ENERGY SUPPLY, ECONOMICS AND TRANSITION

ENV-410
Energy supply, economics and transition: Proximity in the diffusion of innovations

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Laboratory for Human-Environment Relations in Urban Systems

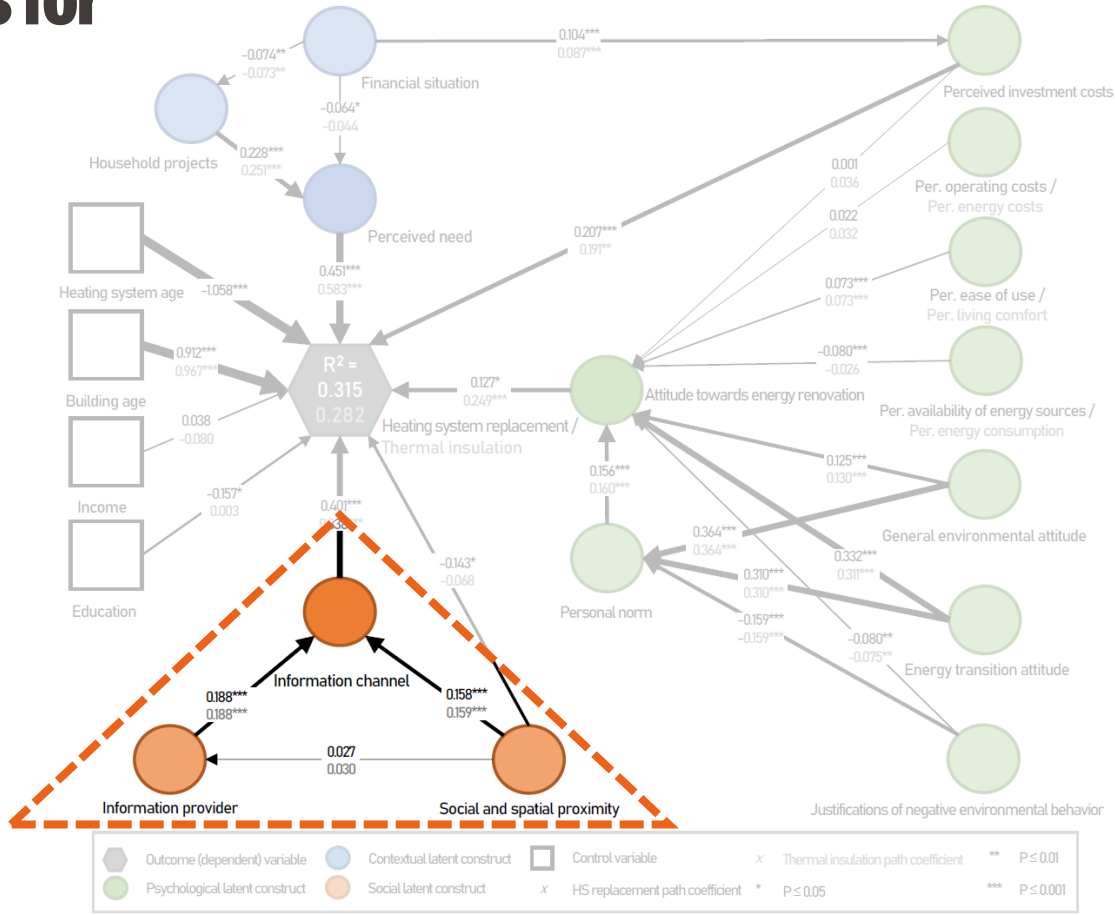
May 7, 2025

Christophe Balliff / Philippe Thalmann / Claudia Binder

Recap: Behavioral perspective on the diffusion of innovations

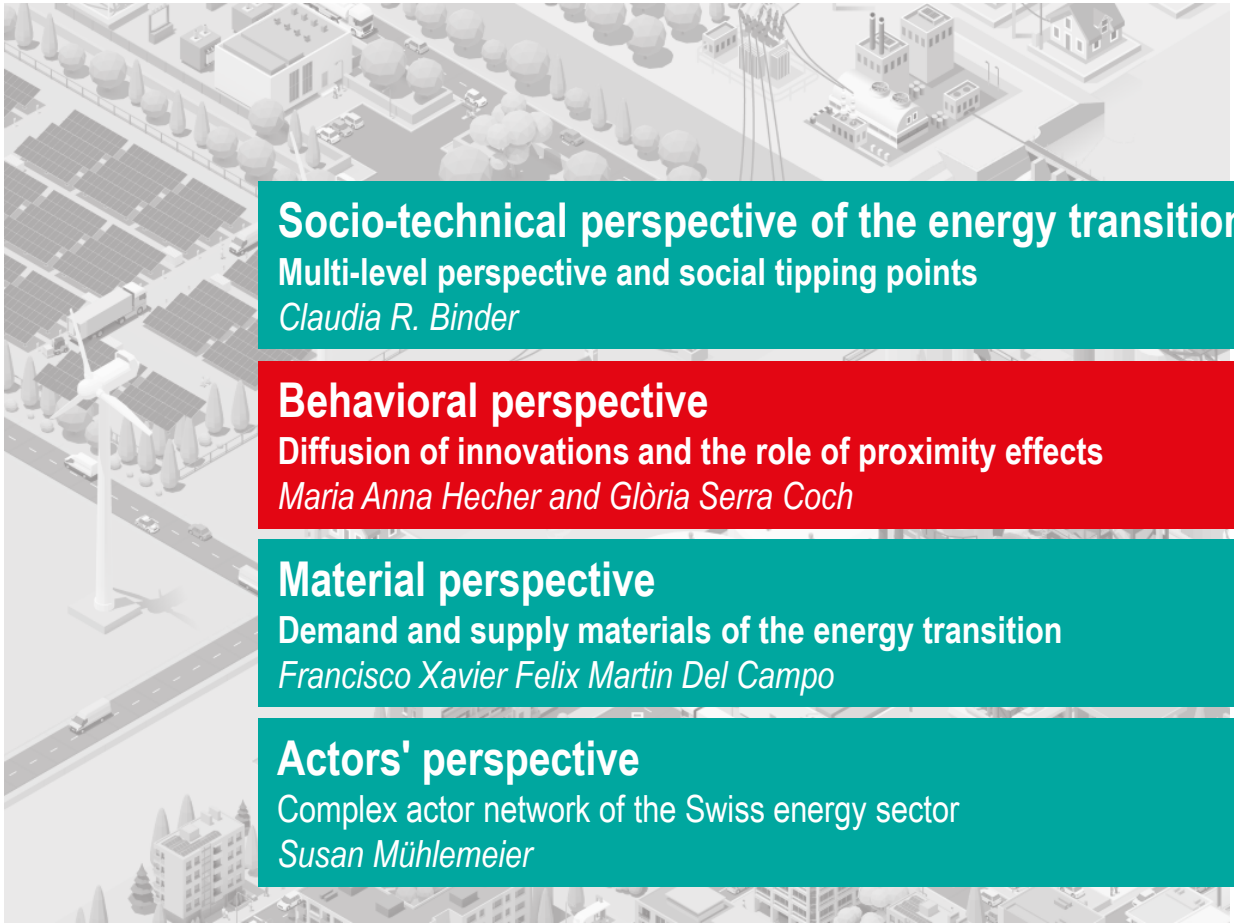
- Technically and economically viable solutions can still fail without social acceptance.
- Policies to support innovation diffusion must account for the diverse characteristics of both adopters and non-adopters.
- Windows of opportunity should be actively used to promote technology (co-)adoption and accelerate the diffusion of emerging technologies.
- Social influence plays a crucial role and can be strengthened through trust and spatial proximity.
- Consumer preferences must be integrated into current energy models to achieve more realistic and robust outcomes.

Recap: Drivers for building renovations



Ladino Cano et al. (in preparation)

Energy transition perspectives



Socio-technical perspective of the energy transition

Multi-level perspective and social tipping points

Claudia R. Binder

Behavioral perspective

Diffusion of innovations and the role of proximity effects

Maria Anna Hecher and Glòria Serra Coch

Material perspective

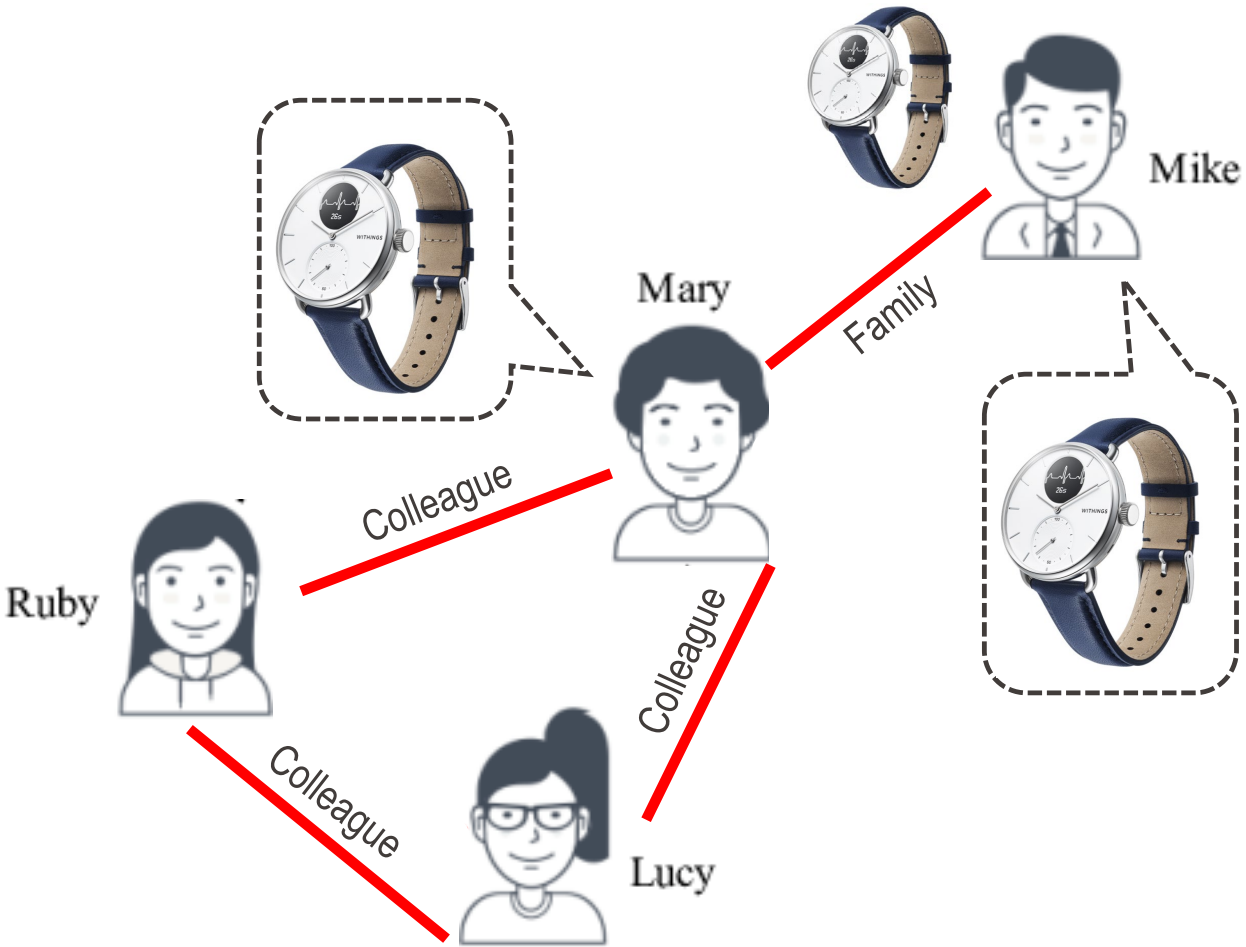
Demand and supply materials of the energy transition

Francisco Xavier Felix Martin Del Campo

Actors' perspective

Complex actor network of the Swiss energy sector

Susan Mühlemeier



Graphics adapted from Cen et al 2019

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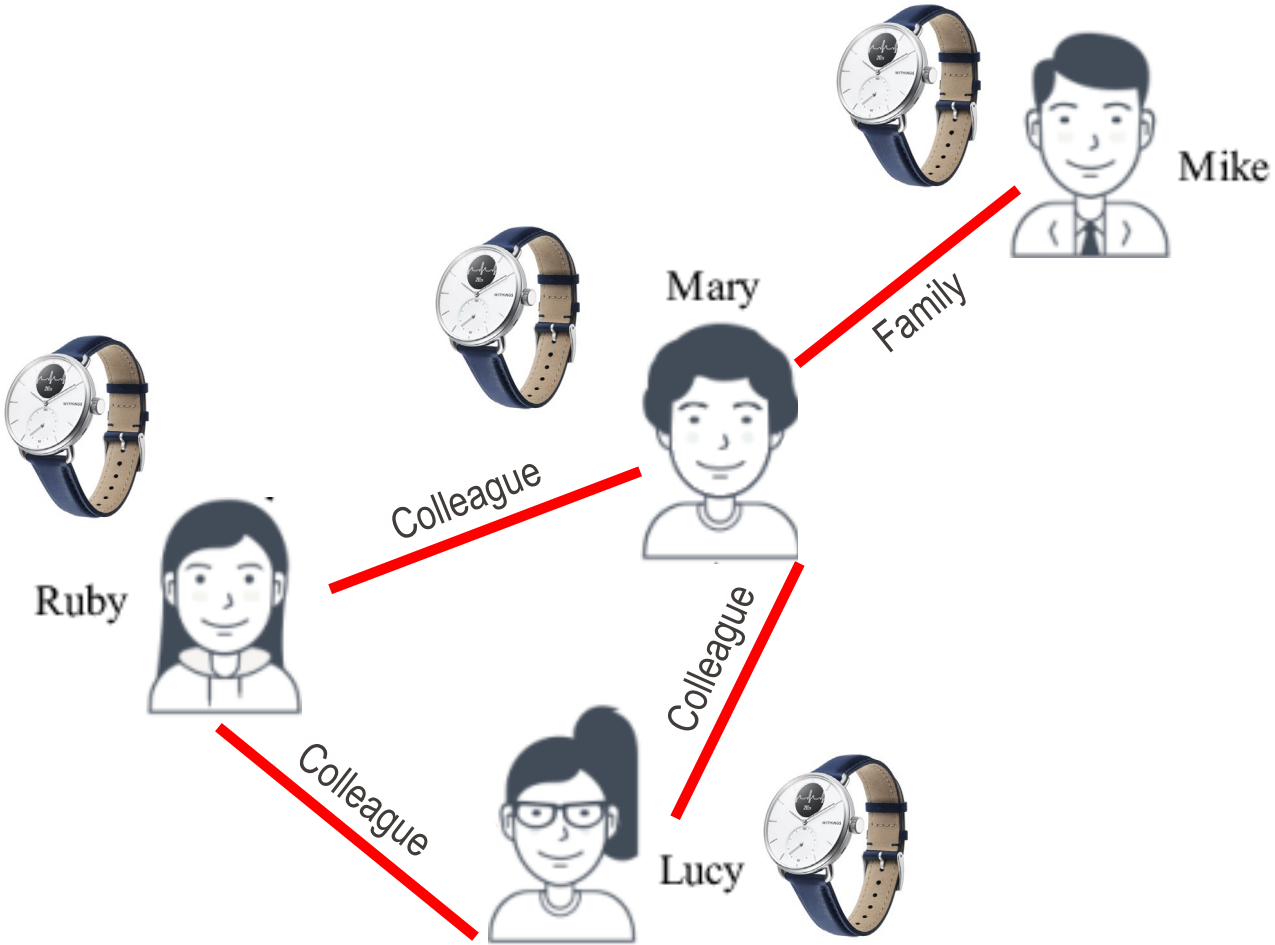

Graphics adapted from Cen et al 2019

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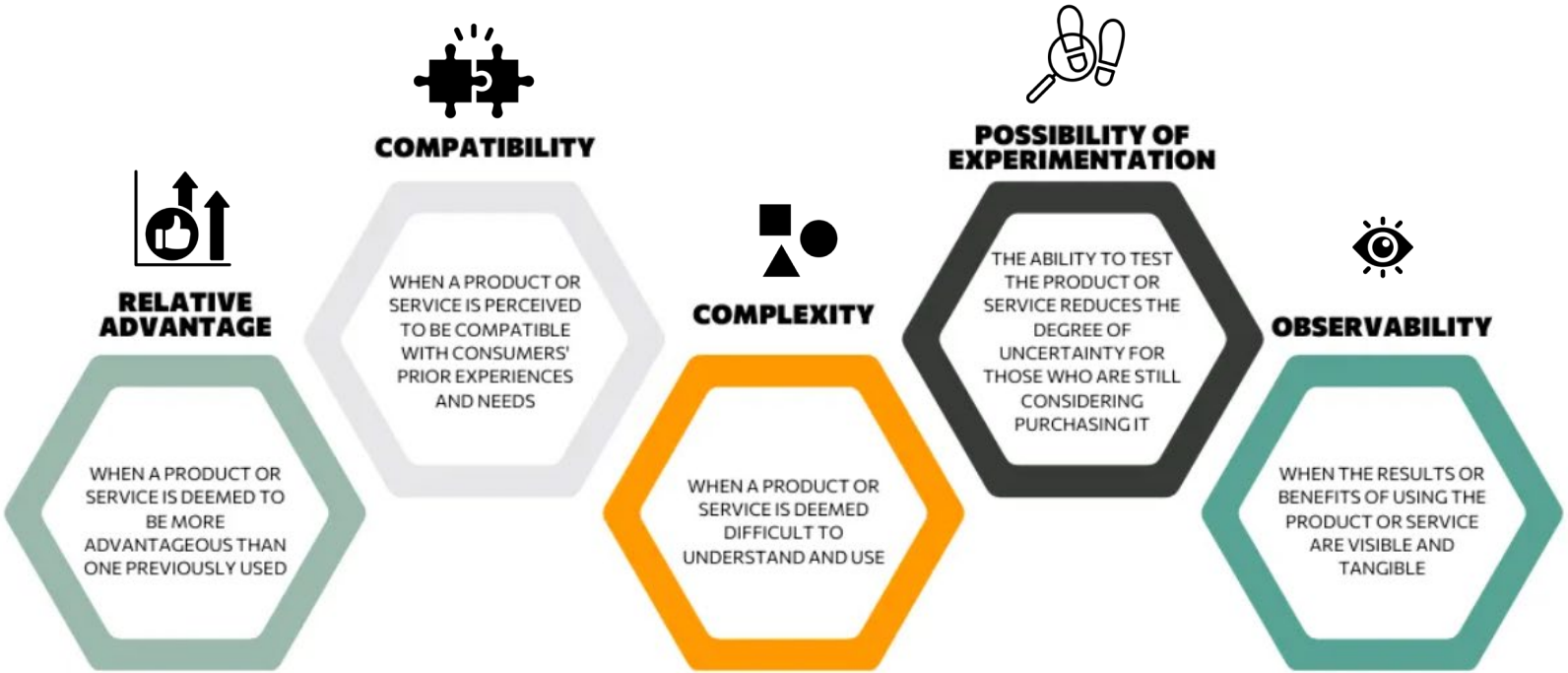
VS.

Rogers: Perceived attributes of an innovation



Rogers, 1962

Rogers: Perceived attributes of an innovation

Christophe Ballif / Philippe Thalmann / Claudia Binder

Perceived Characteristics of innovations Rogers, 1967

vs.

Relative advantage

?

Simplicity

Compatibility

Trialability

Observability

Rogers, 1962

Goals

- Understand the role of **proximity** in the diffusion of energy innovations
- Extend your knowledge about the diffusion of innovations theory and how it can be applied to energy technologies
- Learn about **social network theory** and the role of social influence
- Learn about the **geography of innovations** theory and the proximity dimensions
- Understand how **information networks and exchanges** play a role in the diffusion of energy innovations

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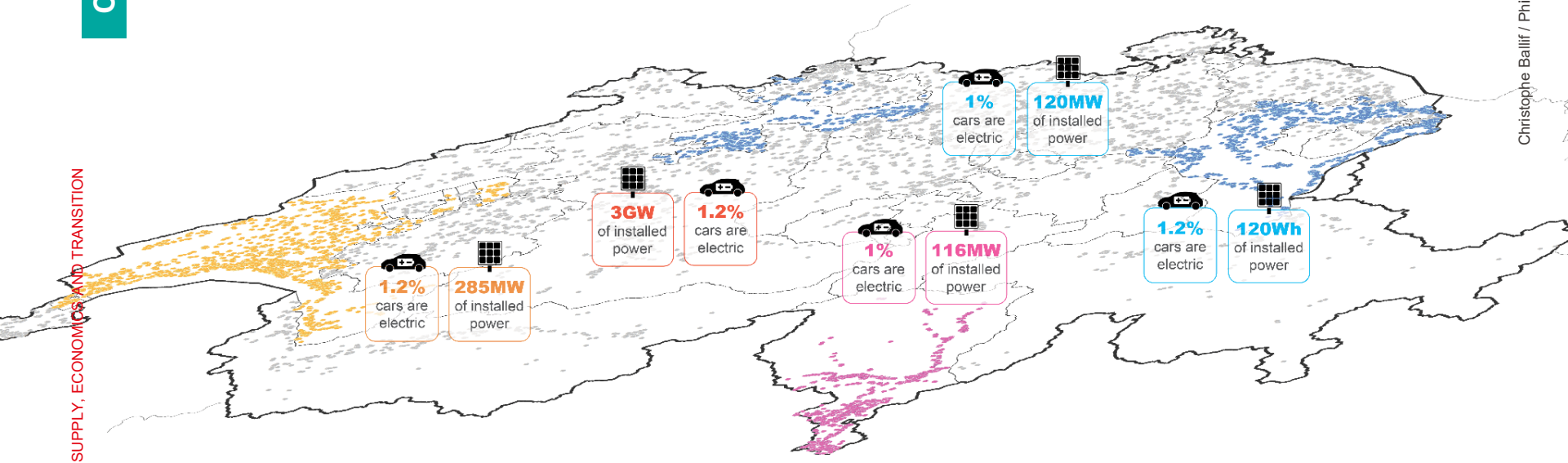
Diffusion of innovative energy technologies

CASE STUDY

Energy Management Systems
Photovoltaic Panels
Electric Vehicles



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EPFL

CASE STUDY

Diffusion of innovative energy technologies

Energy Management Systems
Photovoltaic Panels
Electric Vehicles

…in Switzerland

Residential Adopters

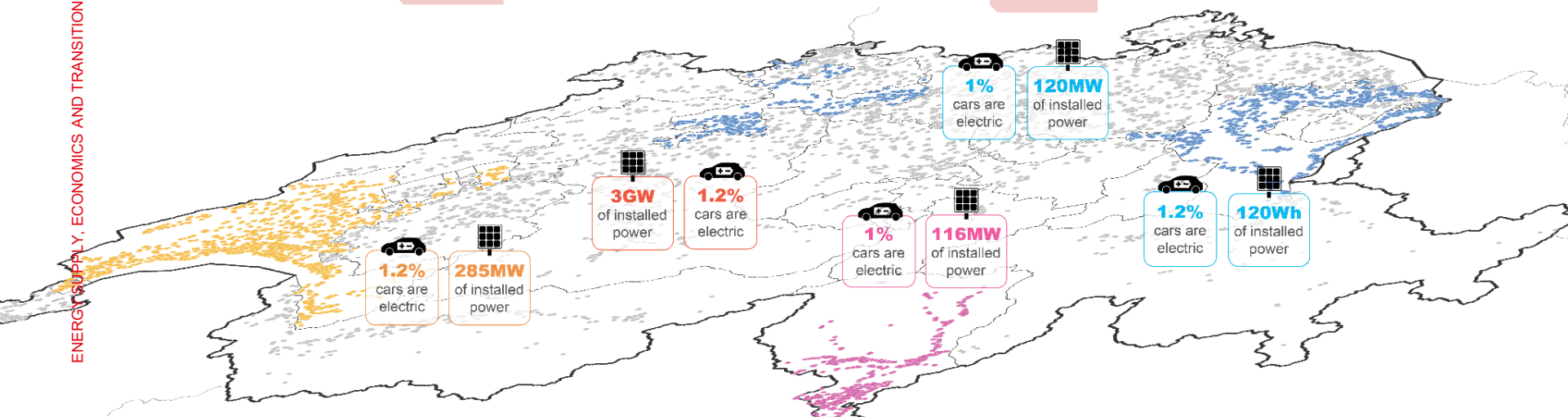
1’300 — 1’300

1’000

Suppliers

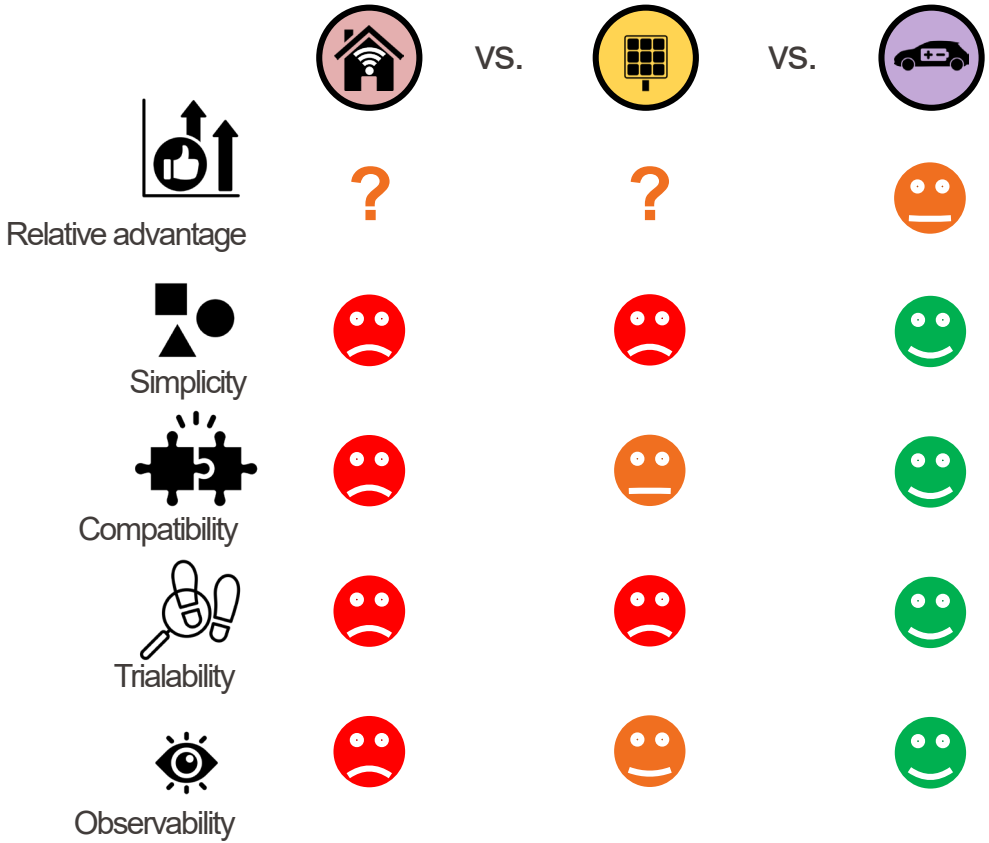
60 — 22

55



Rogers: Perceived attributes of an innovation

Perceived Characteristics of innovations Rogers, 1967



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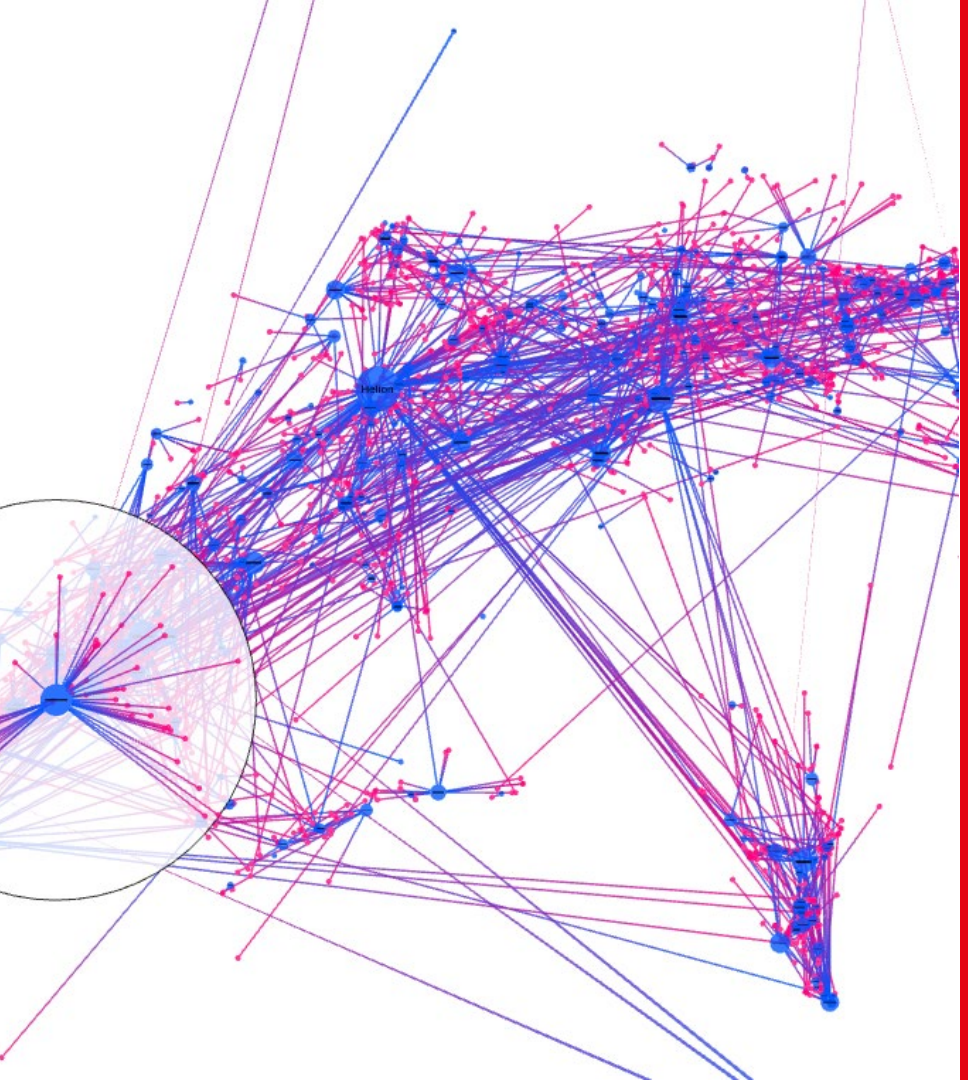
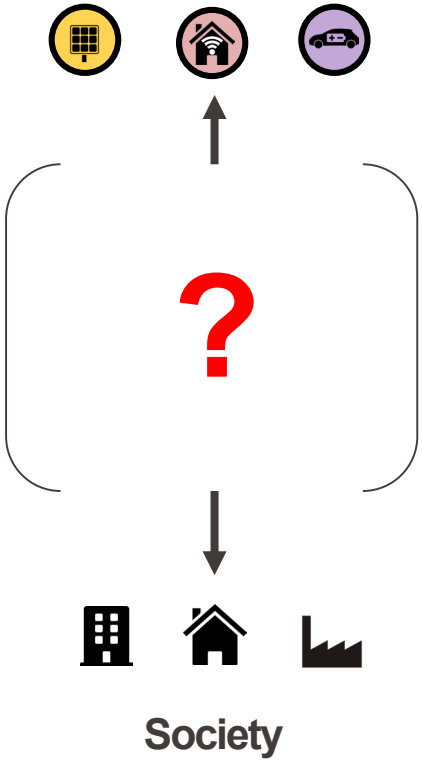


Information exchange for the diffusion of energy innovations

Christophe Balliff / Philippe Thalmann / Claudia Binder

Diffusion of Innovations

Innovation-diffusion is the process in which an ***innovation*** is **communicated** through certain ***channels*** over ***time*** among the members of a ***social system.***



Rogers, 1962; Cohen et al. 2019; Tagliapietra et al; 2019

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Diffusion of Innovations

Innovation-diffusion is the process in which an ***innovation*** is communicated through certain ***channels*** over ***time*** among the members of a ***social system.***

Communication channel

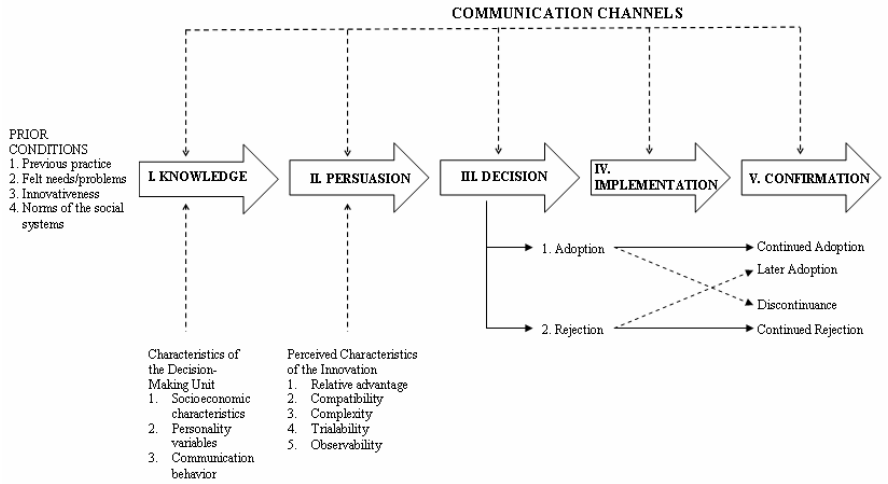
Mass-media → bringing awareness
Interpersonal channels → forming attitudes

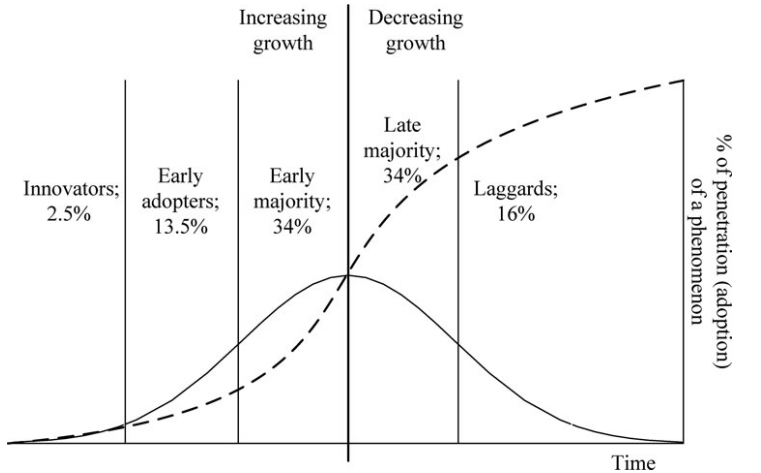
Innovation

I. Perceived Attributes of Innovations
1. Relative Advantage
2. Compatibility
3. Complexity
4. Trialability
5. Observability

Time

Social system





Rogers, 1962

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Diffusion of Innovations

Innovation-diffusion is the process in which an ***innovation*** is communicated through certain ***channels*** over ***time*** among the members of a ***social system.***

channels

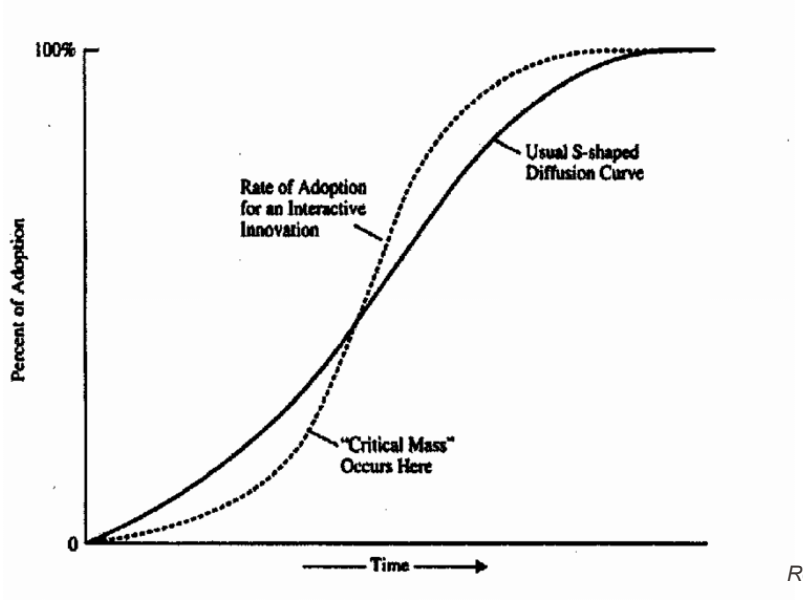
Time

Innovation

Social system

Fully comprehending the diffusion of innovation needs an analysis that goes **beyond the individual and analyses the entire social system**.

Rogers, 1962



Rogers, 1962

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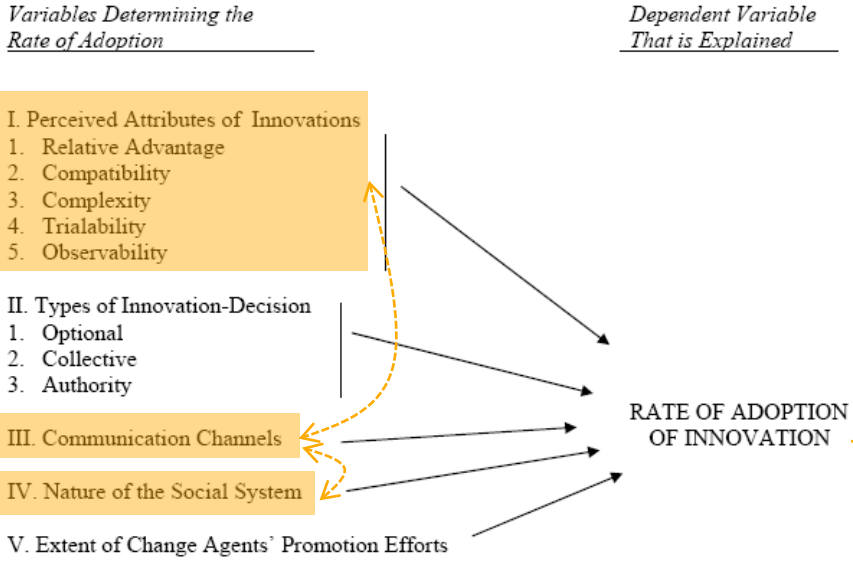
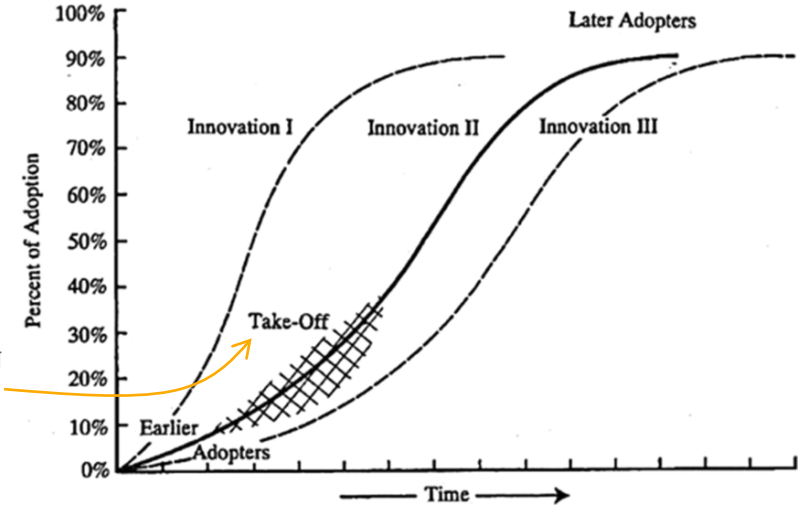
Diffusion of Innovations





Rogers, 1962

Diffusion of Innovations: information exchanges

Innovation-diffusion is the process in which an ***innovation*** is **communicated** through certain ***channels*** over ***time*** among the members of a ***social system.***

Rogers, 1962; Cohen et al. 2019; Tagliapietra et al; 2019

Speaker
Christophe Balliff / Philippe Thalmann / Claudia Binder

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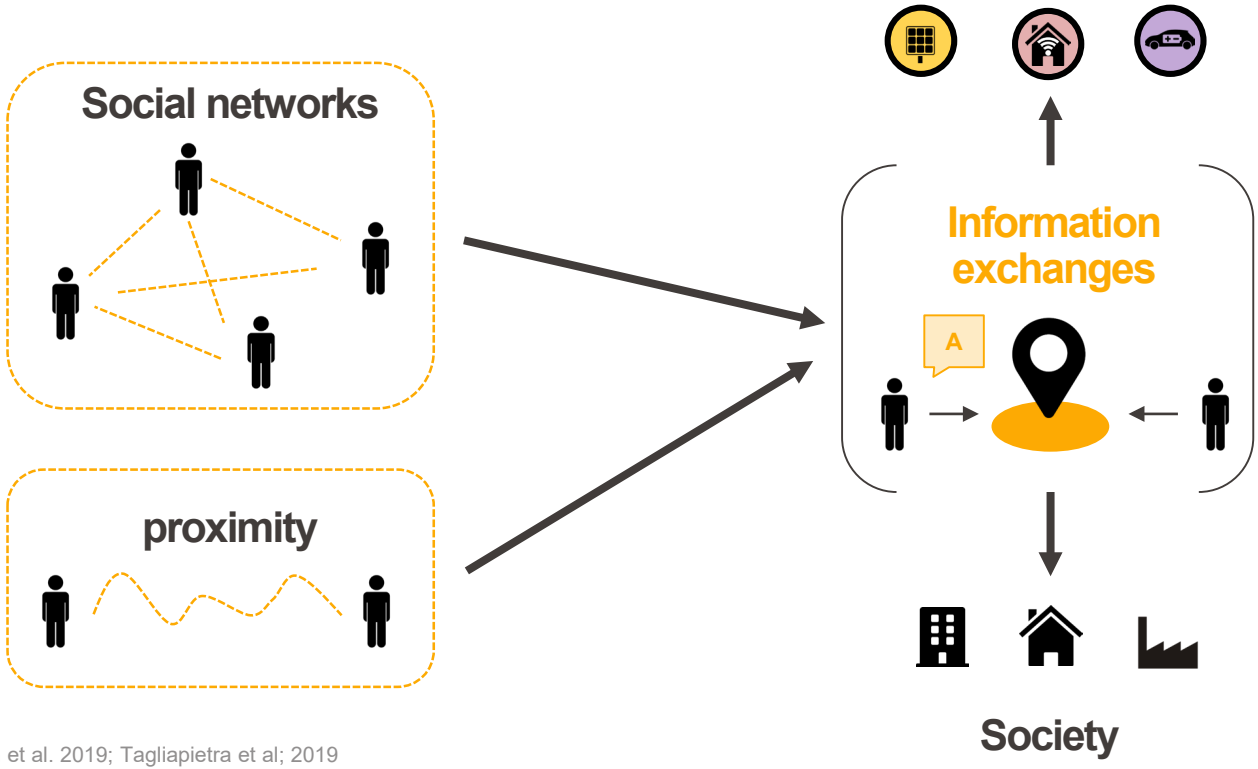


Rogers, 1962; Cohen et al. 2019; Tagliapietra et al; 2019

Speaker
Christophe Ballif / Philippe Thalmann / Claudia Binder

Christophe Balliff / Philippe Thalmann / Claudia Binder

CASE STUDY

Information exchanges

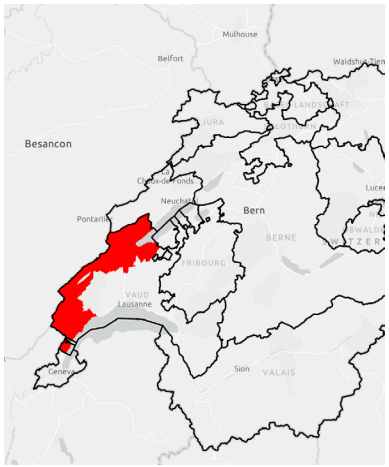
Does social influence matter for PV diffusion?

Survey

1,125 respondents representative sample of population in **Nyon** and **Jura-Nord Vaudois**

↓

198 PV adopters



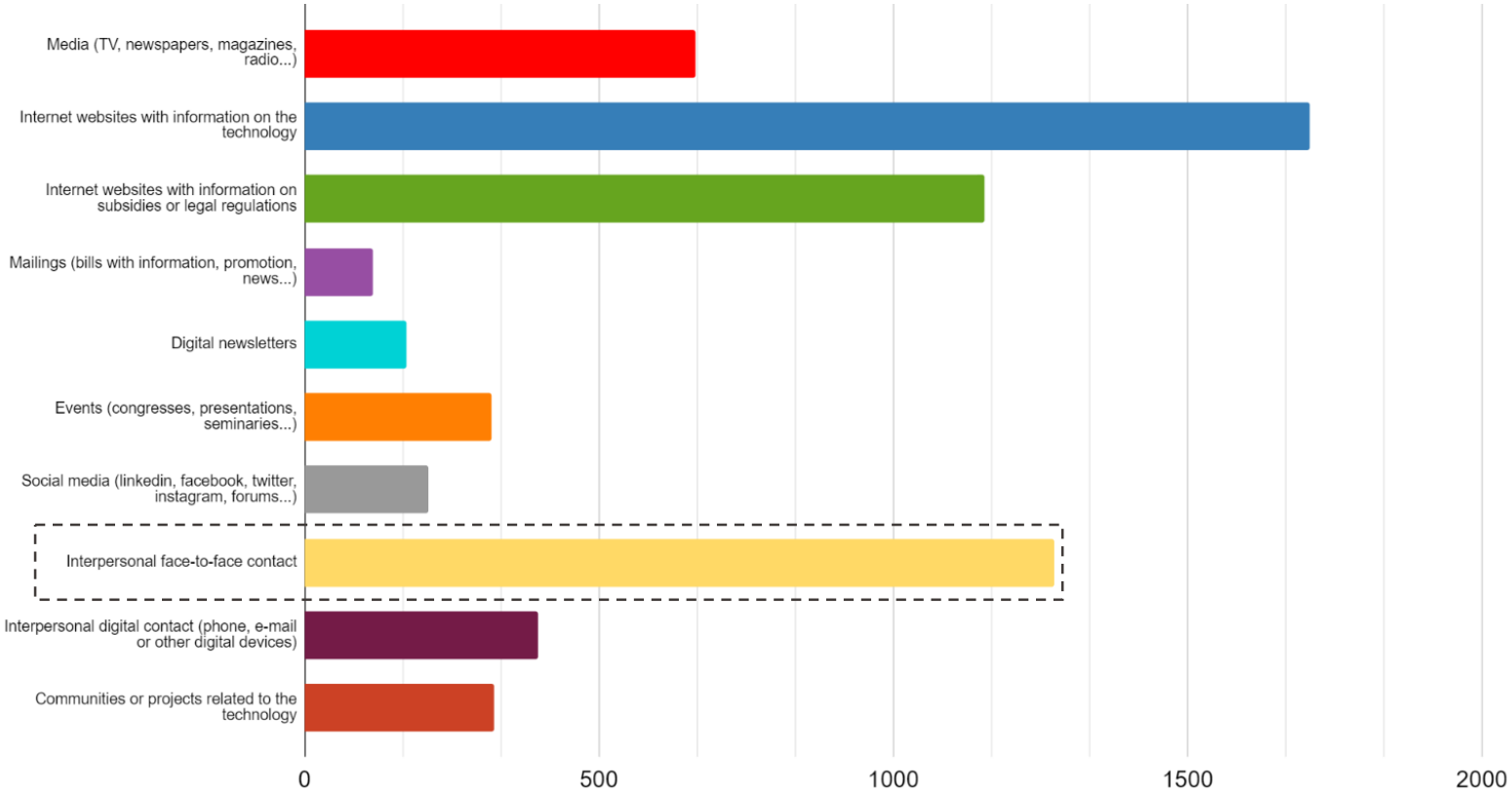
Age
Sex
Household Composition
Home ownership
Type of dwelling
Ownership duration
Relationship with neighbors
Identification with the neighborhood
Responsibility of energy expenditure
Interest in the environment
Exchange about environment questions
Panel installation in the social group
Installation of PV panels by neighbors
Exchange with neighbors
Advice given in the past
Consideration of own impact in the environment
Impact of habits in the environment
Preocupation with climate impact of energy use
Support of environmental protection
Priority given to environmental issues
Professional status
Civil status
Level of education

Serra-Coch et al., 2022

Information exchanges

CASE STUDY

Which type of channels do people use to exchange information?



N = 2300; multiple answers

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Empirical take-aways

- **Social influence** matters for the diffusion
- **Face-to-face interactions** are very important

Social networks

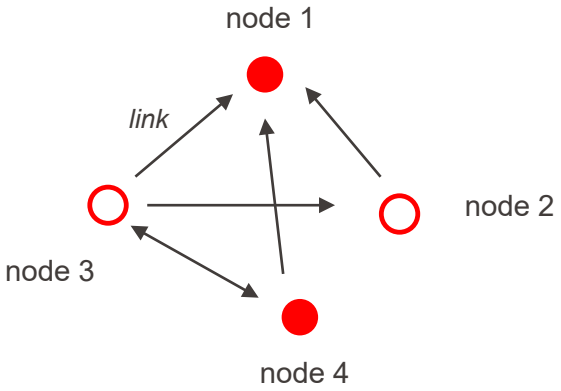
Christophe Balliff / Philippe Thalmann / Claudia Binder

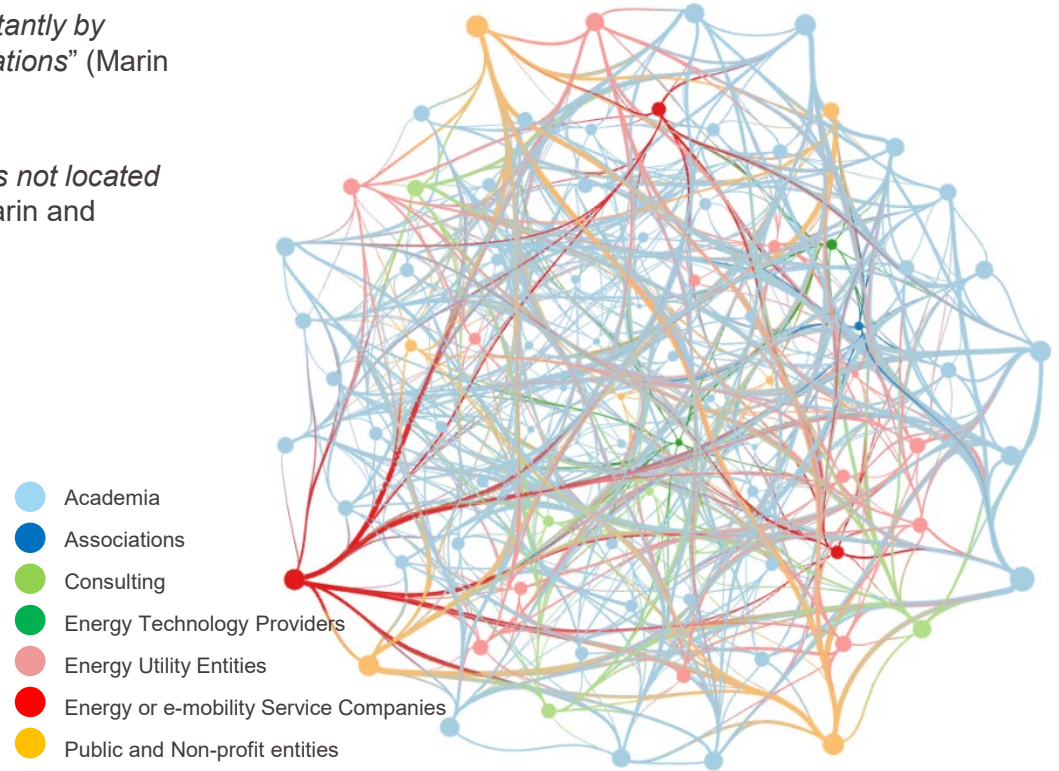
Social network analysis

Social network analysis (SNA) is the field that studies systems of social relationships through networks (Borgatti and Halgin, 2014).

"*social life is created primarily and most importantly by relations and the patterns formed by these relations*" (Marin and Wellman, 2014, p. 2)

social network analysts argue that *"causation is not located in the individual, but in the social structure"* (Marin and Wellman, 2014, p. 4)





Serra-Coch et al., under review in 2025

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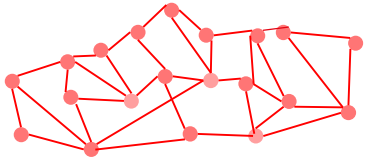
CASE STUDY

Social network analysis

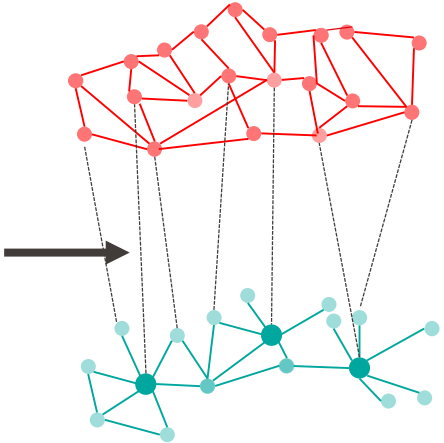
Interactions between professionals and energy technology adopters

PROFESSIONALS



ADOPTERS

ADOPTERS-PROFESSIONALS



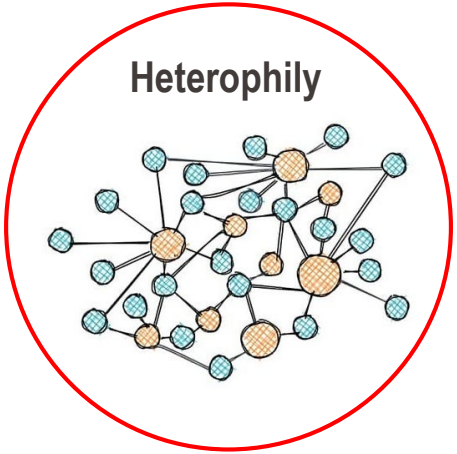
1. *Interactions of professionals with other organisations*

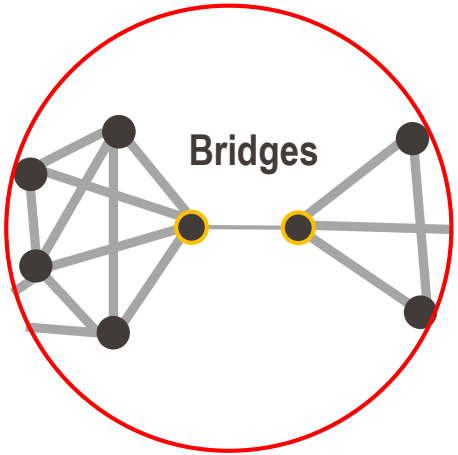
2. *Interactions of adopters with personal contacts*

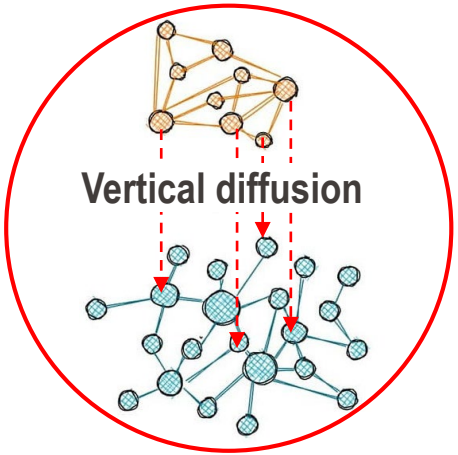
3. *Interactions of adopters with professionals*

Social networks to support innovation

How can we leverage social networks to diffuse energy innovations?







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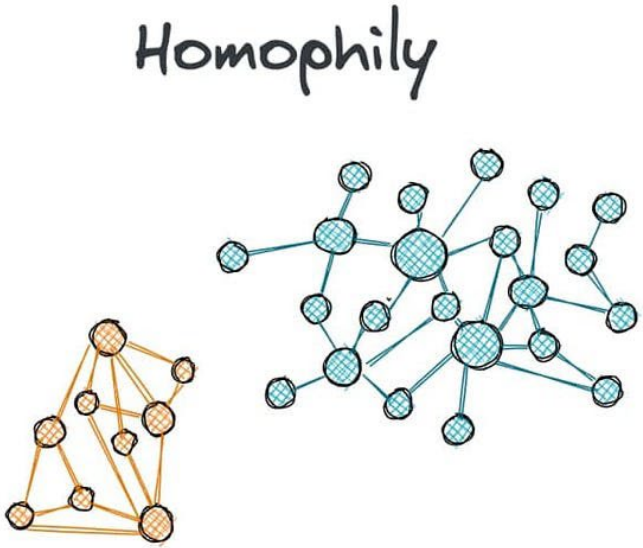
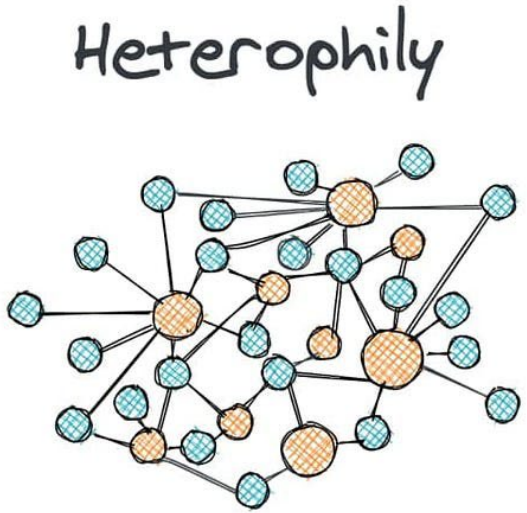
Heterophily

Without «new» people there are no «new» ideas





Source: Rogers, 1962 | Graphics by Sergei Ivanov GML Newsletter

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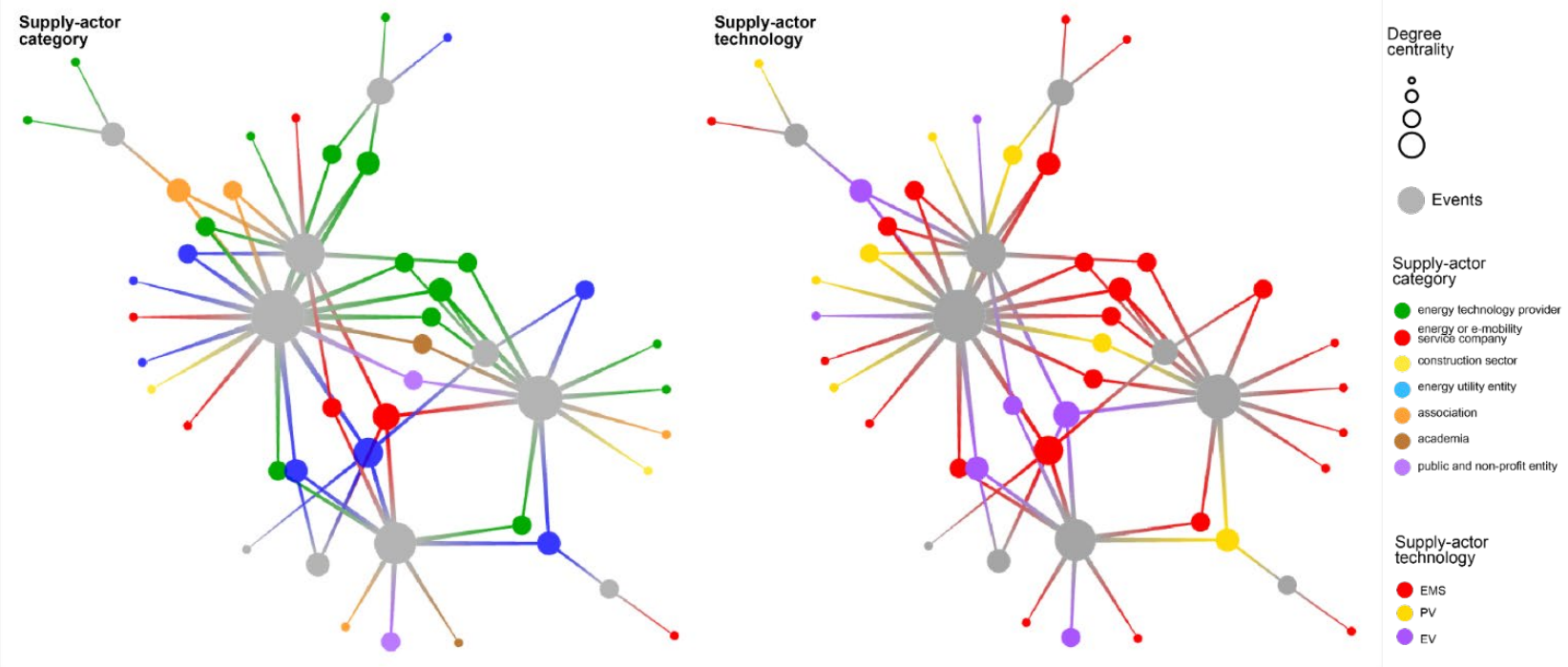
CASE STUDY

Heterophily

Different types of suppliers are connected by the events they attend



Network of events mentioned by supply-side respondents for information exchange. Generated with the software Tulip. The layout is the force-directed FM^3 (OGDF) algorithm. Source: Serra-Coch, 2023

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CASE STUDY

Heterophily

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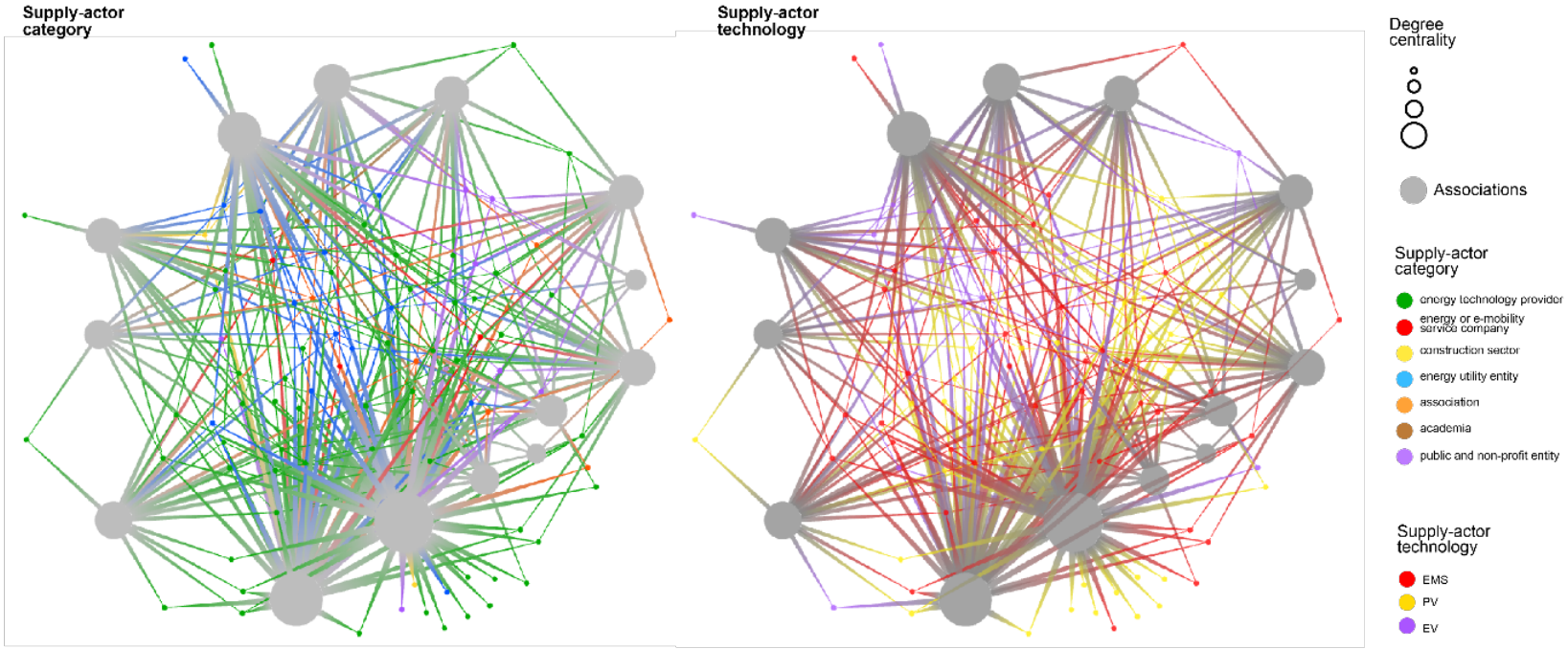
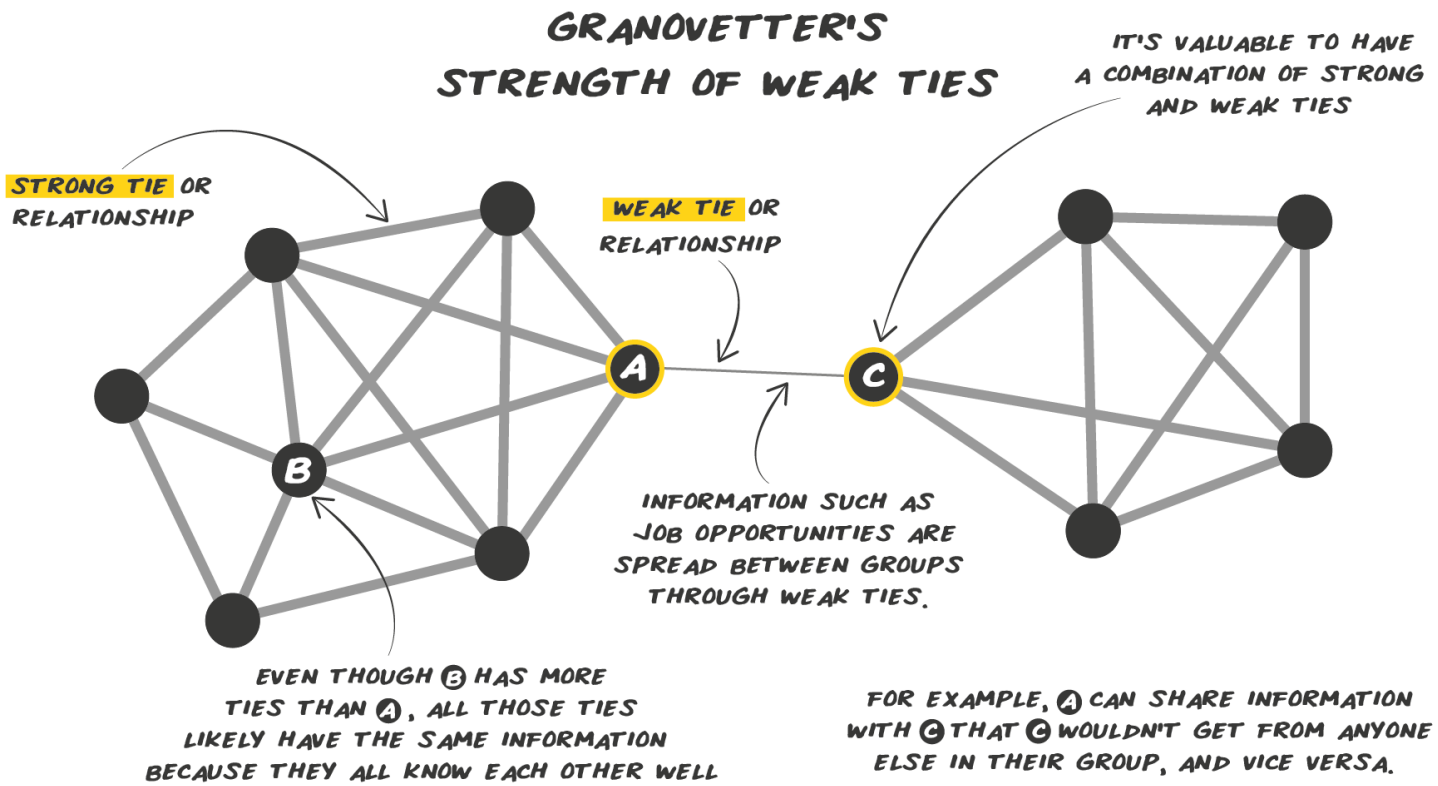


Network of associations mentioned by supply-side respondents for information exchange. Generated with the software Tulip. The layout is the fast multipole embedder (OGDF) algorithm. Source: Serra-Coch, 2023

Bridges

Intermediaries have a key role for the diffusion of innovations



Source: Grannovetter 1973 | Graphics by The Reliants Project

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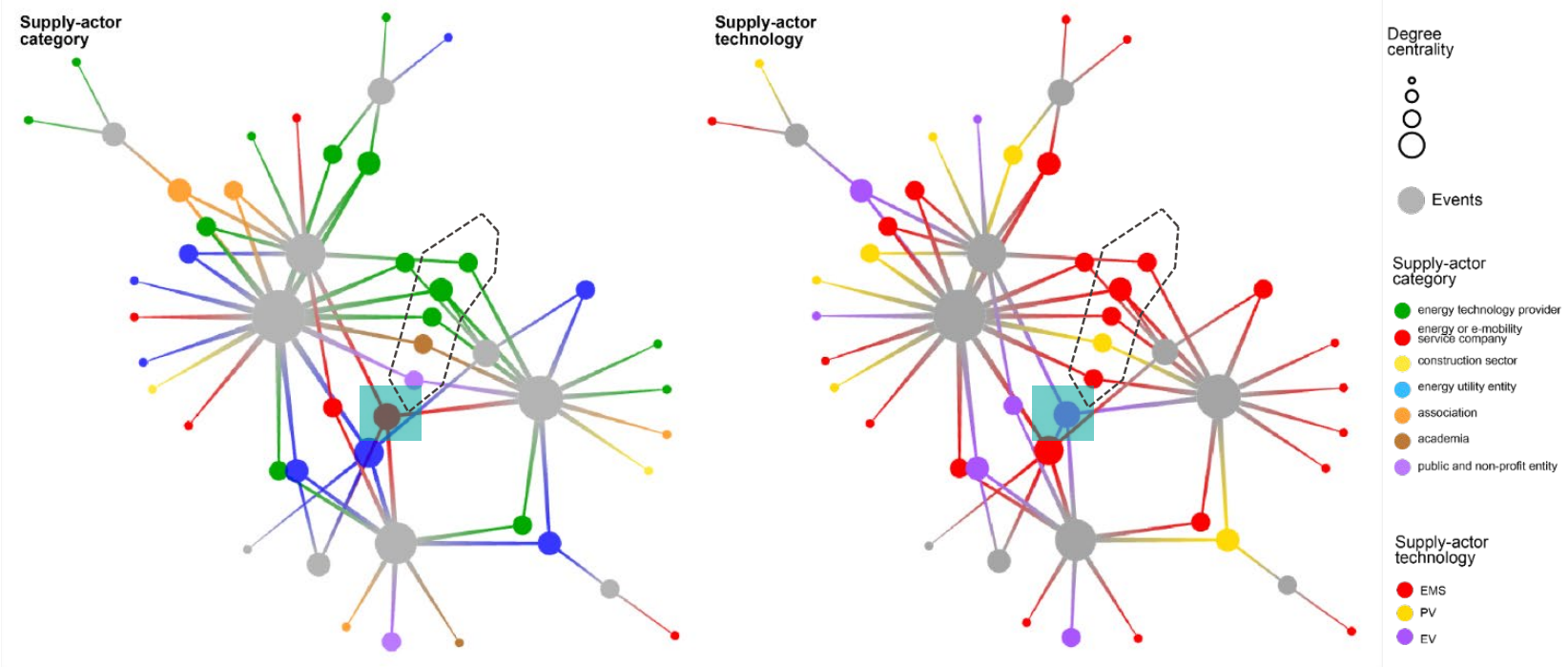
CASE STUDY

Bridges

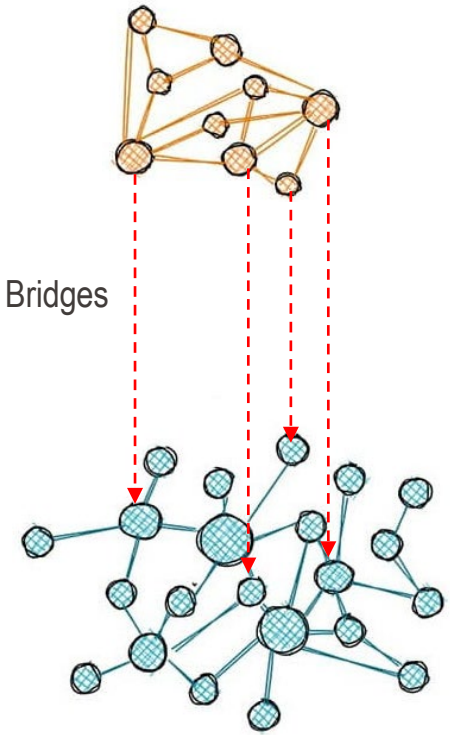
Some suppliers are bridges (intermediaries) between different groups



Network of events mentioned by supply-side respondents for information exchange. Generated with the software Tulip. The layout is the force-directed FM^3 (OGDF) algorithm. Source: Serra-Coch, 2023

Vertical diffusion

Connecting people from different socio-economic backgrounds

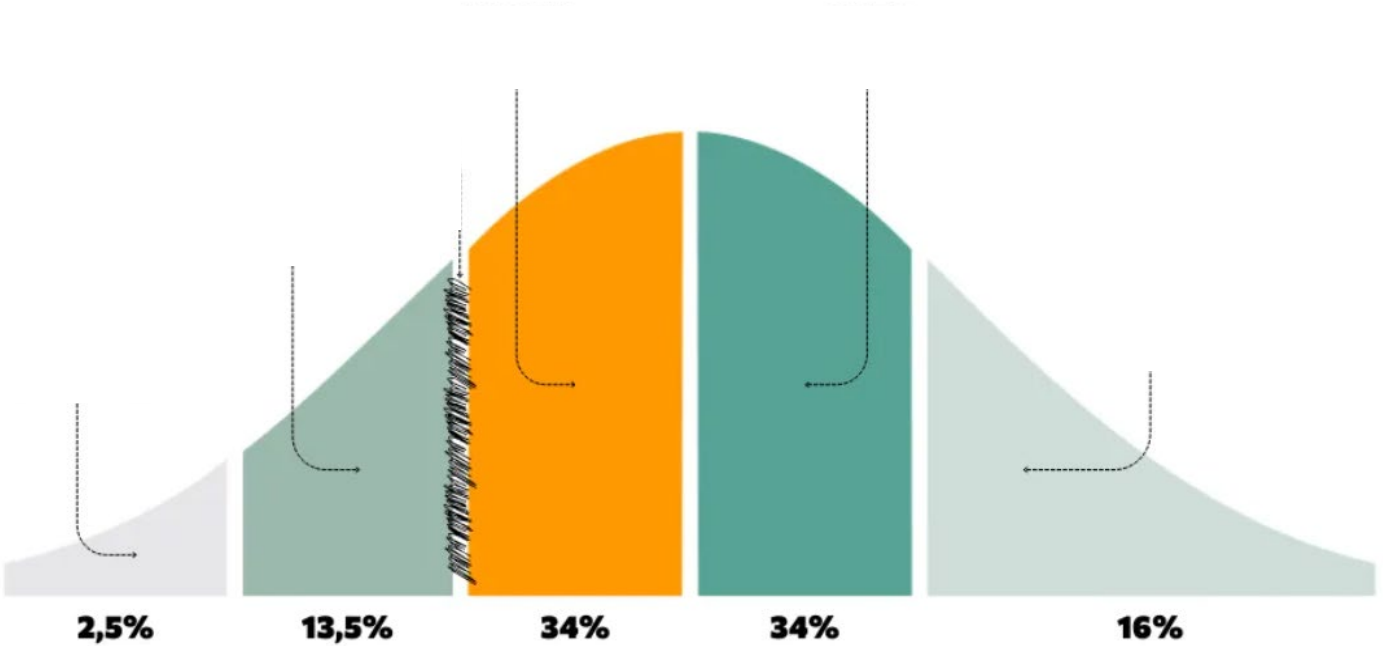


« Innovators »

Majority of the population

Vertical diffusion

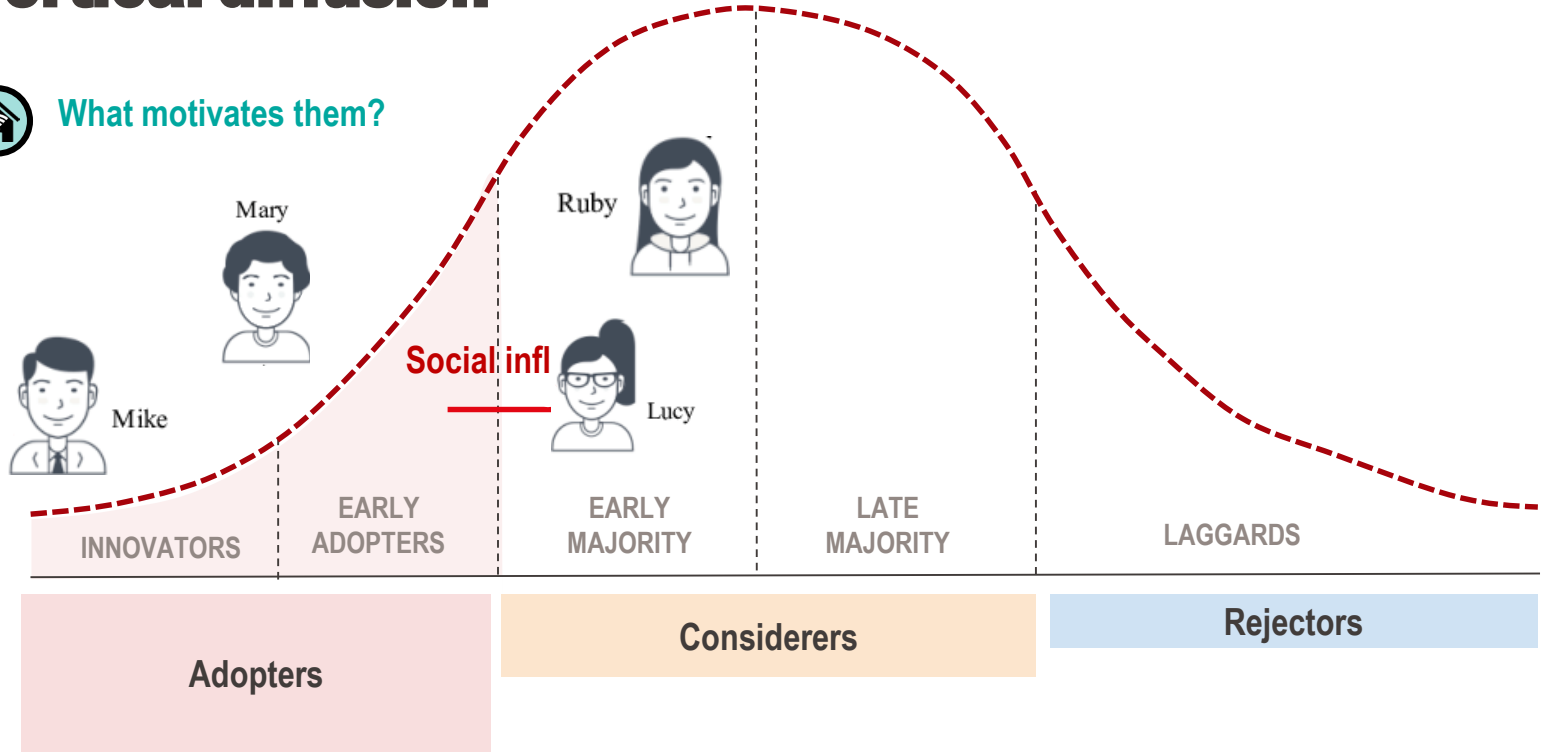
Adopter categories based on innovativenes (Rogers)



Vertical diffusion

CASE STUDY

What motivates them?



- ✓ Want to be more sustainable
- ✓ Have a privileged context

- ✓ Recommendations from others
- ✓ Seeing others who have it

- ✓ Financially not attractive
- ✓ Want financial incentives

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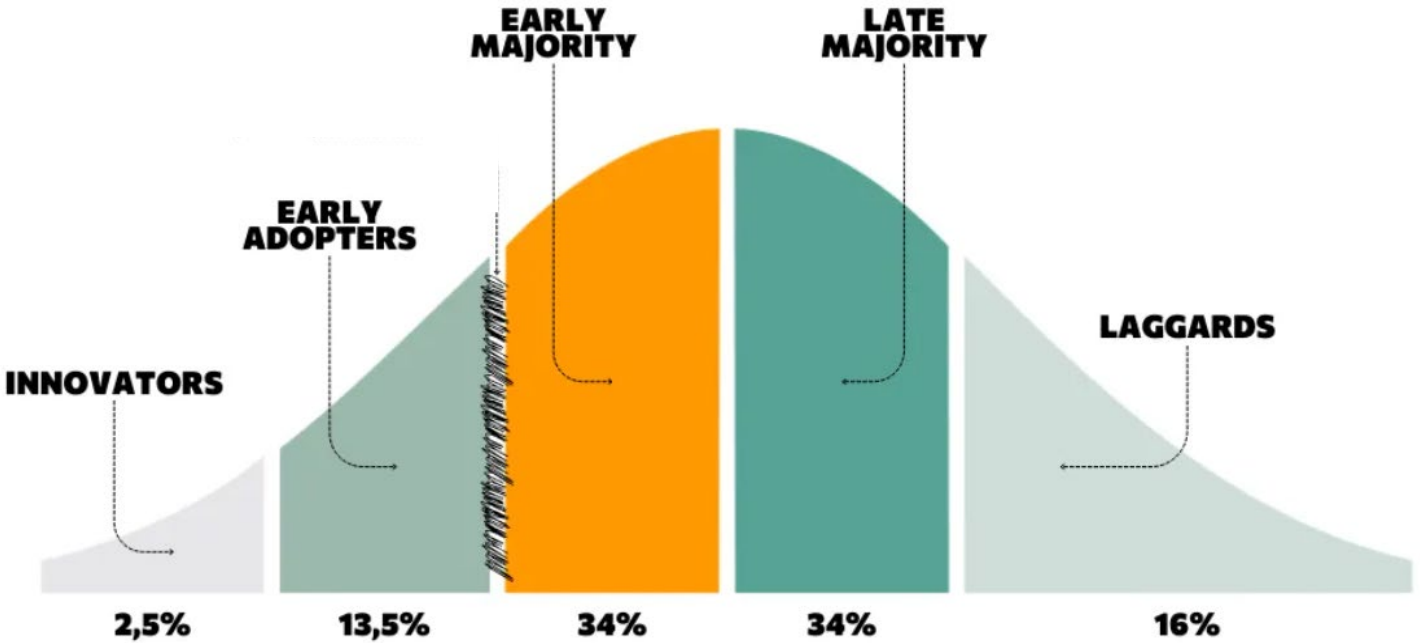
Vertical diffusion

Adopter categories based on innovativenes (Rogers)



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Typologies of PV adopters

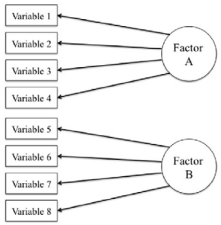
CASE STUDY

Swiss household survey
5.000 responses
Focus on 3 technologies (EMS, PV, EV)
Focus on 4 cantons with 3 languages (SO, SG, VD, TI)

Socio-demographics | Technology | Adoption process | Information exchange | Household characteristics | Personal context | Environmental attitudes

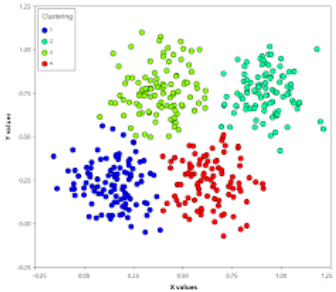
Factor analysis of motivation variables

- Factorability of the sample
- Eigenvalues
- Factor analyzer (Varimax rotation)
- Factor's scores



Clustering analysis of motivation factors

- Delete outliers
- Clustering Ward's method
- Clustering validation



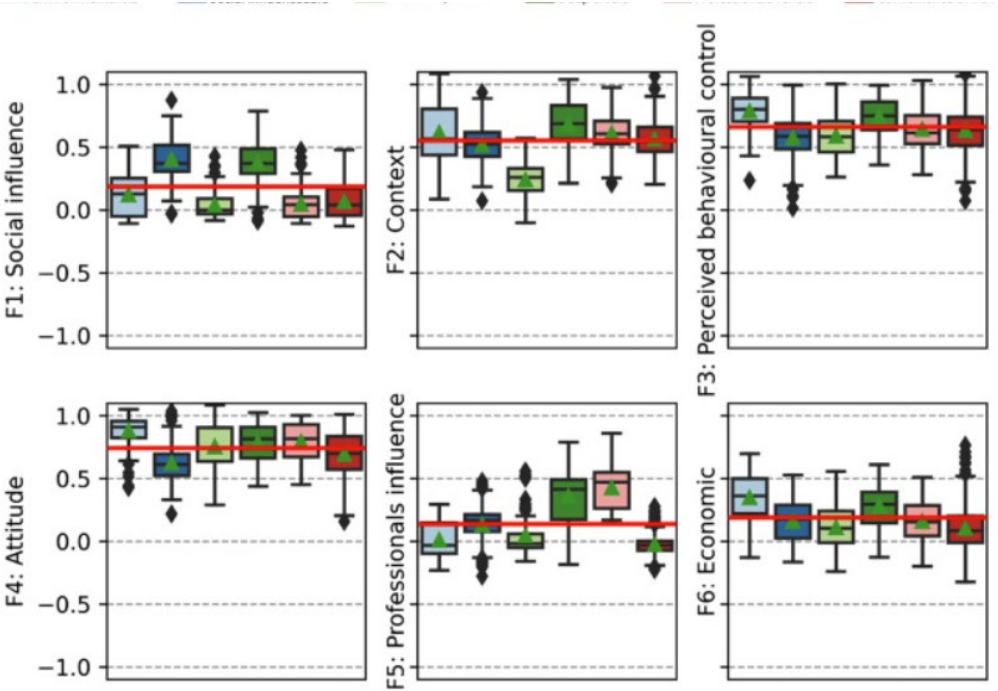
Clusters

Implications of multi-dimensions relations for PV adoption

Martinez-Alcaraz et al., 2025

Typologies of PV adopters

CASE STUDY



Martinez-Alcaraz et al., 2025

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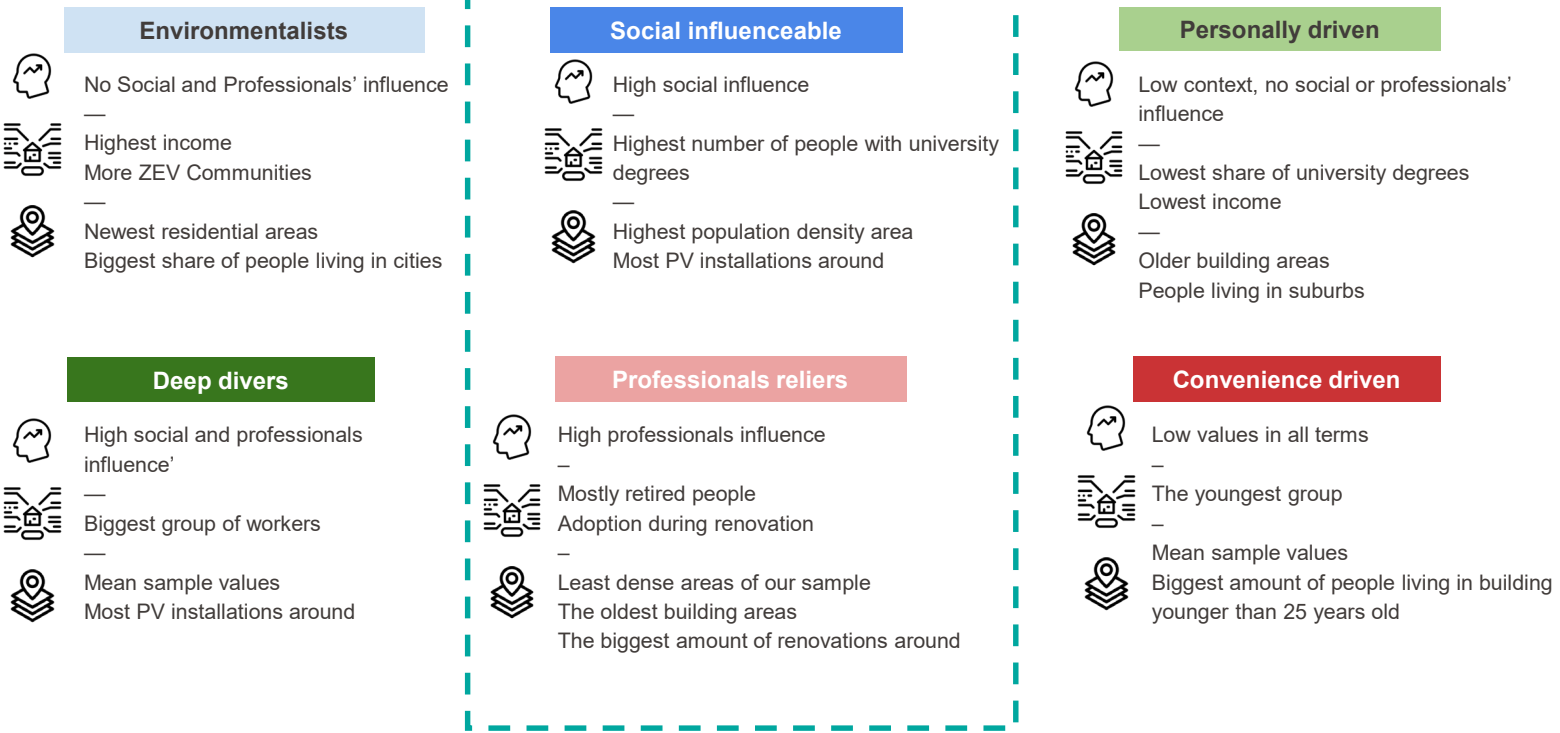
Typologies of PV adopters

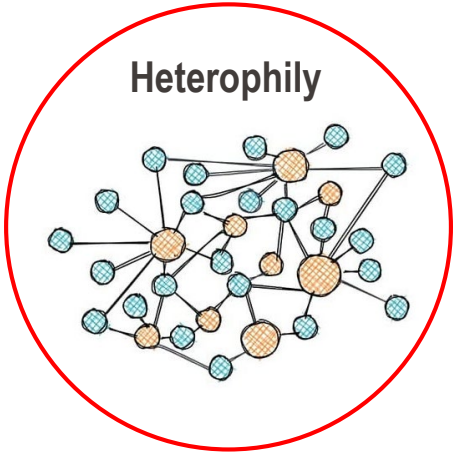
CASE STUDY



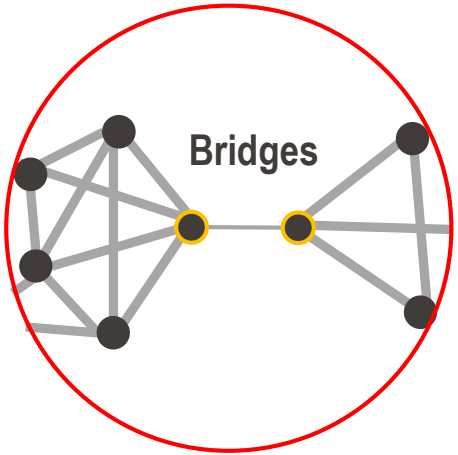
Martinez-Alcaraz et al., 2025

Social networks to support innovation

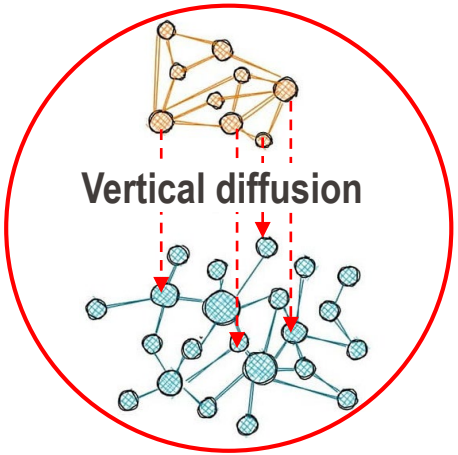
How can we leverage social networks to diffuse energy innovations?



Certain degree of **heterophily** to bring new ideas in



People who act as **bridges** between groups

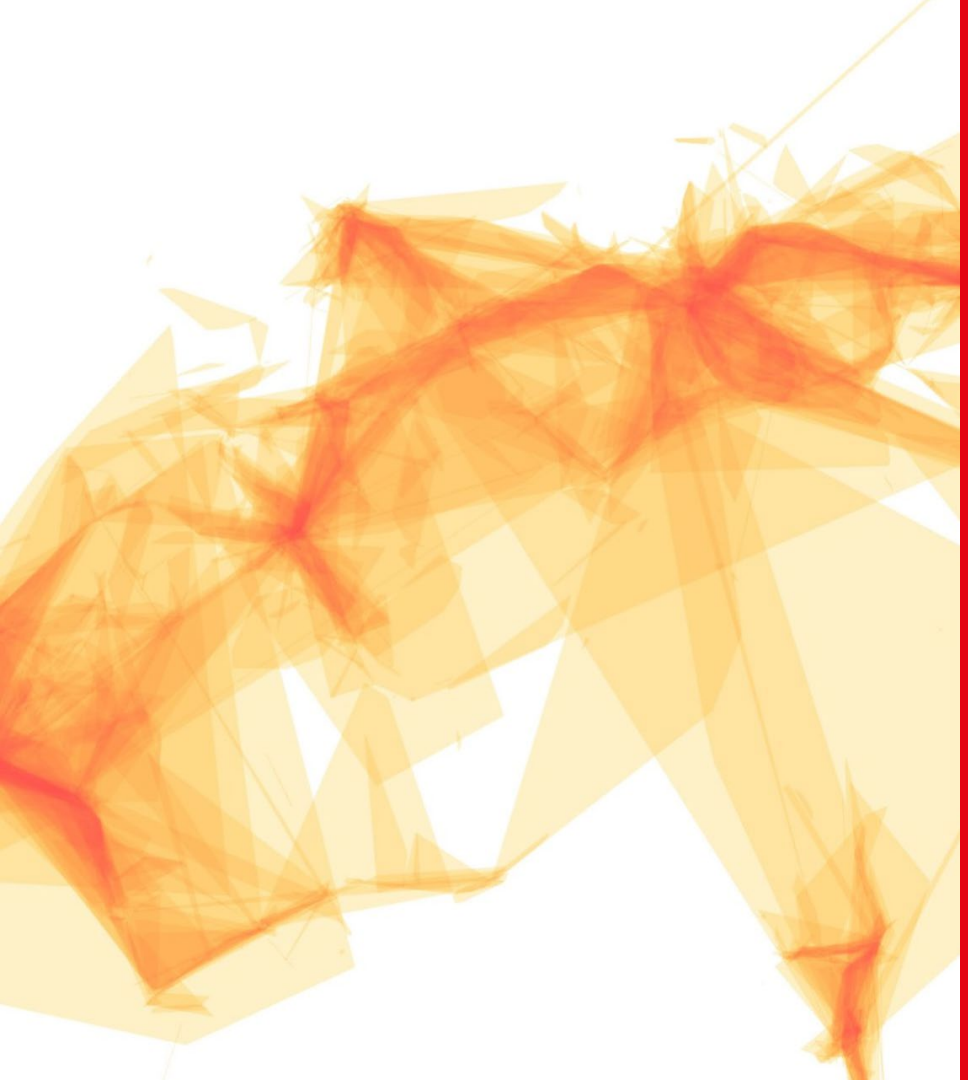


Vertical diffusion with groups of different socio-economic backgrounds

Christophe Ballif / Philippe Thalmann / Claudia Binder

Empirical take-aways

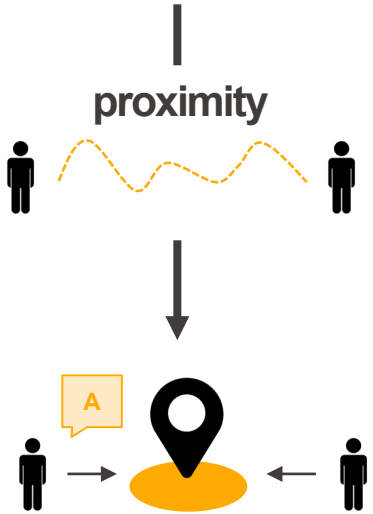
- **Heterophilic** networks with intermediaries **bridging** groups and **vertical diffusion** between different people support the diffusion of innovations



Proximity

Proximity

Innovation-diffusion is the process in which an ***innovation*** is **communicated** through certain ***channels*** over ***time*** among the members of a ***social system.***



Hagerstrand, 1967; Boschma and Frenken, 2010; Paci and Usai, 1999

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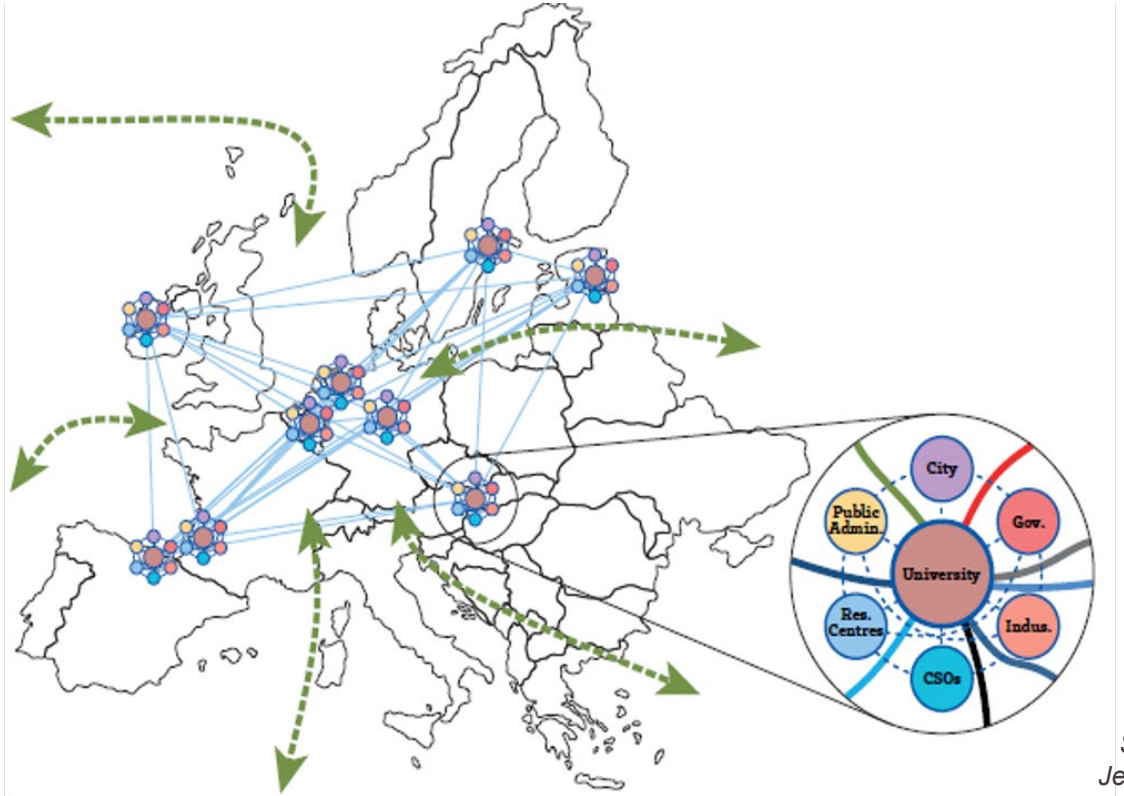
(tacit) knowledge exchanges

Why do we need proximity?



Source: Asheim et al., 2007; Crevoisier & Jeannerat, 2009; Senker, 1995; Glasmeier, 1991; Maillat et al., 1995

Graphics by Enlight

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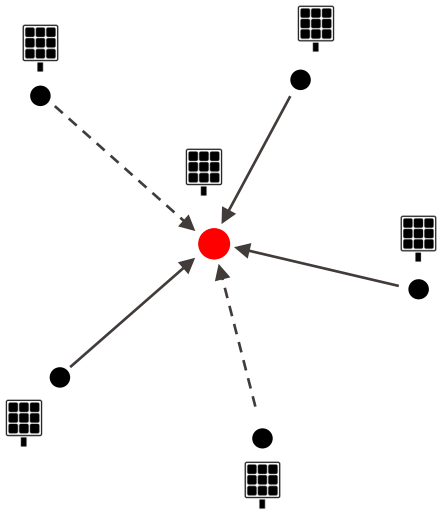
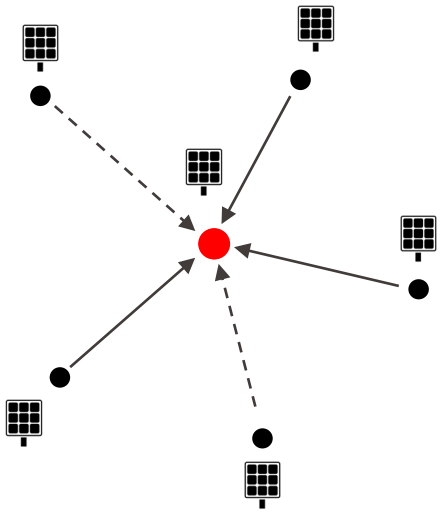
Proximity effects



SourcePalm, 2017; Wolske et al., 2020; Baranzini et al., 2017; Carattini et al., 2018; Irwin, 2021; Graziano & Gillingham, 2015; Barrot et al., 2008; Rogers, 2003; Al-Taie & Kady, 2017

Proximity effects & information

Proximity effects take place when attitudes, values or behaviours of an individual are affected by behaviours of close individuals.



can work through:

- Interpersonal communication and persuasion
- normative social influence

can be:

- active: conscious verbal exchange (word of mouth)
- passive: visual cues (visibility)

Source: Palm, 2017; Wolske et al., 2020; Baranzini et al., 2017; Carattini et al., 2018; Irwin, 2021; Graziano & Gillingham, 2015; Barrot et al., 2008; Rogers, 2003; Al-Taie & Kady, 2017

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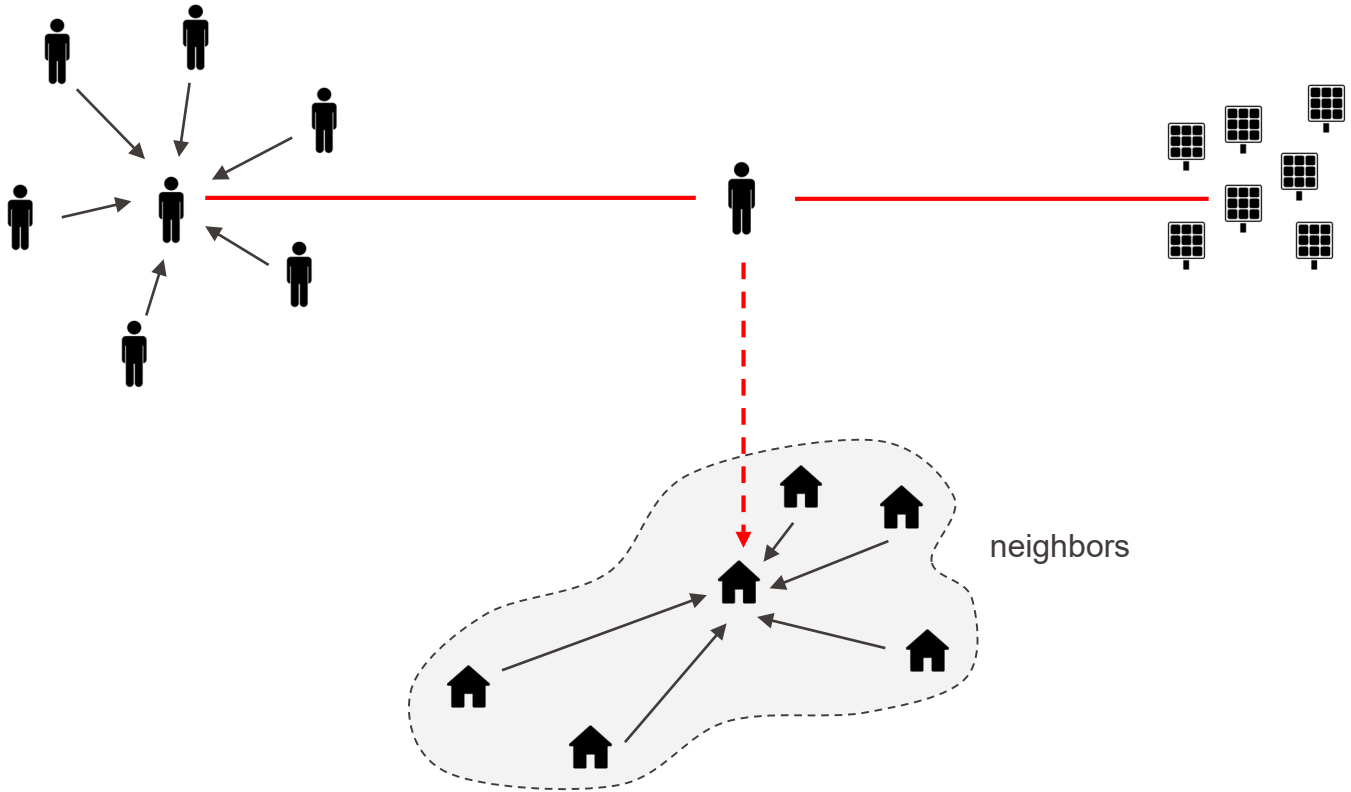
Proximity effects & information



Source: Palm, 2017; Wolske et al., 2020; Baranzini et al., 2017; Carattini et al., 2018; Irwin, 2021; Graziano & Gillingham, 2015; Barrot et al., 2008; Rogers, 2003; Al-Taie & Kady, 2017

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CASE STUDY

Proximity effects

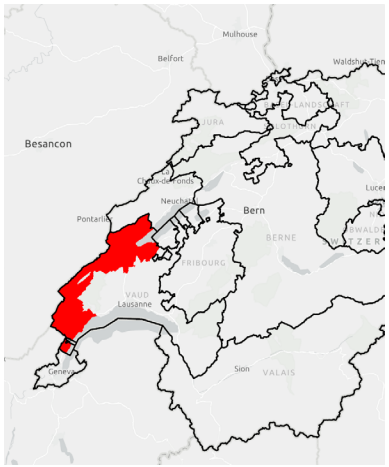
Does proximity matter for social influence?

Survey

1,125 respondents representative sample of population in **Nyon** and **Jura-Nord Vaudois**

↓

198 PV adopters



Age
Sex
Household Composition
Home ownership
Type of dwelling
Ownership duration
Relationship with neighbors
Identification with the neighborhood
Responsibility of energy expenditure
Interest in the environment
Exchange about environment questions
Panel installation in the social group →
Installation of PV panels by neighbors
Exchange with neighbors
Advice given in the past
Consideration of own impact in the environment
Impact of habits in the environment
Preocupation with climate impact of energy use
Support of environmental protection
Priority given to environmental issues
Professional status
Civil status
Level of education

With whom did they exchange about the topic?

Where are they located?

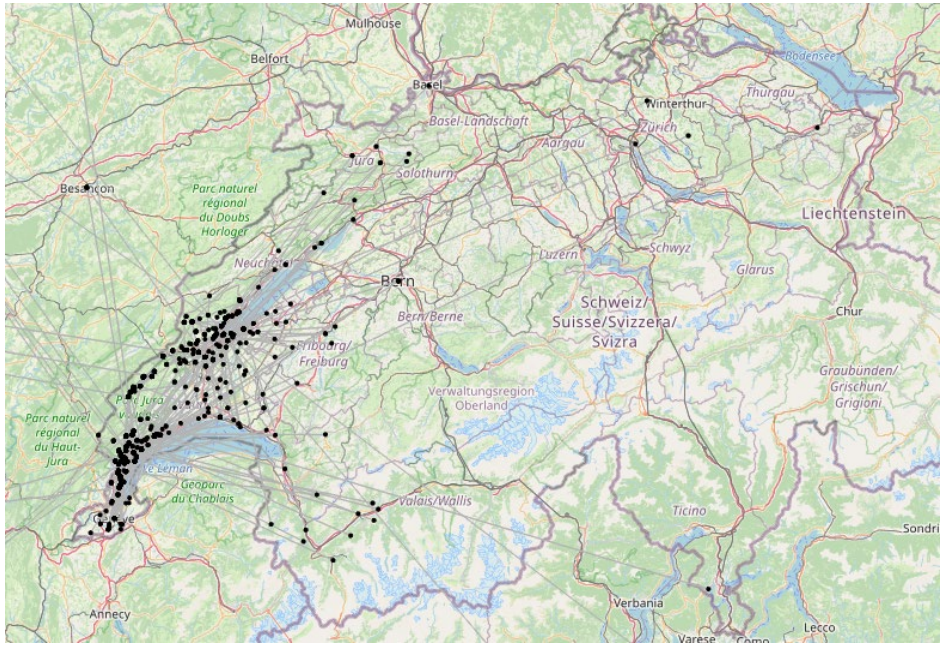
Are there PV panels around them?

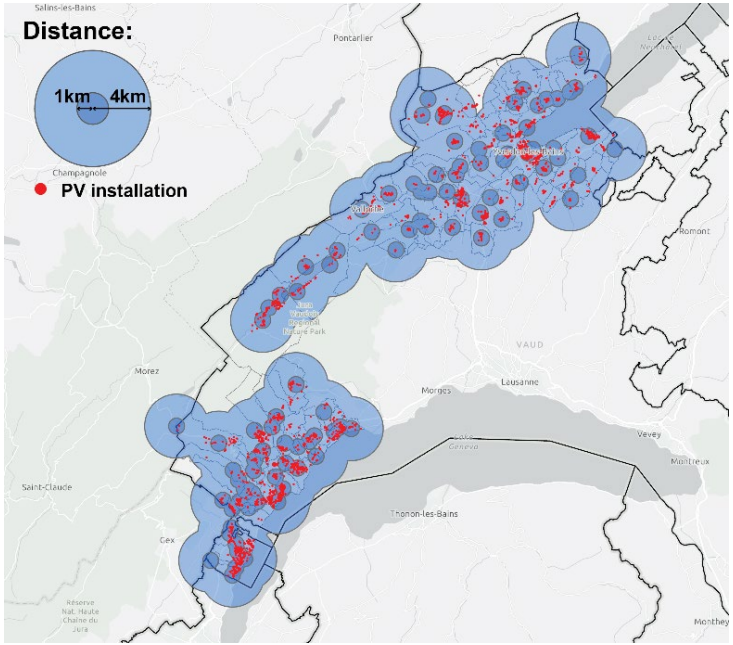
Serra-Coch et al., 2022

Proximity effects

Does proximity matter for social influence?

CASE STUDY





Serra-Coch et al., 2022

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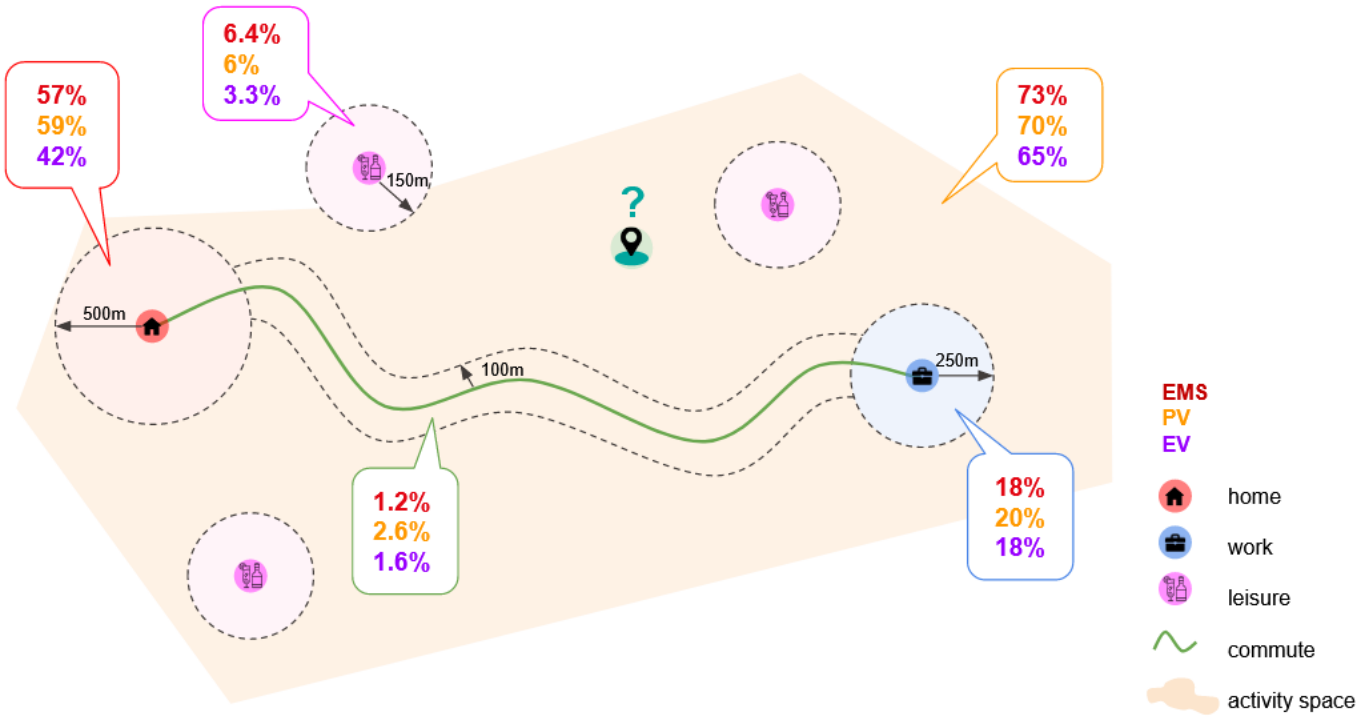
CASE STUDY

Proximity

Adopters exchange information about EMS, PV & EV around their home



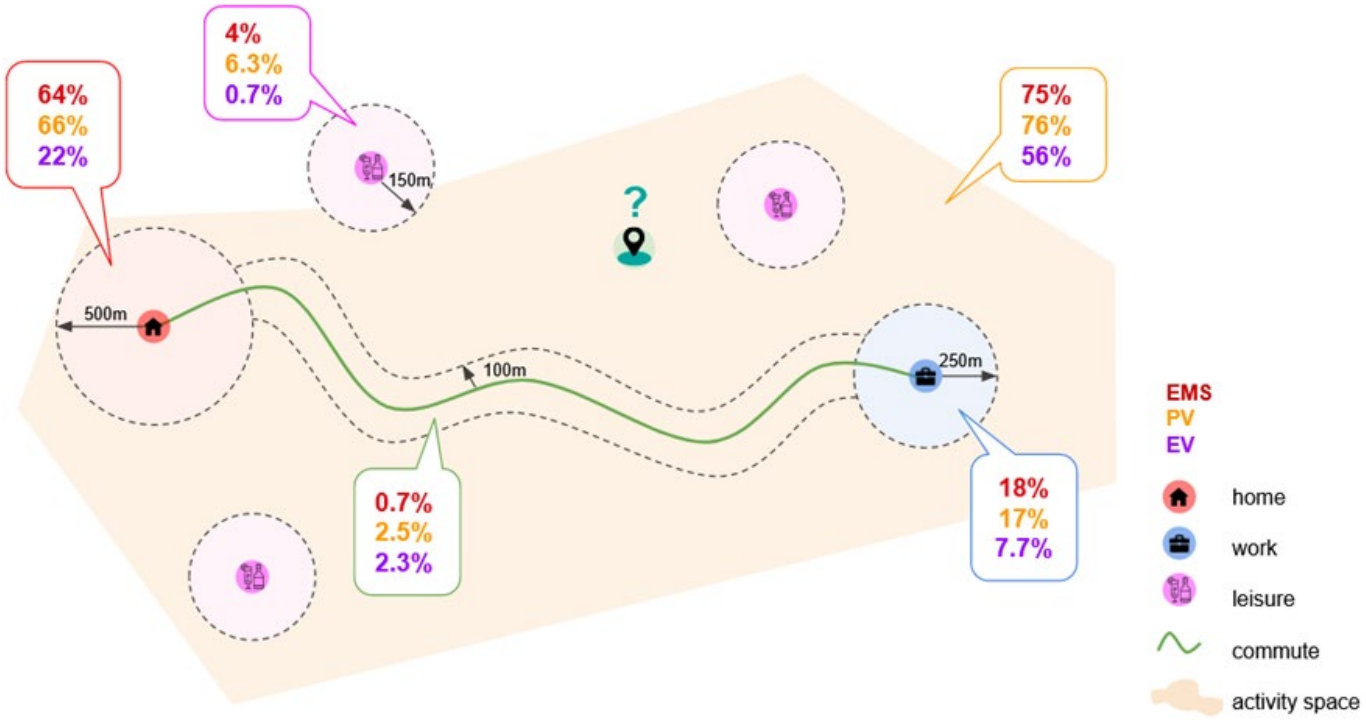
Personal

Serra-Coch et al., under review in 2025

CASE STUDY

Proximity

Both with personal contacts and professionals
With different patterns between technologies

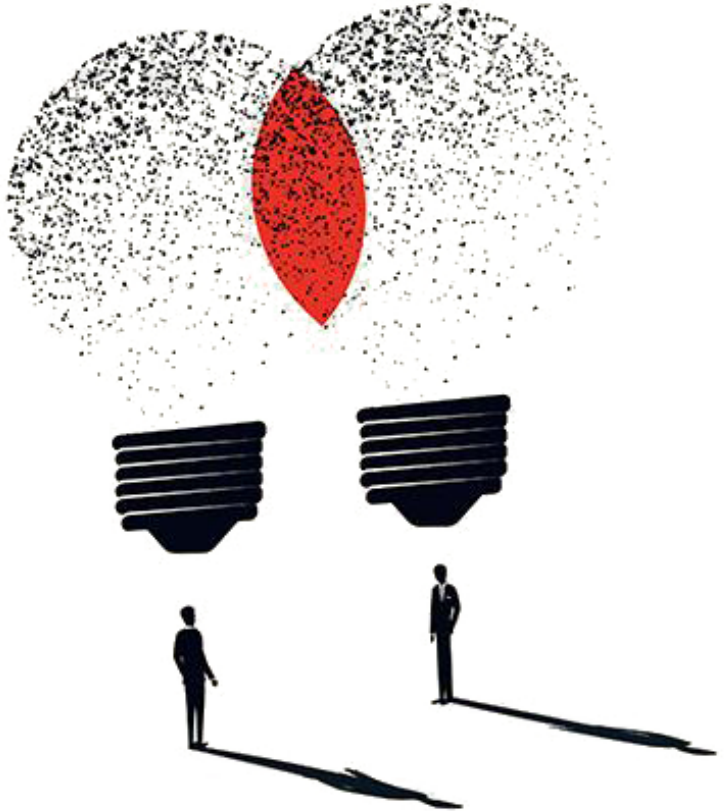


Professional

Serra-Coch et al., under review in 2025

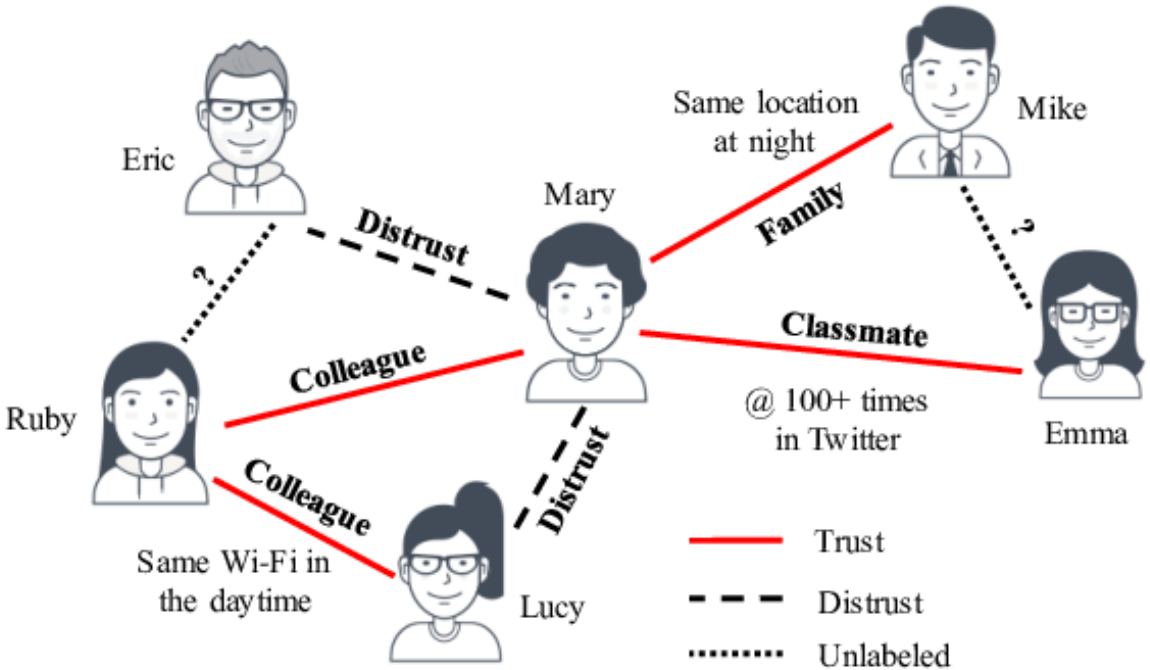
Social proximity

How about how close we feel to a person? Regardless of physical distance…



Social proximity

Our relationships can be defined in terms of how much we trust people



Source & Graphics: Cen et al. 2019

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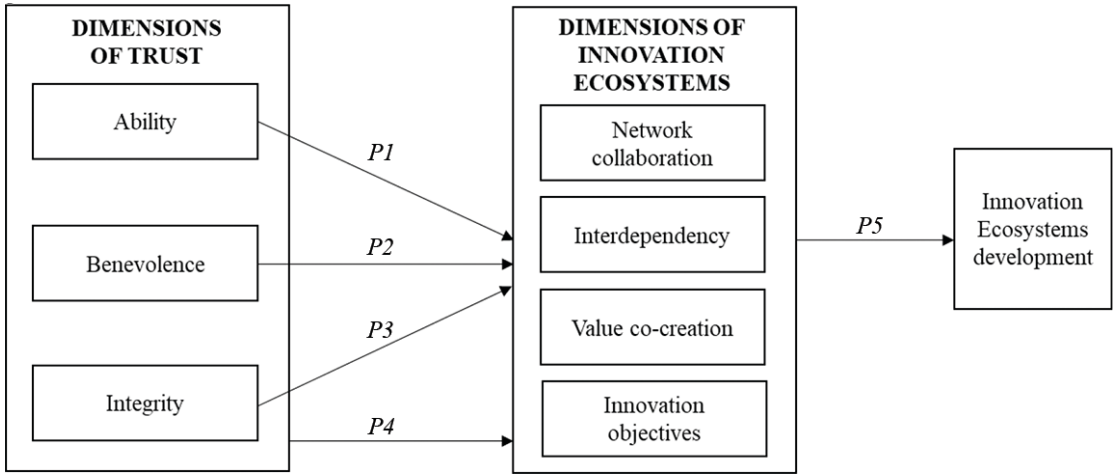
Social proximity

Trust is key for communication and cooperation → innovation



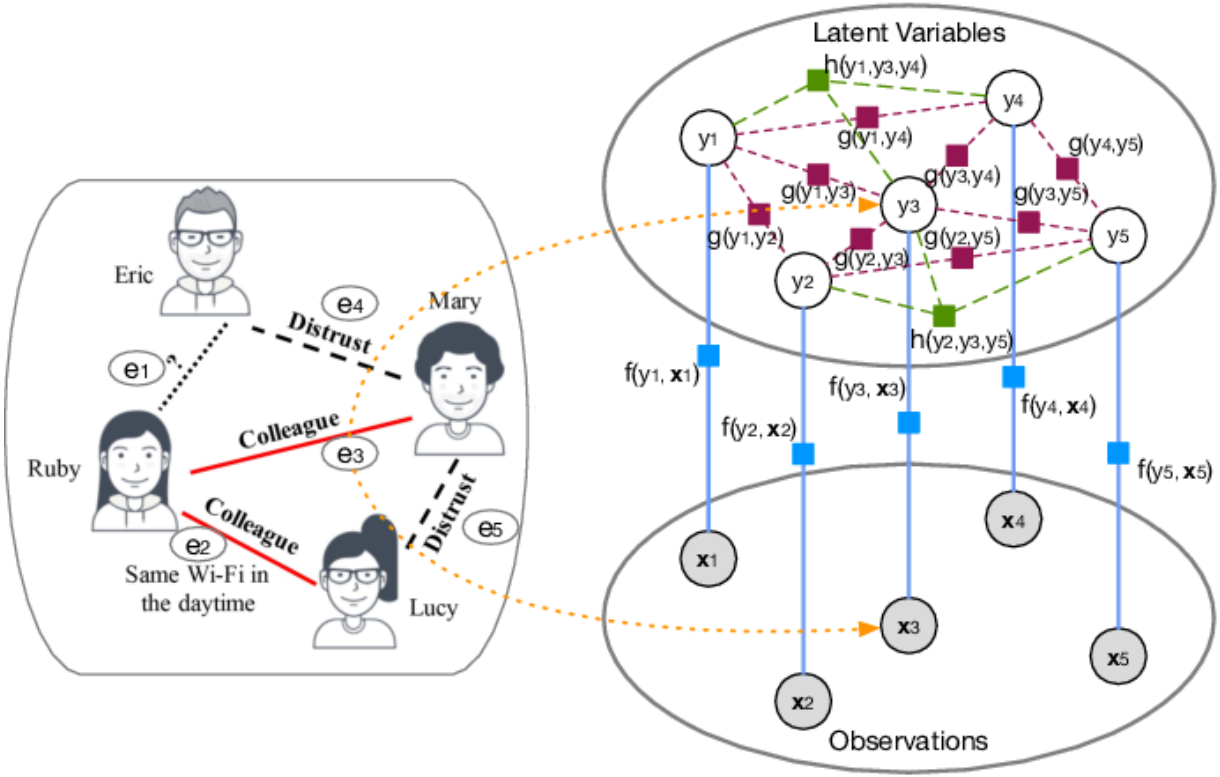
Note: P = Proposition

Cities and sustainability Binder and Serra Coch / Claudia Binder

Source: Kalil et al., 2020

Social proximity

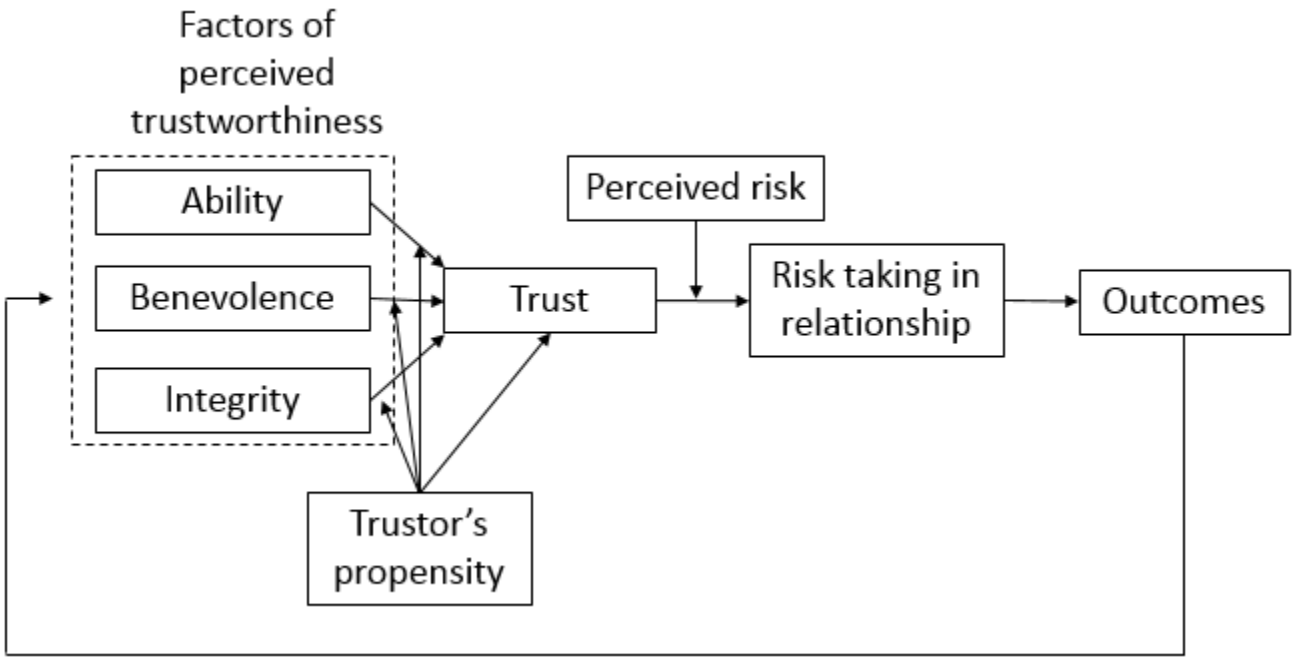
Trust is key for communication and cooperation → innovation



Source & Graphics: Cen et al. 2019

Social proximity

Intermediaries as trust enablers



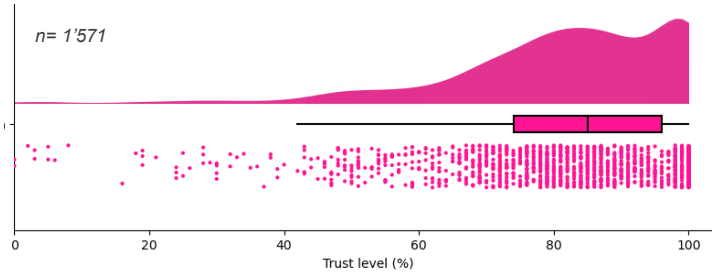
Source: Majava et al. 2016

Social proximity

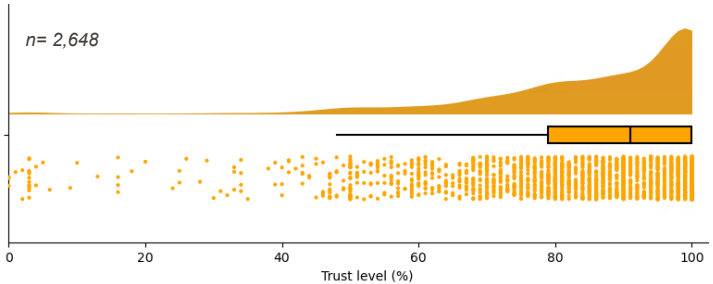
Trust is high overall and highest between adopters and their personal contacts

CASE STUDY

With professionals



With personal contacts



TRUST

Serra-Coch et al., under review in 2025

Christophe Balliff / Philippe Thalmann / Claudia Binder

Social proximity

There is a relationship between frequency of interaction and trust

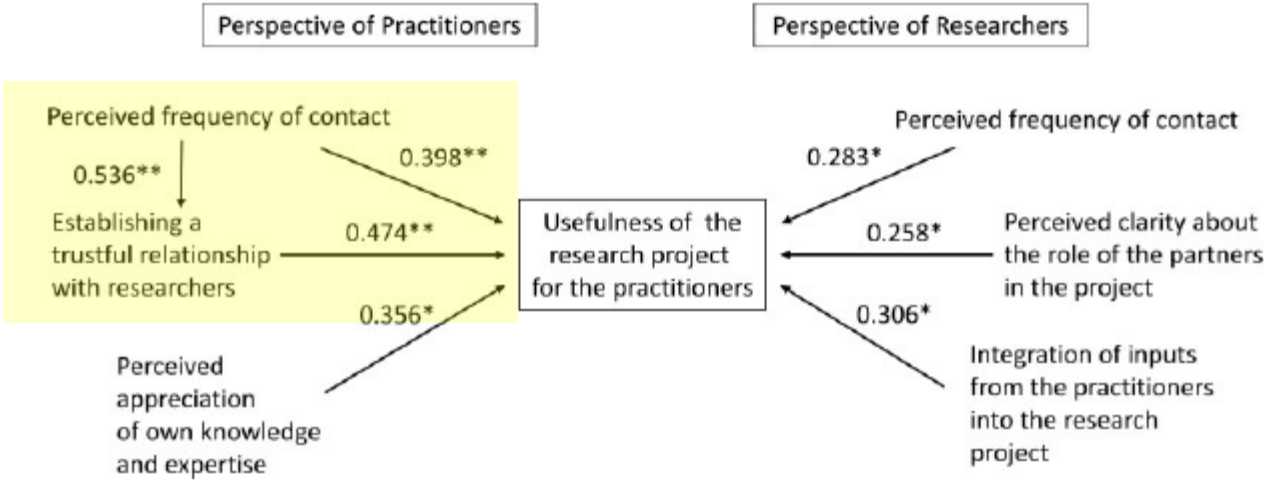


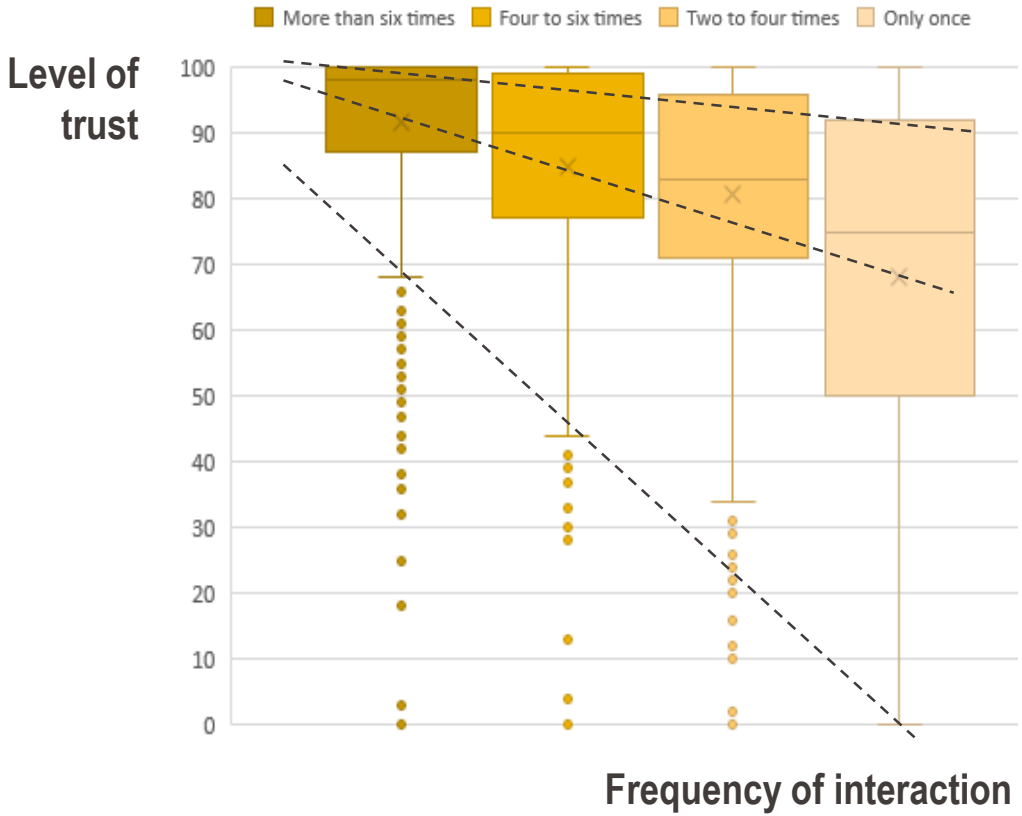
Figure 5. Significant aspects related to the usefulness of the research project for practitioners according to the analysis of the responses of researchers and practitioners (* $p < 0.05$, ** $p < .0.01$).

Source: Binder et al., 2020

Social proximity

CASE STUDY

Adopters trust more those with whom they interact more often



Social proximity

Trust and frequency of interaction are related in both cases

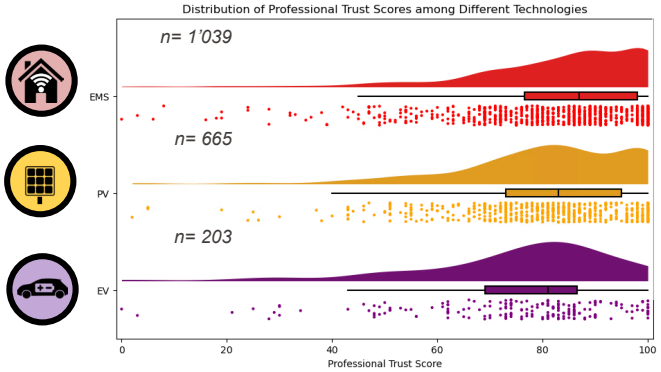
CASE STUDY

CASE STUDY

Social proximity

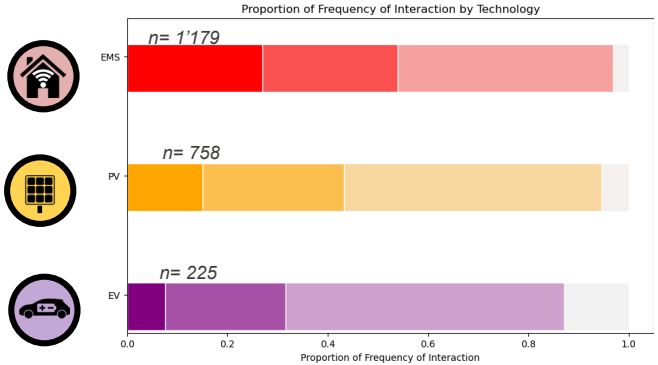
EV adopters exchange less often and trust less the professionals

With professionals



Kruskal-Wallis H p-value: 0

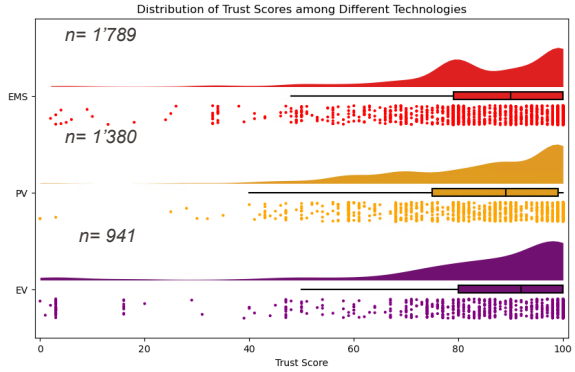
Dunn's Test (Post-hoc: (p < 0.05): EMS vs. EV: p = 0.00000 EMS vs. PV: p = 0.00064 EV vs. PV: p = 0.002



Kruskal-Wallis H p-value: 0

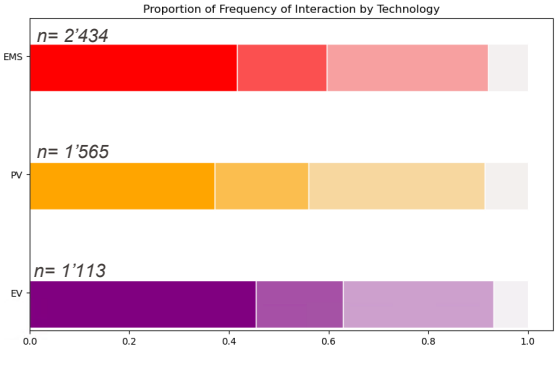
Dunn's Test (Post-hoc: (p < 0.05): EMS vs. EV: p = 0.0 EMS vs. PV: p = 0.0 EV vs. PV: p = 0.00

With personal contacts



Kruskal-Wallis H p-value: 0

Dunn's Test (Post-hoc: (p < 0.05): EV vs. PV: p = 0.00959



Kruskal-Wallis H p-value: 0.0

Dunn's Test (Post-hoc: (p < 0.05): EMS vs. EV: p = 0.0 EV vs. PV: p = 0.00

> 6 times 4-6 times 2-4 times 1 time

Serra-Coch et al., under review in 2025

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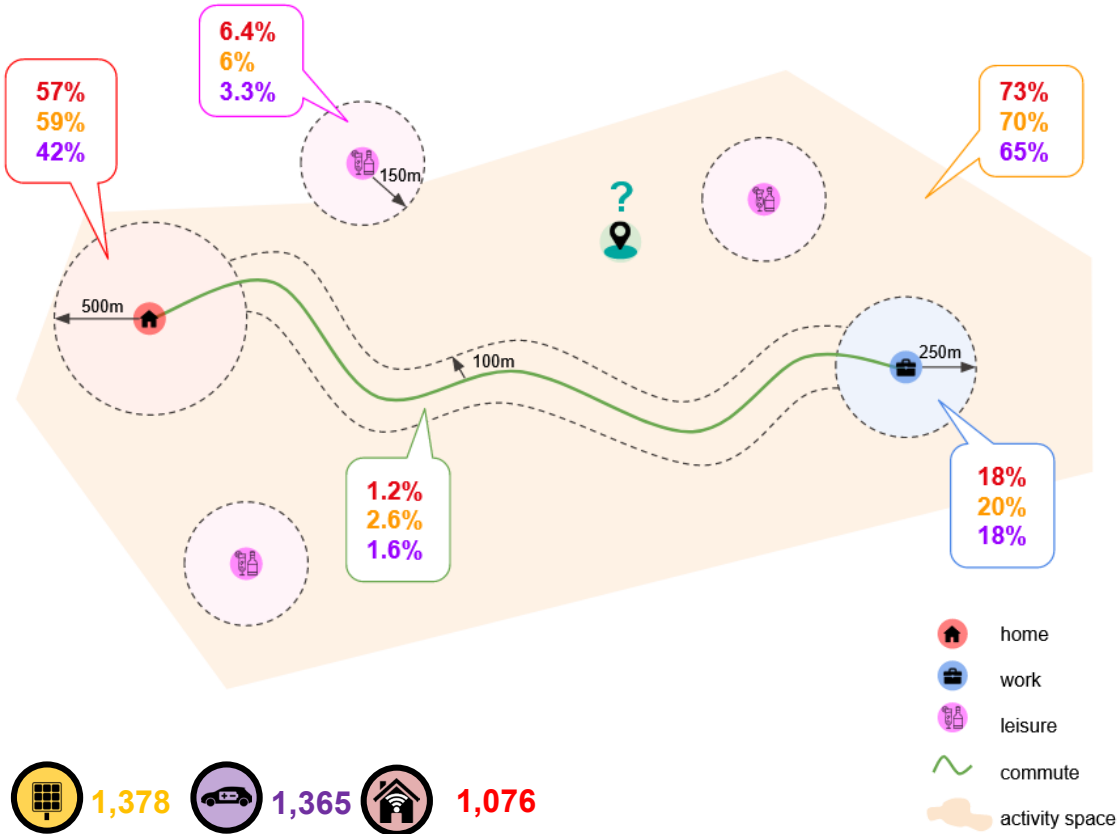
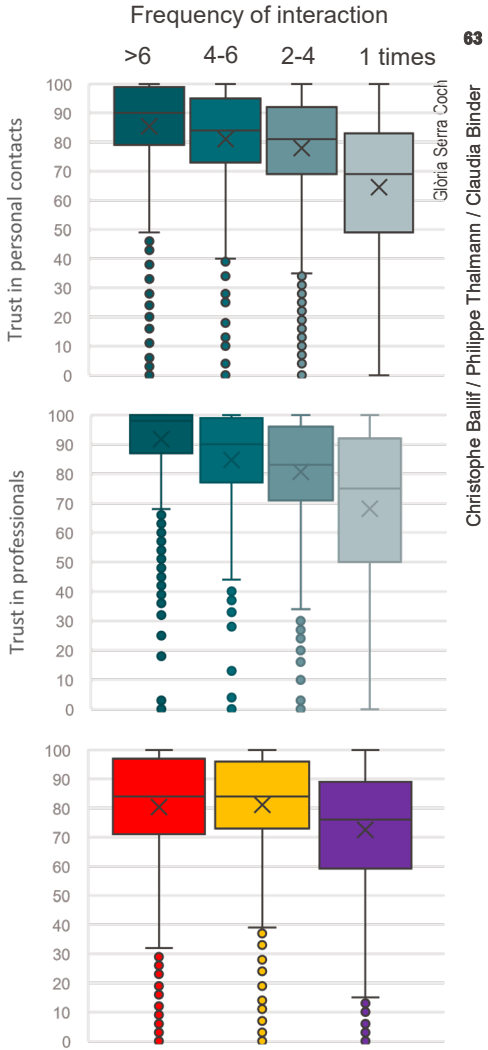
CASE STUDY

Proximity

Both social and geographical proximity are relevant
And different for the 3 technologies



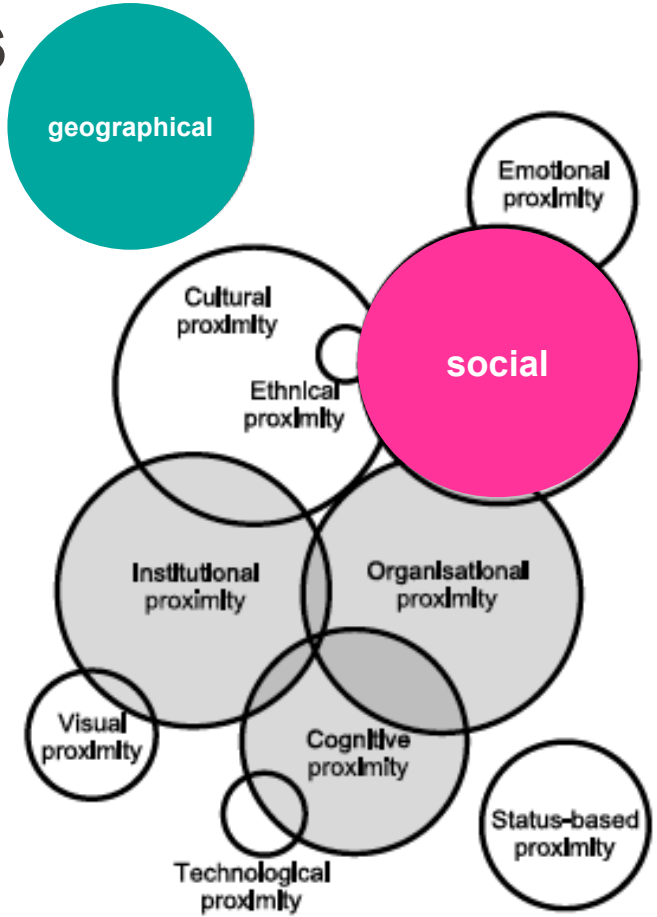
Serra-Coch et al., under review in 2025



Gloria Serra Coch

Christophe Balliff / Philippe Thalmann / Claudia Binder

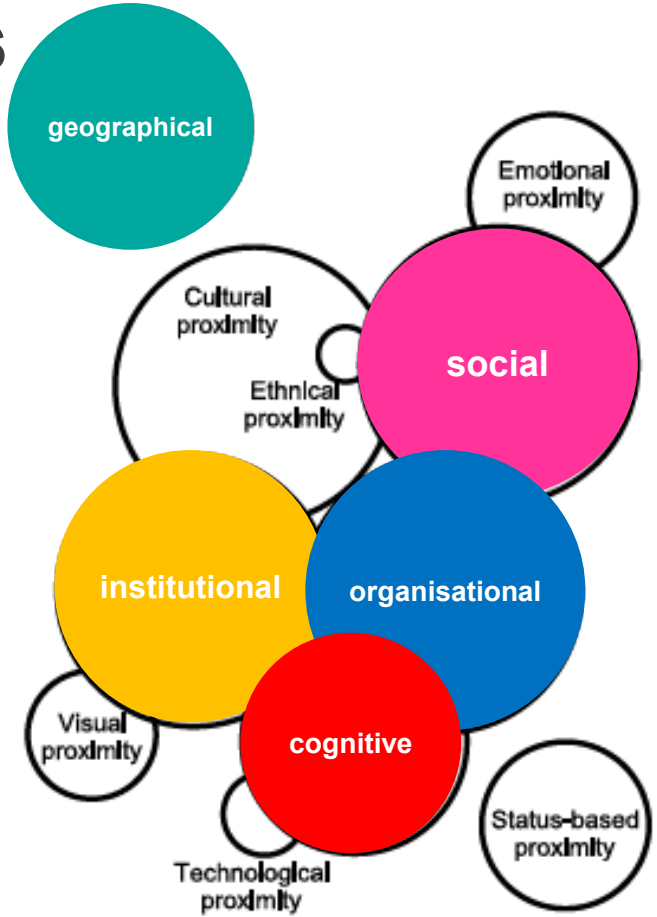
Proximities



Source: Micek, 2020

Proximities

Geography of innovations



Source: Micek, 2020

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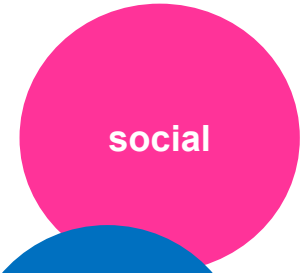
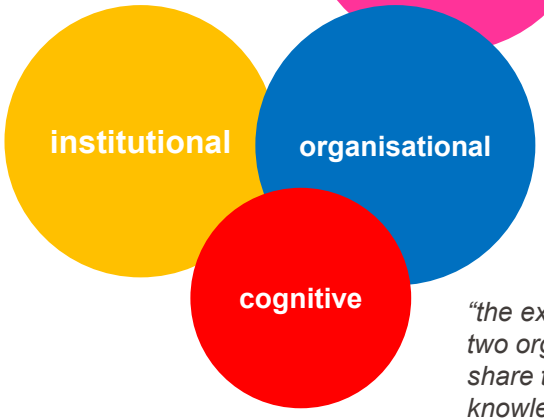
Proximities

Geography of innovations

"the spatial, physical or temporal distance between economic actors, both in its absolute and relative meaning"



"the extent to which members of two organizations have friendly relationships"



"the extent to which two organizations operate under the same institutions"

"the extent to which two organizations are under common hierarchical control"

"the extent to which two organizations share the same knowledge base"

Boschma and Frenken, 2009b, 2010; Boschma and Ter Wal, 2007; Boschma and Frenken 2009a; Boschma 2005; Balland et al., 2022

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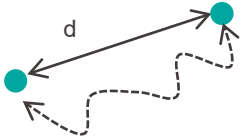
CASE STUDY

Proximities

Geography of innovations

geographical

"the spatial, physical or temporal distance between economic actors, both in its absolute and relative meaning"



social

"the extent to which members of two organizations have friendly relationships"

Trust & interactions → Friendly relations

institutional

"the extent to which two organizations operate under the same institutions"

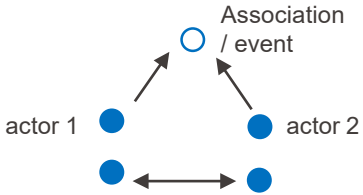
Lang Region vs. Lang Region

Region → institutions (norms)
Language → culture (conduct)

organisational

"the extent to which two organizations are under common hierarchical control"

"The extent to which two organisations are affiliated"



cognitive

"the extent to which two organizations share the same knowledge base"

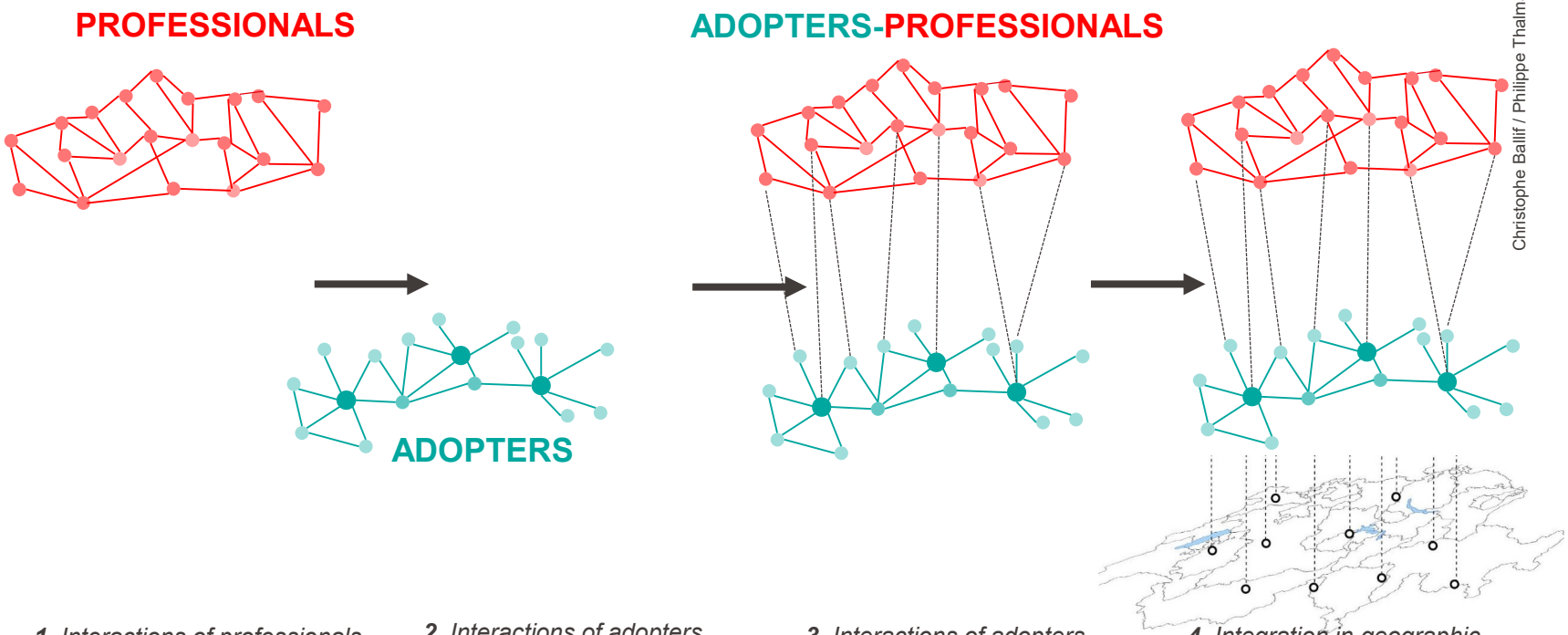
= work → = expertise/experience → = skills /knowledge base

Field Type vs. Field Type

Social network analysis

Interactions between professionals and energy technology adopters

CASE STUDY



1. Interactions of professionals with other organisations

2. Interactions of adopters with personal contacts

3. Interactions of adopters with professionals

4. Integration in geographic context

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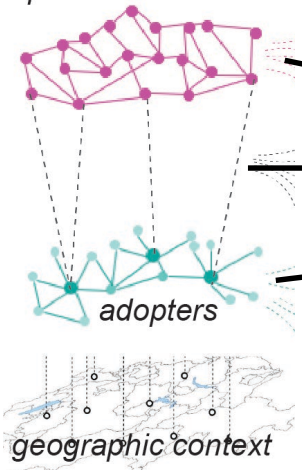
CASE STUDY

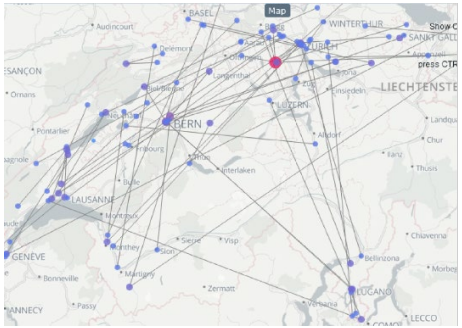
Information networks

SNA

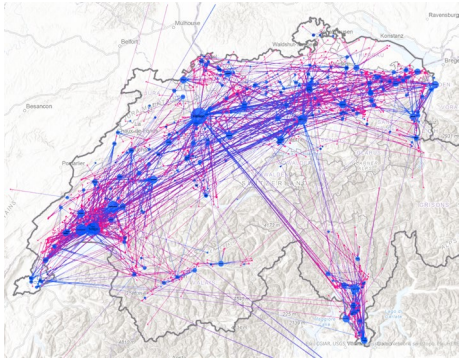
3 networks



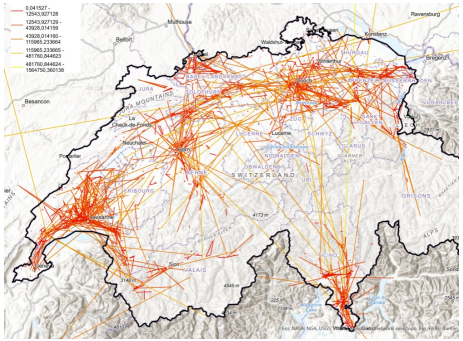
104 nodes
71 links
density=sparse
degree assortativity=
disassortative
modularity=strong



2'481 demand +
340 supply nodes
1'670 links
density=sparse
degree
assortativity=
disassortative
modularity=strong



2'635 respondent +
2'862 contact nodes
3'152 links (1'353
outside home)
density=sparse
degree assortativity=
disassortative
modularity=strong

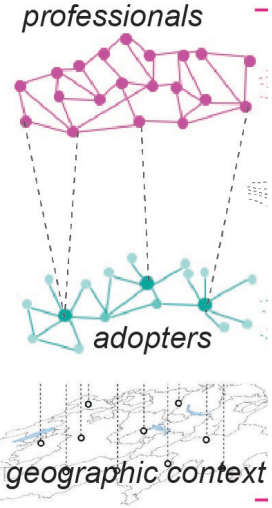


CASE STUDY

Information networks

SNA

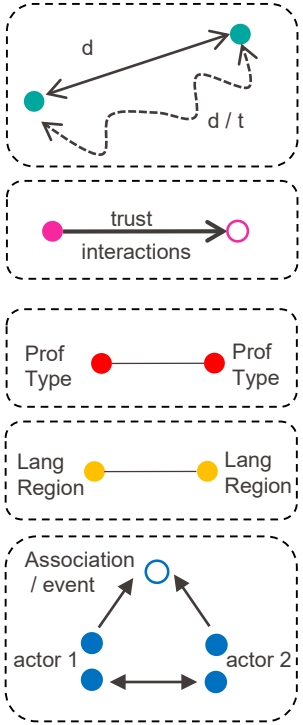
3 networks



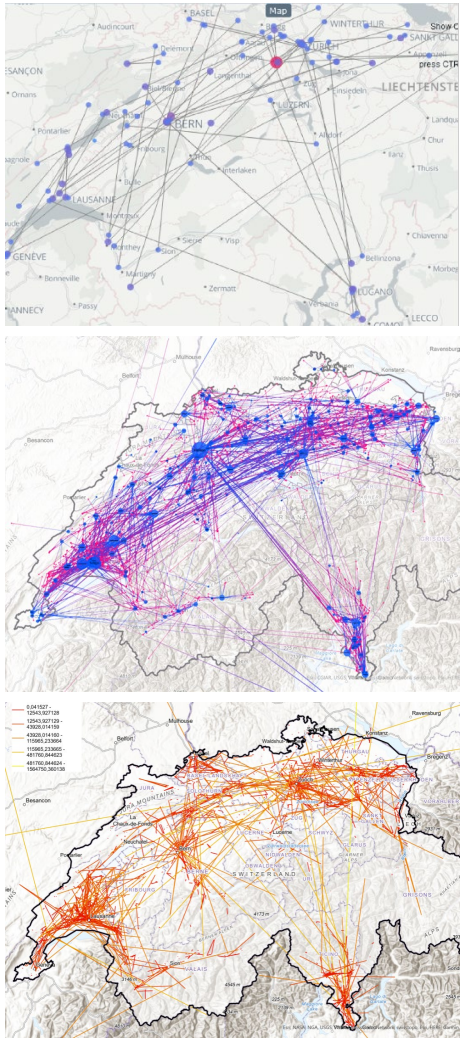
Proximity dimensions framework

5 proximity dimensions

- *Geographical*
- *Social*
- *Cognitive*
- *Institutional*
- *Organisational*

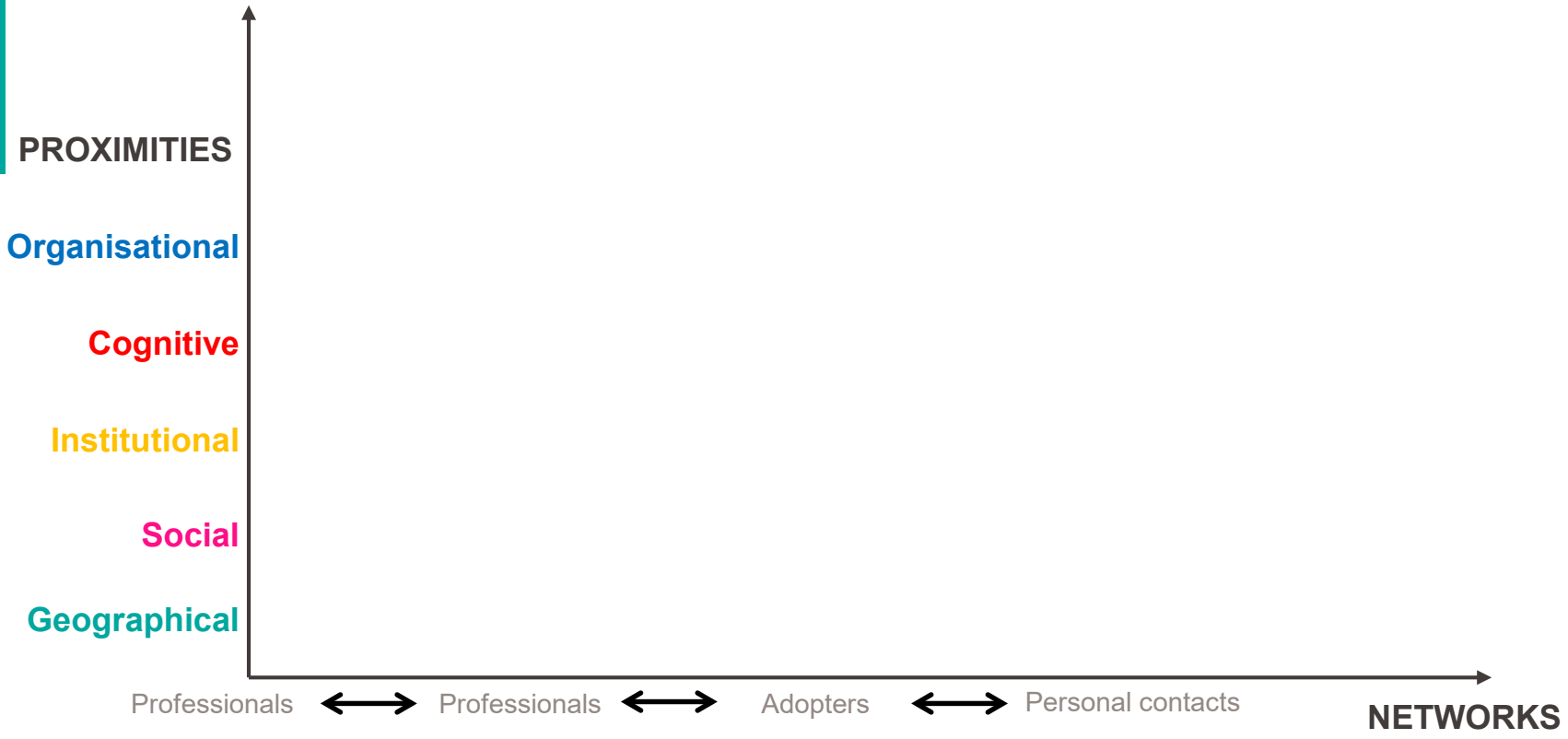


Mix of proximity dimensions conducive to diffusion in each network



Proximities

CASE STUDY



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Geographical Proximity

Proximity is more relevant between adopters than between professionals

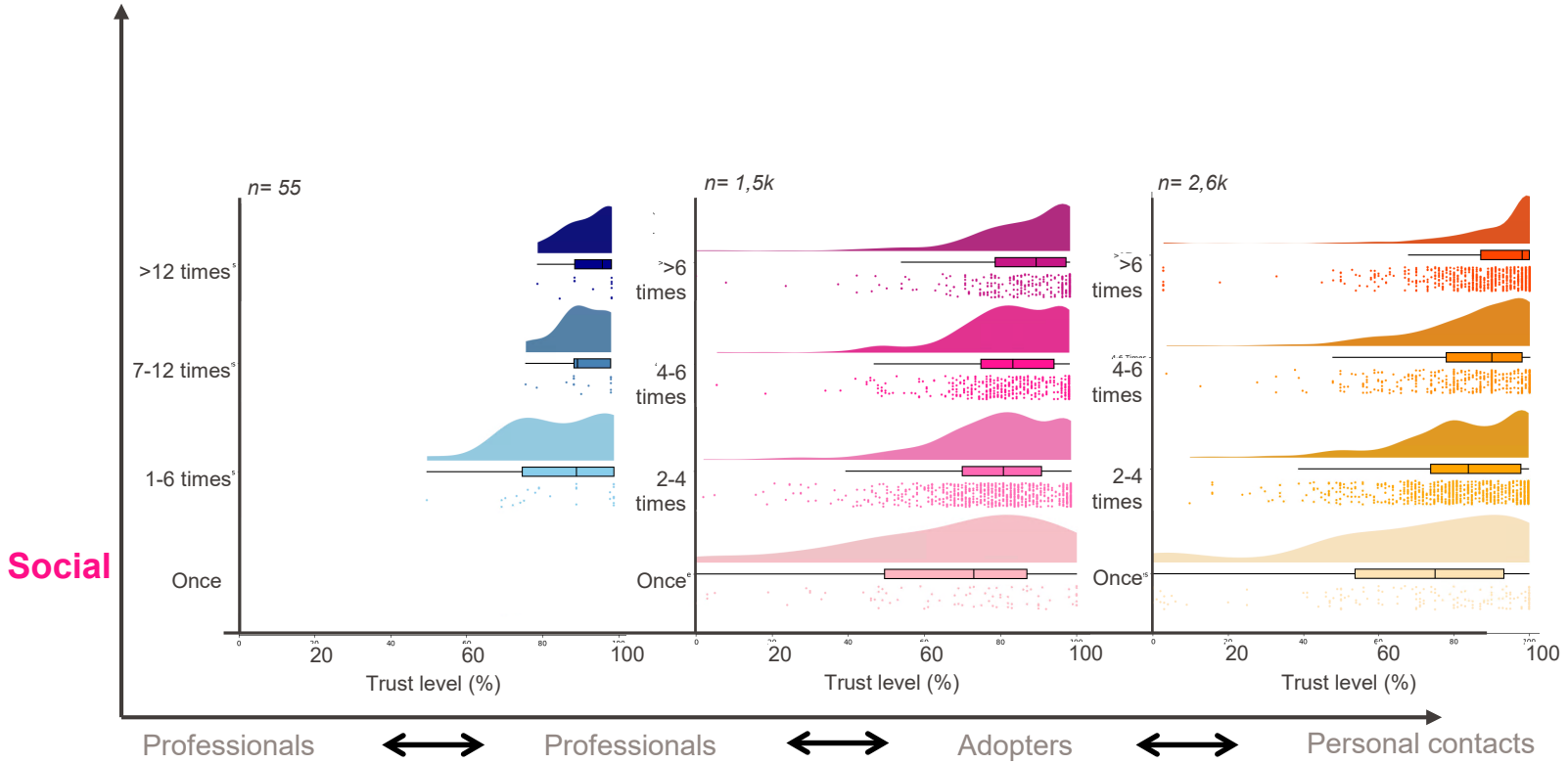
CASE STUDY

Serra-Coch et al., under review in 2025

Social proximity

Social proximity is associated to frequency of interaction in all networks

CASE STUDY



Serra-Coch et al., under review in 2025

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CASE STUDY

ENERGY SUPPLY, ECONOMICS AND TRANSITION

Geographical

Social

Institutional

Cognitive

Organisational

Serra-Coch et al., under review in 2025

Proximity dimensions

Different balance of proximities for the three networks

Serra-Coch et al., under review in 2025

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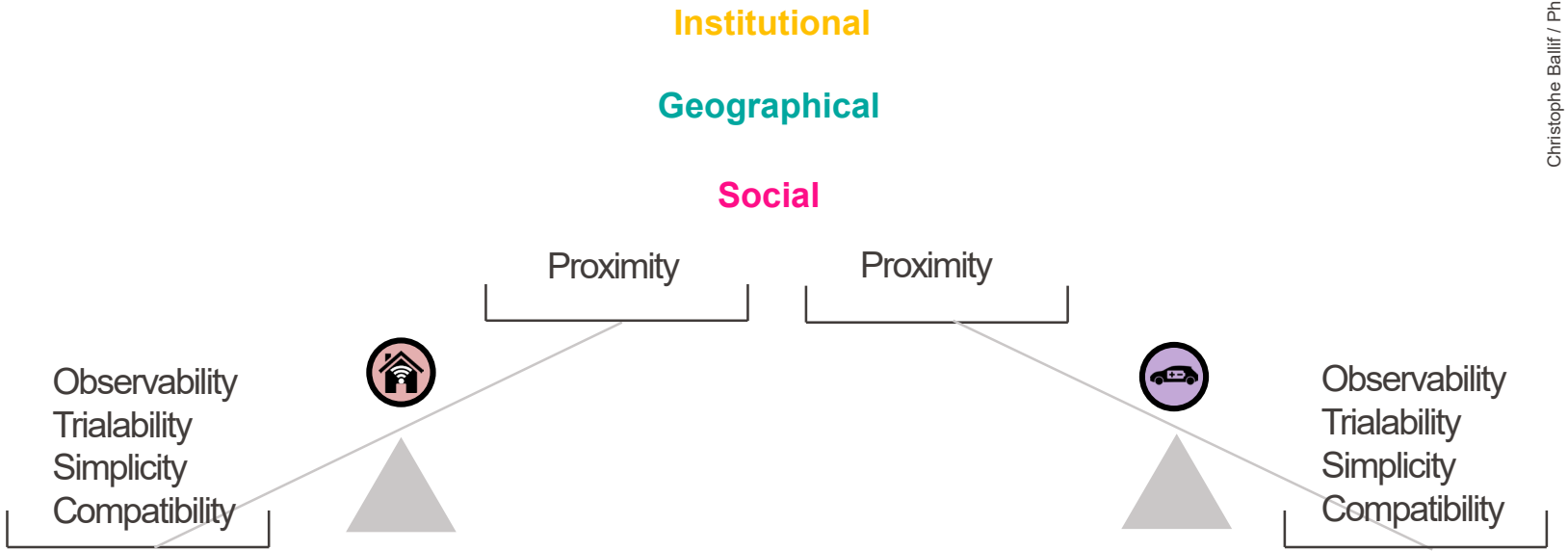
Proximity dimensions

Proximity to compensate characteristics of the technology

CASE STUDY



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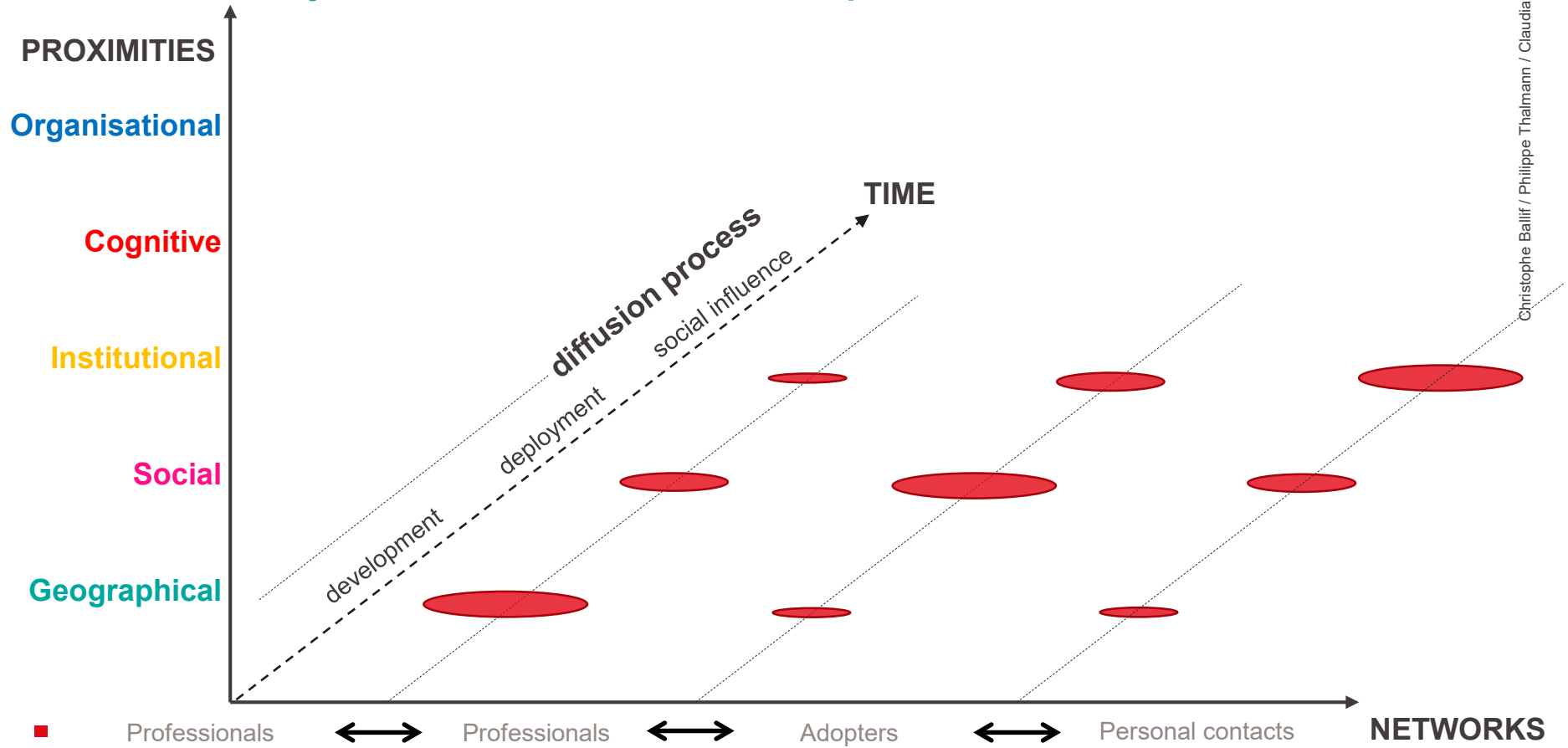
Proximity dimensions

How do they relate to the innovation-diffusion process?



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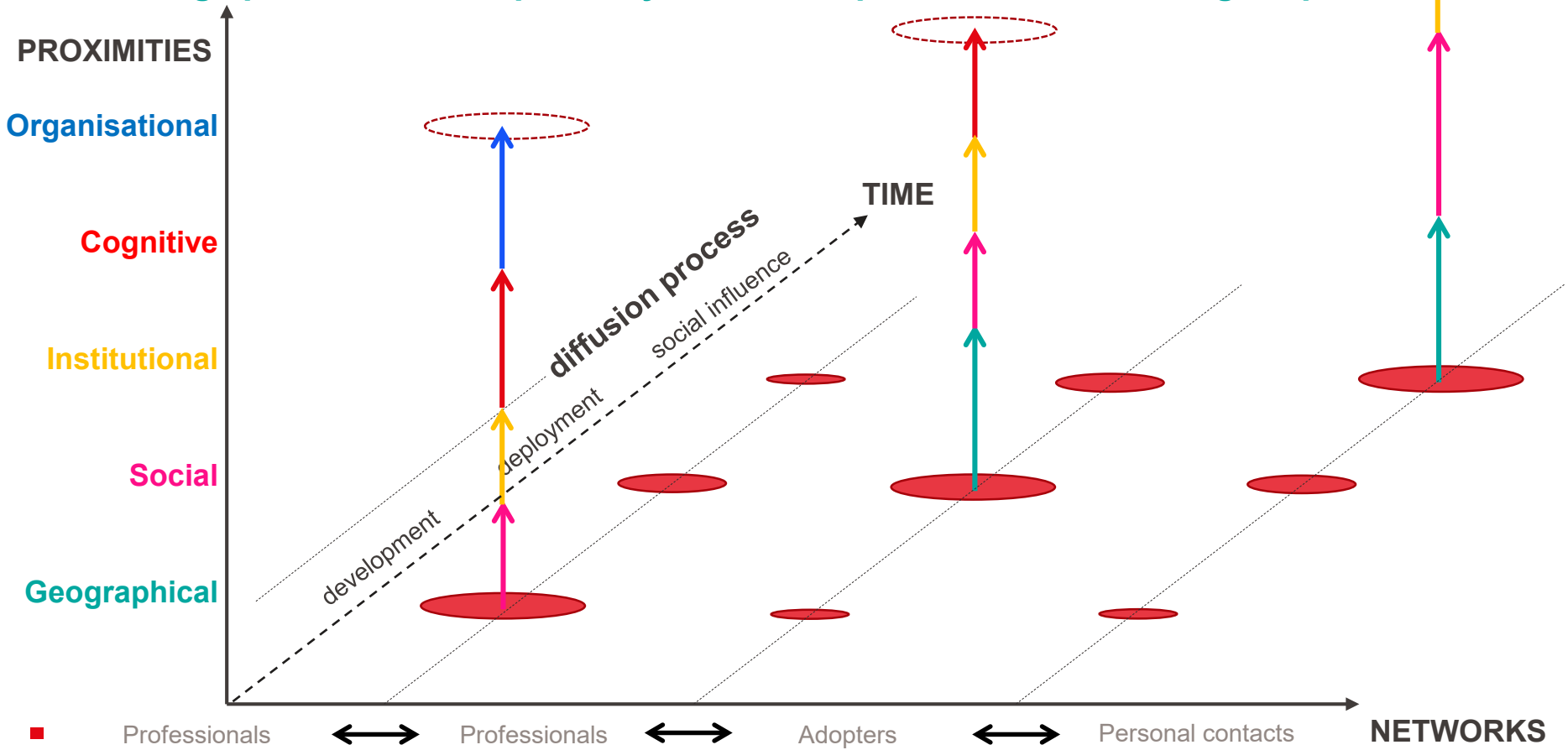
Proximity dimensions

Geographical and social proximity are more important the further along the process



Empirical take-aways

- Adopters exchange around **home,** with **close contacts**
- **Trust** is a very important factor, and it seems to be built on the **frequency of interactions**
- **Different** actors(professionals-adopters-personal contacts) need **different proximity dimensions**
- **Geographical and social proximity** become more important the further along in the process.

Information exchanges

How are these information exchanges?

With whom?

When?

About what?

Where?

How intimate?

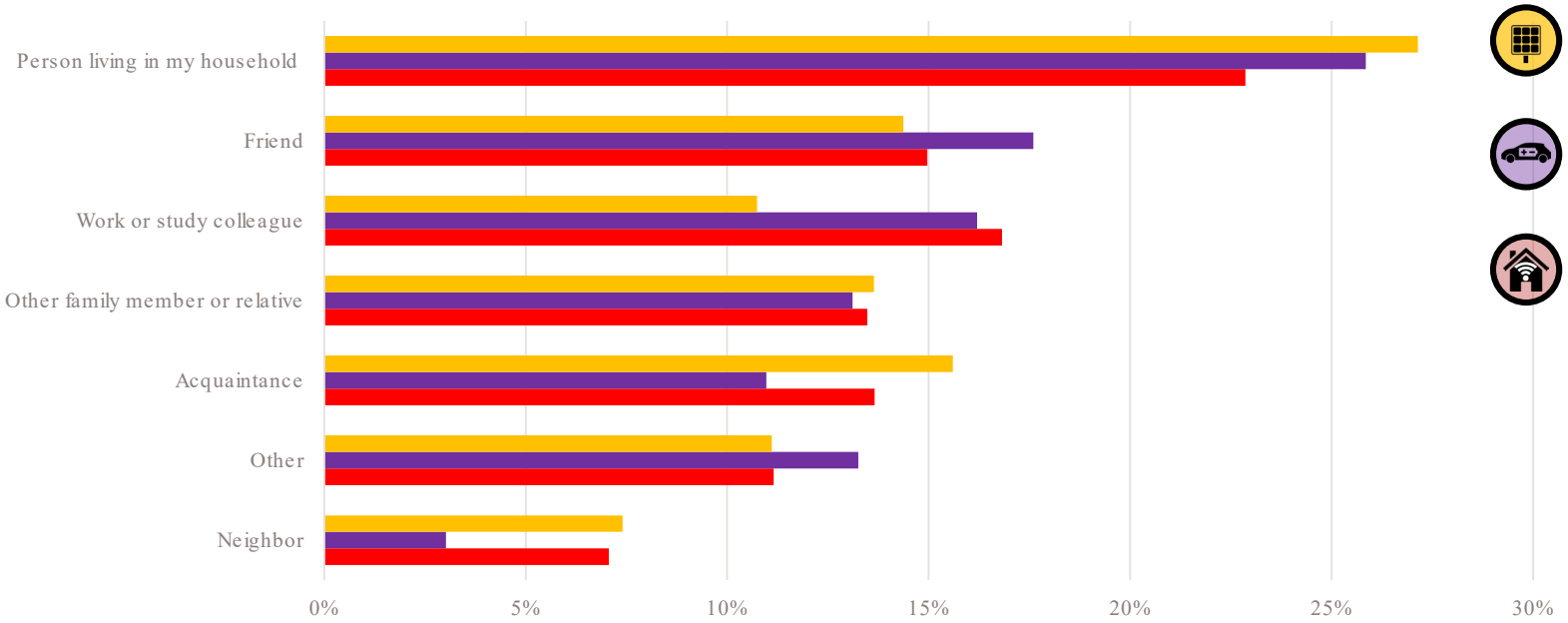
How often?

CASE STUDY

With whom?

"neighborhood effects" do not happen among neighbors Particularly for EV adopters

Personal contacts



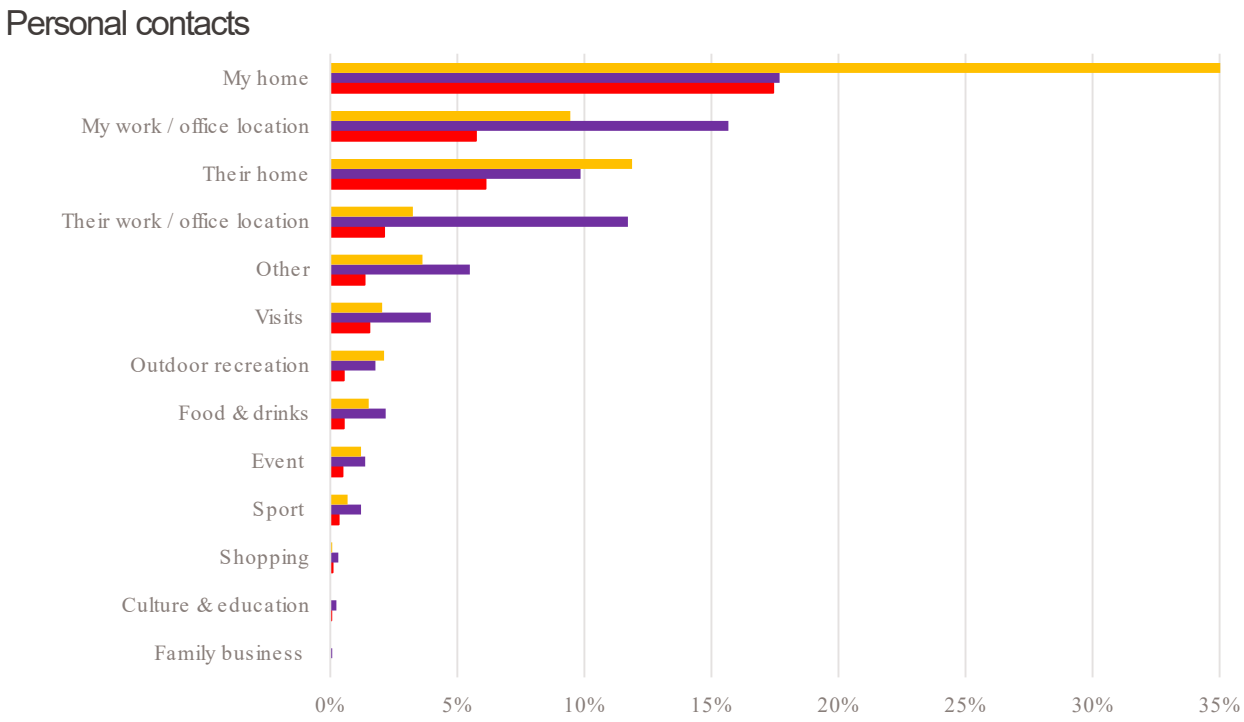
Most relevant personal interaction during the decision process to adopt the technology.

Serra-Coch et al., under review in 2025

CASE STUDY

Where?

Technology adopters exchange information mostly at home, particularly PV adopters



Place of most relevant personal interaction during the decision process to adopt the technology, excluding those that interacted with their partner or other person living in their household.

Serra-Coch et al., under review in 2025

CASE STUDY

About what?

Personal contacts:

- Introduce the technology
- Share success stories and personal experiences

Professionals:

- Provide practical details
- Explain financial viability

Serra-Coch et al., under review in 2025

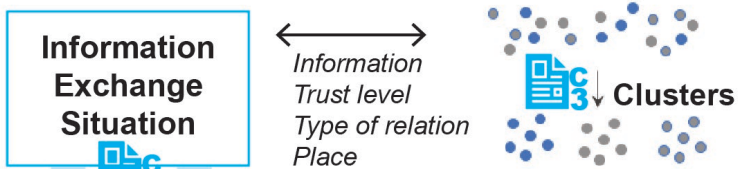
About what?

EV adopters seem less interested in economic factors but more in success stories
PV adopters seem more interested in economic factors

Serra-Coch et al., under review in 2025

Information exchange

CASE STUDY



Information types

Clustering using Latent Semantic Analysis (LSA)

LSA focuses on reducing the complexity of the dataset by identifying patterns (latent structures) in the data, making it easier to group similar data points based on these patterns

Information exchange situation

the most relevant in person interaction when discussing the technology…

a. Professionals **b. Personal contacts**

Clustering using k-prototypes

K-Prototypes clustering is a variant of the K-Means algorithm designed to handle mixed data types, including both categorical and numerical features

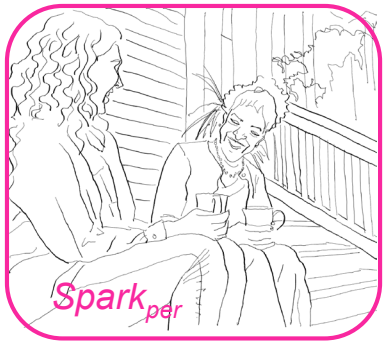
- Level of trust
- Level of Innovativeness
- Level of knowledge
- Type of link
- Place of exchange
- Information type: Clusters

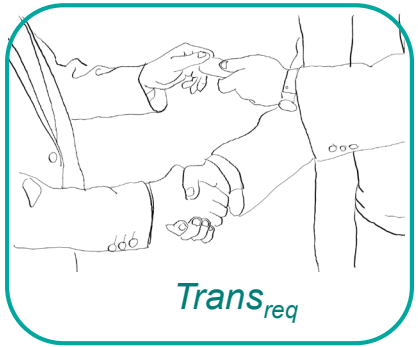
Christophe Balliif / Philippe Thalmann / Claudia Binder

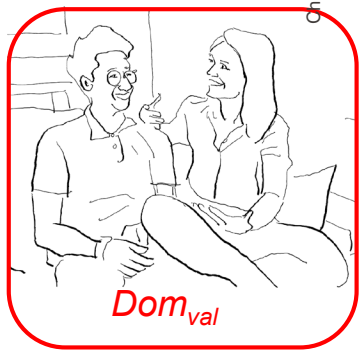
CASE STUDY

Information exchange

Different types of exchange play diverse roles…



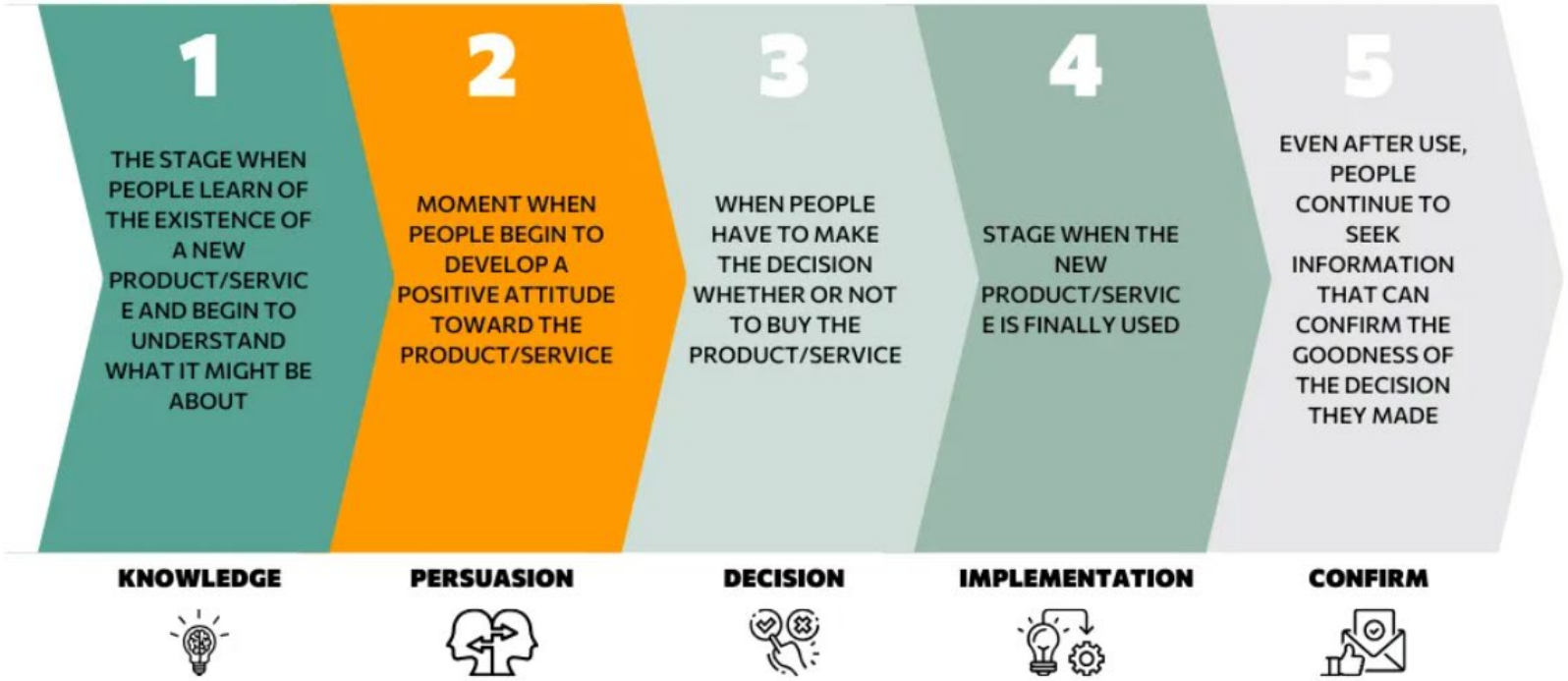




Serra-Coch et al., under review in 2025

Rogers: 5 stages of decision-making

CASE STUDY



Rogers, 1962

CASE STUDY

Information exchange

Personal context

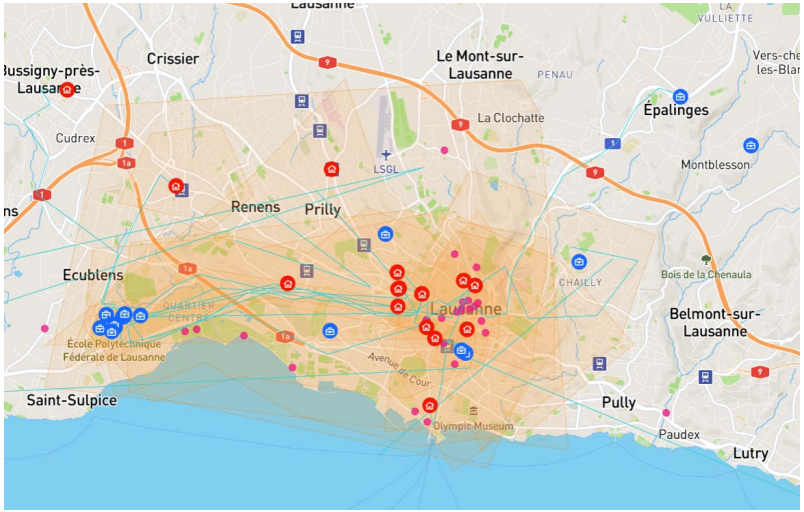
Area of activity - Draw a polygon of the approximate area where you spend most of your time in a regular week.

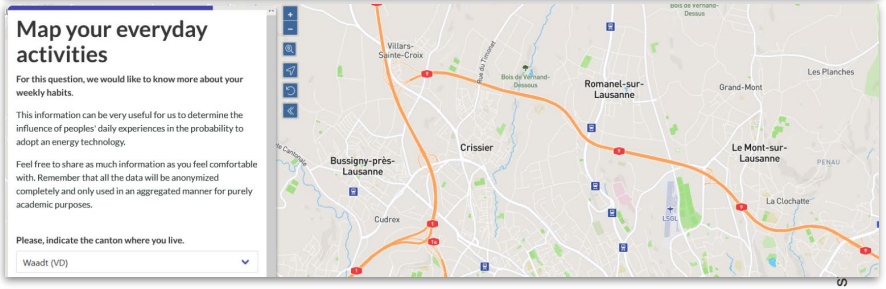
Where is your home?

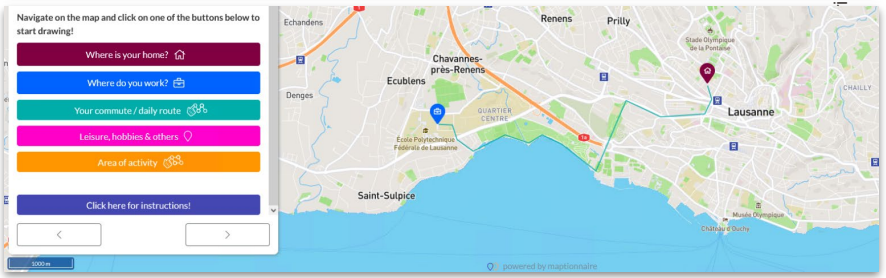
Where do you work?

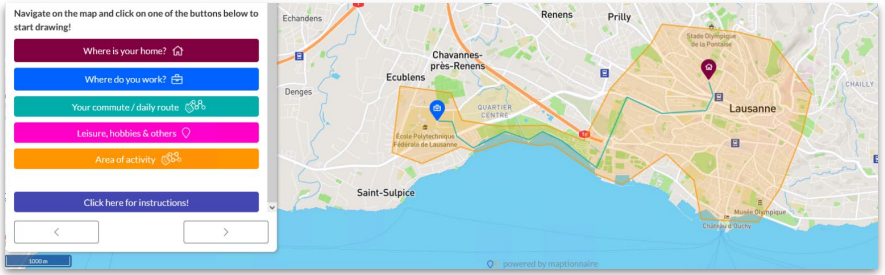
Your commute route / daily route?

Leisure, hobbies & others







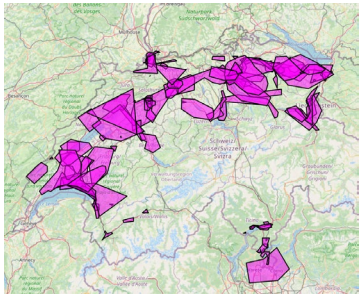
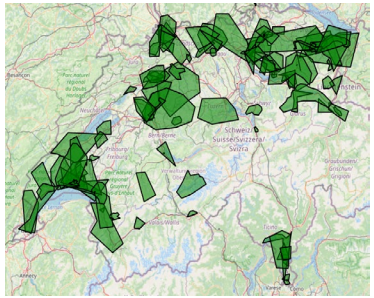
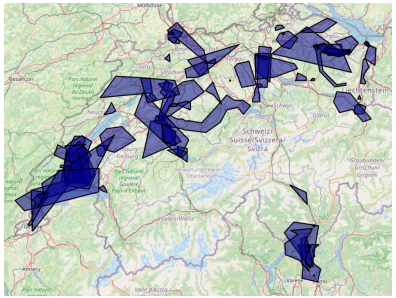
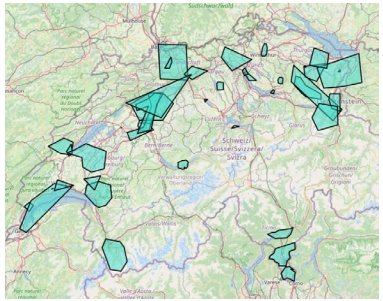
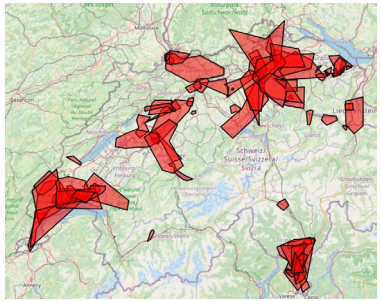


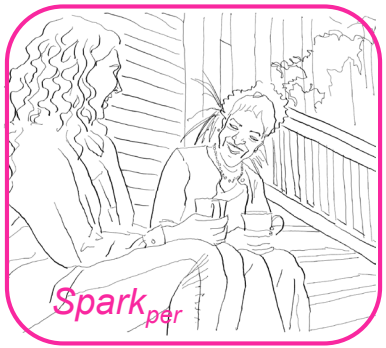
From spark to private, with different contexts

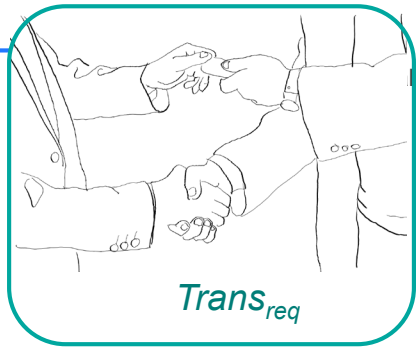
spark

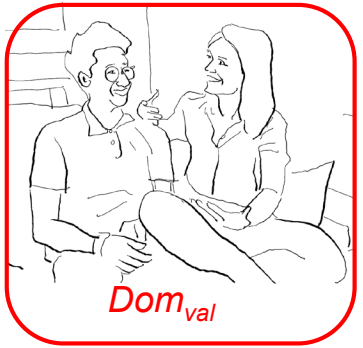
private

practical







KNOWLEDGE

PERSUASION

DECISION

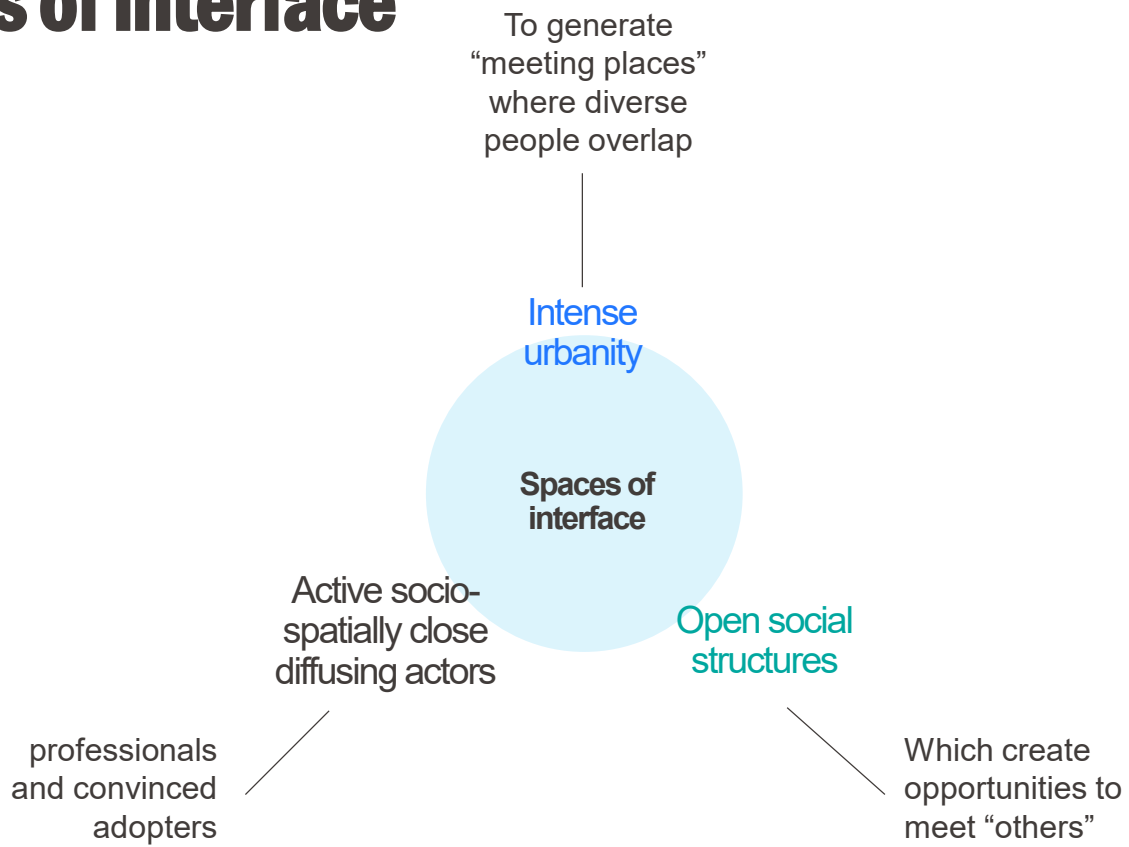
IMPLEMENTATION

CONFIRM

Serra-Coch et al., under review in 2025

Spaces of interface

CASE STUDY



Serra-Coch et al., under review in 2025

Empirical take-aways

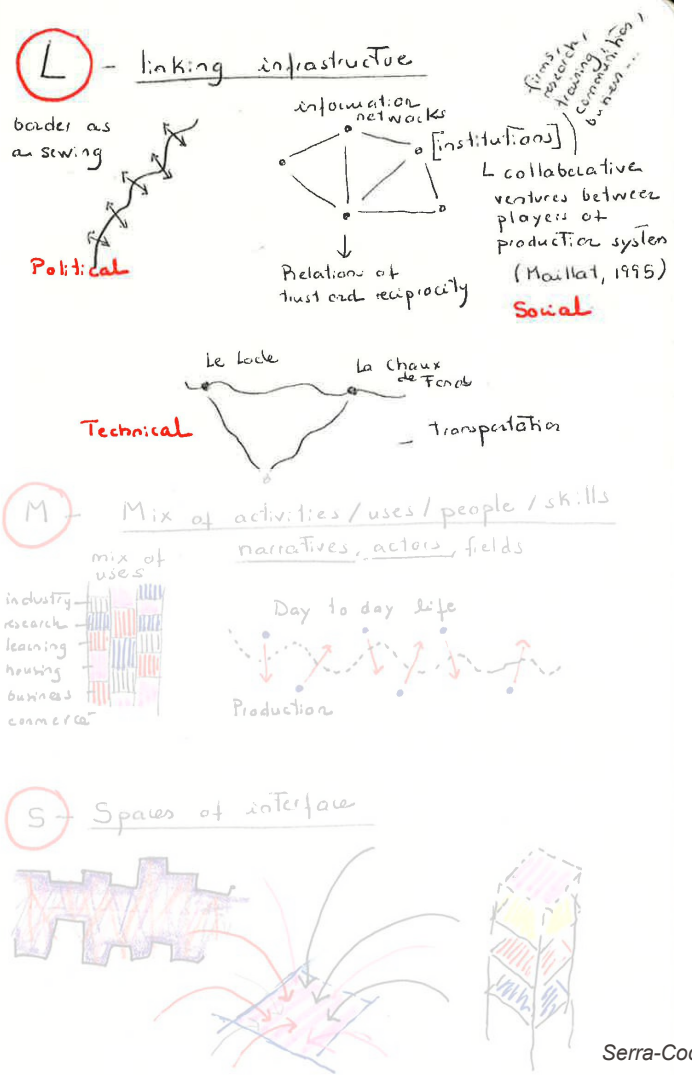
- **Neighbourhood effects** do not happen among neighbours
- We need **spaces of interface** that foster interactions

Christophe Balliff / Philippe Thalmann / Claudia Binder

So what?

Practical Contributions

Linking Infrastructure with Sufficient Connectivity and Balanced Diversity

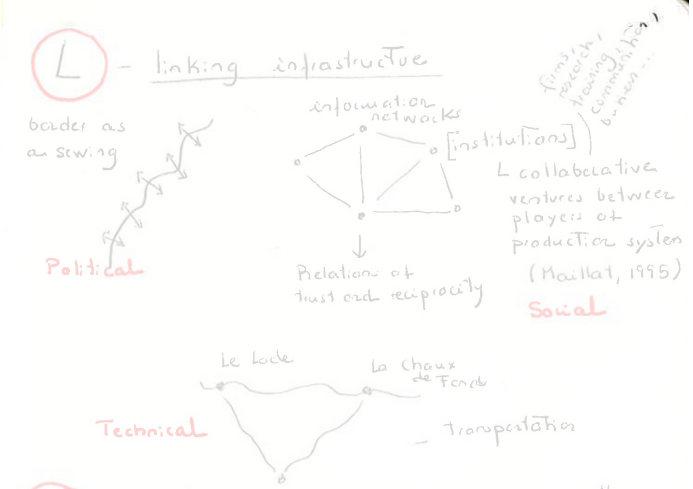


Glasmeier, 1991; Maillat, 1995; Moine, 2013; Senker, 1995

Serra-Coch et al., 2025

Practical Contributions

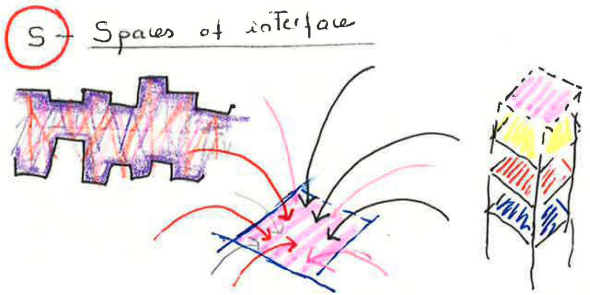
Linking Infrastructure with Sufficient Connectivity and Balanced Diversity



Fostering **Spaces of Interface** to Increase Information Exchange

- With urban intensity
- Active close actors
- Open social structures

Stravrides, 2006; Cenzatti, 2008; Wolfrum, 2018



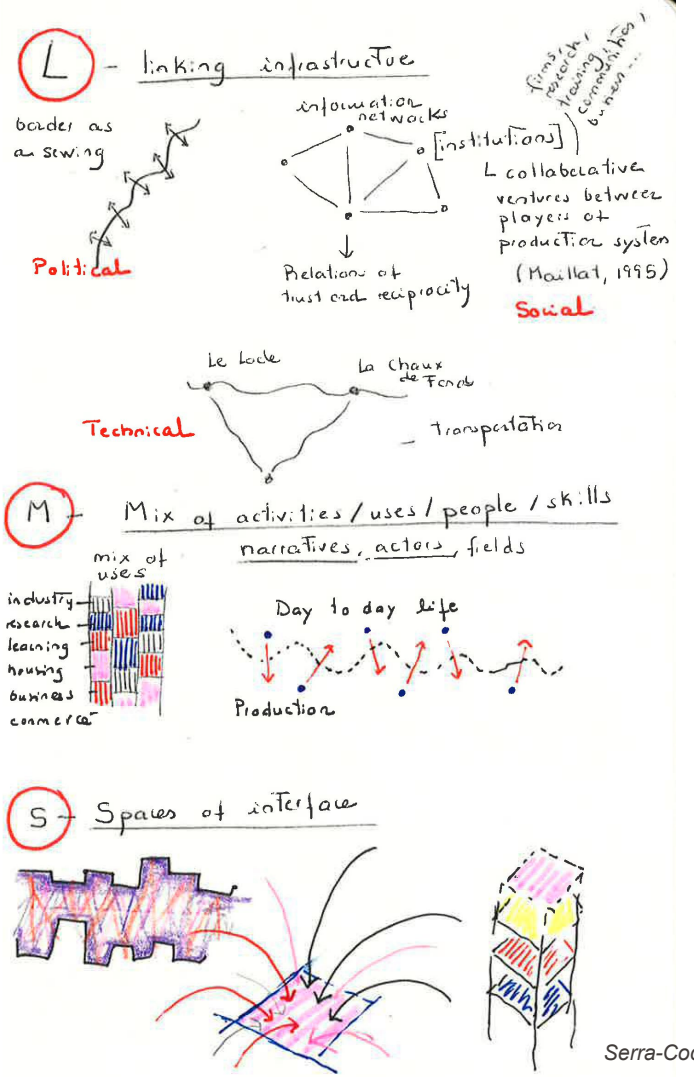
Serra-Coch et al., 2025

Practical Contributions

Linking Infrastructure with Sufficient Connectivity and Balanced Diversity

Nurturing **socio-spatially mixed contexts** that support trust and openness

Fostering Spaces of Interface to Increase Information Exchange



Bnejamin, 1925; Breschi, 2001; Nello, 2011; Muñoz, 2018

Serra-Coch et al., 2025


3 – 50 – 80 – 75
11 SUSTAINABLE CITIES AND COMMUNITIES

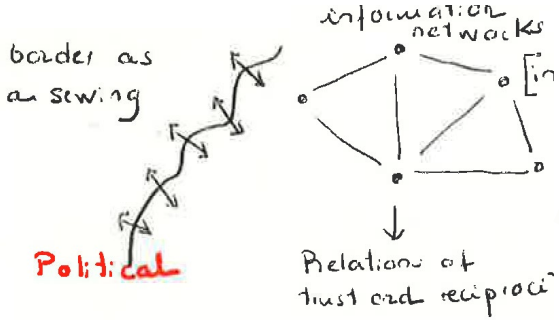
Christophe Ballif / Philippe Thalmann / Claudia Binder

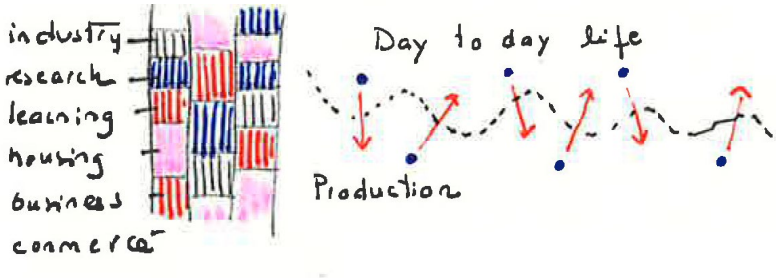
CITIES

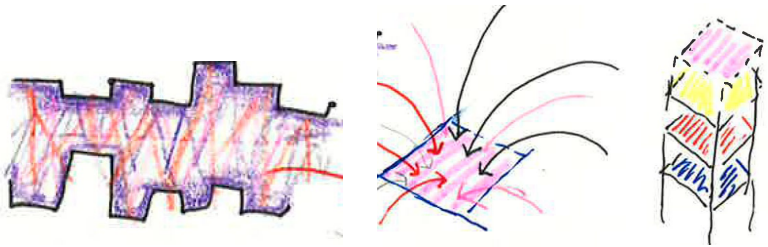
Linking Infrastructure,

Mixticity, and

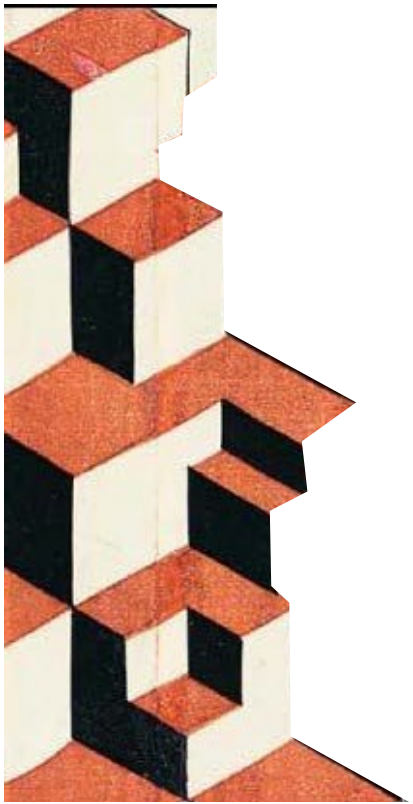
Spaces of Interface



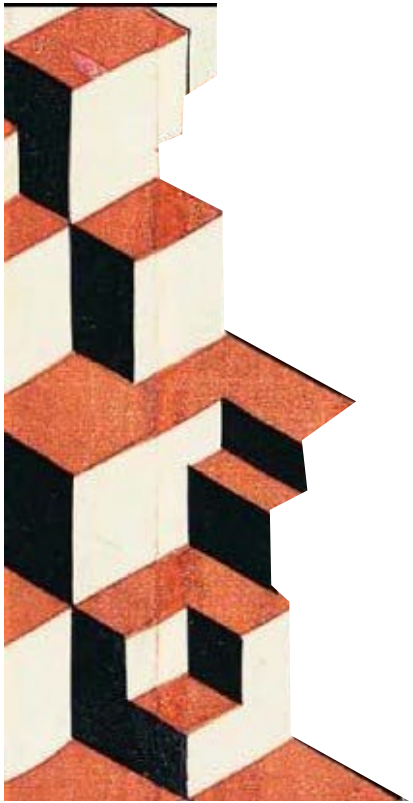





FLORENCIA



Bridge the gap



Theoretical learning points

- Diffusion of innovations: innovation + channels + time + social system
- Relevance of interpersonal communication

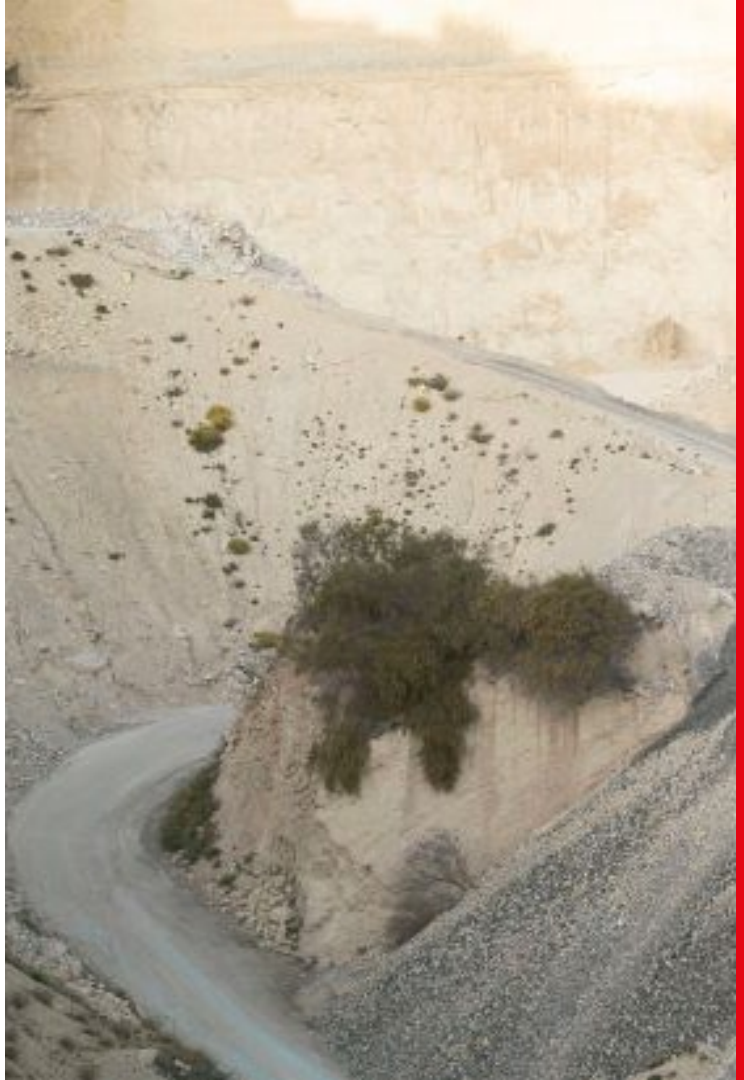
- Social network analysis
- Homophily vs. heterophily
- Strength of weak ties
- Vertical diffusion

- Proximity dimensions

Christophe Balliff / Philippe Thalmann / Claudia Binder

Empirical take-aways

- **Social influence** matters for the diffusion
- **Face-to-face interactions** are very important
- **Heterophilic** networks with intermediaries **bridging** groups and **vertical diffusion** between different people support the diffusion of innovations
- Adopters exchange around **home,** with **close contacts**
- **Trust** is a very important factor, and it seems to be built on the **frequency of interactions**
- **Different** actors(professionals-adopters-personal contacts) need **different proximity dimensions**
- **Geographical and social proximity** become more important the further along in the process.
- **Neighbourhood effects** do not happen among neighbours
- We need **spaces of interface** that foster interactions
- Different patterns for different **energy technologies**



Thanks!

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