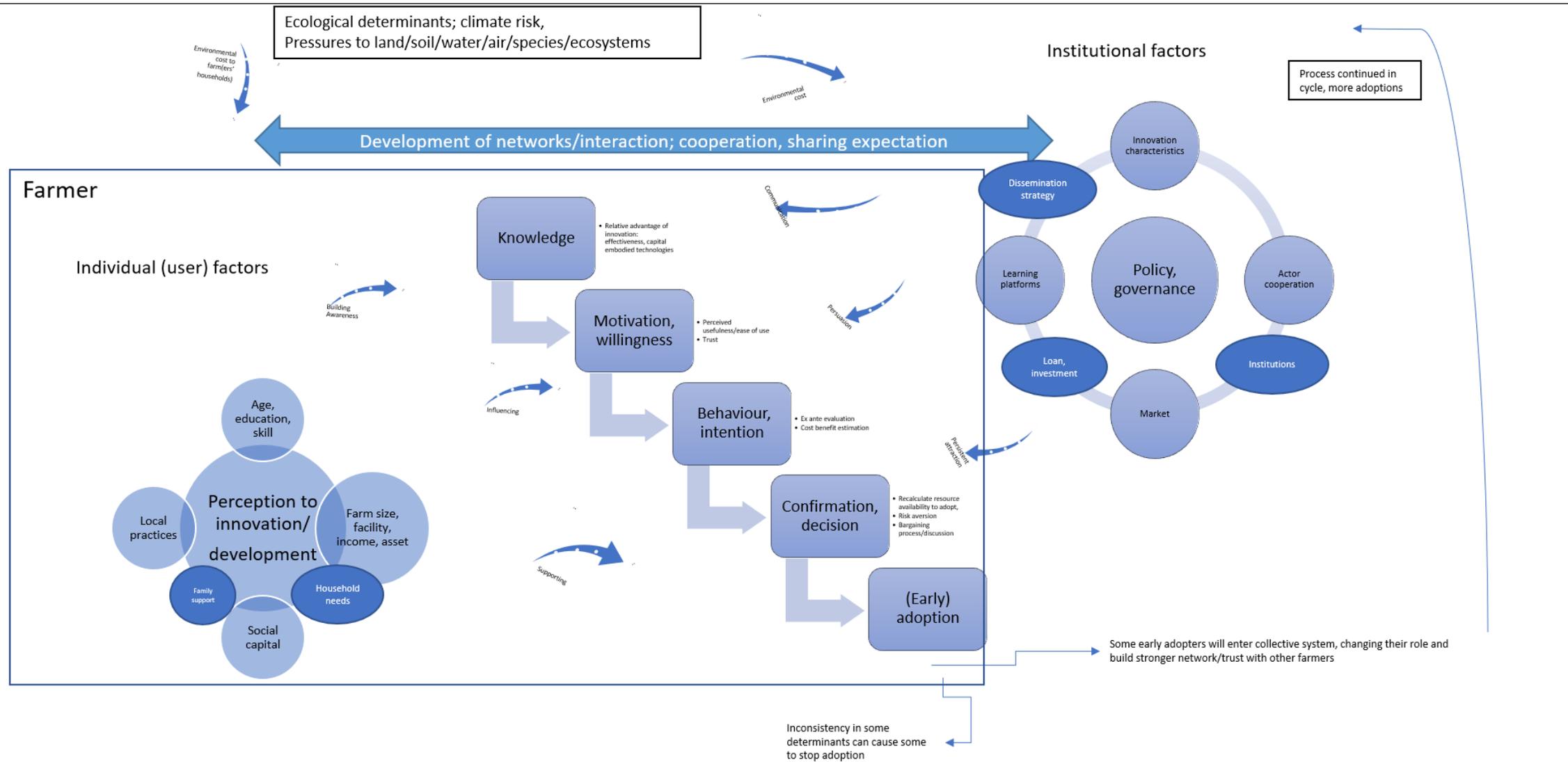
CASE DISTRIBUTION



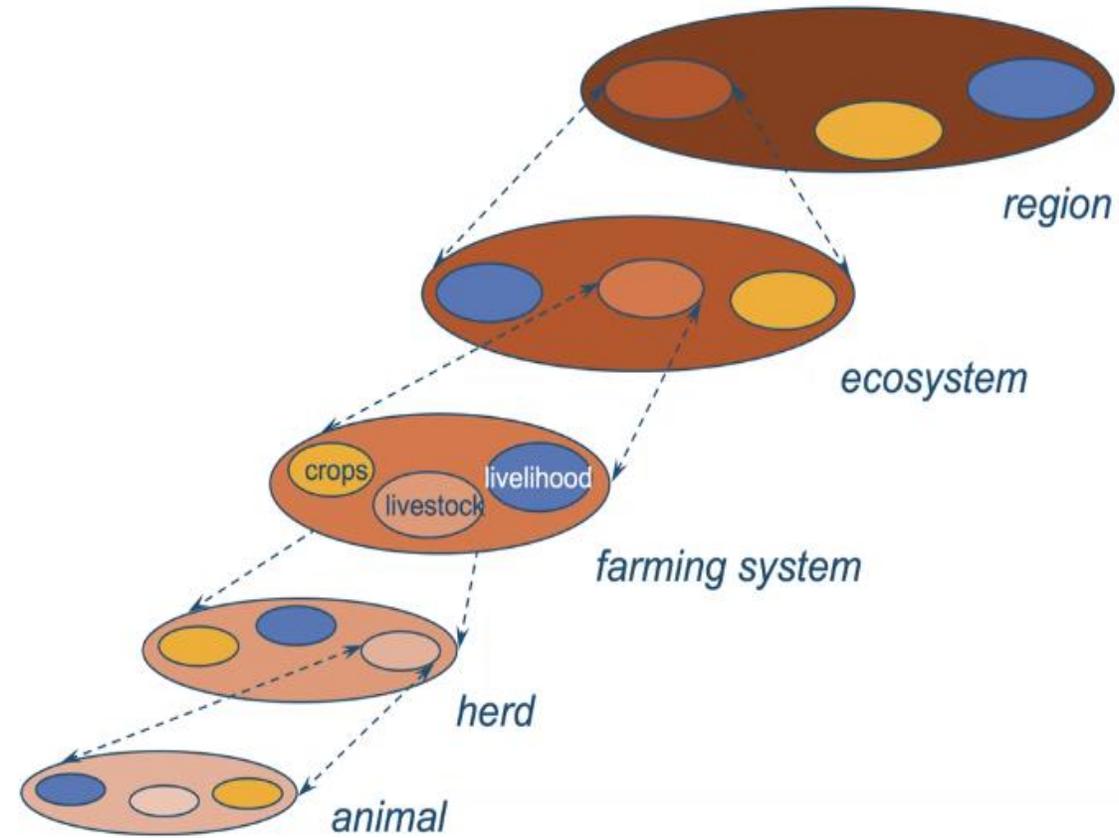
Mapping the important factors

- Scoring the importance of the identified factors:
 - 1 for factors that have a significant correlation to the decision for adoption, and 0.5 for factors that have a lower correlation to the decision
 - Quantitative and mixed-method papers; significant factor = $p\text{-value} \leq 0.05$
 - Qualitative papers; significant factor = the most emphasized points in the result and analysis
 - In the end, we used range classification for accumulated scores; e.g. 6-10 = important factors and 1-5 = less important factors
- Many technology adoption studies use statistical approach to measure the strength of correlation between multiple factors with farmers technology adoption decision. Different treatment are applied for qualitative papers that did not use that correlation level approach. This depends on the nature of the selected papers.





Aggregation levels



WAGENINGEN UNIVERSITY
WAGENINGENUR

Review of the reviews

	Title	Publication year	Authors	Countries case studies	Agriculture/livestock technologies
1	A systematic literature review of the factors affecting the precision agriculture adoption process	2019	Pathak, Hari Sharan Brown, Philip. Best, Talitha	United States, Germany, Denmark, Turkey, Hungary, Nigeria, Canada, Brazil and Iran.	<ul style="list-style-type: none"> Precision Agriculture: Yield monitoring, grid/GPS soil sampling, aerial photos and satellite imagery, geographical information system Management techno: variable rate, automation irrigation
2	Drivers of Precision Agriculture Technologies Adoption: A Literature Review	2013	Pierpaoli, Emanuele. Carli, Giacomo. Pignatti, Erika. Canavari, Maurizio	United States, Nigeria, Iran, Canada	Precision agriculture technologies
3	Factors influencing the adoption of precision agricultural technologies: a review for policy implications	2012	Tey, Yeong Sheng. Brindal, Mark	Australia, United States	Precision agriculture: (1) GPS, (2) yield monitoring systems, (3) remote sensing systems, (4) soil sampling regimens and (5) variable-rate applicators.
4	Technology Adoption by Agricultural Producers: A Review of the Literature	2018	Ugochukwu, Albert I. Phillips, Peter W. B.	Global review	Livestock health and breeding technologies; animal health (vaccines), disease prevention, and management practices to breeding (artificial insemination, embryo transplants, and sexed semen), genetics, and genomics innovations
5	A review of social science on digital agriculture, smart farming and agriculture 4.0	2019	Klerkx, Laurens. Jakku, Emma. Labarthe, Pierre	General review	Precision farming, digital agriculture



Inclusion criteria, framework synthesis

- Innovation intended for farmers, smallholders, rural stakeholders,
- Setting/context of papers are on innovation/technology adoption/diffusion/dissemination (including its knowledge exchange) in animal agriculture, mixed crop-livestock/animal system
- Analysing adoption barriers/factors by farmers
- Review papers with case-studies from multiple countries
- Year of publication after 2000

To search for the review, three key concepts were defined; 1. Animal farming, 2. Technology or innovation adoption, and 3. Review studies. These are used as search terms. This query was used in Google Scholar.

