

# **Social network analysis of the European network for food systems science — initial results**

Milestone Report

30 April 2025

# Milestone 3 "Social networks analysed"

## Highlights

- Using social network analysis, we study how food systems thinkers are connected in a European network for food systems science and how information, resources, and influence flow through the network
- The results show a potential community of over 200 individuals from over 130 organisations across 30 countries. The respondents have worked on over 120 projects & participated in over 130 networks.
- Six barriers are identified for collaboration and communication in the network. The analysis will be continued with further data collection through surveys and workshops.

Trang Nguyen, Kelly Rijswijk, Bobby Tsvetkov, Thom Achterbosch. Social network analysis of the European network for food systems science – initial results. Memorandum, FoSSNet project (EU grant agreement no. 101134861), Wageningen University and Research, 30 April 2025



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# Why Social Network Analysis?

- Social Network Analysis (SNA) studies how people are connected and how these connections shape **behavior, influence, and communities**.
- Unlike traditional approaches that focus on individuals alone, **SNA** looks at **relationships** first—who interacts with whom and how **information, resources, or influence** flow through networks. It helps us understand the bigger picture of social structures beyond just individual choices.
- The SNA will not only help to **optimise how FoSSNet's consortium members interact and collaborate**, but also with external relevant stakeholders part of the wider FoSSNet network, ultimately enhancing the project's capacity to drive food systems science forward.

# Objectives of the SNA

- Map and analyse the relationships among individuals, institutions and networks involved in FoSSNet:
  - How are the stakeholders within FoSSNet interconnected?
  - Which institutions or individuals act as central hubs in the network?
  - What are the key areas of collaboration (e.g., research, education, policy)?
  - How well are different geographic regions, scientific disciplines, etc., represented within the network?
- Identify key areas where collaboration can be improved
  - Where are the gaps in network functioning (e.g. knowledge transfer/sharing/flows & collaboration)?
  - What are the blind spots in discipline and geography?



# Key concepts

- **Food system science (FSS)** weaves together knowledges on the dynamic relationships including feedbacks between food system drivers, core activities, [supporting services] and outcomes, to study and foster transformative action on innovation, conservation, restoration and exnovation in interconnected social, economic and biophysical systems.
- **Food system scientists** consider all four aspects of a food system: drivers, activities, outcomes and feedbacks.
  - Level 1 are (mostly disciplinary) scientists looking at 1 aspect of the FS
  - Level 2 are (more inter or transdisciplinary oriented) scientists that look at two aspects of the FS, and they may or may not include the feedback loop between these parts,
  - Level 3 are FS scientists that look at all 4 aspects of a FS, including the feedback loops between the drivers, activities and outcomes.
  - All these scientists work in various domains that belong to interconnected social, economic and biophysical systems.

# Methods

- **Data collection**

- Primary data: survey with FoSSNet “core” members, which consist of:
  - FoSSNet consortium partner members (63 people)
  - External participants who were invited to the first FoSSNet conference which took place in March 2025, in Oxford.
- Every survey respondent was asked to list the top 5 colleagues they collaborate with on food system science (FSS) activities.
  - For each of these collaborations, follow-up questions on the type of FSS activities and the duration of the relationship.
- The questionnaire also includes questions about the respondents’ demographic characteristics, expertise, FSS specialisations, research/policy/education/communication orientation, food systems science projects and networks.

# Methods

- **Analysis – Quantitative:** three analytical levels and associated metrics
  - 1. The whole network:
    - Number of nodes (actors)
    - Number of ties (relationships linking nodes)
    - Density (how connected the network is), diameter, average path lengths
  - 2. Clusters within the network
    - Communities: clustering
    - Clustering coefficient: tendency of nodes to form communities
  - 3. Individual/institution (node) positions within the network
    - Degree centrality: number of connections
    - Betweenness centrality: how often a node acts as a bridge between other nodes
    - Closeness centrality: nodes with low closeness centrality are far from others, making them less well-connected in the network.

# Analysing the SNA survey



- **Network Mapping** – Create visuals showing connections between individuals (and institutions)
- **Understanding the Patterns** – Identify **clusters, key players, and isolated nodes** to uncover collaboration dynamics in food systems science.
- **Software:** R (mainly for analysis) & Kumu (additional visualization)



# Respondents

- 71 respondents:
  - 34 FoSSNet consortium members (out of 63)
  - 37 Others: non-consortium members who were invited to the conference
- They come from 43 organisations from 15 countries
- They have worked on over 120 projects & participated in over 130 networks (related to FSS)

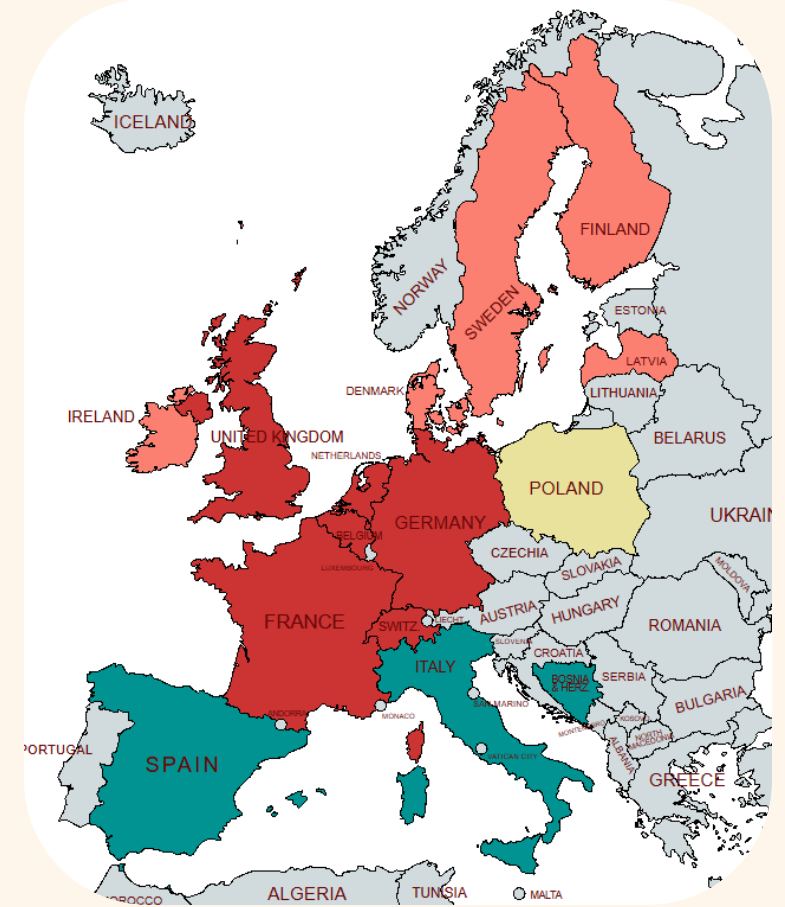
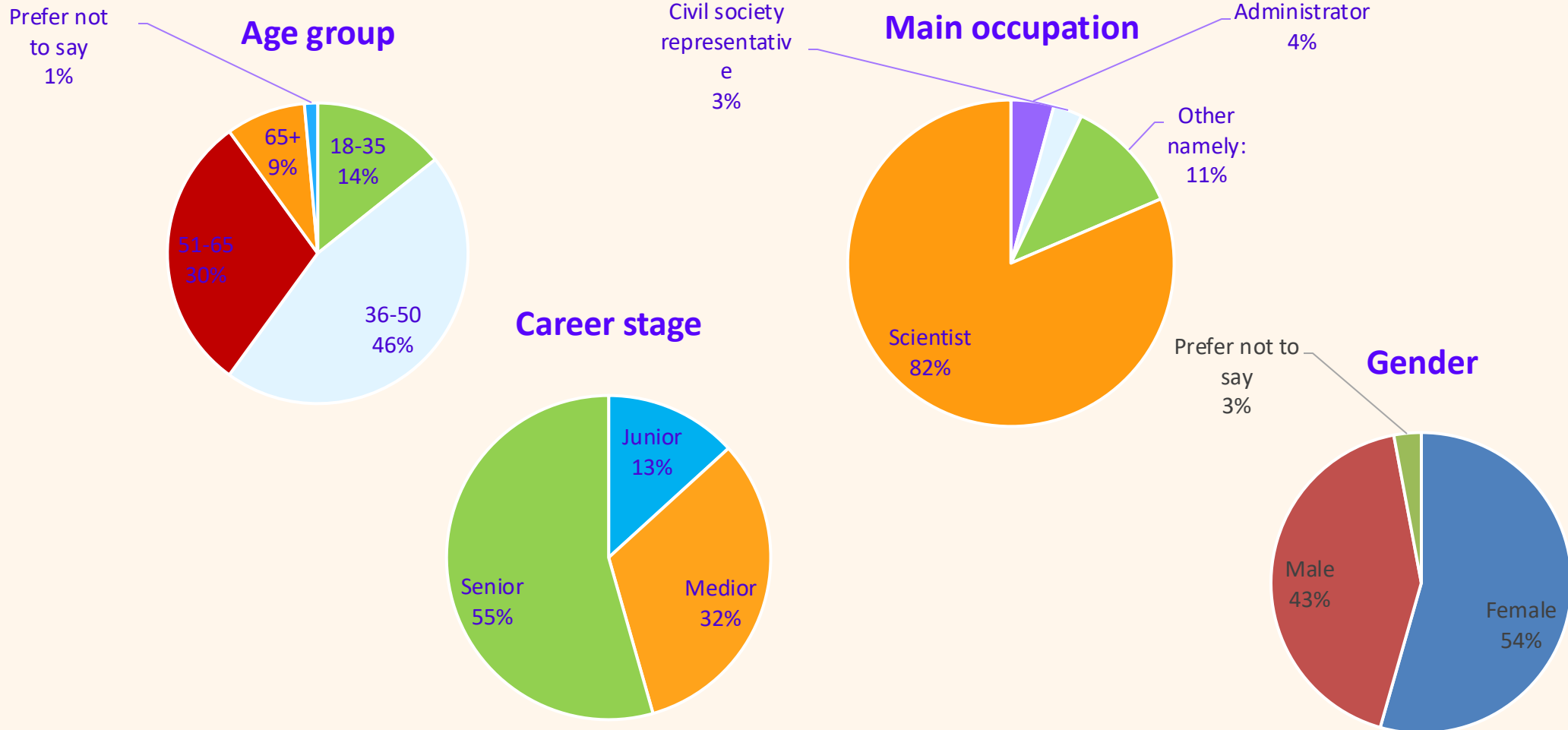


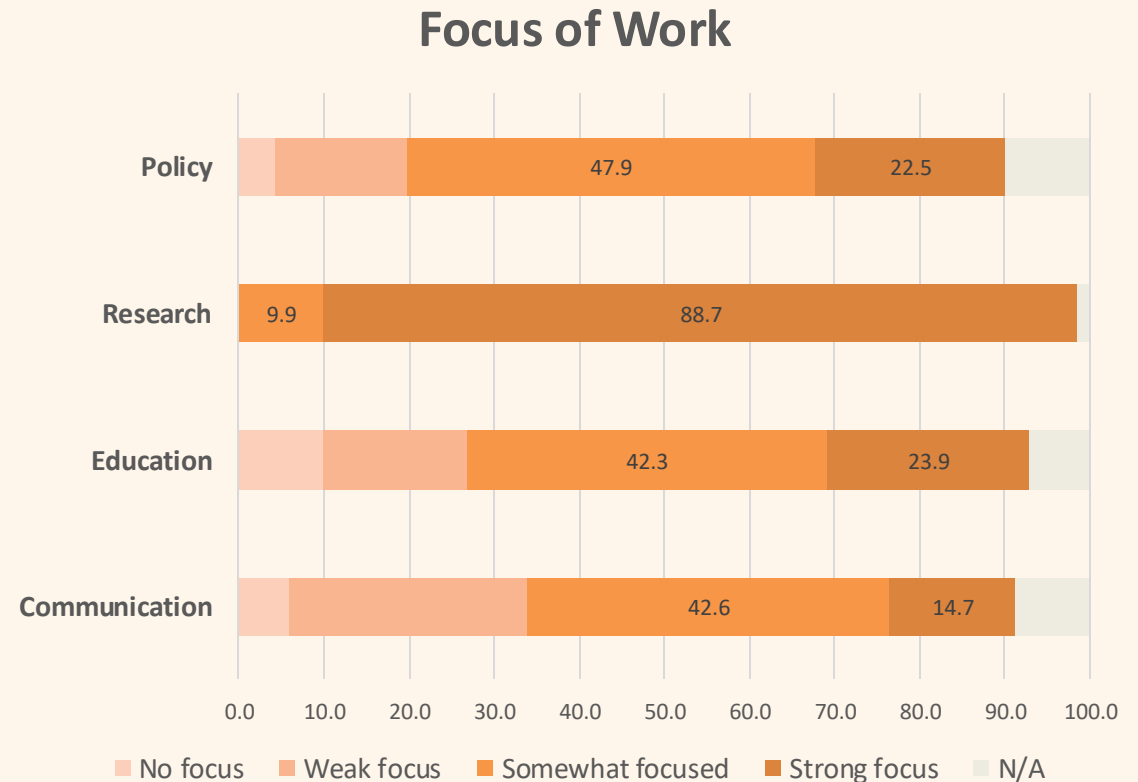
Figure: Map demonstrating the countries represented by the respondents

# Diverse group of (mostly) scientists



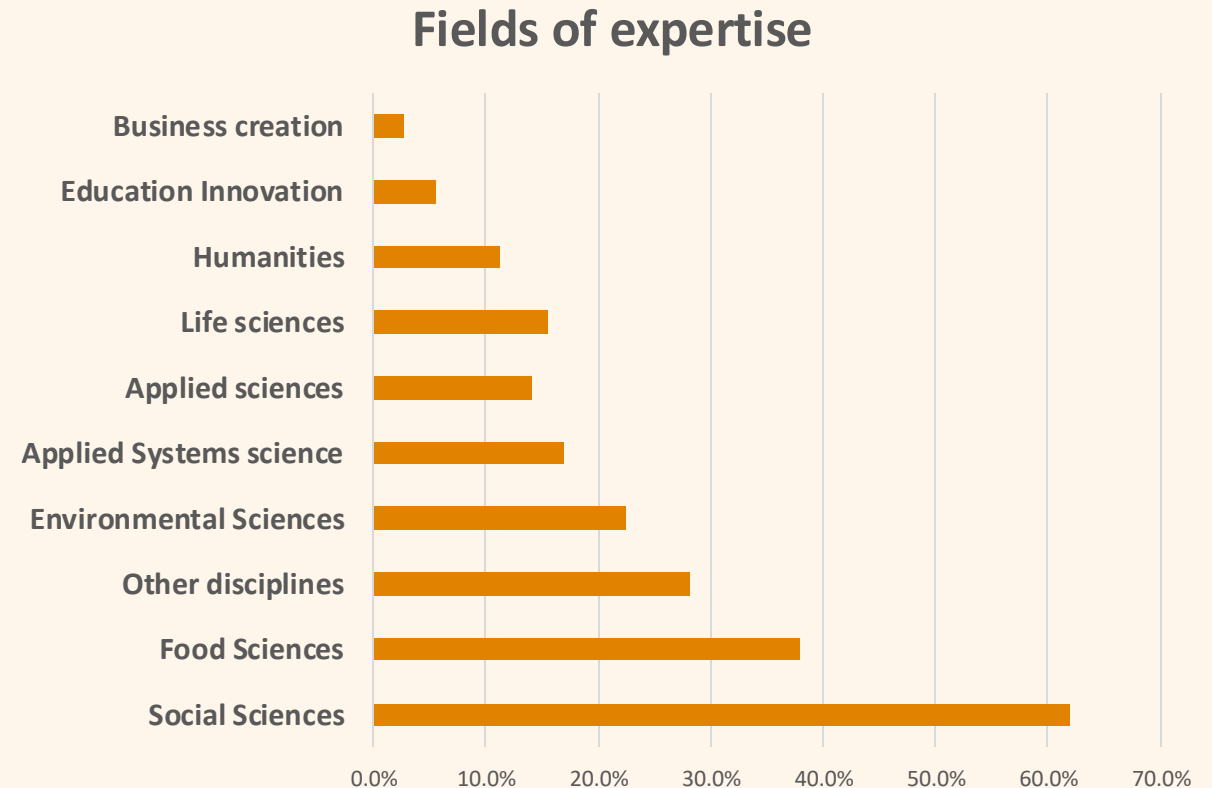
# A research-oriented network

- The respondents were mostly researchers/scientists, with less focus on policy, education or communication
- There was interest in how food system scientists are connected to society through linkages with the private sector, which was not addressed by this question.



# Diverse disciplines, social sciences as majority

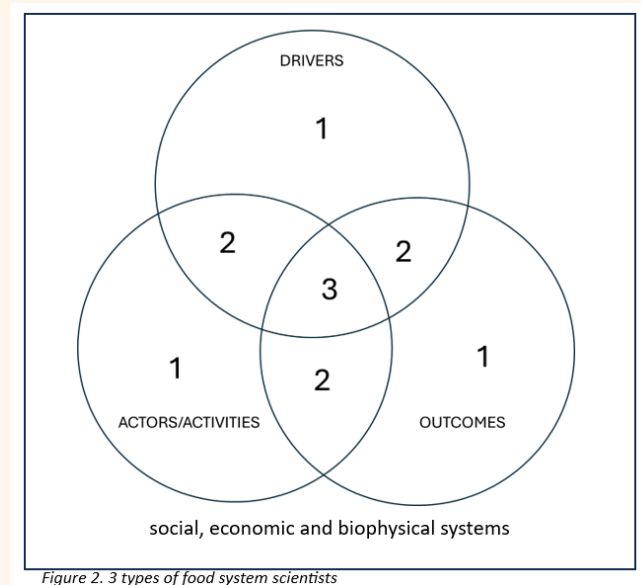
- FoSSNet members were mostly social scientists (as encouraged by the HEU call), followed by food scientists
- Other disciplines include computer sciences, policy science, animal sciences, nutrition, science communication, etc.



# System approach to study food systems

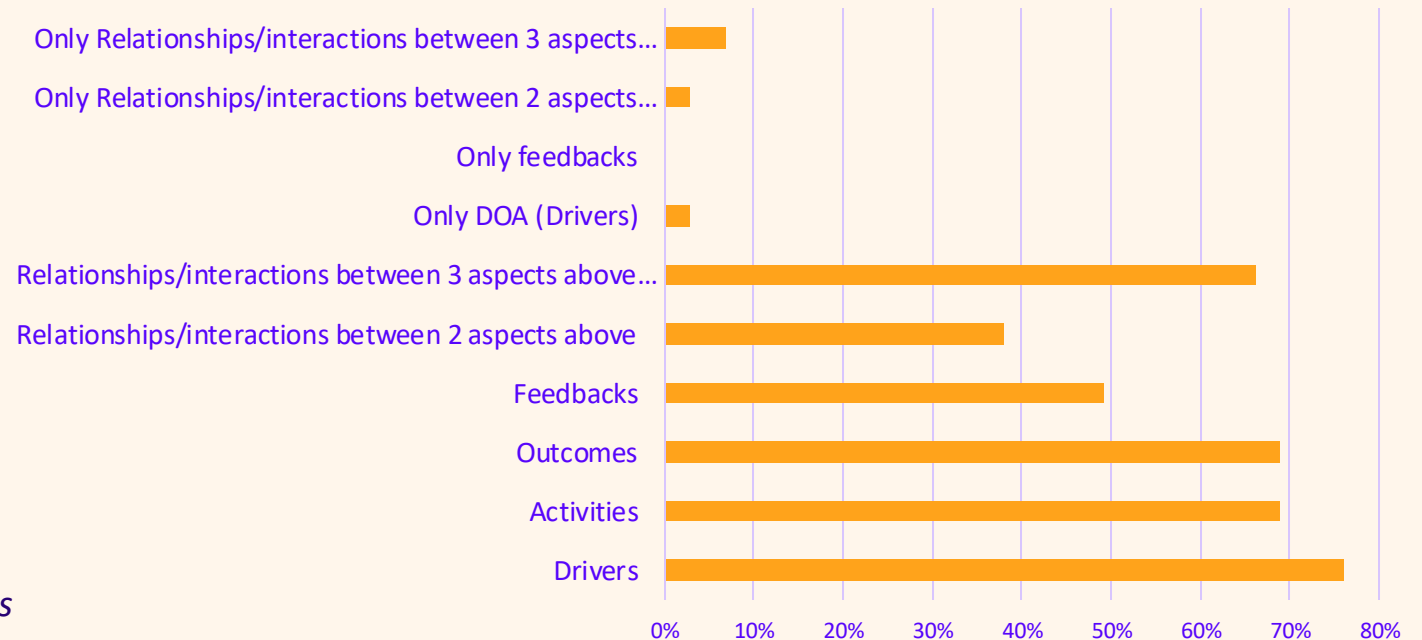


- The majority of respondents study the drivers; and relationships or interactions among at least 3 aspects of food system science (drivers, outcomes, actors/activities)



*Illustration of different types of food system scientists*

## Areas of Food System Science





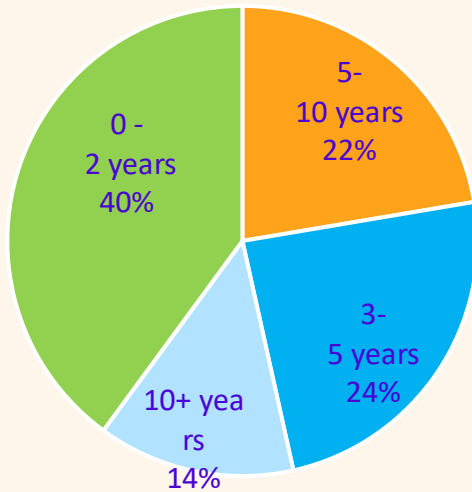
# Collaborations expand the network

- Most collaborations on FSS are inter-organisational



# Relationships were mostly based on research and communication activities

Duration of relationships



	Collaboration activities	% of all connections
RESEARCH	Working in projects together	79%
	Applying for research grants	60%
	Publishing scientific publications	58%
POLICY	Members of science advisory board steering committee	15%
	Development and formulation of policies	14%
	Other	8%
EDUCATION	Development of bachelors/masters/postgraduate programmes	13%
	Development of career trainings	11%
	Other	7%
COMUNICATION	Co-organisation of events and gatherings	44%
	Building partnerships	37%
	Collaboration on social media platforms and websites	17%

# Central hubs and individuals

- Due to privacy, we cannot disclose the names of individuals and organisations in this milestone report.
- Most nodes in the network are sparse or isolated, with a majority having only one connection.
- The top 5 connected individuals have more than 10 connections each.
- There were a few overlaps between the most connected individuals and those who most often act as a bridge (based on betweenness centrality)



# Gap 1: Lack of bridges between and within communities

- The network is characterised by clear, distinct communities (modularity of 0.89), suggesting specialisation
- These communities are sparse (density of 0.1), suggesting a lack of connection among these communities, and not very tightly connected internally (low clustering coefficient of 0.09).
- It can take 13 steps to connect the two most distant people, on average, two researchers are about 5-6 steps apart



# Gap 2: Vulnerable Hub-driven Network

- Potentially "hub"-driven network: nodes with much higher degrees than others could be critical for communication within the network. This makes the network vulnerable to overreliance on a few hubs, as well as unequal influence and power dynamics



# Gap 3: Lack of Collaboration beyond Research

- To foster science and innovation, FoSSNet has to increase its presence in areas beyond research

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COMUNICATION	Co-organisation of events and gatherings	44%
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# Gap 4: Limited Engagement beyond Academia

- **Limited stakeholder diversity:** The network is dominated by researchers and scientists, with underrepresentation from policy, education, communication and private sectors.
- **Untapped interdisciplinarity:** While disciplines beyond social and food sciences are present, their potential remains underutilised

# Gap 5: Limited role of earlier career researchers

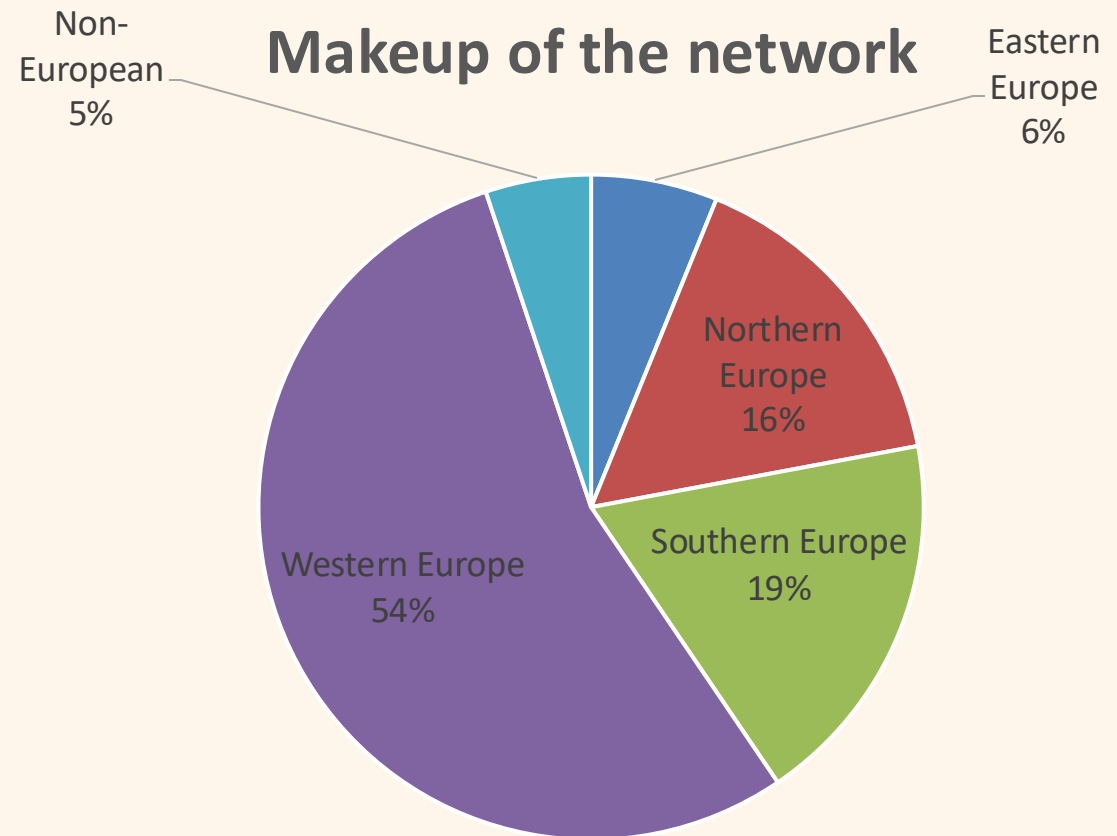
- Despite FoSSNet's ambition to foster the role of early career researchers, by engaging them in various roles in FSS and supporting their networking, they are currently:
  - Focussed on research
  - More likely to work with people of their own organisations
  - Have fewer types of collaborations



Figure: Types of collaborations reported by early career researchers

# Gap 6: Uneven geographical coverage

- The network is dominated by representatives from Western Europe
- 5 countries from Southern Europe, 3 from Eastern Europe





# Key results

- Scope of the FoSSNet network:
  - The survey involves more than 200 individuals from over 130 organisations across 30 countries
  - The respondents have worked on over 120 projects & participated in over 130 networks (related to FSS)
  - The result shows unbalanced geographical coverage, skewed towards Western Europe.
- Depth of the FoSSNet network:
  - The network comprises a diverse group of predominantly scientists from various disciplines, with a strong research orientation and fairly balanced gender representation; however, it remains senior-heavy, lacks sufficient reach beyond academia
  - The network is characterised by professional research-based relationships built through collaborative projects, joint research grant applications, co-authored scientific publications, etc., rather than the duration of the relationship.

# Recommendations

- Connectivity can be strengthened by events or working groups that promote interaction beyond existing hubs, and help isolated nodes to form connections through structured activities (e.g. co-mentorships).
- To reduce reliance on hubs, the network can continue to avoid concentrating key tasks or communications through just a few central actors and develop multiple paths of communication.
- To promote equity, the network should be aware of the potential for hubs to dominate decision-making; implement checks or participatory governance mechanisms.
- The network can be truly interdisciplinary if the diversity of disciplines can be leveraged.
- In the network, mostly specialisation exists (as shown by distinct communities), but there is potential for more tightly-knit groups or further connection-building within communities to enhance collaboration.
- The SNA can be repeated to evaluate if network balance has improved.

# Limitations of the study

- **Low response rate** below the gold standard for reliability in a SNA (75%): the identified gaps using network metrics should not be used as definitive, but for validation and reflection by national consortium partners during the next phase (national workshops)
- **Limited network scope:** Important ties may be omitted if a respondent has worked closely with more than five close contacts, leading to an incomplete picture of the network.
- **Underrepresentation of weak ties, bias towards strong ties:** Since respondents can only name five collaborators, occasional or informal collaborators might be omitted. Relationships among the named contacts beyond those reported may be absent, leading to potential underestimation of cohesion.

# Lessons learnt for the national-level SNA

- **Ensure survey participation to increase the response rate:** there will be time assigned for the SNA survey completion during the national feedback workshop
- **Increase the number of contacts that can be named by the respondent:** to cover weaker ties and increase the network scope
- **Add questions related to private sector involvement and business orientation:** there was great demand for understanding how the network (members) are connected to the private sector's initiatives and innovations related to FSS



# Next steps

- **National-level workshops:** In each partner country, FoSSNet consortium partners will conduct a national-level SNA, and discuss gaps and bottlenecks in their networks.
- **Consolidation of results** of national-level SNAs: provide an overview and comparisons of the networks of food system scientists across Europe.
- **Another round of FoSSNet SNA** will be conducted near the project's conclusion, to examine how the network will have evolved and which gaps have been closed (or widened).

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# Contact



# FoSSNet partners



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