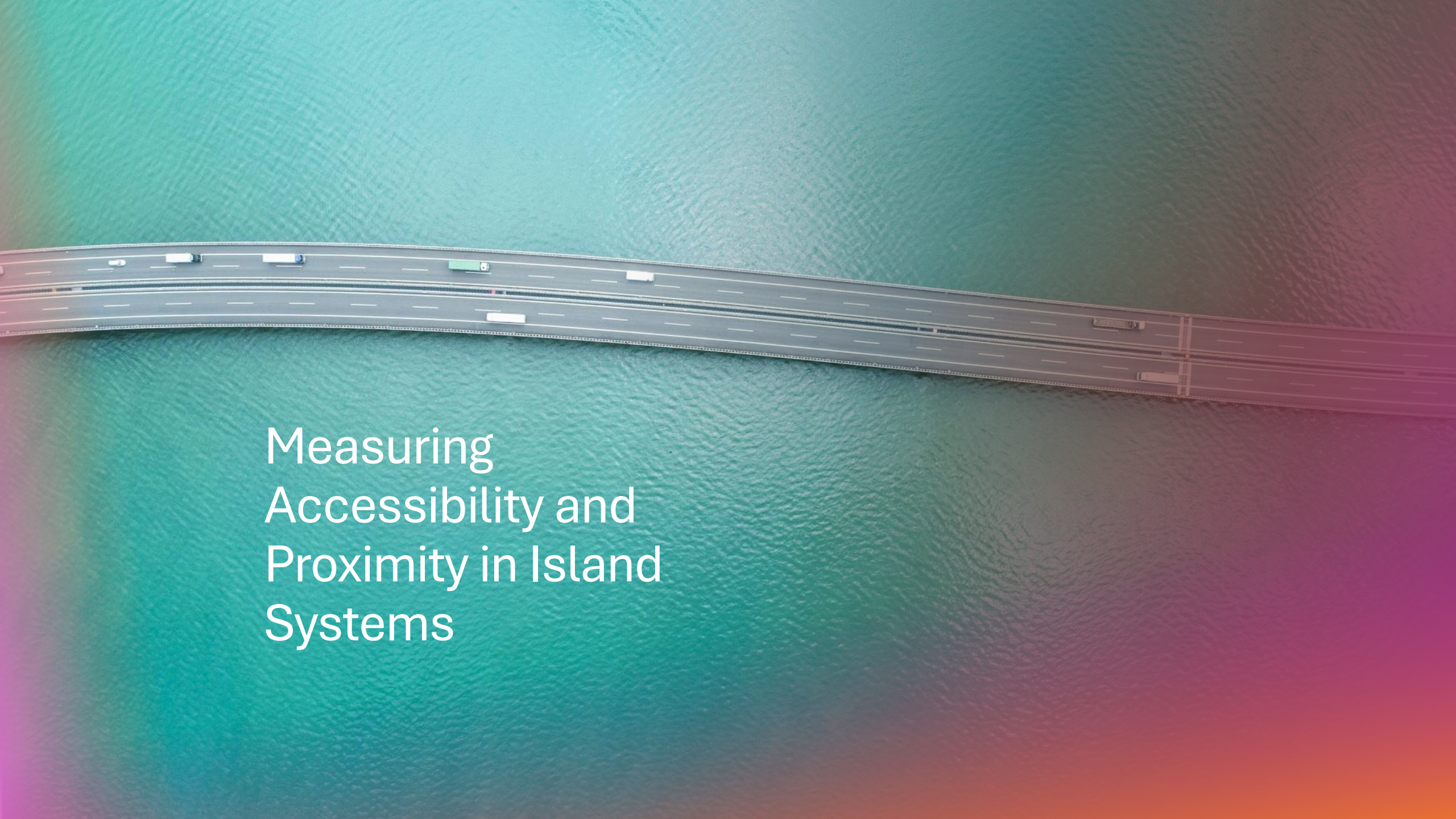


An aerial photograph of a long, multi-lane highway bridge spanning a body of water. The bridge has multiple lanes in both directions, with white dashed lines separating them. Several vehicles, including cars and trucks, are visible traveling across the bridge. The water is a deep teal color, and the sky is a gradient of blue and purple. The bridge curves slightly to the right as it extends into the distance.

Measuring Accessibility and Proximity in Island Systems

What is Accessibility?



Accessibility is the ease of reaching opportunities, services or destinations.



It depends not only on distance, but also on travel time, transport options and connectivity.



Accessibility can be measured through:

Infrastructure (roads, ports, transport networks)

Activities (access to jobs, services, facilities)

Combined approaches
(infrastructure + opportunities)



For islands, accessibility is more than geography: sea barriers, transport frequency and limited connections make access more challenging.



Accessibility ≠ Distance

Question: Is 20 km
always the same
distance?

Case 1: 20 km by road in mainland Greece

- ~20–25 min
- Any time
- Many route choices

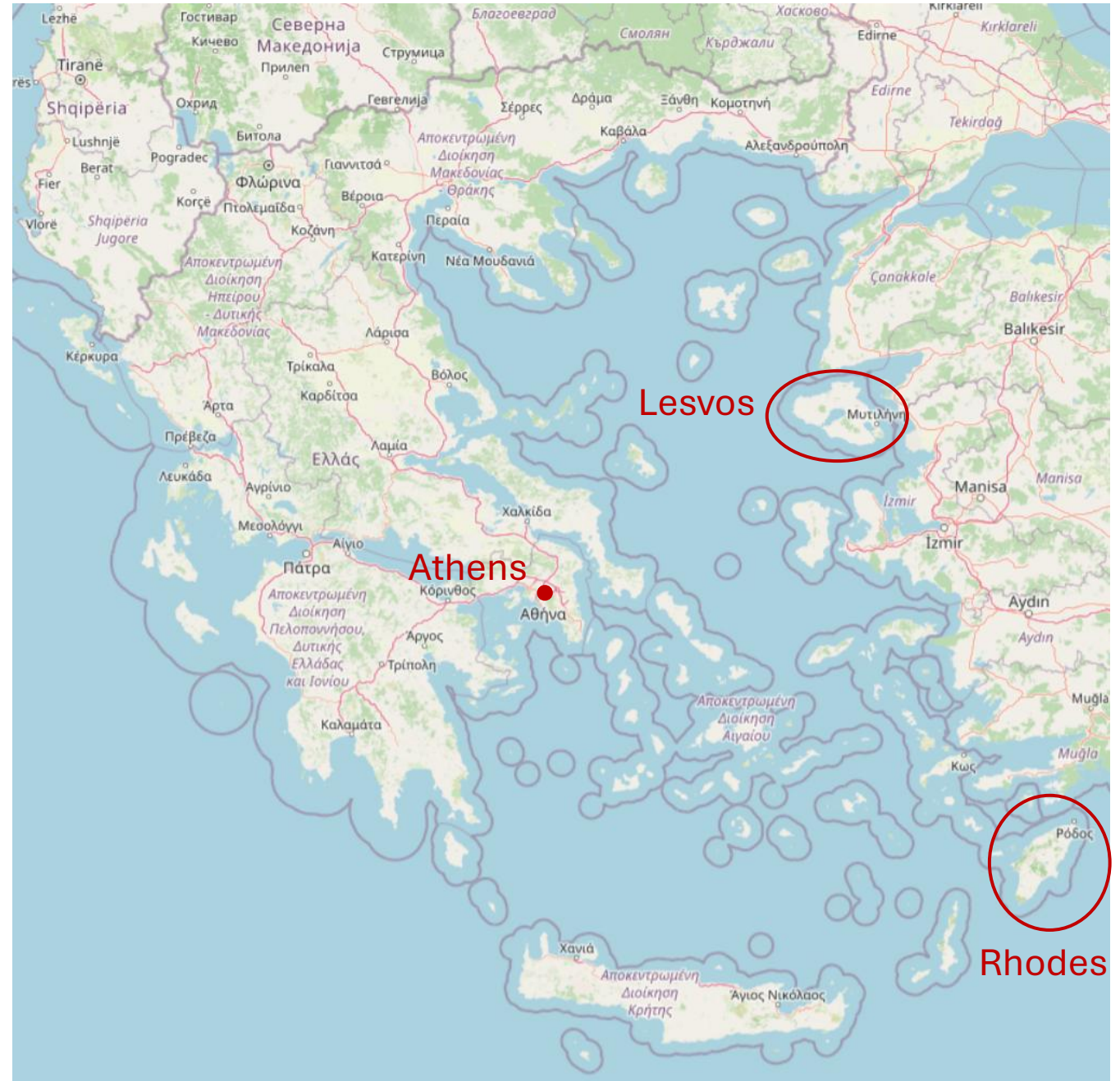
Case 2: 20 km across the sea

- Ferry required
- Waiting time
- Fixed schedules
- Weather dependency

Same distance, very different accessibility.

Which island is "closer" to Athens?

- Lesvos (285 km)
- Rhodes (439 km)



Why Islands are Different



sea barriers



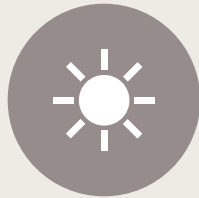
limited roads



ferry schedules



weather

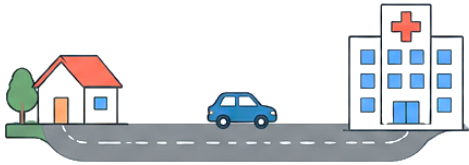


seasonality



mountainous
terrain

MAINLAND



Road → Hospital

One connection
Shorter time • Lower cost

The sea
introduces an
additional layer
of connectivity.



Road



Port



Ferry

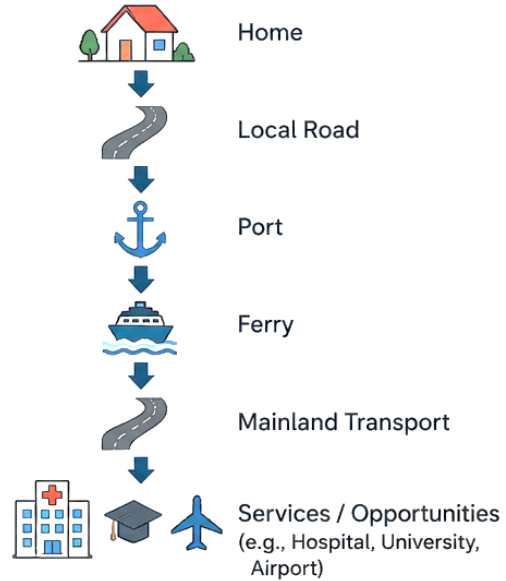


Mainland Transport



Services / Opportunities
(e.g., Hospital, University, Airport)

ISLAND



Multiple connections
More time • Higher cost • More uncertainty

- Roads
- Ports
- Ferries
- Airports
- Digital connectivity

Connectivity

Nearest ≠ Most Accessible

Hospital A – Closest

15 km
from the island

 Ferry:
once every
12 hours



 **NOT the most accessible**
Long waiting time and low frequency

Hospital B – More Distant

40 km
from the island

 Ferry:
every 1–2 hours
(frequent)



 **MOST accessible**
Frequent connections and minimal waiting

Accessibility depends on the entire journey, not only on distance.

Proximity ≠ Accessibility

WHAT IS PROXIMITY?

 Proximity describes **how close** two locations are in space.

MEASURED BY

 **Euclidean Distance**
(straight-line distance)

 **Network Distance**
(distance along roads/paths)

 **Travel Time**
(time needed to reach destination)

EXAMPLE

SETTLEMENT A



Distance to Hospital:
3 km

SETTLEMENT B



Distance to Hospital:
8 km

 Which settlement is more proximate to the hospital?
 **Settlement A (3 km)**

BUT PROXIMITY IS NOT ACCESSIBILITY

 Proximity only tells us **how close** something is.

 It does not tell us **how easy** it is to reach.

FACTORS THAT AFFECT ACCESSIBILITY

 Transport options
(ferry, bus, road)

 Travel time & waiting time

 Frequency of services

 Weather conditions

 Terrain / road quality



PROXIMITY IS ABOUT DISTANCE.

ACCESSIBILITY IS ABOUT REACHING OPPORTUNITIES.



Health



Education



Jobs

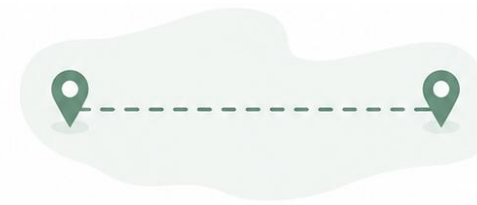


Services



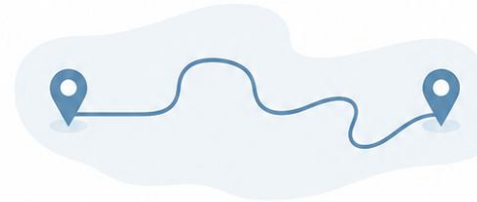
Connections

Why do we need Network Analysis?



Straight-line distance

Shortest possible distance ignoring barriers



Road network

Follows the transport network



Real journey

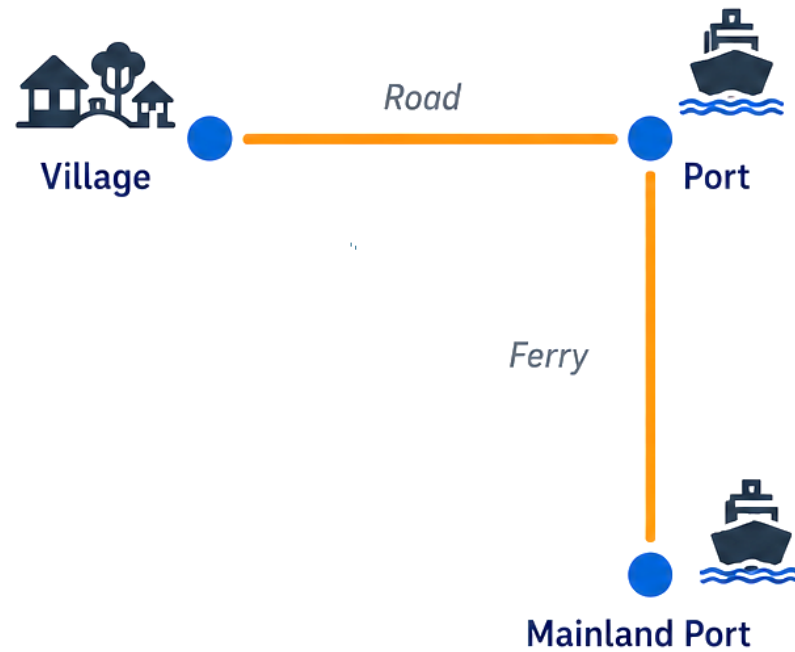
Includes different modes, transfers and waiting time



Accessibility

Reflects real travel conditions based on time, cost and connectivity

Network Thinking



NODE

A place in the network
(e.g., village, port)



EDGE

A connection between places
(e.g., road, ferry route)



PATH

A sequence of edges
connecting nodes
(e.g., Village → Port →
Mainland Port)



NETWORK

The entire system of
nodes and edges

Examples of Networks



Road network



Ferry network



Electricity network



Internet network

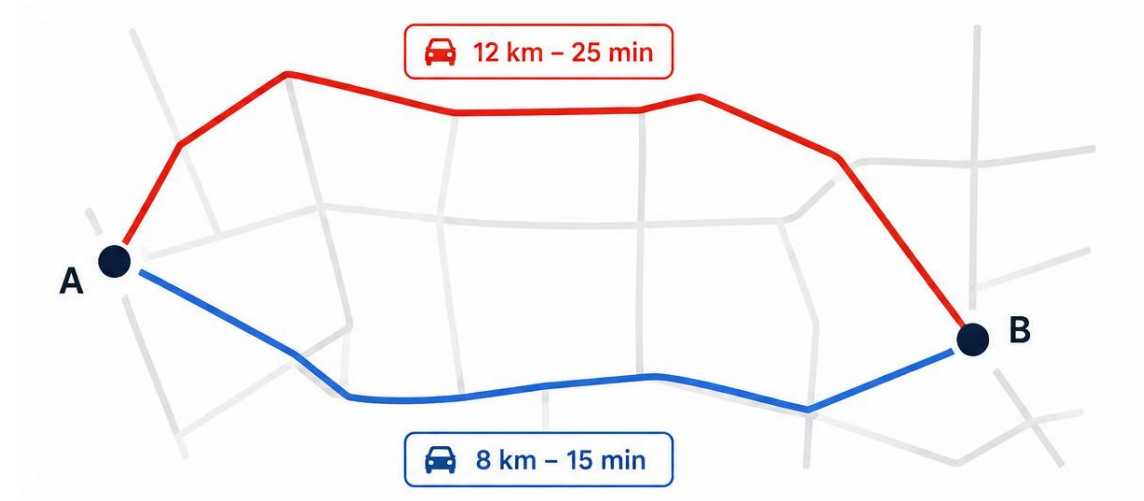
The Island Travel Chain

Village
|
Road
|
Port
|
Ferry
|
Mainland Port
|
Hospital

**A journey is a sequence
of connected networks**

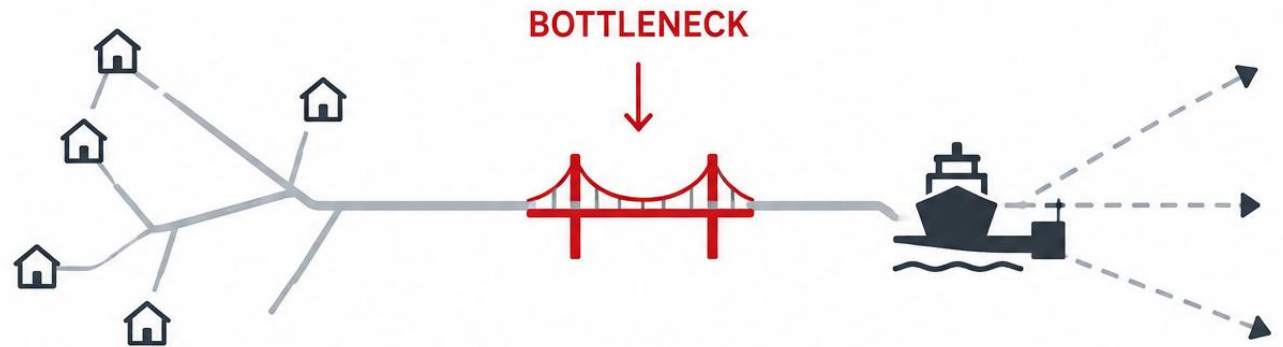
Shortest Path

Which one would you choose?



GIS calculates the shortest (or fastest) route.

Bottleneck



If this link fails,
the whole system is blocked.

→ Bottlenecks are **critical links**.



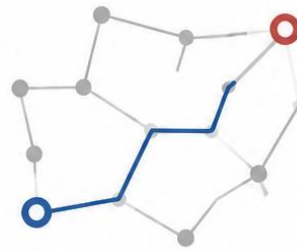
Network Resilience

What happens if

- ferry is cancelled?
- road is blocked?
- port closes?

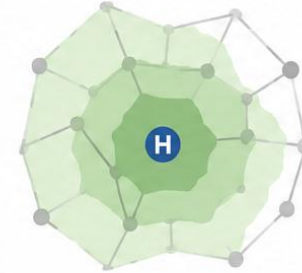
Accessibility changes immediately

GIS Network Analysis



SHORTEST PATH

Find the shortest (or fastest) route between two places.



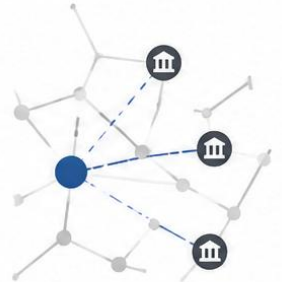
SERVICE AREA

Identify areas that can be reached within a given time or distance.

	DESTINATIONS		
ORIGINS			
	12	25	18
	8	30	22
	15	20	10

ORIGIN-DESTINATION MATRIX

Measure travel between multiple origins and destinations.



CLOSEST FACILITY

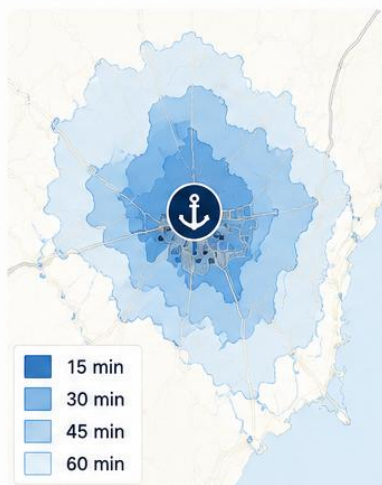
Find the nearest facility that meets your needs.

Accessibility Indicators

INDICATOR	PLANNING QUESTION	WHAT IT SHOWS	EXAMPLE	GIS TOOL / METHOD
 1. DISTANCE How far is the nearest service?	How far is the nearest hospital?	Straight-line or network distance to the closest facility.		Buffer (Euclidean / Network distance)
 2. TRAVEL TIME How long does it take to get there?	How long does it take to reach the hospital?	Travel time using the transport network.		Isochrones (Travel Time Analysis)
 3. COVERAGE Who is served?	What percentage of the population is within 30 minutes?	Population within a given travel time threshold.		Service Area (Network Analysis)
 4. OPPORTUNITIES How many services are reachable?	How many schools, hospitals and ports can be reached in 30 minutes?	Number of opportunities within a travel time threshold.		Accessibility Index / Potential Accessibility

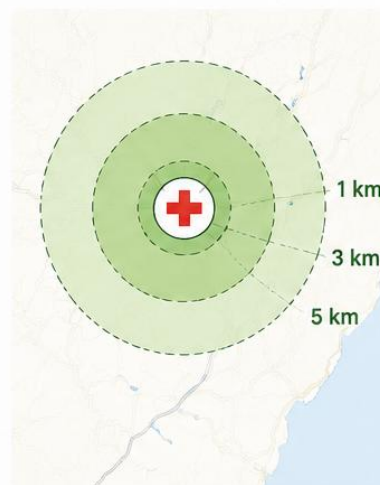
Mapping Accessibility

1. ISOCHRONES



Areas that can be reached within the same travel time.

2. BUFFERS



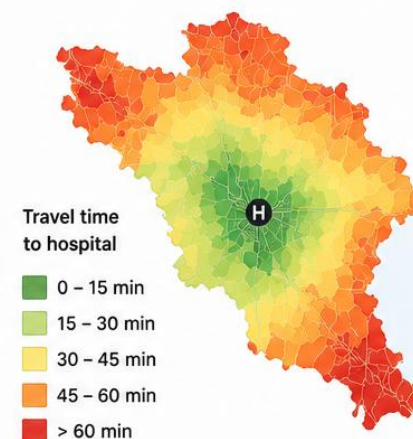
Areas within a specified distance from a point.

3. SERVICE AREAS



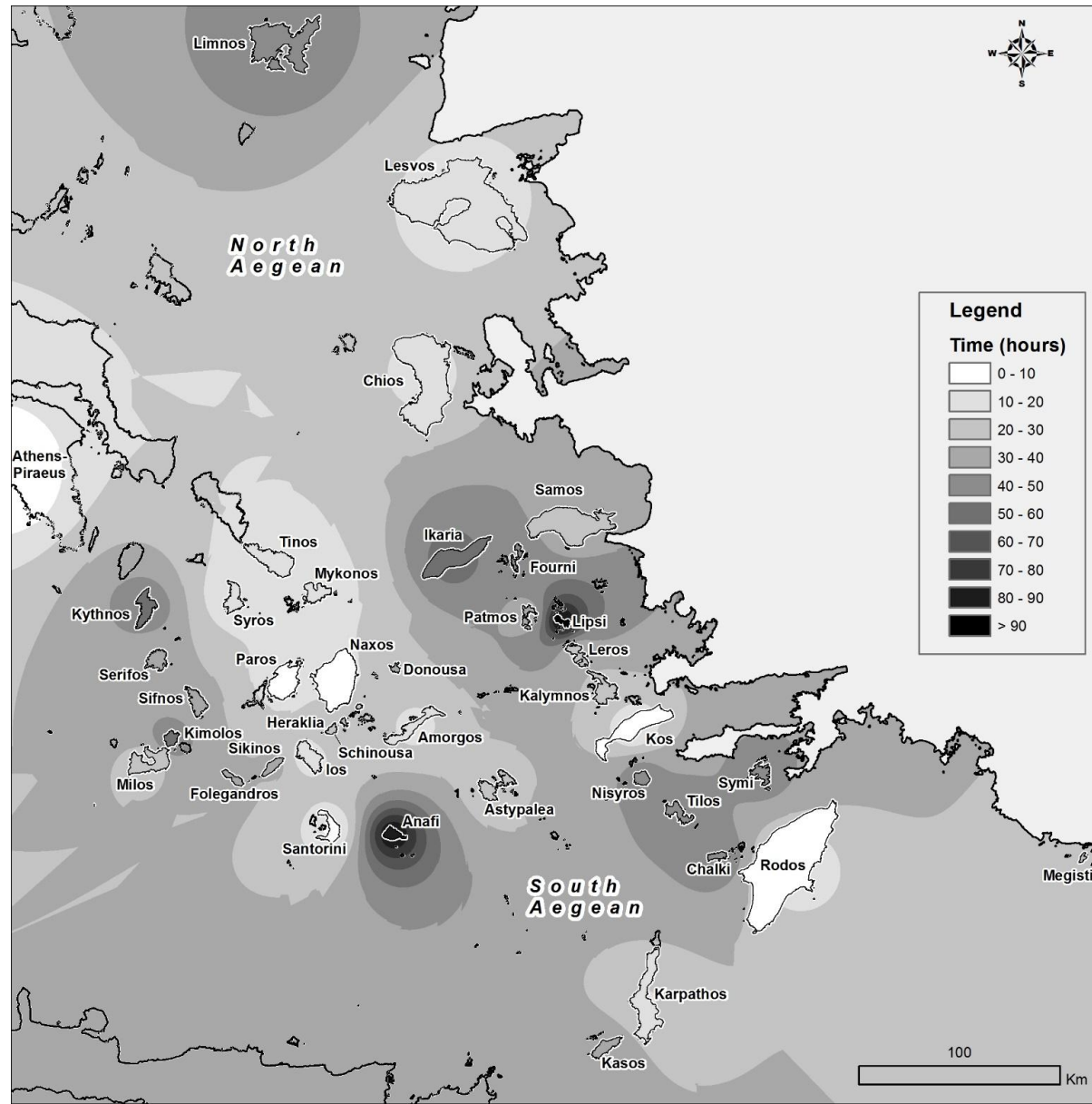
Areas that can be reached from a facility within a given time using the network.

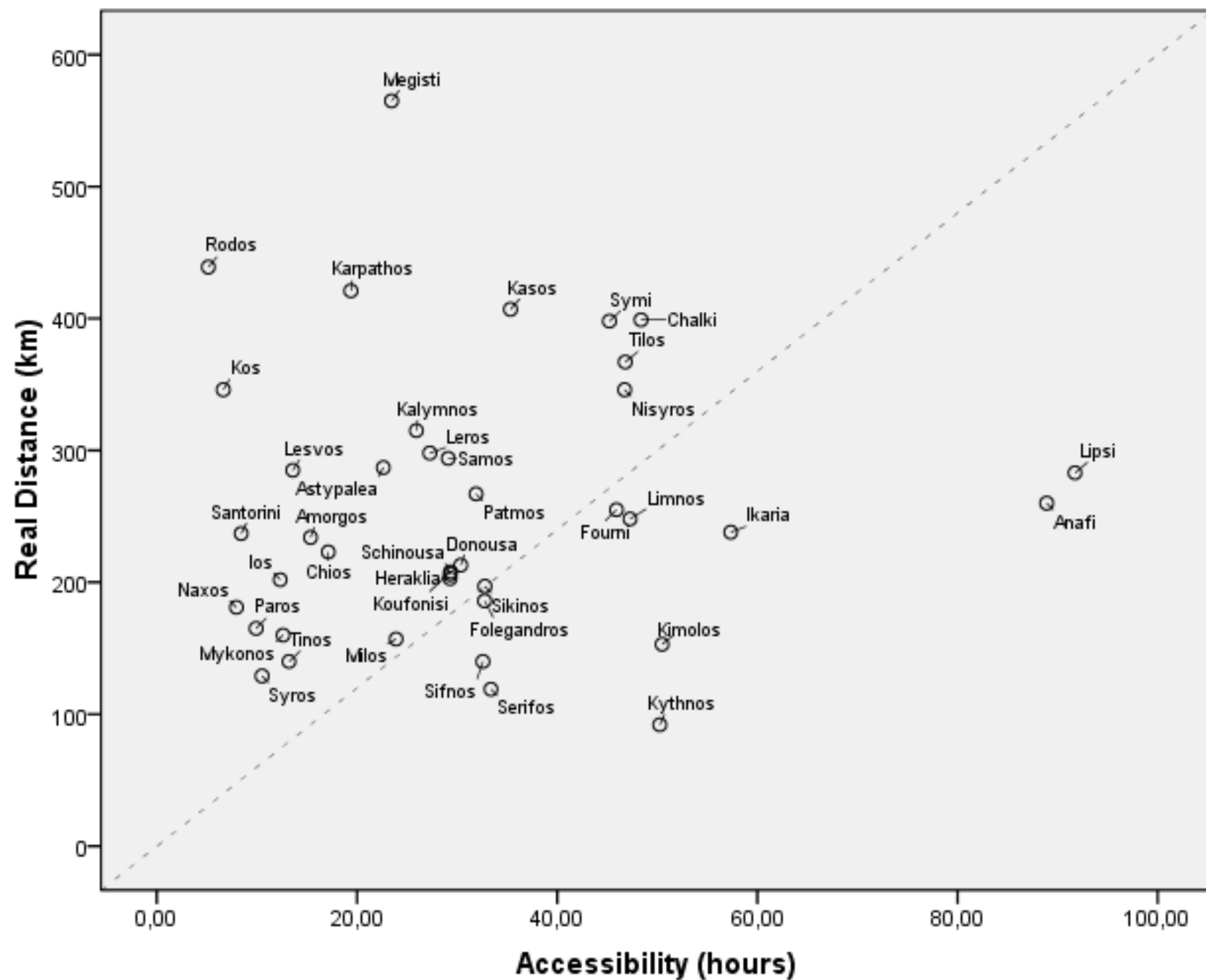
4. TRAVEL TIME MAPS



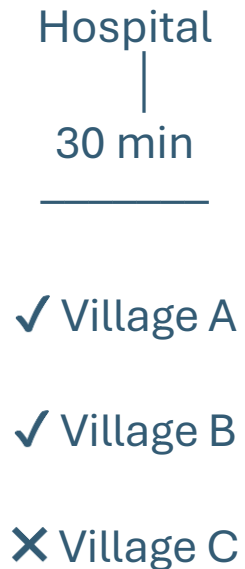
Maps showing how long it takes to reach a destination.

Accessibility from Athens metropolitan area for Aegean Islands in isochrone lines (hrs)





Accessibility and Equity



Poor accessibility may lead to:

- unequal access to healthcare
- unequal access to education
- social exclusion
- regional inequalities

Equal distance does not mean equal opportunity.

Accessibility and Sustainability

Accessibility



Access to services



Quality of life



Resilience



Sustainable islands

Accessibility supports:

- social sustainability
- economic development
- territorial cohesion
- resilience

Accessibility and Tourism

Accessibility can stimulate economic development, but it may also increase pressure on island environments and communities

Positive Impacts

Tourism

Local economy

Employment

Investment

Negative Impacts

Congestion

Environmental pressure

Overtourism

Housing pressure

Planning Applications

How can planners use accessibility?



Locate new health
centers



Improve ferry
connections



Optimize public
transport



Improve access to
schools



Identify isolated
communities



Prioritize
infrastructure
investments

Transport Equivalent Threshold

Objective: Reduce transport inequalities between islands and the mainland.

Supports:

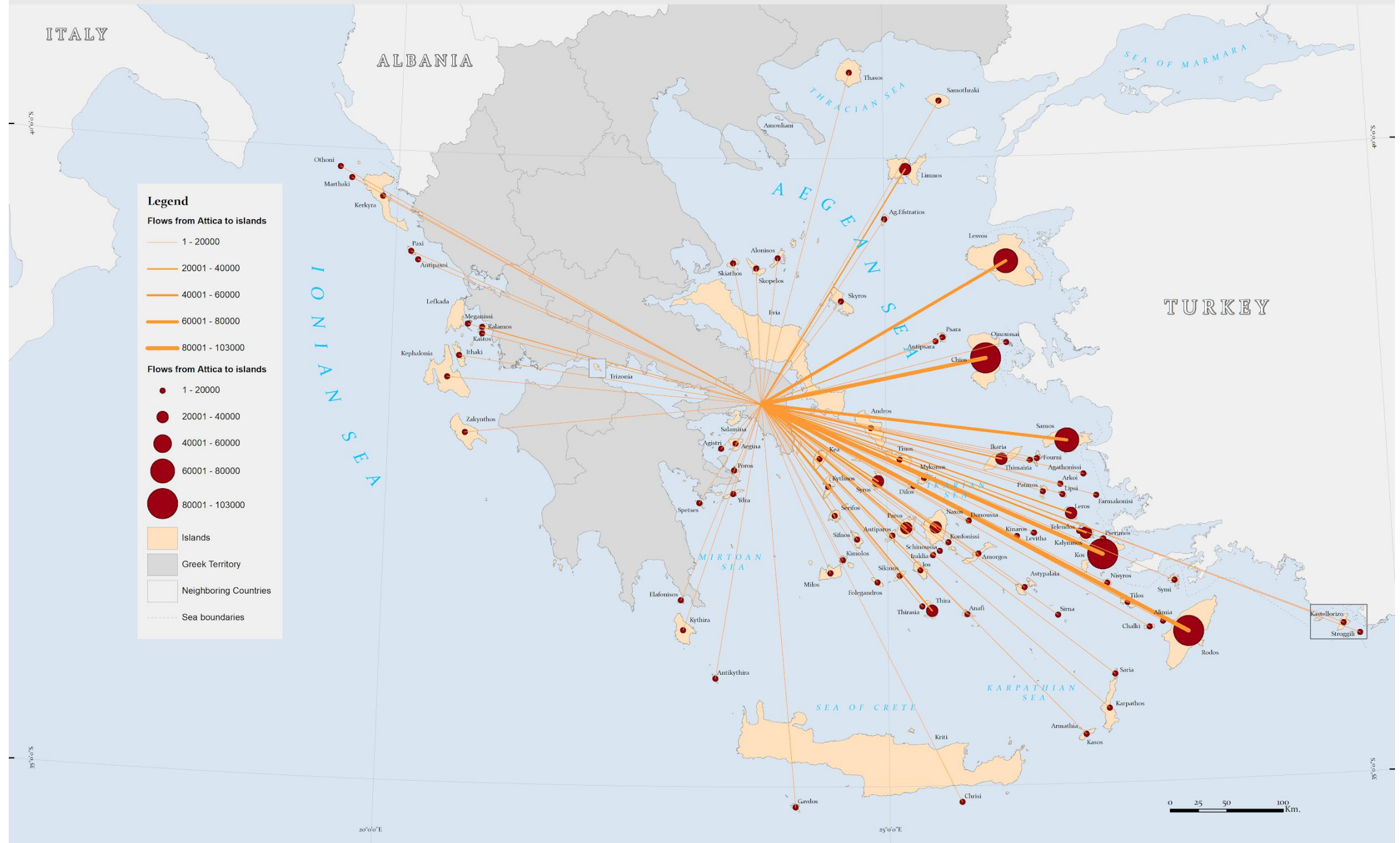
- Permanent island residents (passenger fares)
- Island businesses (freight costs)

Implemented: Greece, 2018

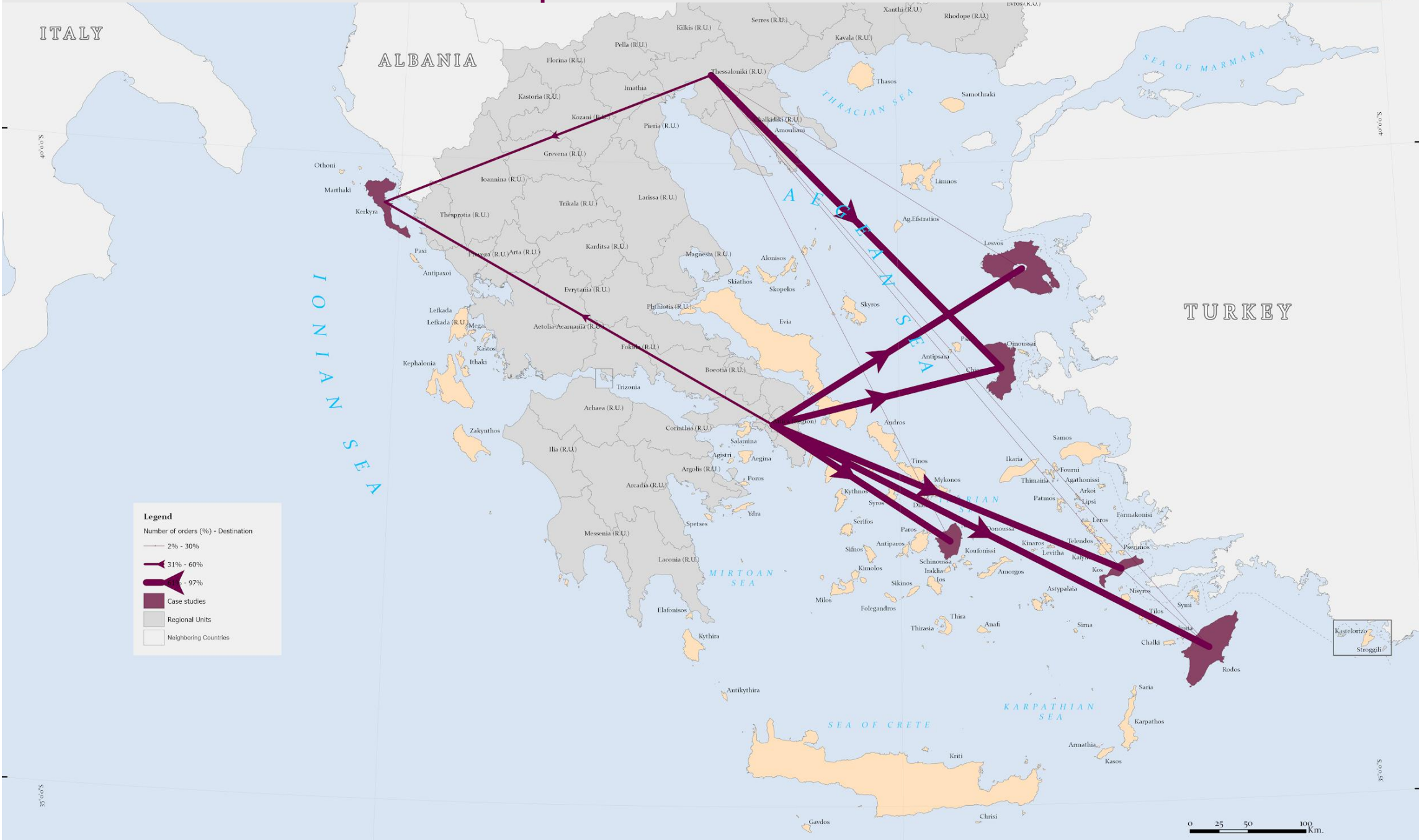
Mechanism: Eligible users receive reimbursement through an online platform.



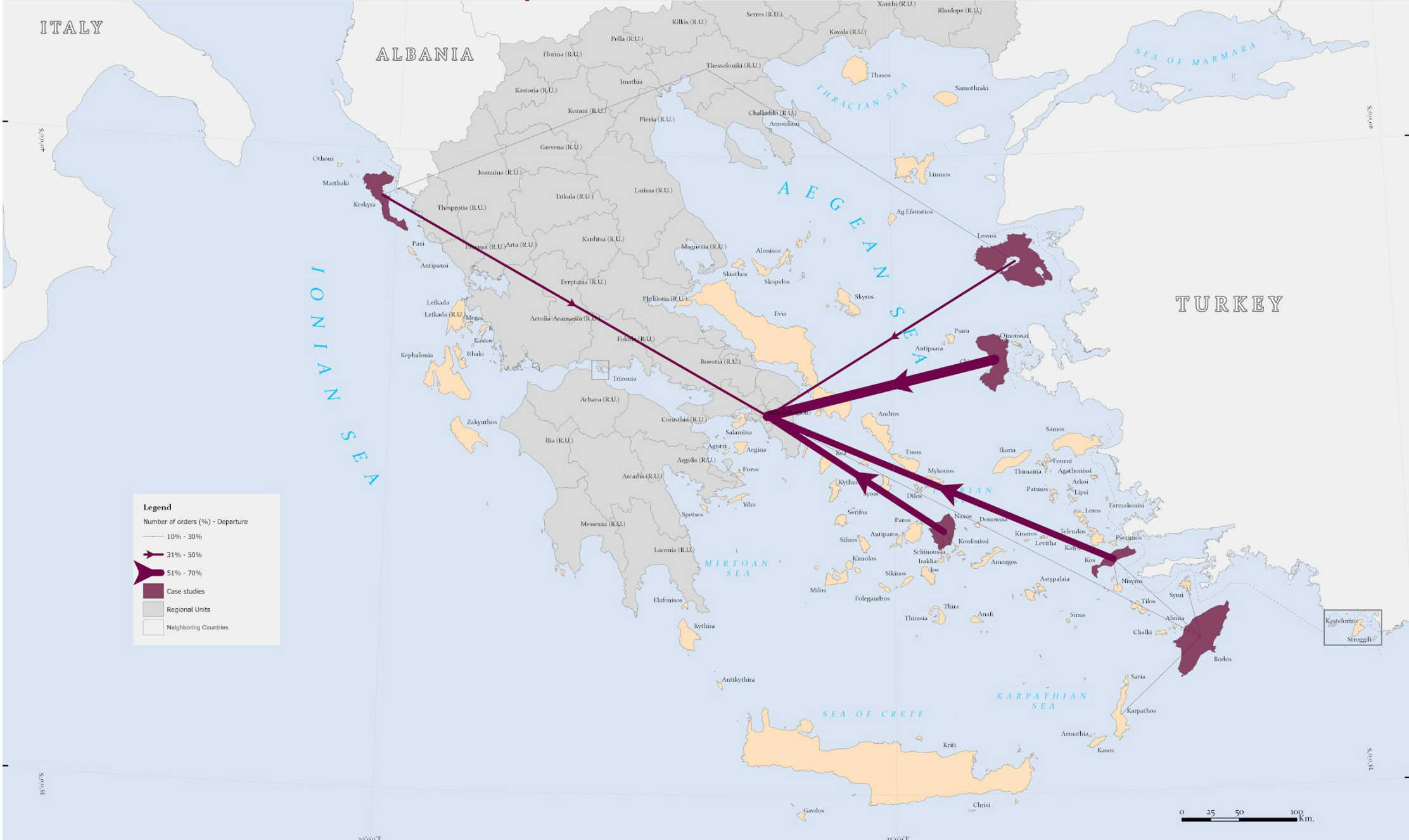
Freight transport flows to the islands



Imports to the islands



Exports from the islands



Key Messages



Accessibility ≠
Distance



Connectivity
matters



Spatial analysis
supports planning



Evidence supports
policy

Transition to Lab



build a road
network



calculate
accessibility



identify isolated
settlements



propose planning
solutions