

# ADOPTION OF IRRIGATION TECHNOLOGY: UNDERSTANDING THE ROLE OF SOCIAL CAPITAL WITHIN THE ADOPTION DECISION PROCESS

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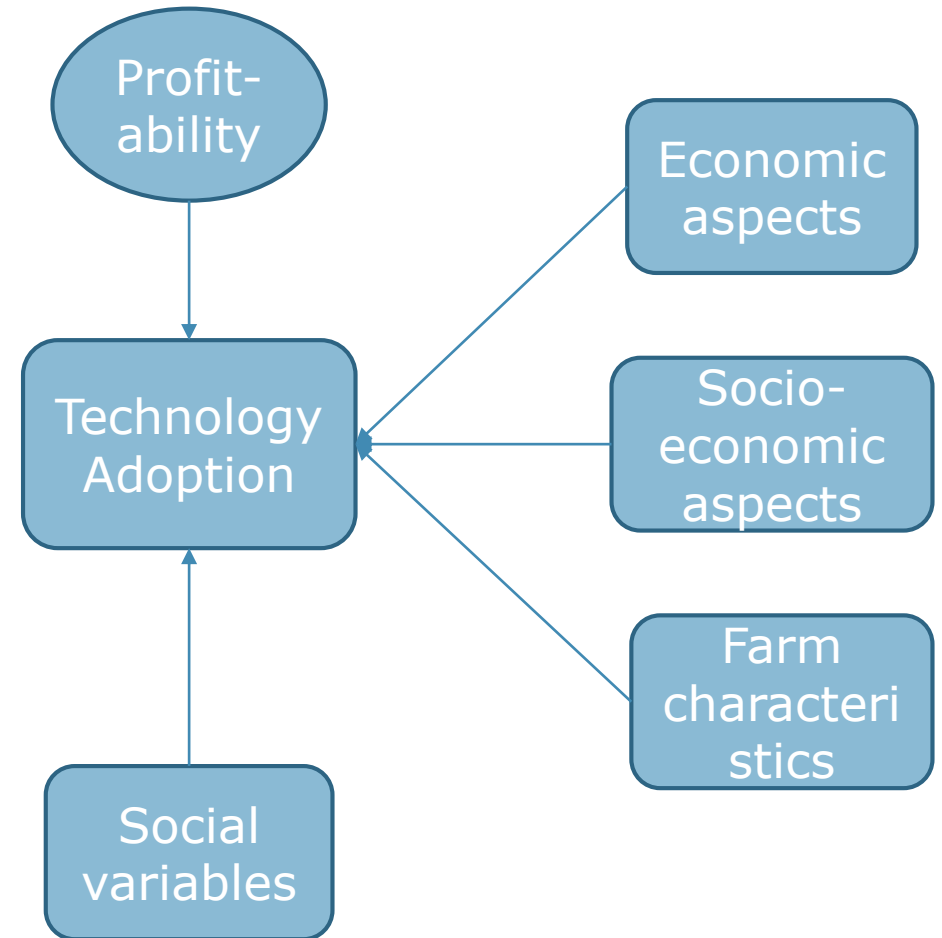
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# Introduction

- Innovation and adoption in agriculture: economic growth & development
- Individual decisions embedded in complex system → social environment
- **Social capital**
- We argue: social capital components play role in adoption decision process

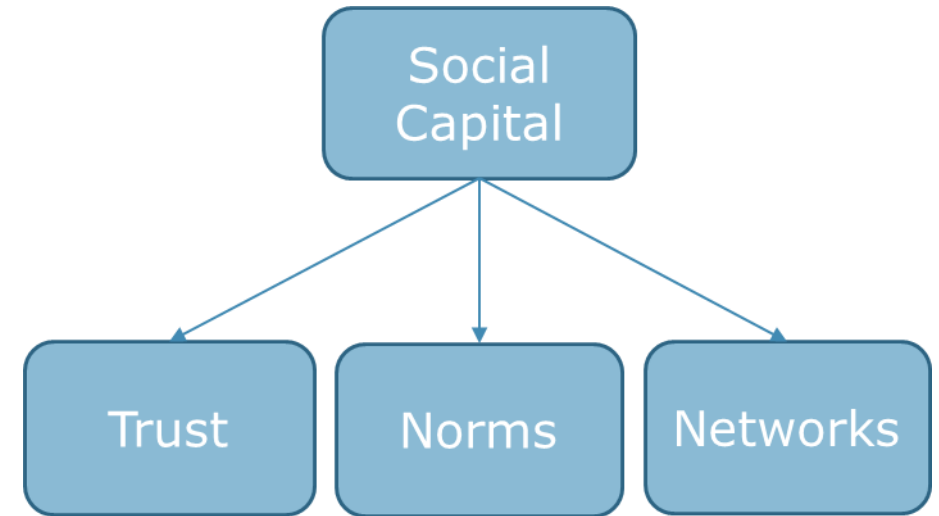
➔ **What is the relationship of social capital and the behavior regarding the use of technology?**

➔ **How could social capital be a construction of its different components?**



# Literature review

- By-product of social activities (PUTNAM, 1993)
- Social capital: increase in economic growth, facilitates economic & community development (e.g. WOOLCOCK & NARAYAN, 2000)
- But: no consensus on definition in literature
- Benefits:
  - Promotes collective work
  - Reducing transaction costs
  - Support farmers in coping with risk
  - Control/enforce common agreed norms

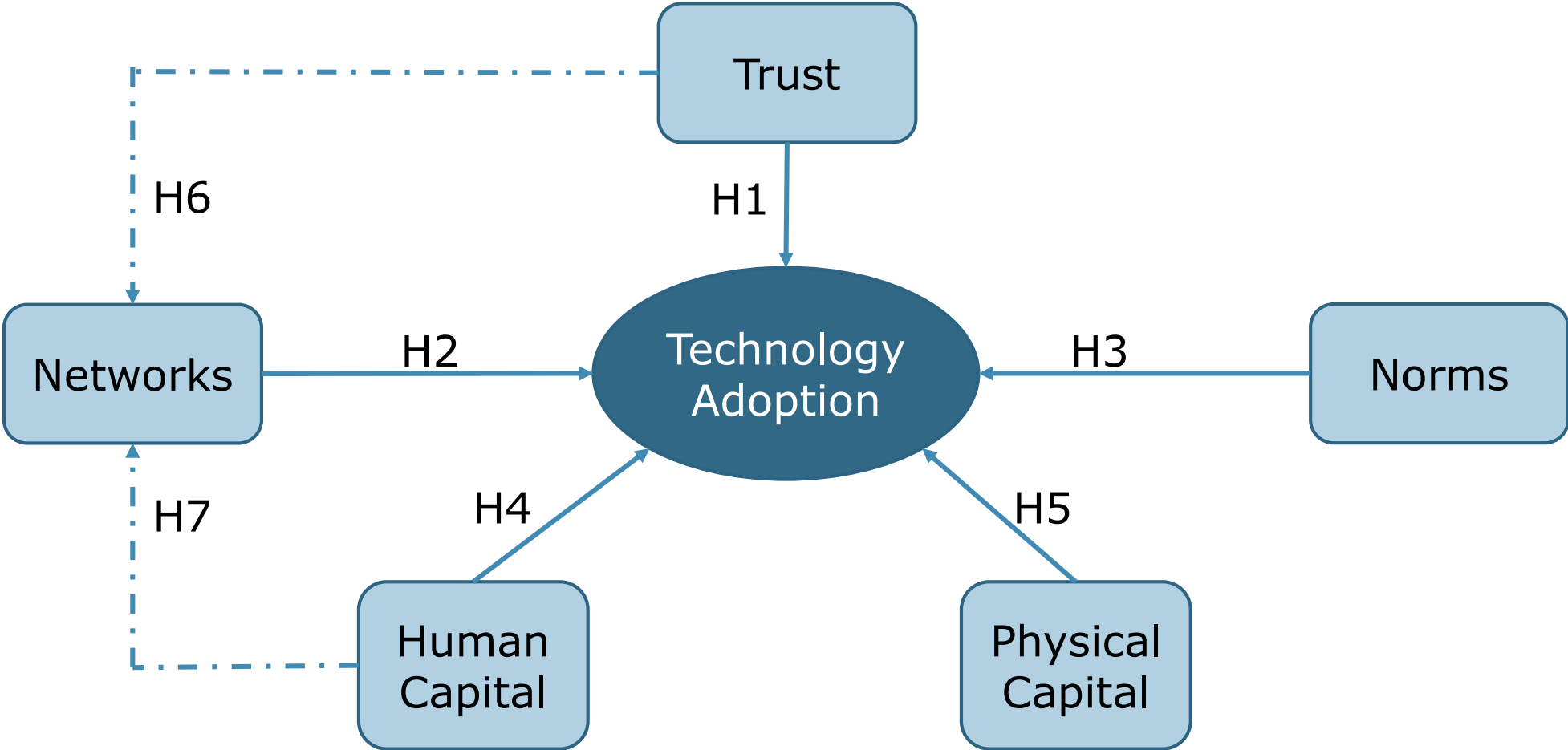


Definition: **Social capital is understood as networks, norms and trust of social interrelationships that facilitate cooperation and coordination of people to achieve desired goals and mutual benefit** (NARAYAN & CASSIDY, 2001; PUTNAM, 1993; WOOLCOCK, 1998)

# Literature review (cont.)

- Information flow:
  - **Trust** = catalyst → transformation of information in usable knowledge
  - **Networks** = environment for exchange of information
- Disadvantages:
  - Ties constantly renewed and reconfirmed
  - Too strong ties → distrust, intolerance, violence
  - Closed networks → isolated, lose incentive
- **Human capital**: related to social capital → interdependence (Burt, 1997; Chou, 2006; Kaasa, 2007)

# Research hypotheses



# Case study

- Chile: 5th biggest wine exporter (OIV, 2013)  
export value 2013: US \$ 1.8 billion (ODEPA, 2014)
- 2012: 128,638 ha planted area (ODEPA, 2014)

## Water management:

- Irrigation Development Law, 1981
- Investment Irrigation Law, 1985

## Associations:

- Asociaciones de Canalistas
- Comunidades de Agua
- Junta de Vigilancia

# Survey region

- Standardized questionnaire
- **5 point Likert-scale** (1 = strongly disagree – 5 = strongly agree) for social capital components
  
- Region: **Central Chile** → regions O'Higgins and Maule
  - 73% of national wine plantation
  - 2014: 880 million liters (of total 1.3 billion litres) (ODEPA, 2014)
  
- Sampling: **452 vineyards** in 16 municipalities
  - Distributed proportionally (Wine Growing Cadastral 2012 of Agriculture and Livestock Service)
  - At least 1 km kept between respondents → ensure diversity

# Data description

Decision makers	Gender	Educational level	Age	Farm size	Irrigation technology
Owners: <b>45.8%</b>	Male: 92.5%	Primary school: 18.81	Minimum: 23 years	Minimum: 0.25 ha	Adopted: 43.1%
Managers: <b>54.2%</b>	Female: 7.5%	Secondary school: 37.6%	Maximum: 89 years	Maximum: 1,600 ha	Non-adopted: <b>56.9%</b>
		College level: 34.1%	Average: <b>56.9 years</b>	Average: <b>81.62 ha</b>	



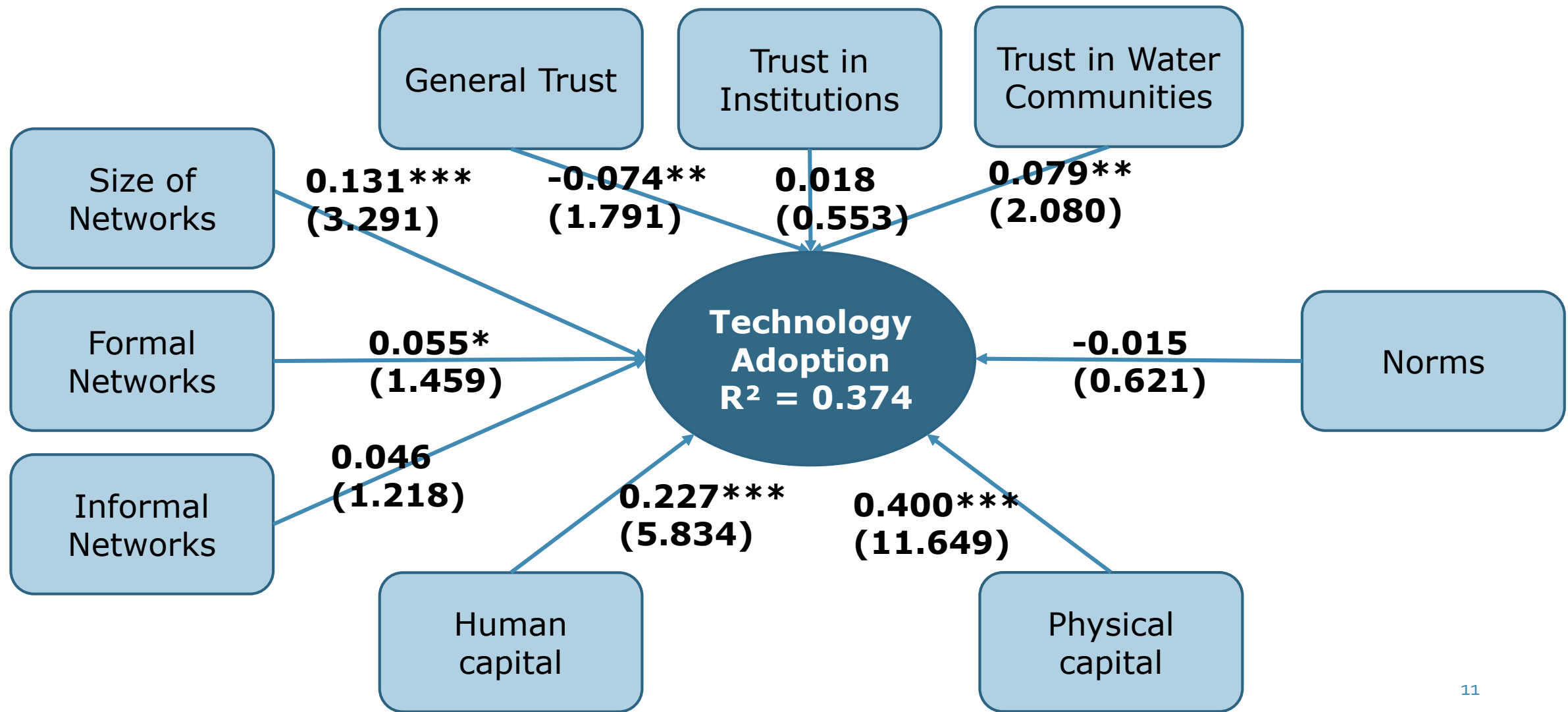
# Methodology

- **Partial Least Squares (PLS) – Structural Equation Model (SEM)**  
(Haenlein & Kaplan, 2004; Huber et al., 2007; Weiber & Mühlhaus, 2014)
  - Interconnection among endogenous and exogenous variables
  - Non-parametric model
  - Less problems with multicollinearity
- Irrigation technology adoption: **adoption of drips or sprinklers**  
binary variable → transformed (KUPEK, 2006)
- Exogenous variables = **social capital components**
- Additional: **human capital** (educational level, in years of schooling)  
**physical capital** (size of farms, in hectares)

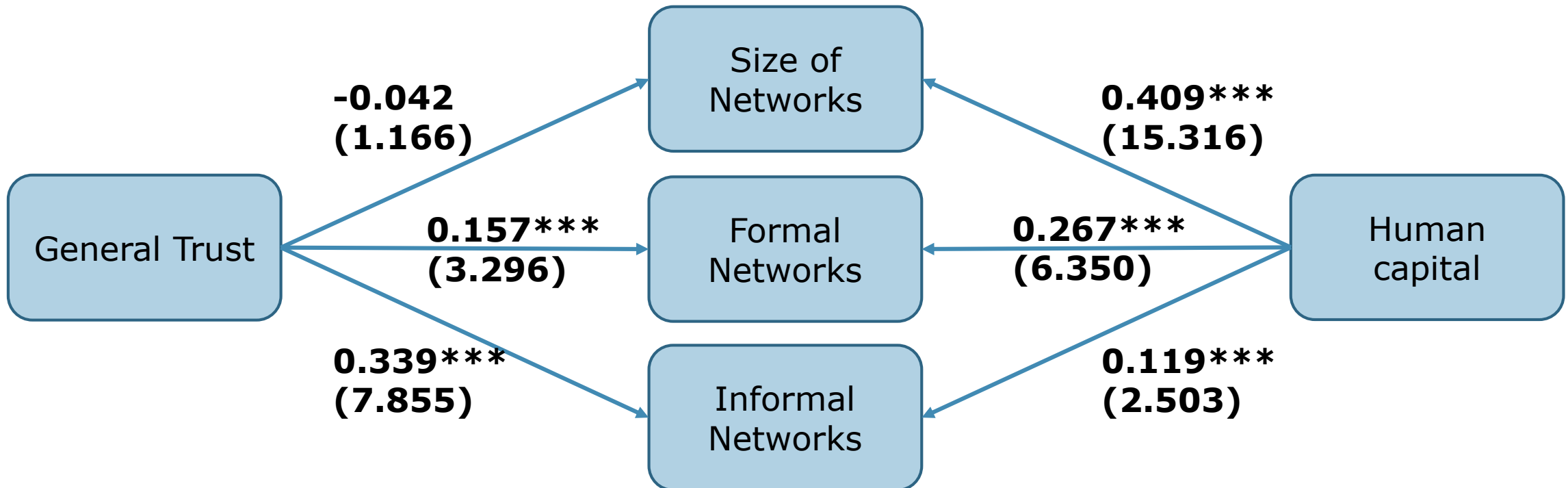
# Methodology (cont.)

Components		Composite reliability > 0.7	Average Variance Extracted > 0.5	Variance Inflation Factor
Networks	Size of Networks	0.784	0.644	1.281
	Formal Networks	0.864	0.760	1.414
	Informal Networks	0.777	0.538	1.423
Norms	Norms	1.000	1.000	1.140
Trust	General Trust	0.823	0.541	1.378
	Trust in Institutions	0.881	0.651	1.317
	Trust in Water Communities	0.865	0.617	1.087
	Human Capital	1.000	1.000	1.333
	Physical Capital	1.000	1.000	1.120

# Results – Irrigation technology



# Results - Interrelations

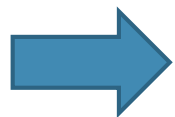


# Discussion

- H1: **Trust** =relevant for validation information flow in network  
but: high trust inside communities: prevent from looking outside
- H2: **Networks**=platform to exchange information, safety net, mutual insurance  
farmers make adoption decision independently from informal relations
- H4 & H5: **Human and Physical Capital** as expected and suggested by  
literature
- H6: **Trust on Networks**: strong relationship, key to social capital  
essential catalyst that helps building confidence  
foundation of creating networks
- H7: between **Human and Social Capital** strong relationship  
higher educational level allows for establishing more complex networks

# Conclusion

- Social capital has **influence** on decision of farmers to adopt irrigation technology on vineyards in Central Chile
- Especially **networks** are important (Formal Networks and Size of Networks)
- **Networks = core component of social capital**  
→ **build on fundament of trust and human capital**



Future extension efforts: consider increasing trust among networks  
Not only economic and individual variables

**Thank You For Your Attention**

**Table 1:** Factor analysis results for irrigation technology adoption.

Item	Mean	Standard deviation	Factor loading	Composite reliability	Average Variance Extracted	Variance Inflation Factor
			> 0.6	> 0.7	> 0.5	
<b>Size of Network</b>				0.784	0.644	1.281
How many commercial contacts do you have?	6.59	5.049	0.809			
How many wine producers do you know who have irrigation technology?	6.96	12.190	0.796			
<b>Formal Network</b>				0.864	0.760	1.414
When I attend to agricultural events, I am usually more active than others.	3.14	1.218	0.872			
I know and meet regularly professionals or experts in agriculture.	4.03	1.163	0.871			
<b>Informal Network</b>				0.777	0.538	1.423
In the area of work, I often communicate with neighbouring farmers.	4.27	1.008	0.748			
I spend time with my friends, because I think it is important to share time with them.	4.03	1.096	0.761			
I always support my farming neighbours when they have a problem.	4.44	0.755	0.691			
<b>Norms</b>				1.000	1.000	1.140
Whenever my friends or family are having a hard time, I support them.	4.65	0.555	1.000			16



<b>General Trust</b>				0.823	0.541	1.378
I can trust in the people around me without the need to be very cautious.	3.59	1.156	0.797			
Farmers are reliable people.	3.88	1.039	0.817			
I consider that other farmers would not harm me for their own benefit.	3.15	1.284	0.702			
The people in the community work together to solve problems of the availability of water.	3.53	1.320	0.604			
<b>Trust in Institutions</b>				0.881	0.651	1.317
The agricultural associations work for the welfare of the farmers and the sector.	3.69	1.115	0.689			
I trust the local government.	3.19	1.201	0.766			
I trust the public institutions.	3.26	1.200	0.863			
I trust the government of Chile.	3.15	1.233	0.893			
<b>Trust in Water Communities</b>				0.865	0.617	1.087
In the last 5 years the confidence among the producers in the water community has increased.	3.49	1.143	0.675			
I trust the Comunidad de Aguas.	3.72	1.015	0.722			
I trust the Asociación de Canalistas.	3.83	0.980	0.877			
I trust the Junta de Vigilancia.	3.53	1.320	0.851			
<b>Human Capital</b>				1.000	1.000	1.333
Education	11.63	4.145	1.000			
<b>Physical Capital</b>				1.000	1.000	1.120
Farm size	81.62	167.184	1.000			

**Table 2:** Fornell-Larcker criterion for irrigation technology model

	<b>Formal Network</b>	<b>General Trust</b>	<b>Human capital</b>	<b>Informal Network</b>	<b>Irrigation Technology</b>	<b>Norms</b>	<b>Physical Capital</b>	<b>Size of Network</b>	<b>Trust in Institutions</b>	<b>Trust in Water Communities</b>
<b>Formal Networks</b>	0.872									
<b>General Trust</b>	0.147	0.735								
<b>Human Capital</b>	0.260	-0.038	1.000							
<b>Informal Network</b>	0.424	0.335	0.106	0.734						
<b>Irrigation Technology</b>	0.228	-0.667	0.409	0.094	1.000					
<b>Norms</b>	0.103	0.269	-0.082	0.262	-0.077	1.000				
<b>Physical Capital</b>	0.143	-0.004	0.263	0.055	0.507	-0.080	1.000			
<b>Size of Network</b>	0.238	-0.008	0.411	0.063	0.352	-0.067	0.250	0.803		
<b>Trust in Institutions</b>	0.114	0.436	-0.186	0.198	-0.068	0.184	-0.030	-0.129	0.807	
<b>Trust in Water Communities</b>	0.201	-0.024	0.040	-0.060	0.132	-0.047	0.040	0.119	0.064	0.786