

CASA

User Guide

COMPLEX
SOCIETY
LAB



PRESENTATION

The Complex Analysis for Socio-environmental Adaptation (CASA) Framework represents a transformative leap in strategic decision-making for governmental, military, and humanitarian operations.

Designed as a Future Decision Aid (FDA), CASA delivers real-time, AI-enhanced intelligence that empowers decision-makers to navigate the complexities of modern security, socio-environmental, and resilience challenges.

Grounded in Complexity Science, CASA integrates principles of Network Theory, predictive analytics, and emergent system modeling to construct a dynamic, learning-based intelligence platform. Unlike traditional static assessment tools, CASA continuously evolves, incorporating multi-source data, predictive modeling, and geospatial analytics to generate relevant scenarios and updated strategic insights.

At its core, CASA identifies, models, and predicts cascading risks across interconnected socio-economic and security systems, equipping stakeholders with a proactive, science-based approach to territorial resilience and crisis mitigation.

Developed through an interdisciplinary collaboration between the United States (Infinitum Humanitarian Systems) and Chile (Complex Society Lab), CASA has been supported by the Office of Naval Research, reinforcing its credibility as a globally relevant tool for resilience planning and adaptation strategies.

This guide provides an overview of the theoretical foundations behind CASA and its operational use:

- **Introduction to CASA model (P.4)**
- **Theoretical foundations behind CASA model (P.8)**
- **CASA Web-Tool User Guide (P.84)**

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INTRODUCTION

CASA offers an advanced methodological approach rooted in Complex Systems Theory, viewing socio-environmental systems as adaptive entities with evolutionary characteristics. CASA utilizes multi-dimensional indicators across social, economic, structural, environmental, technological, political, energy, cultural, and other domains to visualize system behaviors, causal relationships, feedback loops, and decision-making processes.

*“Resilience is the ability of an entity, e.g., asset, organization, community, region, to anticipate, resist, absorb, respond to, adapt to, and recover from disturbances arising from natural or human-made events.”
(Hummel & Lewis, 2013).*

CASA constructs a dynamic, network-based graph of interconnected resilience components, improving upon traditional frameworks. Unlike static models based on independent variables, CASA integrates elements into a complex, multi-scale network organized by elements and superelements. This structure allows for:

- Multi-scalar Analysis: CASA captures interactions at different governance and resilience planning levels, enabling analysis from cities to countries and/or regions.
- High-resolution Mapping: The framework identifies a territorial system's dependencies, vulnerabilities, and opportunities.
- Predictive Modeling: AI-driven algorithms anticipate systemic responses to crises and stressors.



To build CASA, advanced text analytics and machine learning algorithms were applied to analyze the global scientific literature from the past 14 years.

By mapping resilience elements to higher-level structures (sectors and pillars), CASA offers a clear, structured analysis of how key components interact. This methodological innovation ensures a more realistic and interconnected representation of social resilience dynamics.

CASA as a Network

From a mathematical perspective, CASA is a graph comprising 58 nodes and 104 weighted connections, based on relationships identified across more than 80 million peer-reviewed articles in the scientific literature. Each node represents a resilience element, while the weight of each connection reflects its empirical relevance, determined by how frequently these indicator elements appear together in relevant global research papers.

A hierarchical structure emerges from CASA's systemic design, revealing Superelements: clusters of resilience components that operate as functional subsystems. These Superelements were not predefined but emerged organically through CASA's network structure and modularity algorithms.

CASA MODEL



The nodes of this graph represent the different elements of CASA. Their size shows the installed capacities in a territory for that element, collected through a series of indicators. Color nodes represent Superelements detected: "Governance and Economic Development", "Legal issues", "Social Infrastructure and Public Services", "Community Empowerment", "Sustainable Development and Risk Management".



The CASA network illustrates how these Superelements construct the resilience landscape, with key elements such as Access to Health Care (Social Infrastructure), Risk Assessment (Sustainable Development), and Economic Development (Governance) playing pivotal roles in territorial resilience.

By visualizing resilience as an interconnected system, CASA highlights the simple recognition that weaknesses in any one component reduce the overall adaptive capacity of a society. While CASA's structure is scientifically informed using a global baseline, its application is highly localized, allowing users to map resilience capacities specific to their territorial realities through an interactive web platform of indicators. The value of those indicators is derived from questions asked of a User when first describing a territory. Thus, the conjugation between the resilience capacities of a territory, defined by values for each element dependent on indicator data, superimposed on a relational structure, allows users to evaluate the resilience characteristics of a territory and its population.

The following section describes the theoretical basis for why each CASA element belongs to the social resilience system. The structure of this theoretical description is divided into five superelements, each with a color scheme that facilitates reading. Within each superelement, each element is described according to its indicators.

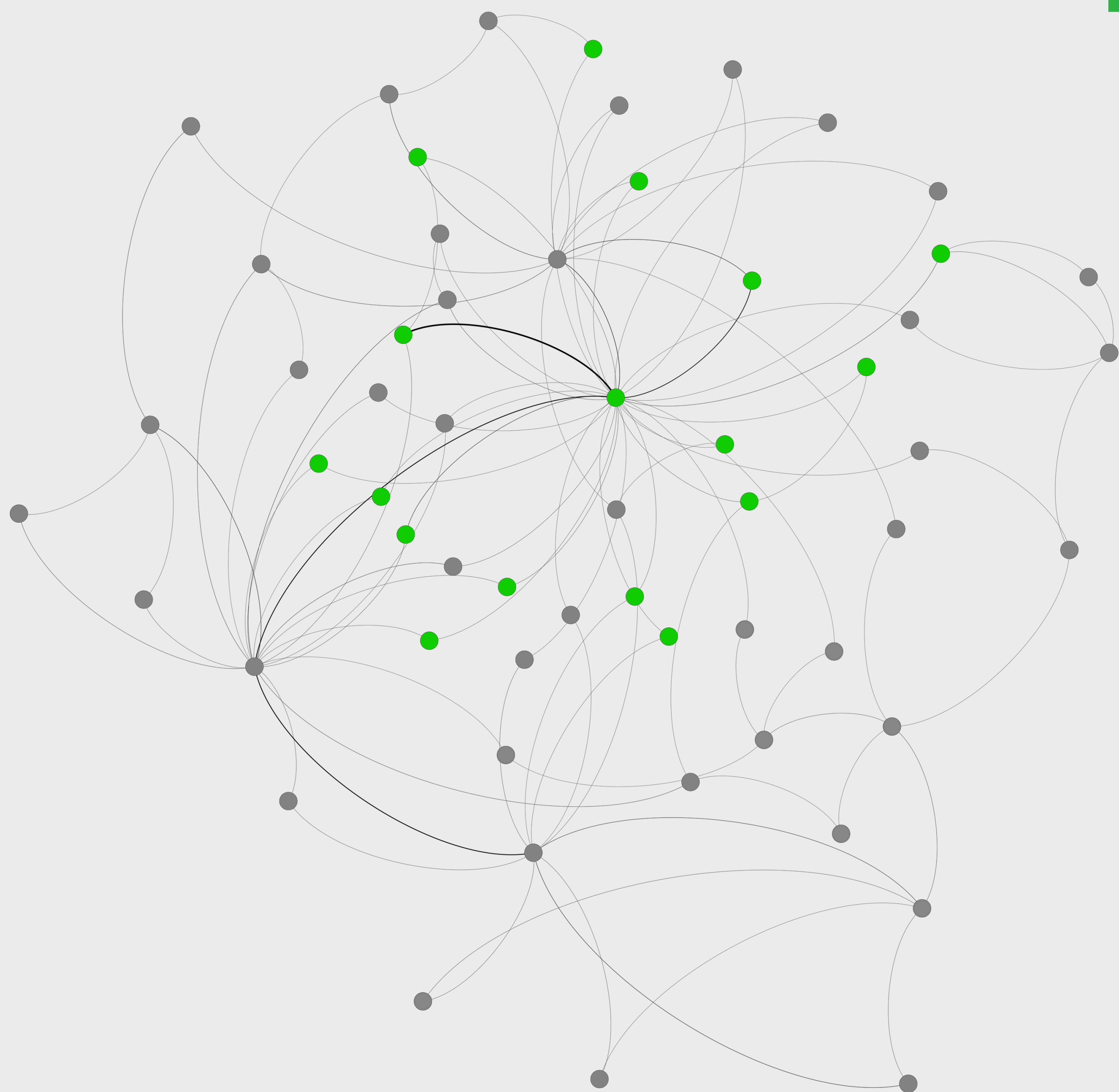


CASA AND RESILIENCE

THEORETICAL BASES ON THE RELATIONSHIP BETWEEN
ELEMENTS AND RESILIENCE



SOCIAL INFRASTRUCTURE AND PUBLIC SERVICES

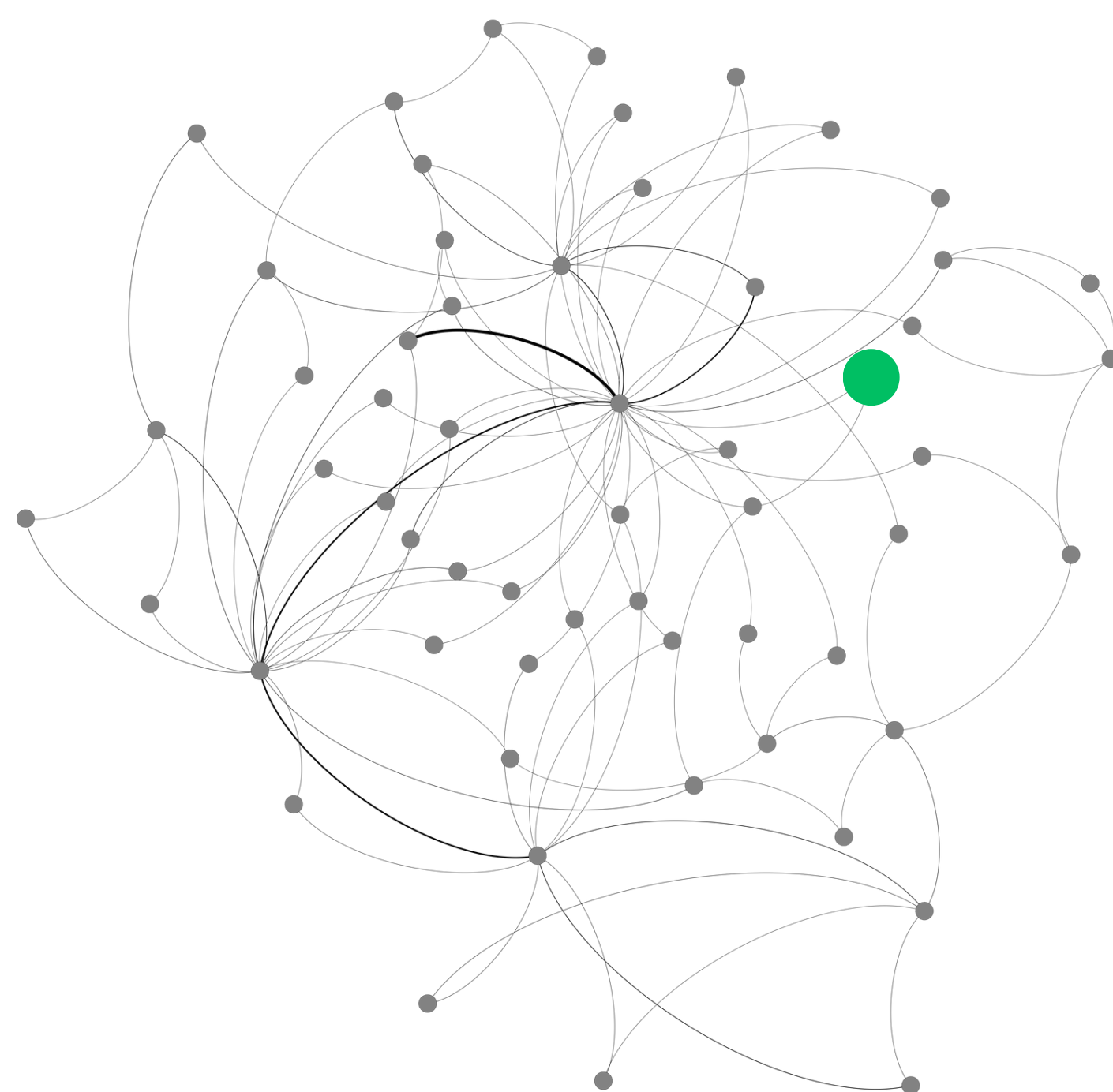


CASA Elements

- Educational Management
- Life Expectancy
- Scientific and Technical Expertise
- Telecommunications Infrastructure
- Refugee and IDP Support Systems
- Social Welfare Systems
- Records Protection and Preservation
- Operational Efficiency
- Information Systems and Accessibility
- Essential Public Services
- Correctional system worker capacities
- Infectious Disease Detection and Management
- Health Care Providers
- Health Care Affordability
- Health Care Accessibility
- Educational Support Infrastructure
- Educational Resources

Educational Management

This element assesses the rate of students in the educational system present in the territory who complete primary and secondary education levels.

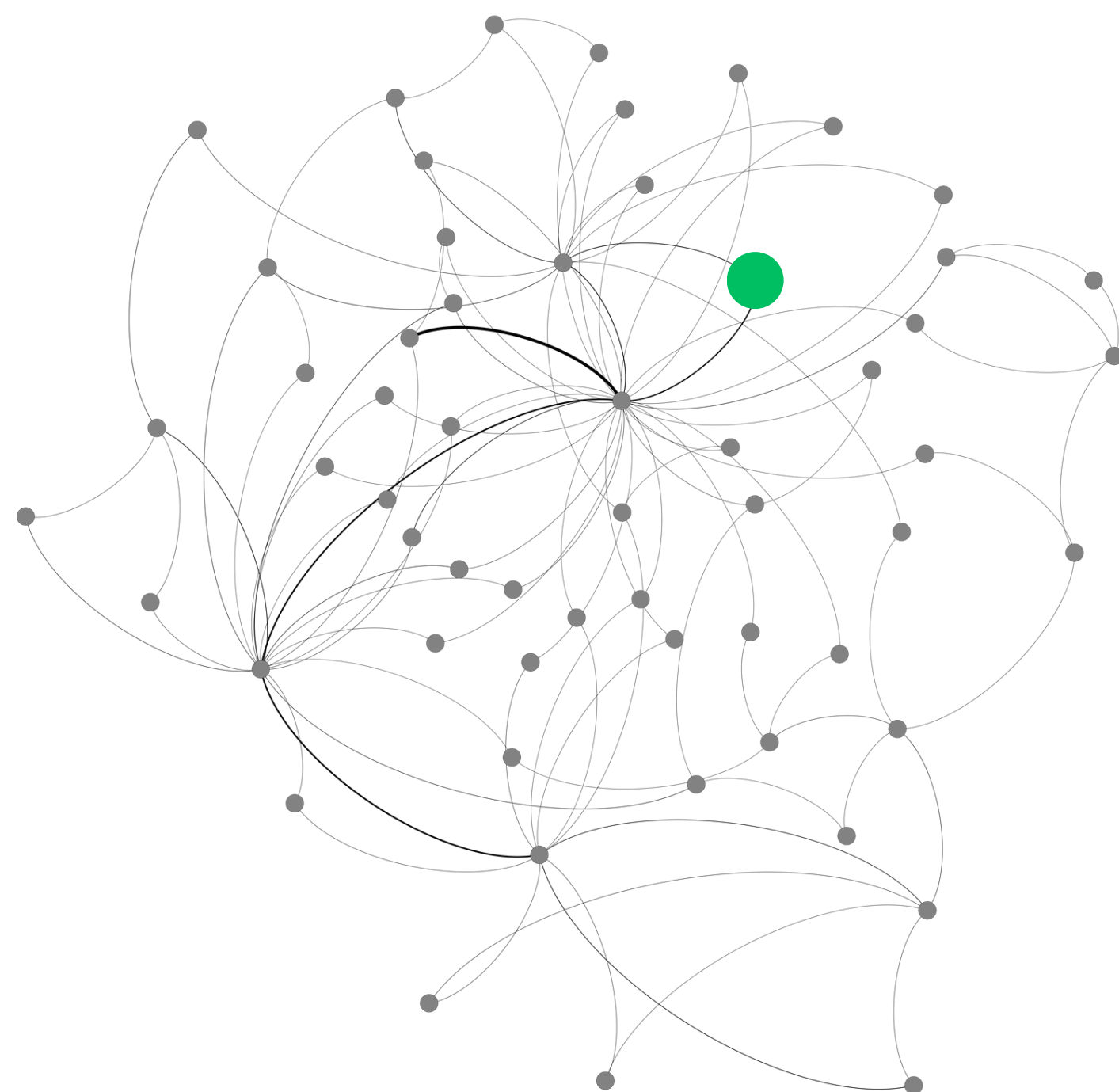


Indicators:

- Completion rate (%) of primary and secondary education.

Life Expectancy

This element assesses the health and well-being of the population through key indicators such as infant and maternal mortality rates, vaccination coverage, and life expectancy at birth.

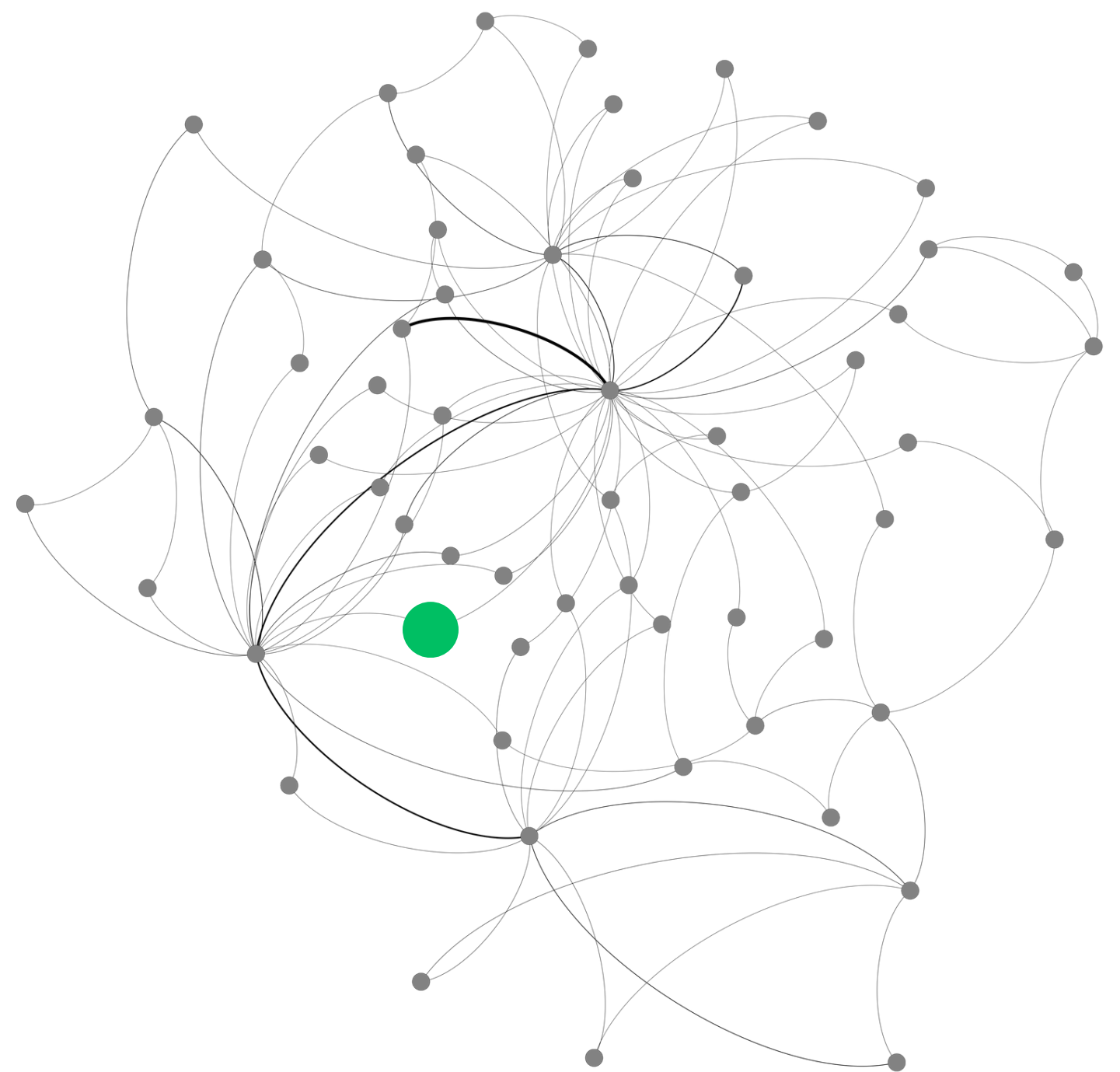


Indicators:

- Infant and maternal mortality rates.
- Life expectancy.
- Percentage of the population that completes the full recommended vaccination schedule.

Scientific and Technical Expertise

This element assesses the existence and development of technical schools and technology centers. Its evaluations should consider their educational quality, availability of resources, adaptation to labor market demands, and their contribution to the development of specialized human capital.

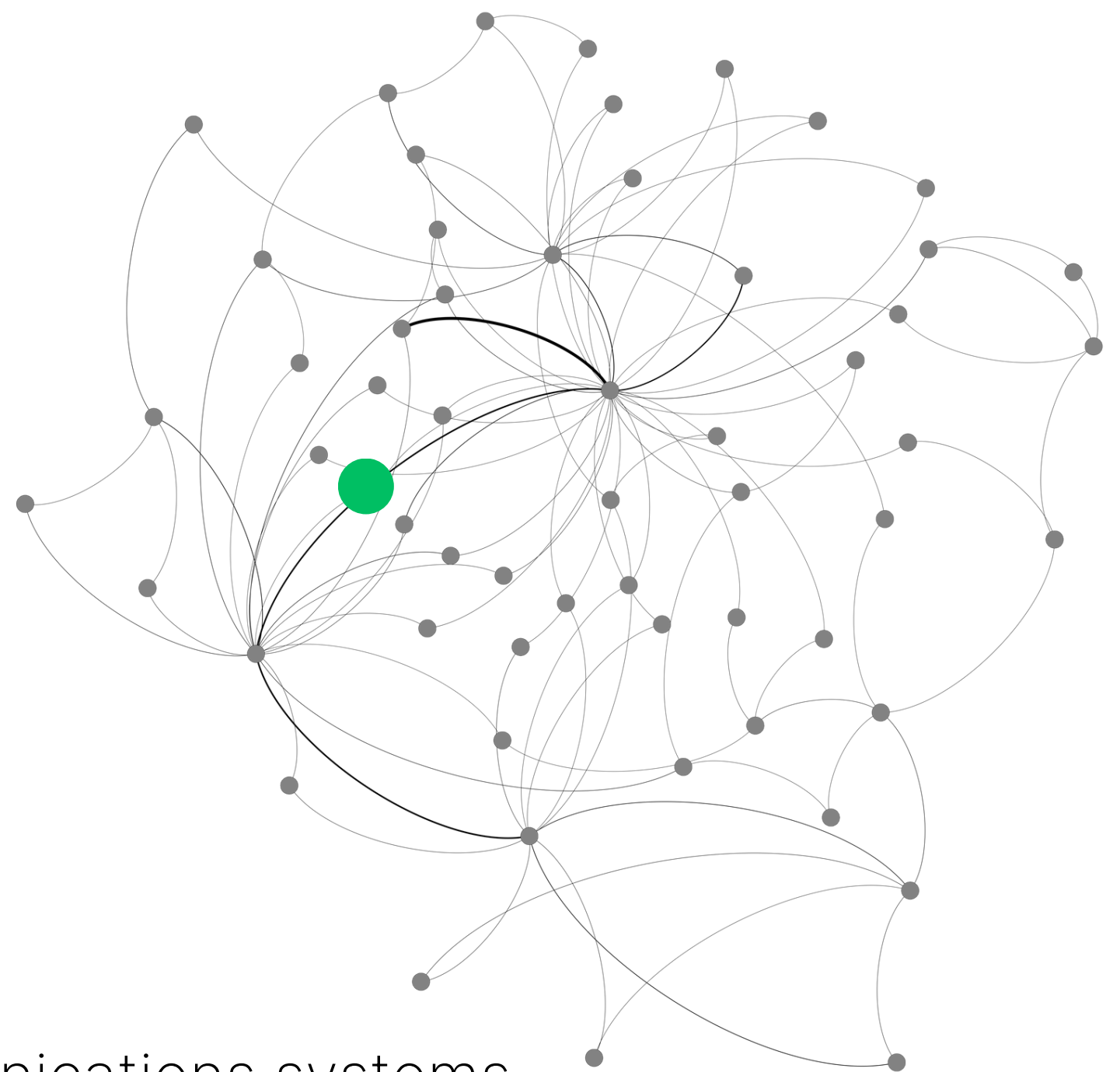


Indicators:

- Status of technical schools and technological centers.

Telecommunications Infrastructure

This element assesses telecommunications infrastructure, its resilience and reliability, as well as internet and telephone regulation and accessibility within a population. It also includes an analysis of the effectiveness of emergency communication systems and the existence of restrictions or censorship during critical times.

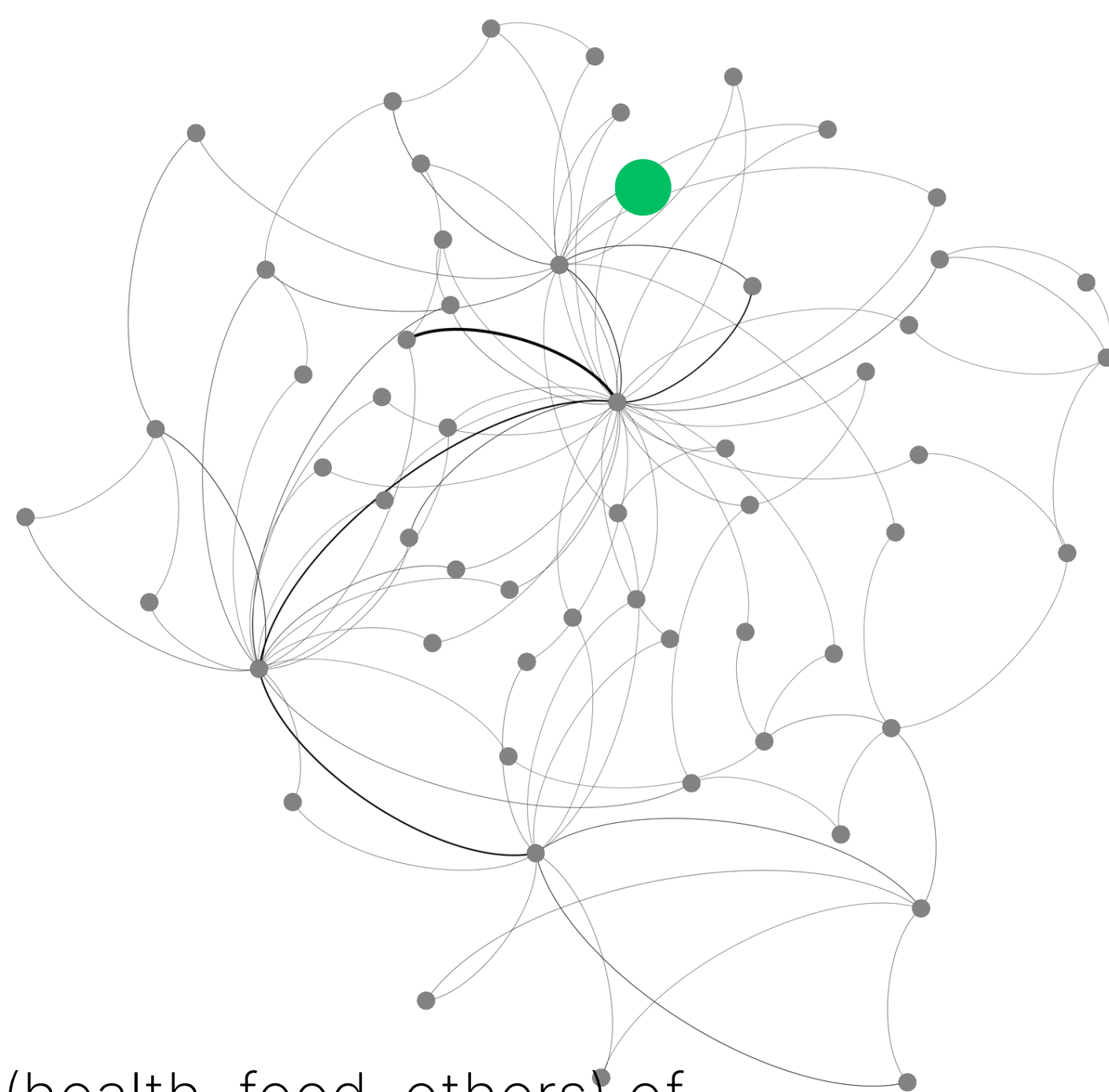


Indicators:

- Effectiveness of emergency communications systems.
- Regulation of the Internet.
- Resilience and reliability of telecommunications infrastructure.
- Percentage of the population with access to telephones.
- Percentage of the population with access to the Internet.

Refugee and IDP Support Systems

This element assesses the availability of resources and coverage for health care, education, food, and other essential services for migrants, refugees, and internally displaced persons.



Indicators:

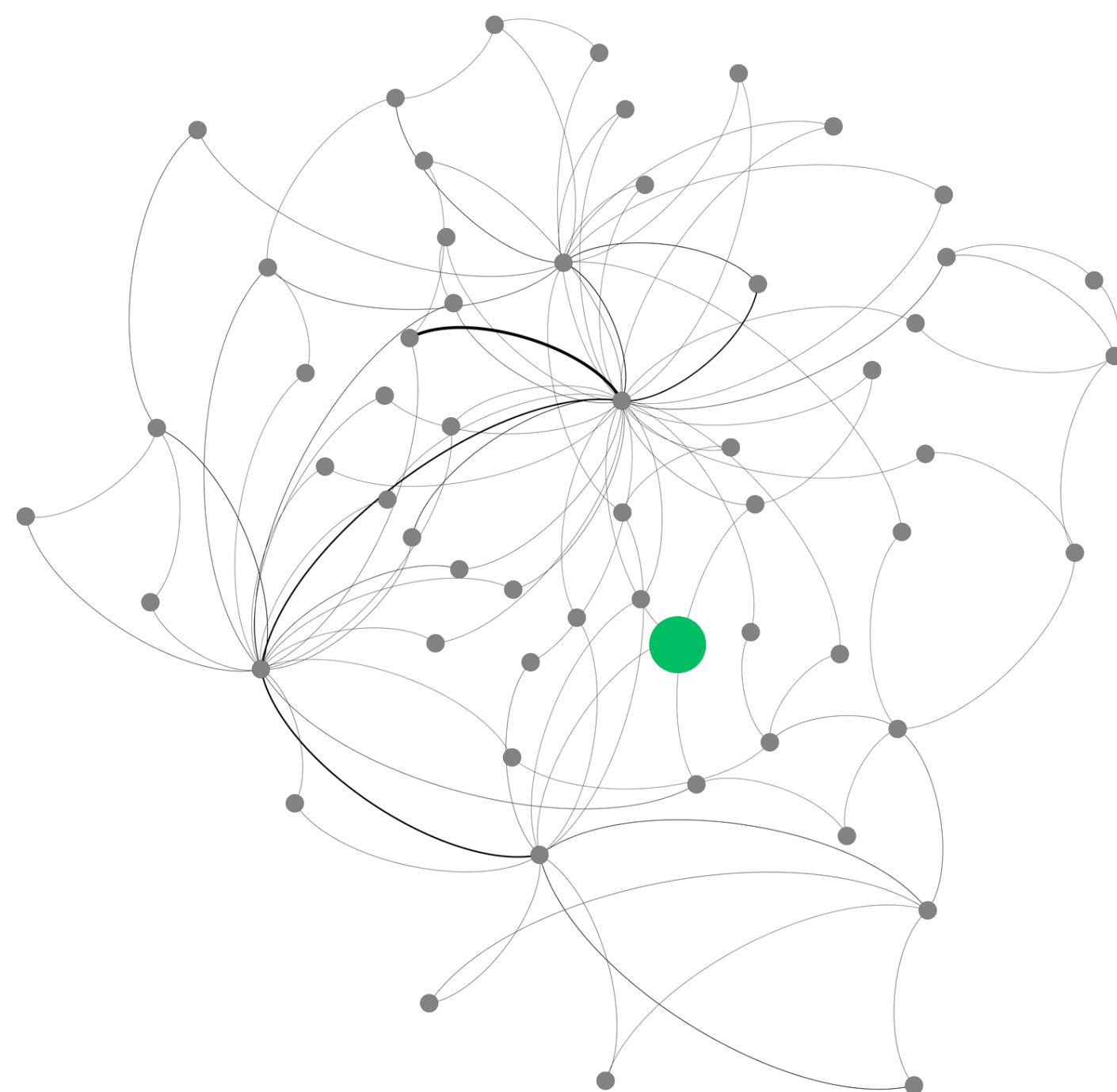
- Resources to meet the basic needs (health, food, others) of migrants, refugees, and/or internally displaced people.
- Percentage represented by migrants, refugees, and internally displaced people served in health and education services in the city.



Refugee camp. Colchane, Chile. Photo by Lorenzo Moscia.

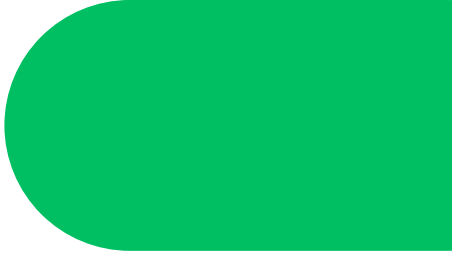
Social Welfare Systems

This element assesses the percentage of Gross Domestic Product (GDP) that the territory allocates to social protection programs and has a pension that allows basic needs to be met with dignity.



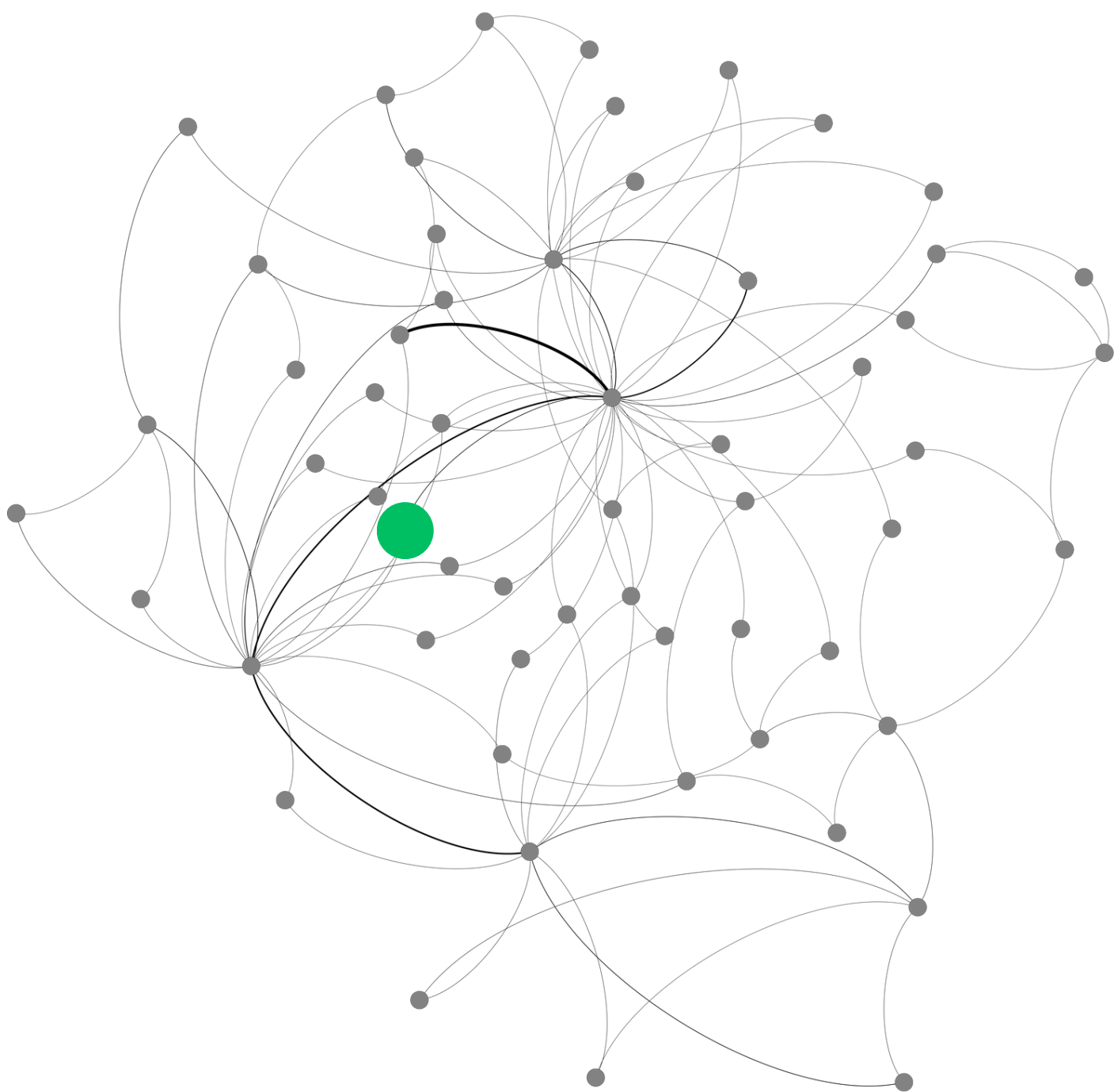
Indicators:

- Percentage of GDP allocated to social protection programs.
- Percentage of the population with a decent pension (similar to the minimum wage).



Records Protection and Preservation

This element assesses the storage and protection conditions of public records.

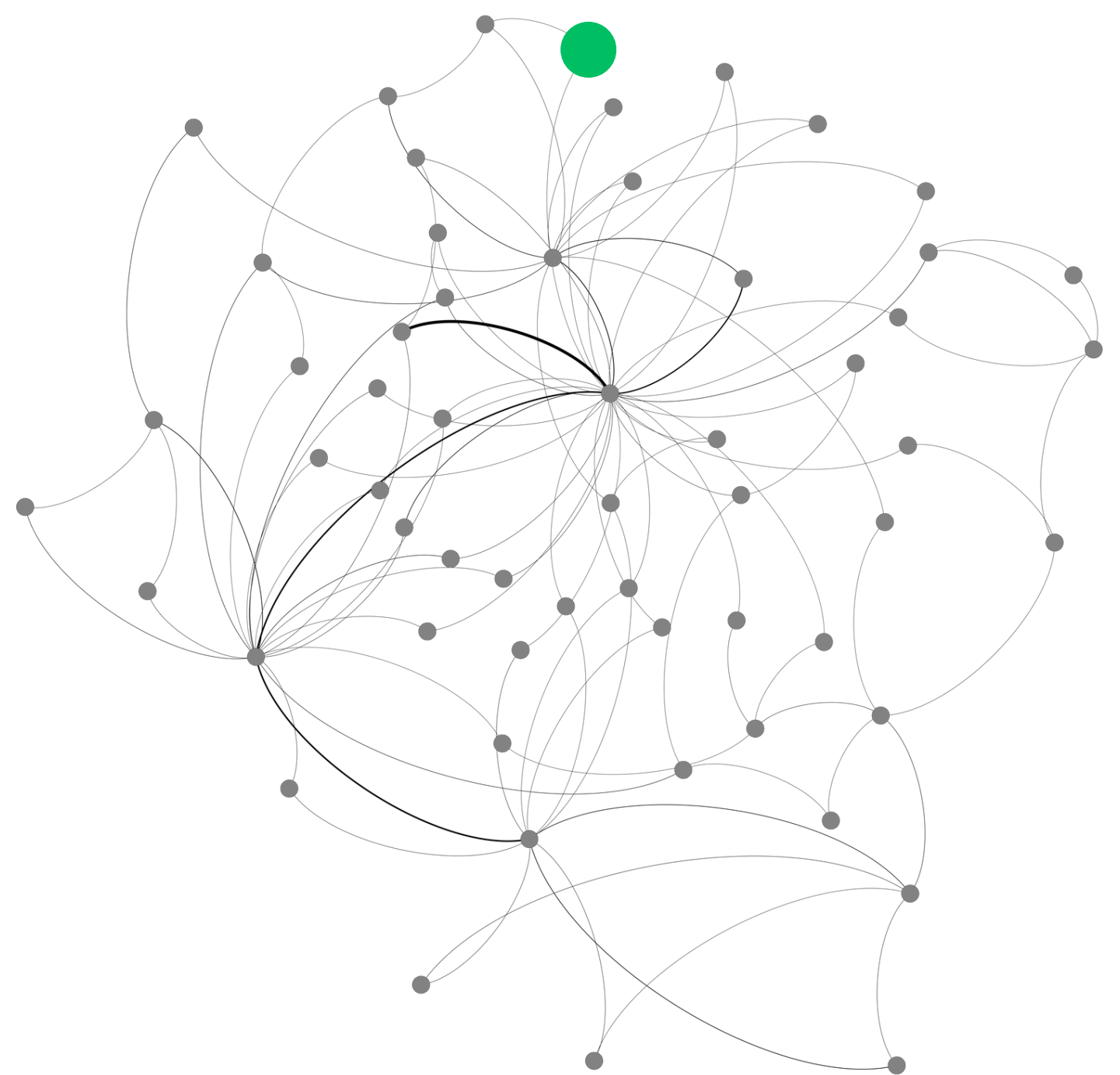


Indicators:

- Storage and protection of public records (birth, death, property, other).

Operational Efficiency

This element assesses the existence of formally established procedures for local budget planning, execution, and oversight, as well as the inclusion of participation mechanisms that integrate committees made up of public servants and community representatives.

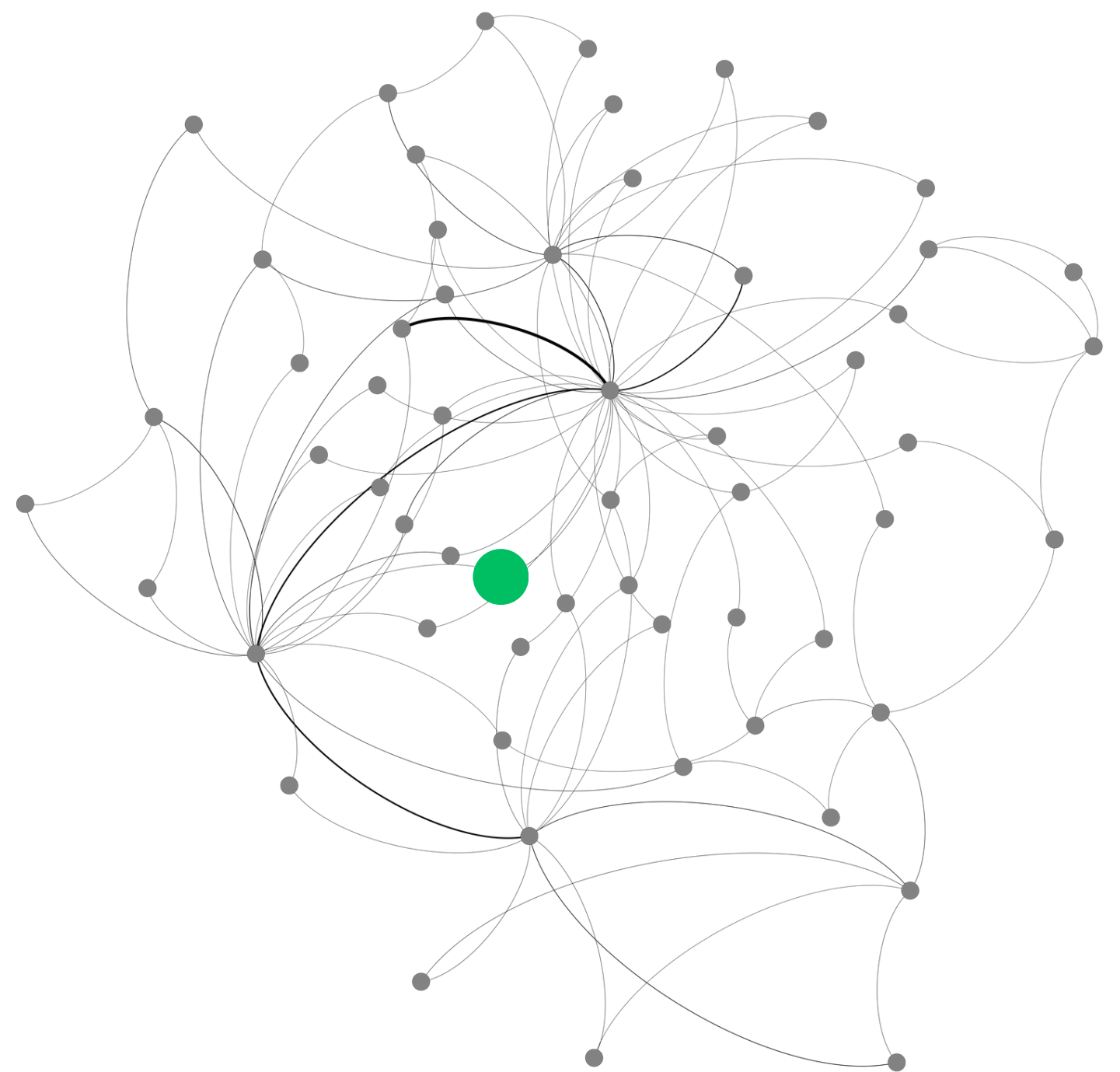


Indicators:

- Financial supervision of local government budget.
- Role of planning committees for the operational implementation of the local government budget.

Information Systems and Accessibility

This element assesses the quality, accessibility, and usefulness of public information in critical contexts, considering its transparency and value for decision-making. It includes the role of the media, official records, community leaders, and other key sources, as well as the availability and updating of emergency contacts to facilitate a coordinated and effective response.

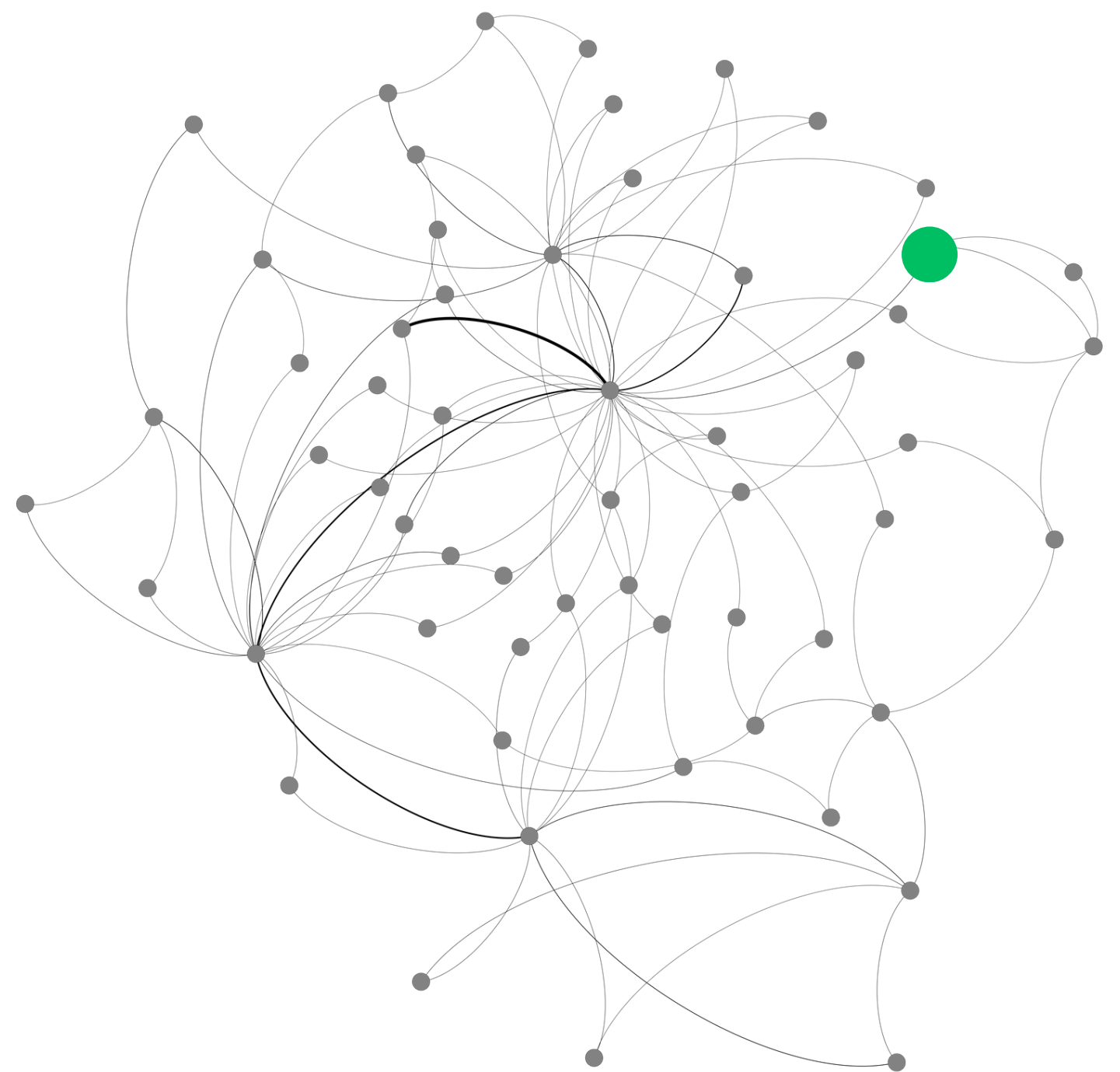


Indicators:

- Role of community leaders.
- Role of established press or official media.
- Quality of information provided in the Emergency Contact Lists.
- Availability of public information.
- Availability of public libraries.
- Accessibility to public records.
- Freedom and diversity of the press.
- Percentage of the population responds to emergencies based on the public information provided.

Essential Public Services

This element assesses the effectiveness of the provision of essential services and the percentage of the population with access to them. It also considers identifying those services whose continuity may be affected, as well as the implementation of measures to ensure their provision is not interrupted.

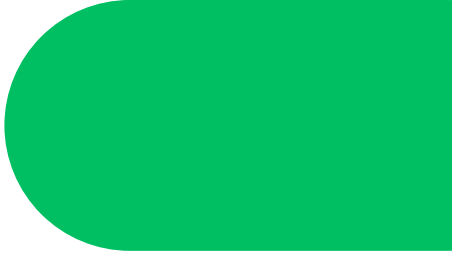


Indicators:

- Effectiveness of actions to keep critical services.
- Percentage of the population with access to essential services (health, sanitation, energy, transport, security, information, food)

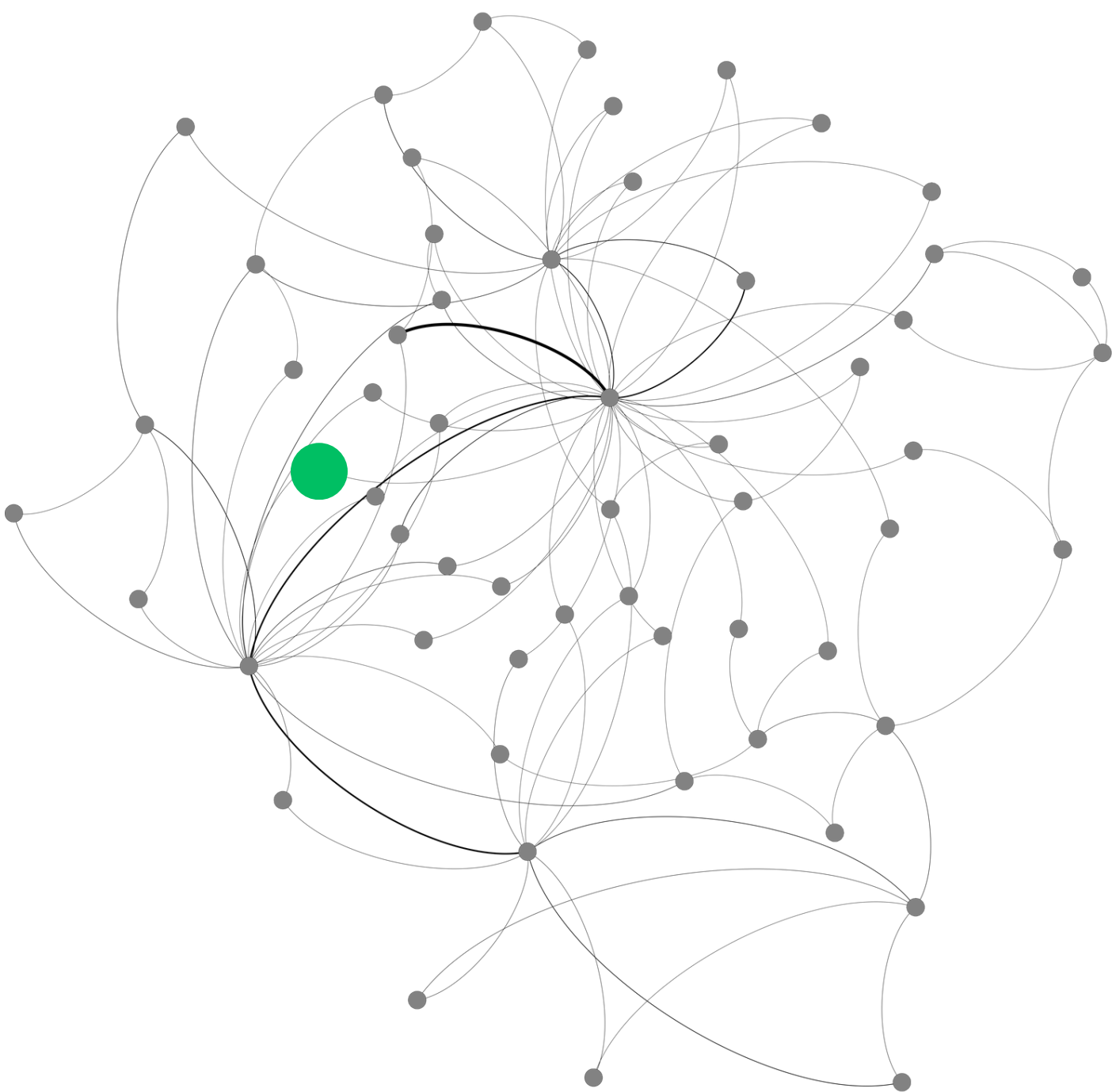


Energy sources. San Pedro de Atacama, Chile. Photo by Lorenzo Moscia.



Correctional system worker capacities

This element assesses the training and preparation of prison staff to address and manage crises within the prison system, including emergencies, internal conflicts, riots, and security risks.

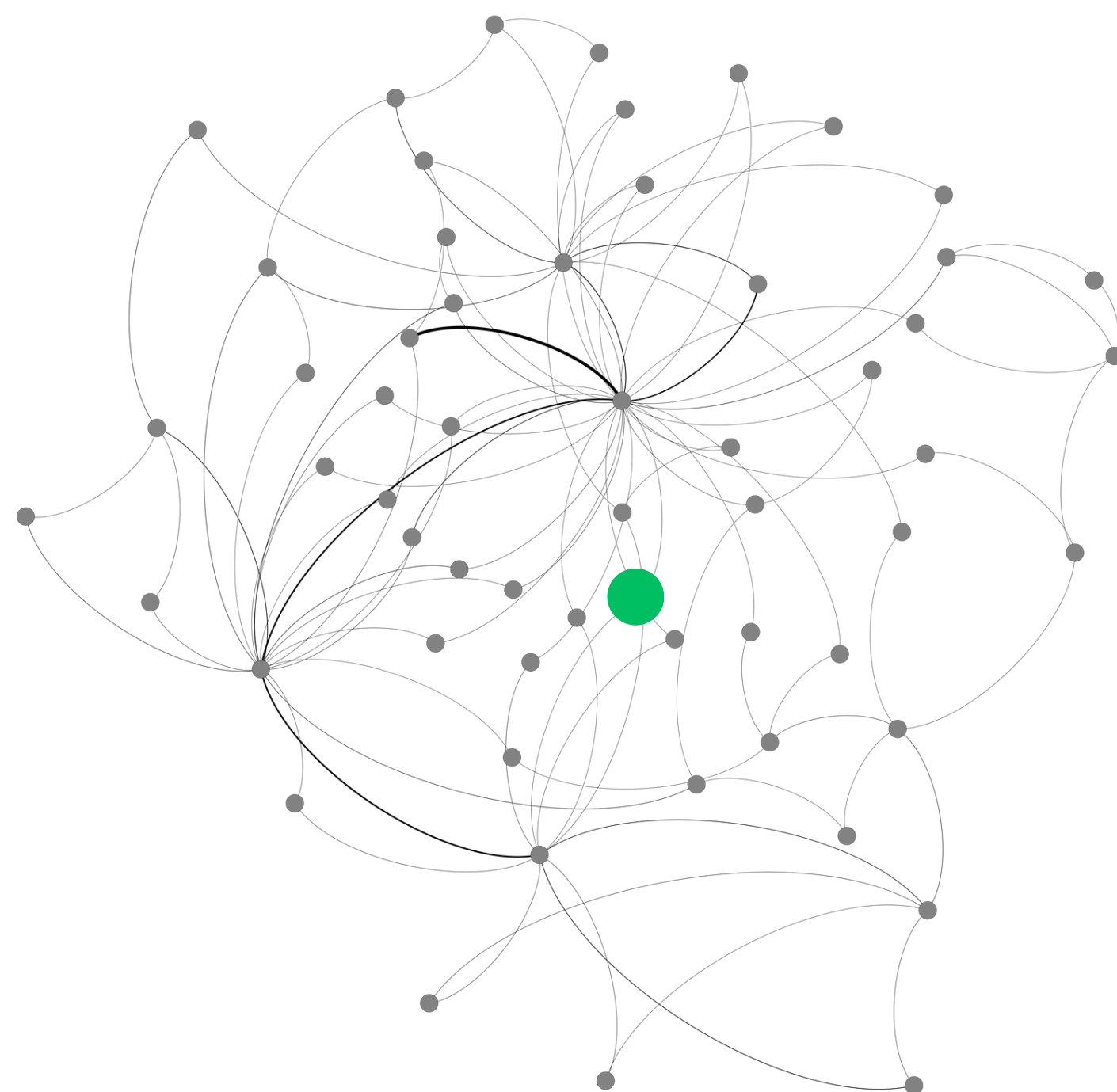


Indicators:

- Training of prison officials.

Infectious Disease Detection and Management

This element assesses the availability of specialized facilities for the treatment of infectious diseases, the efficiency of epidemiological surveillance systems in detecting and controlling outbreaks, and vaccination coverage against diseases not included in regular schedules.

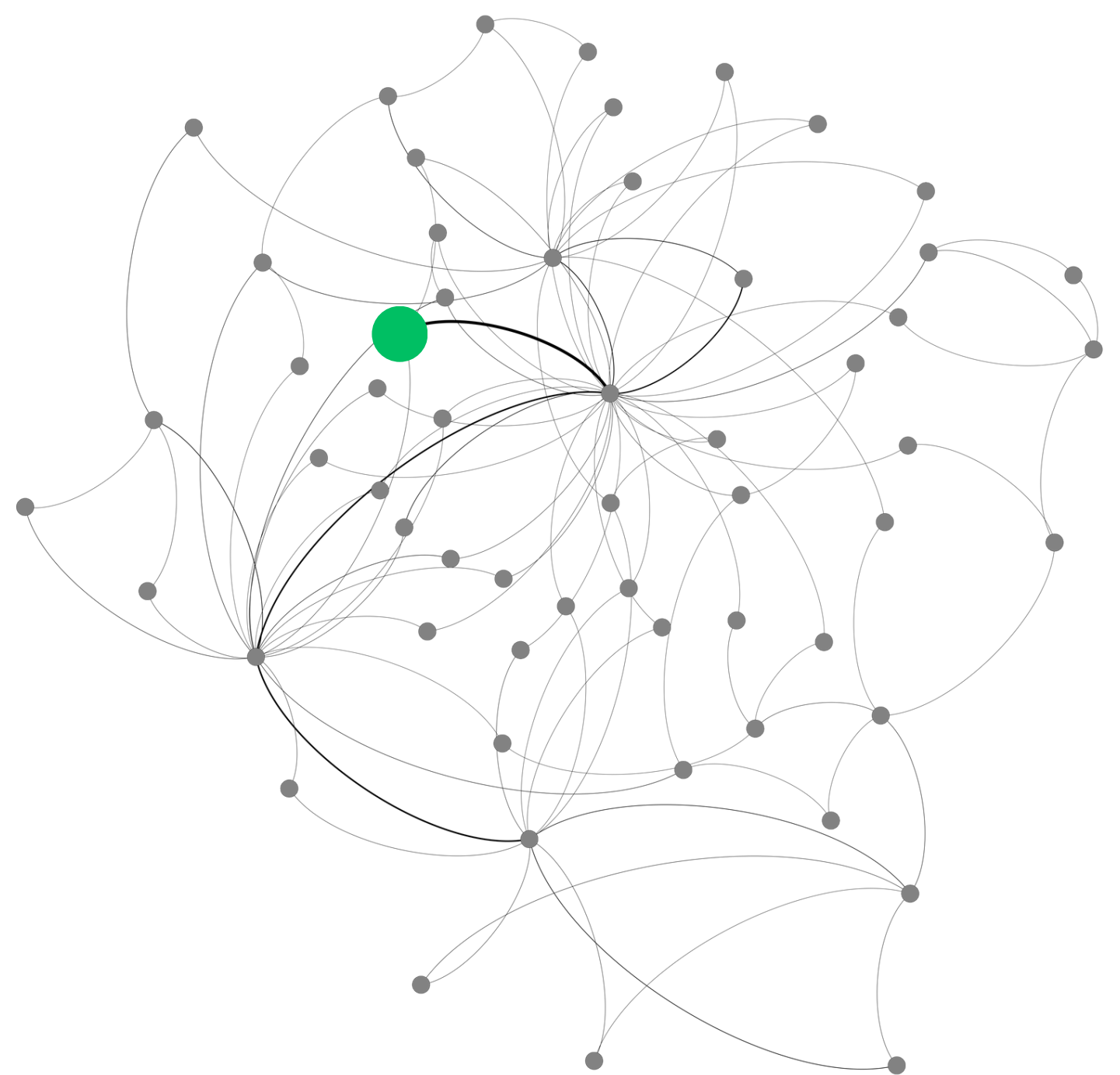


Indicators:

- Availability of facilities for the treatment of infectious diseases.
- Efficiency of infectious disease monitoring systems.
- Percentage of the population that receives vaccinations against infectious diseases that are not part of the recommended schedule.

Health Care Providers

This element assesses the role of trained and licensed health care providers, both public and private, in responding to baseline community needs. It also includes when the community is under stress during a humanitarian crisis (natural disaster, human-caused disaster, infectious outbreak, or resource failure) and the capacity of the larger public health surveillance and reporting system to serve the population.

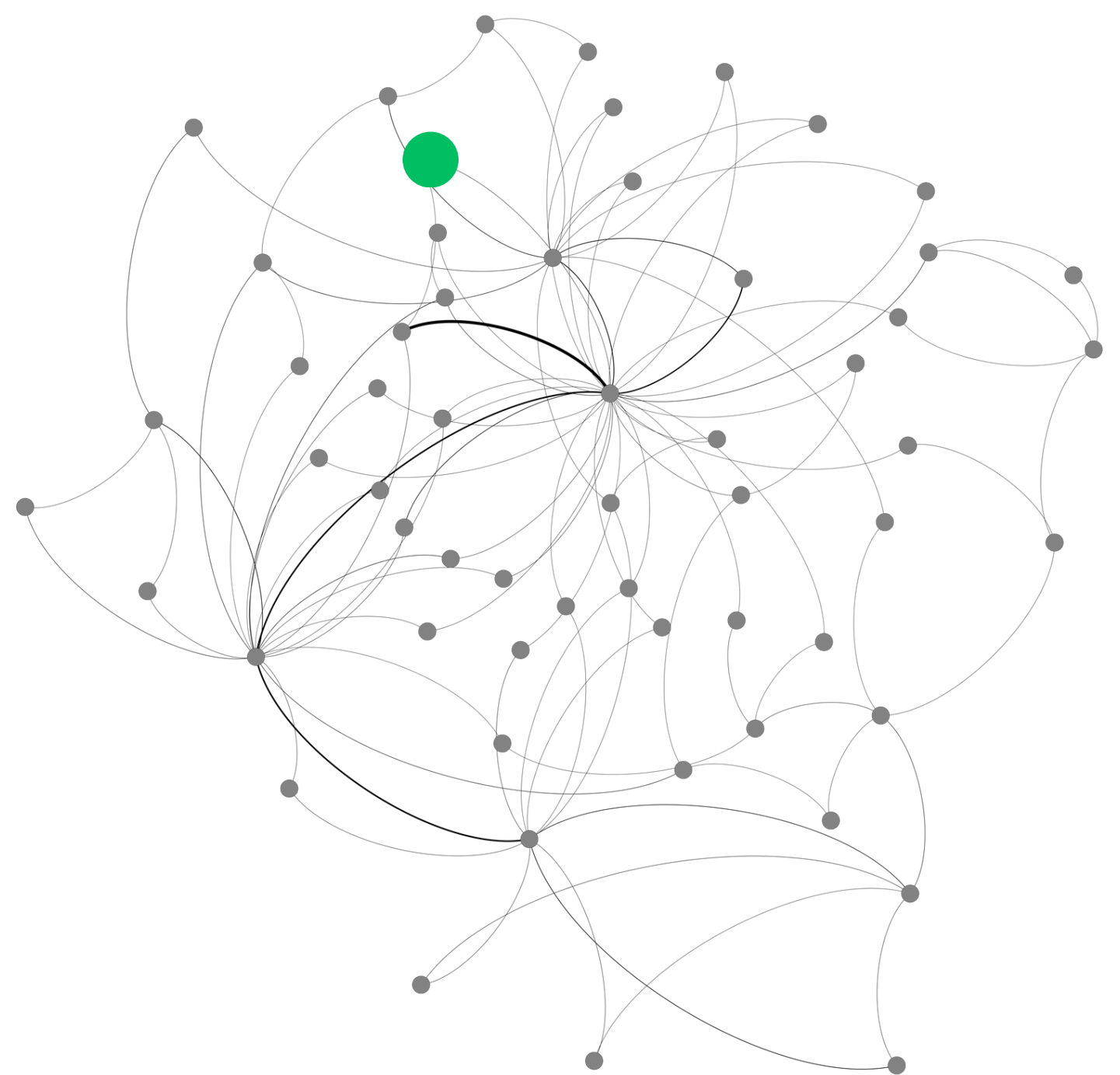


Indicators:

- Role of healthcare providers.
- Per capita presence of healthcare providers
- Percentage of the population that uses public health services.

Health Care Affordability

This element assesses the proportion of the population with effective access to health services and the financial impact of health care on households. This impact is assessed using direct health expenditure as a percentage of household income, a key indicator for measuring financial protection in the health system.

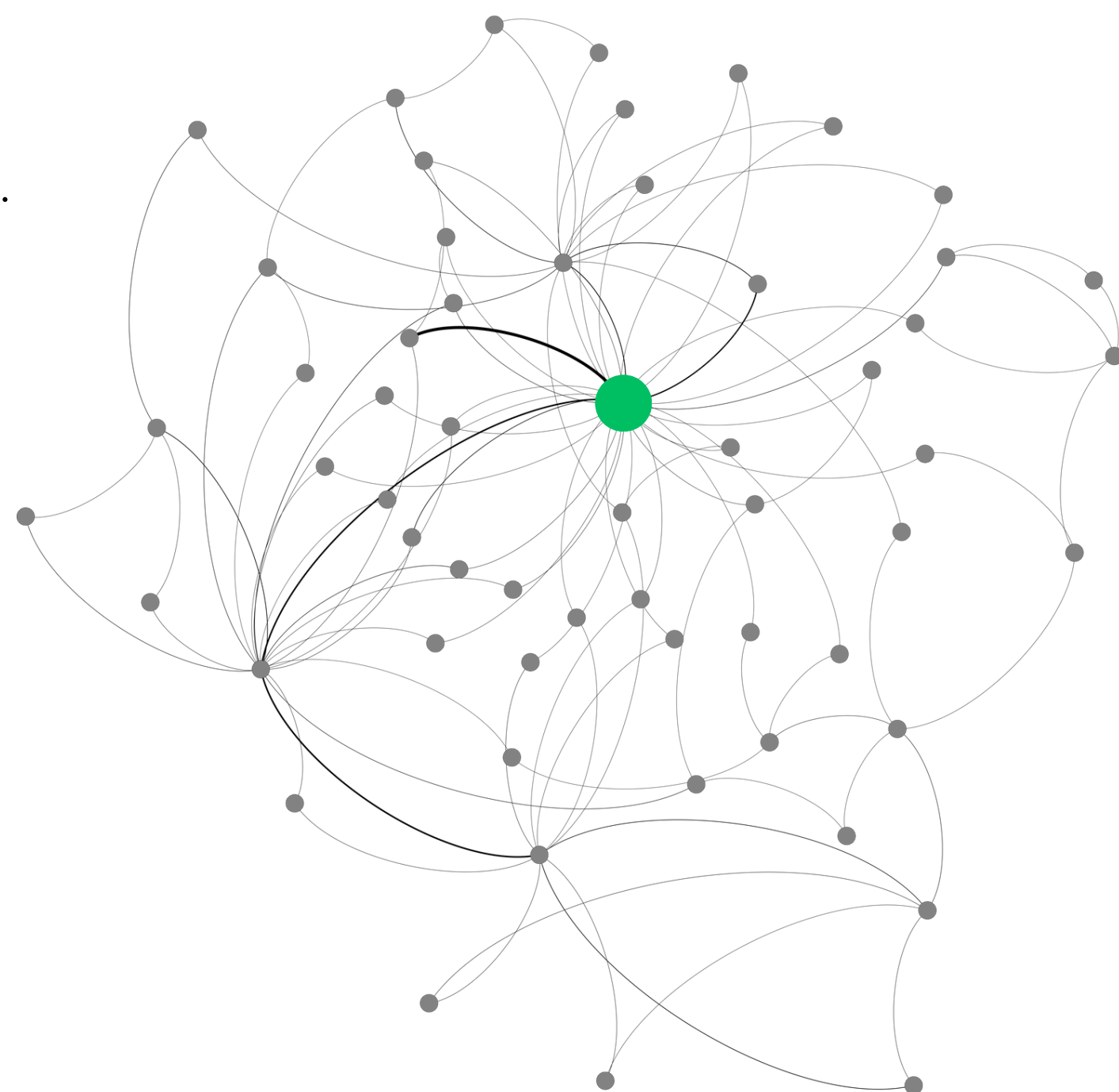


Indicators:

- Out-of-pocket health expenditure as a percentage of family income.
- Percentage of the population with access to affordable healthcare.

Health Care Accessibility

This element assesses the infrastructure and resources available in a territory's health system, including the existence and distribution of healthcare facilities, specialized centers (blood banks, laboratories, reproductive health services, and intensive care units), as well as the availability of medical personnel, hospital beds, and an adequate supply of essential medicines.

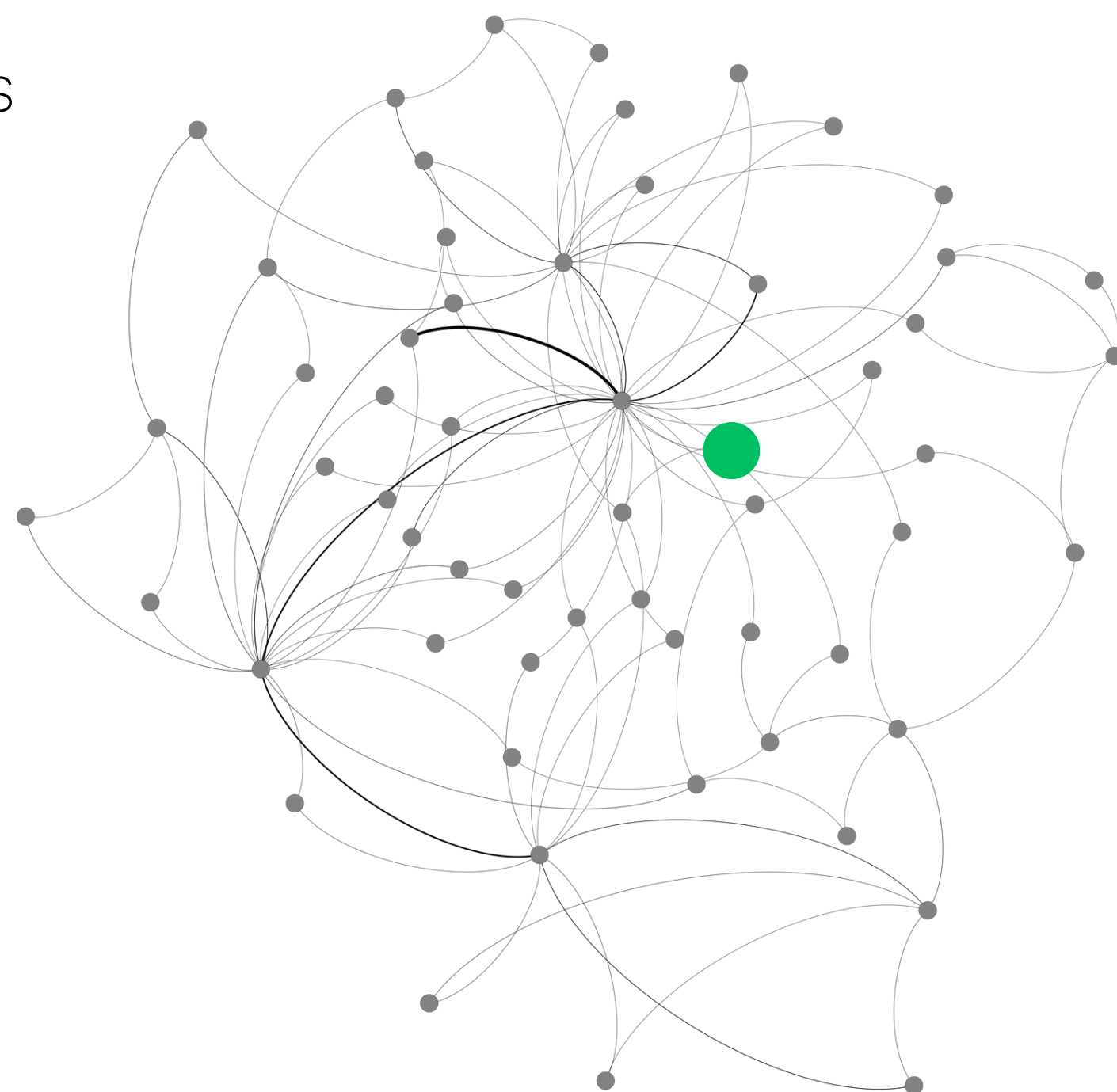


Indicators:

- Existence of Complex Health Facilities.
- Supply of critical-use medications.
- Availability of facilities for reproductive health.
- Availability of general health facilities.
- Availability of intensive health care facilities
- Availability of critical care hospital beds.
- Availability of medical care centers.
- Availability of doctors.

Educational Support Infrastructure

This element assesses the reliability and condition of school infrastructure, including the electrical system, sanitation, water supply, and disaster response capacity. It also covers the implementation and effectiveness of emergency management plans and drills, as well as the resilience of educational facilities to natural disasters or other crisis situations.

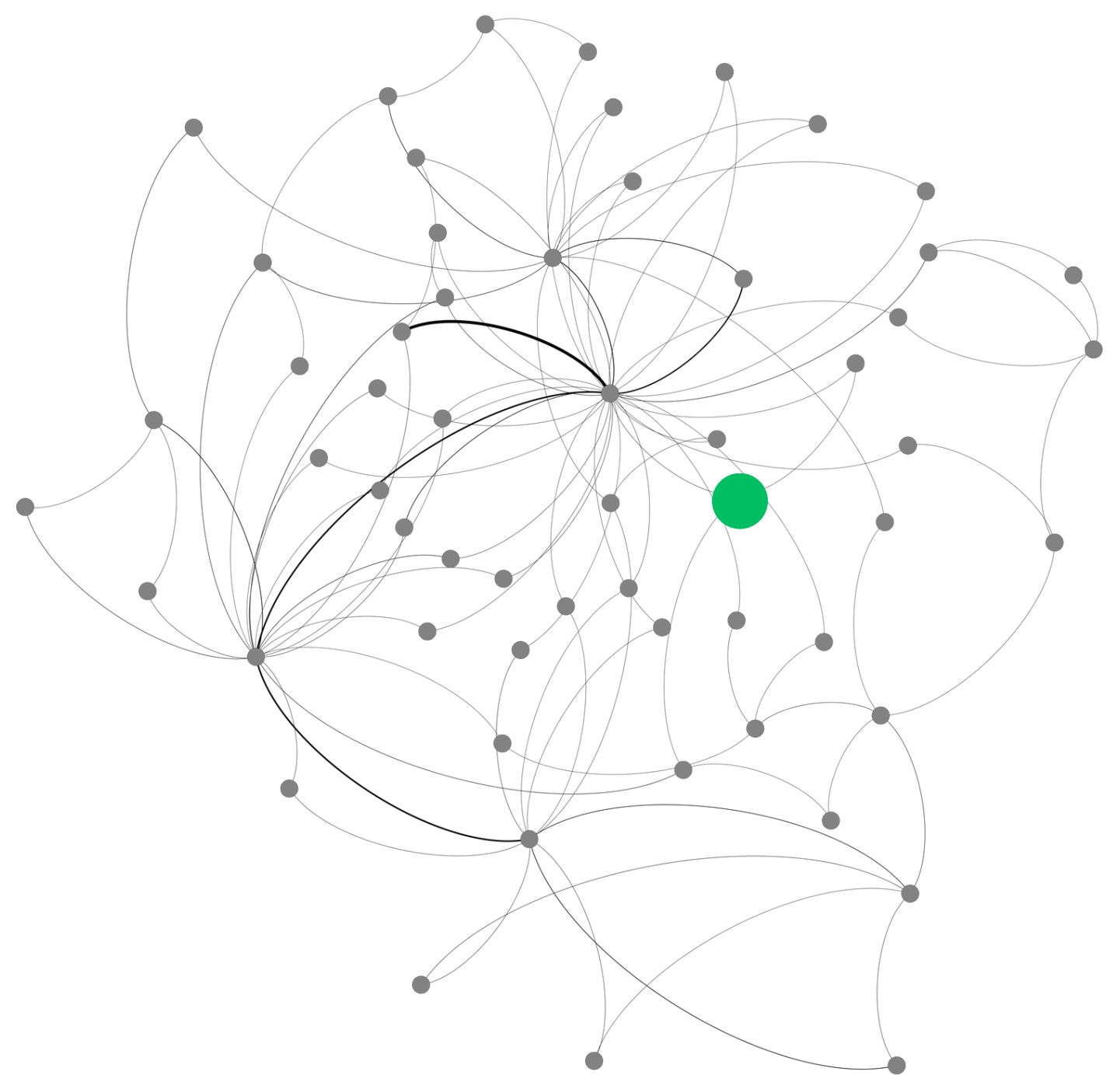


Indicators:

- Status of disaster management plan at schools.
- Resilience of educational infrastructure.
- Effectiveness of emergency drills at schools.
- Status of sanitation systems near schools.
- Reliability of schools' electrical systems.
- Status of water supply systems near schools.

Educational Resources

This element assesses the availability of essential infrastructure and resources in local schools, including access to telecommunications and the Internet, the provision of books and school supplies, and the availability of transportation services for students and teachers.

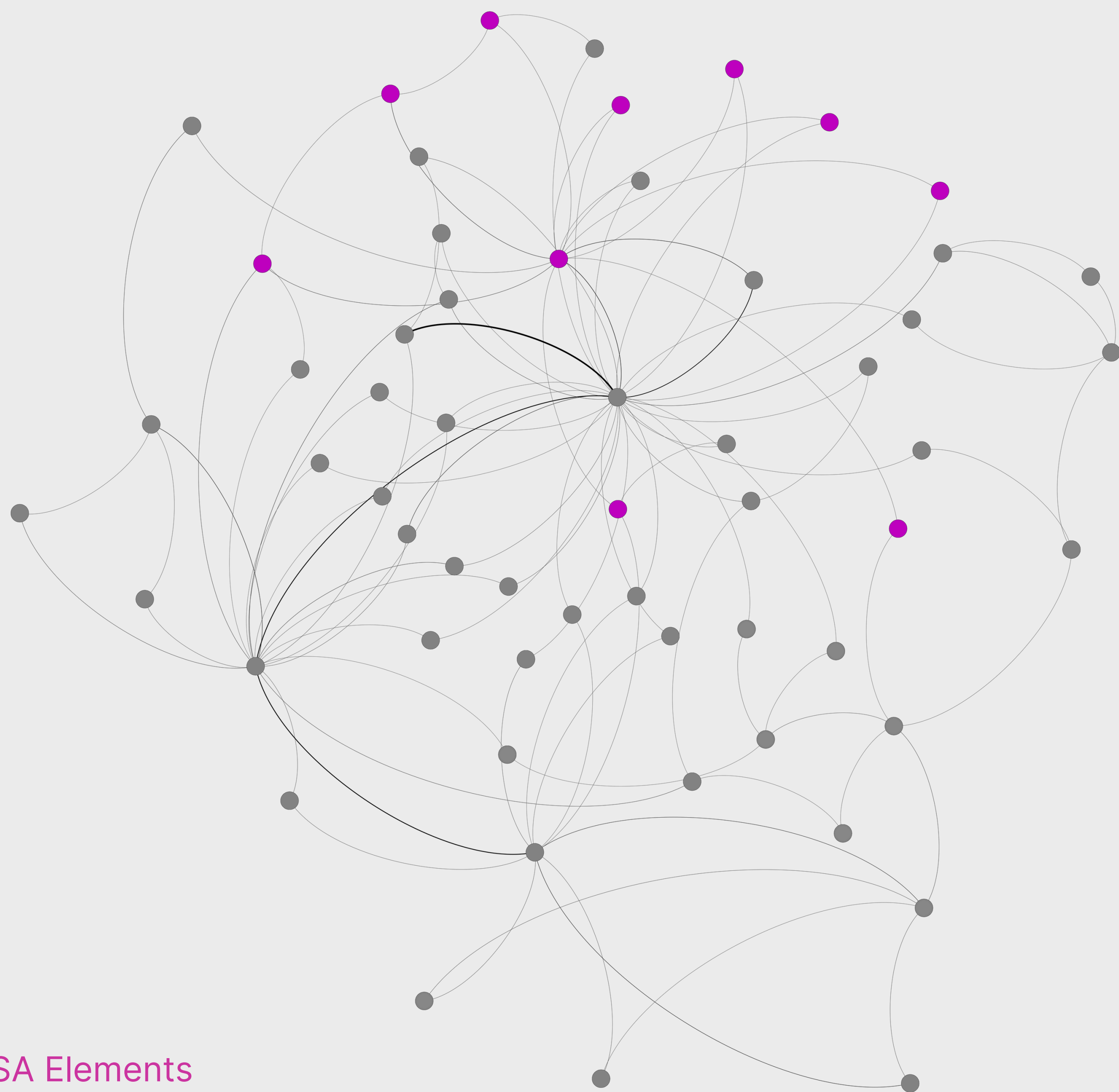


Indicators:

- Availability of books and supplies for students.
- Availability of technological devices in education.
- Availability of transportation to get students and teachers to school.
- Percentage of schools with access to telecommunications and Internet resources.

A photograph of three men sitting around a table in a meeting, overlaid with a semi-transparent purple filter. The man in the center is gesturing with his hands while speaking. The man on the left is looking towards him, and the man on the right is also looking in the same direction. On the table are several water bottles and a pair of glasses. In the background, a whiteboard is visible with some handwritten text.

GOVERNANCE AND ECONOMIC DEVELOPMENT

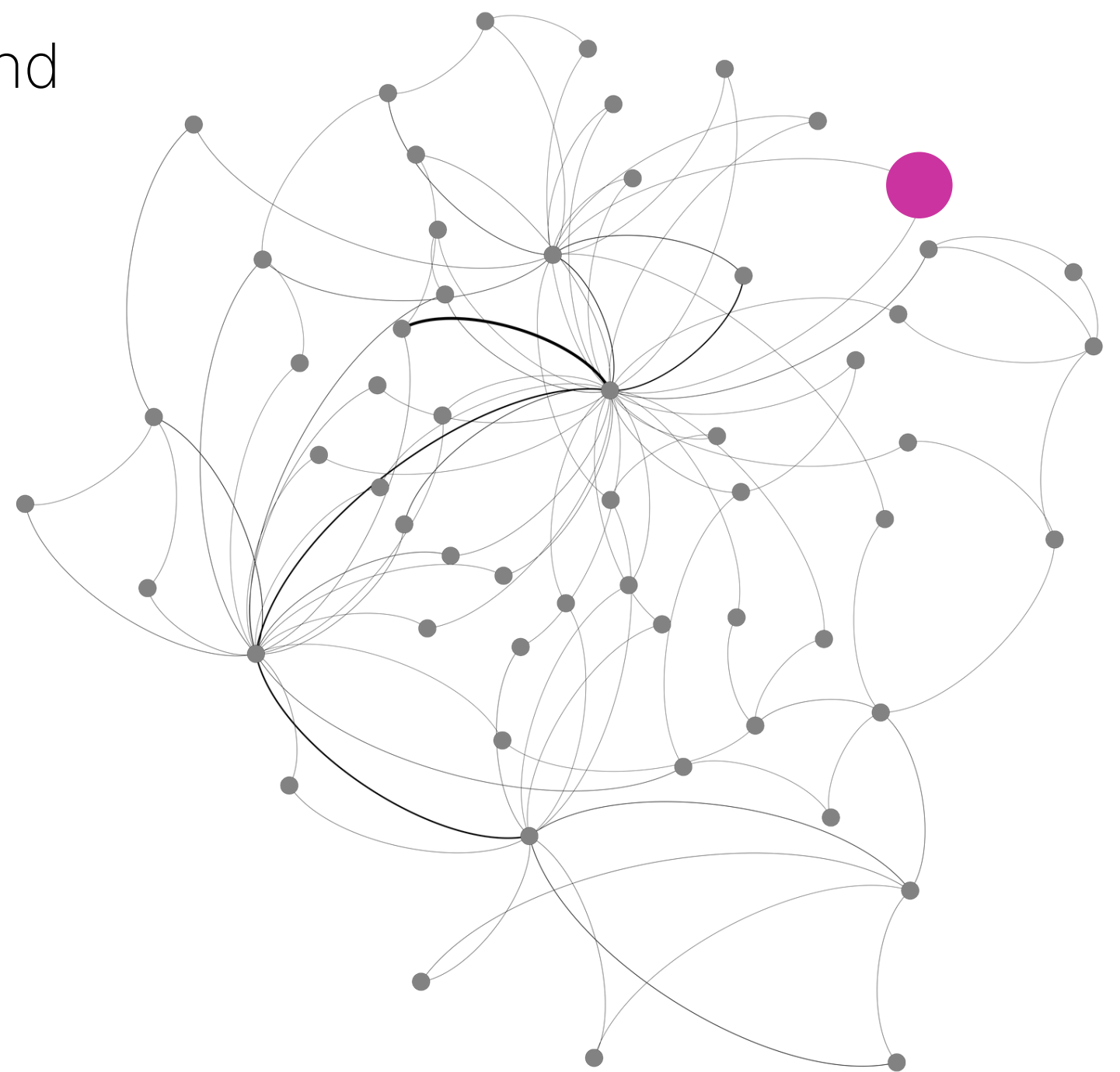


CASA Elements

- Gender Parity and Equity
- Educational Access and Equity
- Accessible and Reliable Governance
- Emergency Management of Critical Elements
- Local Trade
- Local Budgeting
- Economic Development Baseline
- Investment Climate and Policy
- Banking and Financial Sector
- Sanitation Access

Gender Parity and Equity

This element assesses the degree of equity, protection, and participation of women in different spheres of social life, through indicators related to their representation in public office and their impact on the implementation of public policies that promote the development of women and their communities, focusing on economic development and the elimination of gender-based violence.

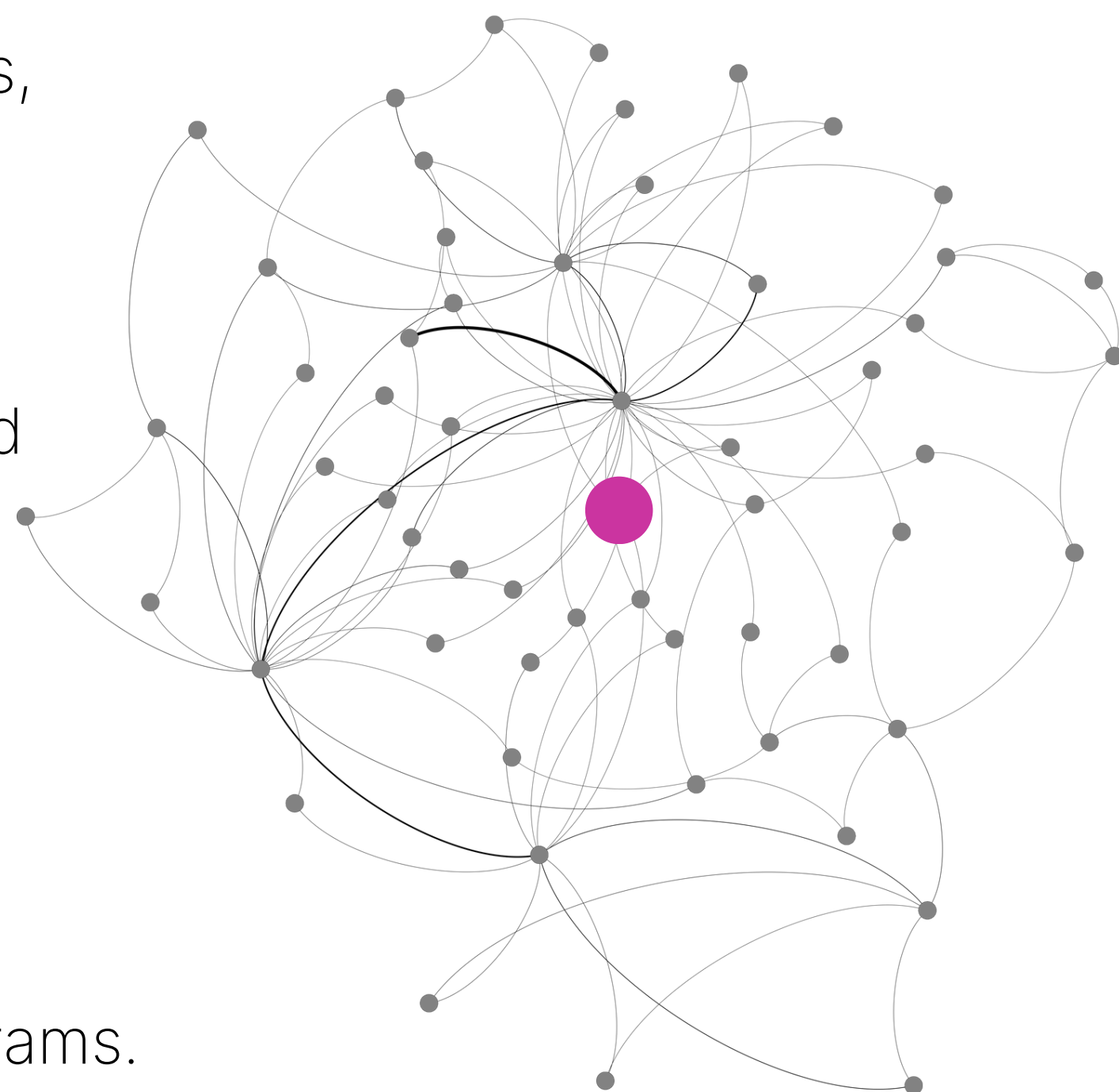


Indicators:

- Role of community institutions.
- Efficiency of strategies for gender equality.
- Percentage of women in public office.
- Gender equality index.

Educational Access and Equity

This element evaluates the availability and accessibility of educational services across all levels—from preschool to higher education—ensuring inclusive coverage for all social groups, genders, and age groups. It also assesses the presence of programs for students with special needs, adult education initiatives, and literacy rates, along with the proportion of the population accessing primary, secondary, and tertiary education, reflecting the overall inclusiveness and universality of the education system.

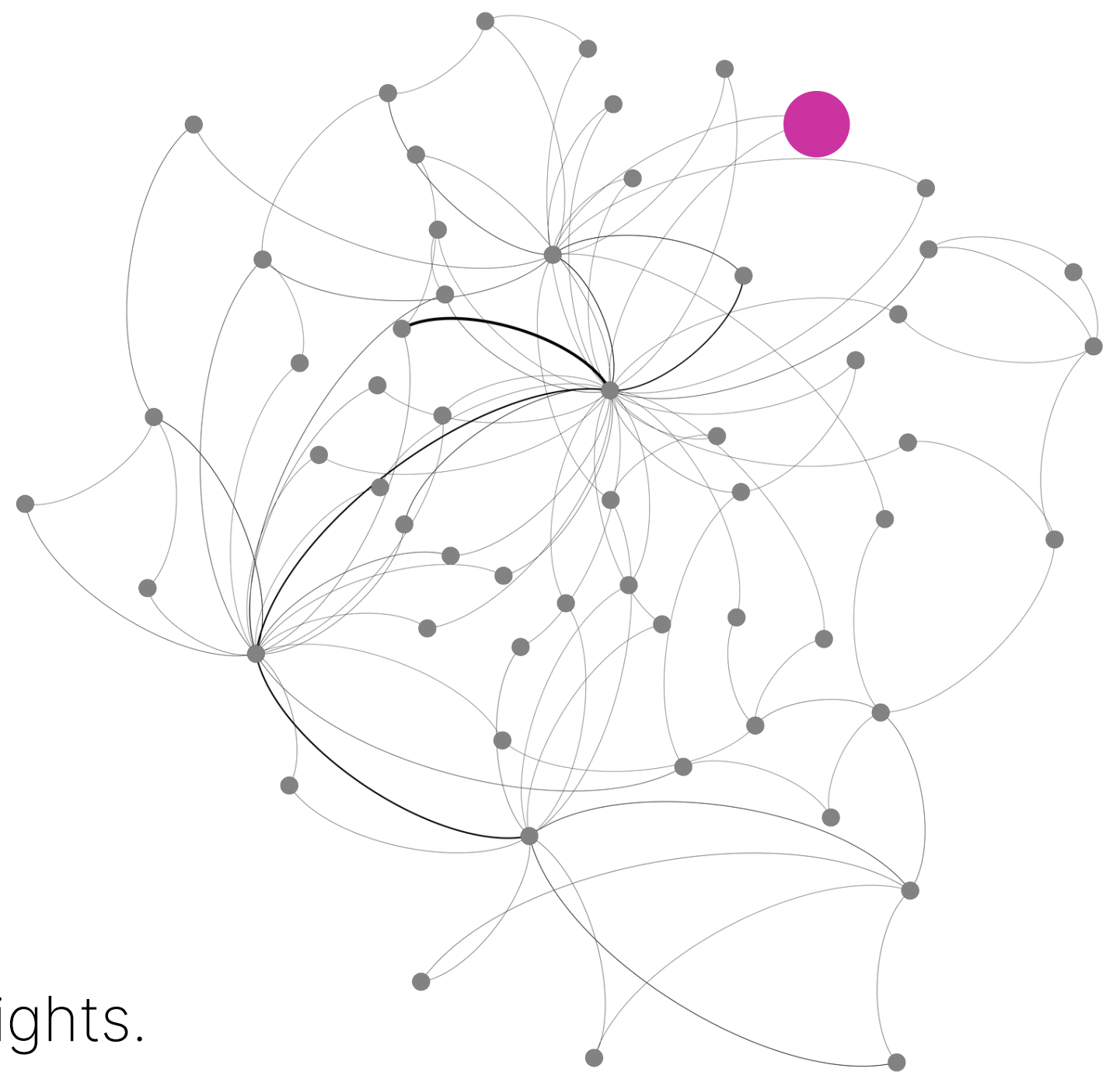


Indicators:

- Availability of adult education programs.
- Education availability.
- Availability of preschools.
- Availability of programs for students with special needs.
- Access to primary school.
- Access to secondary school.
- Percentage of the population with tertiary (university) education.
- Literacy rate of the population.

Accessible and reliable governance

This element assesses the population's access to information about their legal rights and the perception of trust in local authorities. These factors are key to assessing transparency, governance, and institutional capacity to ensure the fulfillment of rights and citizen participation.

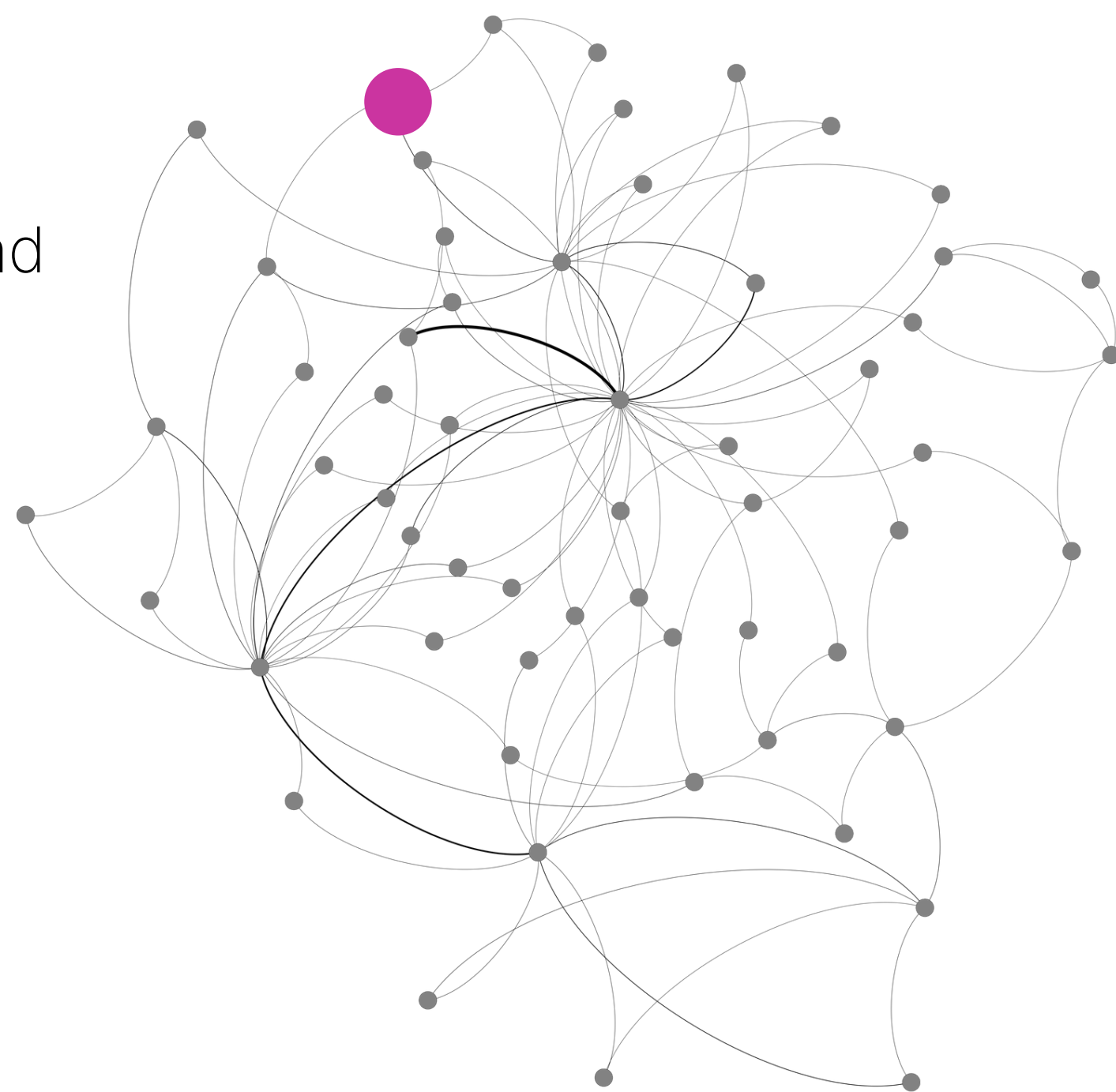


Indicators:

- Access to information about legal rights.
- Confidence in local authorities.

Emergency management of critical elements

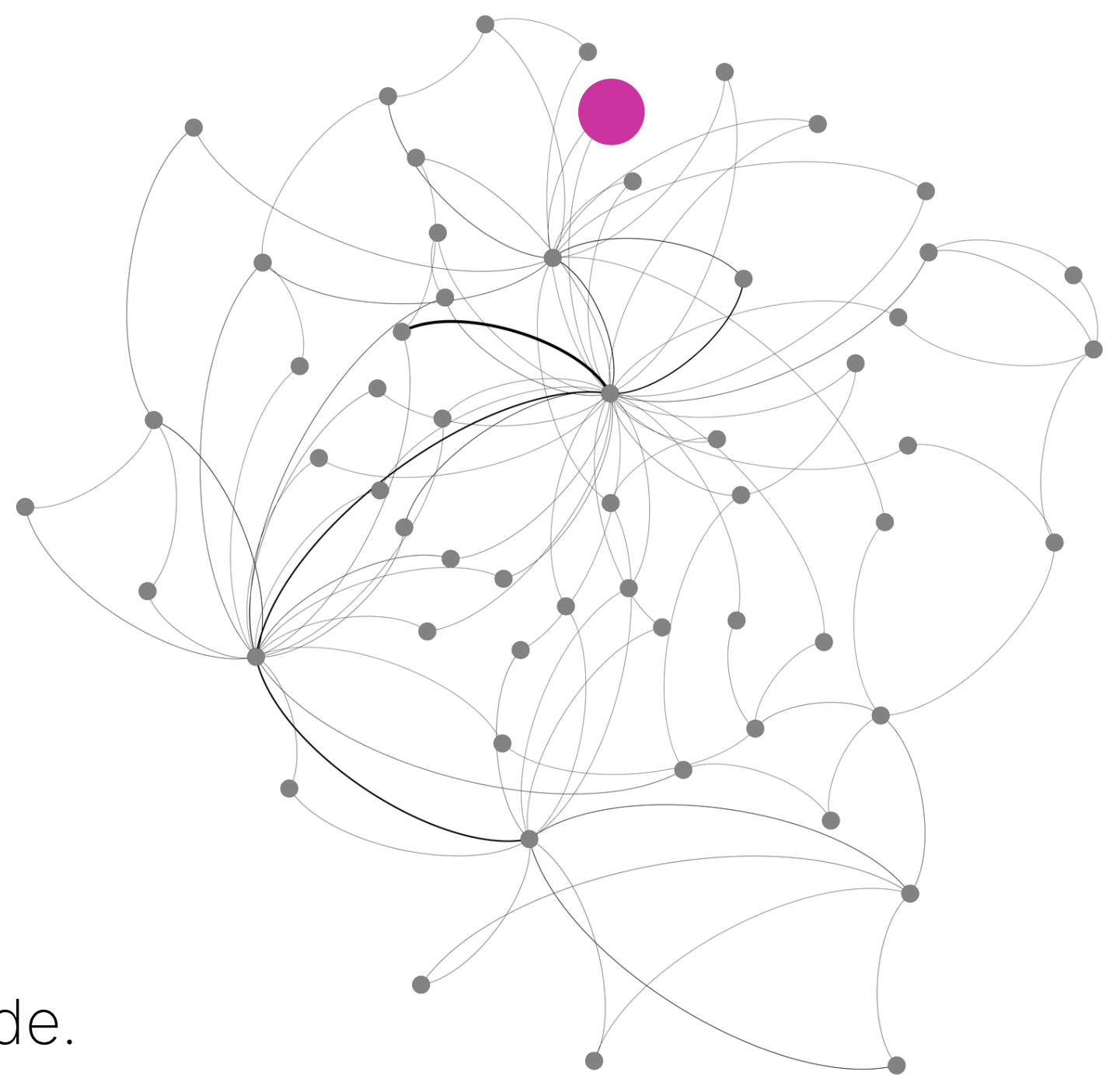
This element evaluates the identification, protection, and strategic planning of essential resources, infrastructure, and services necessary for effective response to critical situations. It examines the development of plans, procedures, and resource allocations aimed at ensuring the continuity of vital services, along with the territory's capacity to distribute supplies, safeguard critical sectors, and maintain economic resilience during emergencies.



Indicators:

- Identification of critical elements (infrastructure, logistical resources, and essential services).
- Status of plans to protect and strengthen critical elements of the local economy.

This element assesses the representativeness of trade associations in the productive sectors, the fairness of treatment of local businesses in the face of trade barriers, and the degree of openness and freedom in transactions. Its sustainability is also reflected in the percentage of activities linked to the circular economy, while its resilience depends on the sufficiency and redundancy of sources of critical materials and supplies.



Indicators:

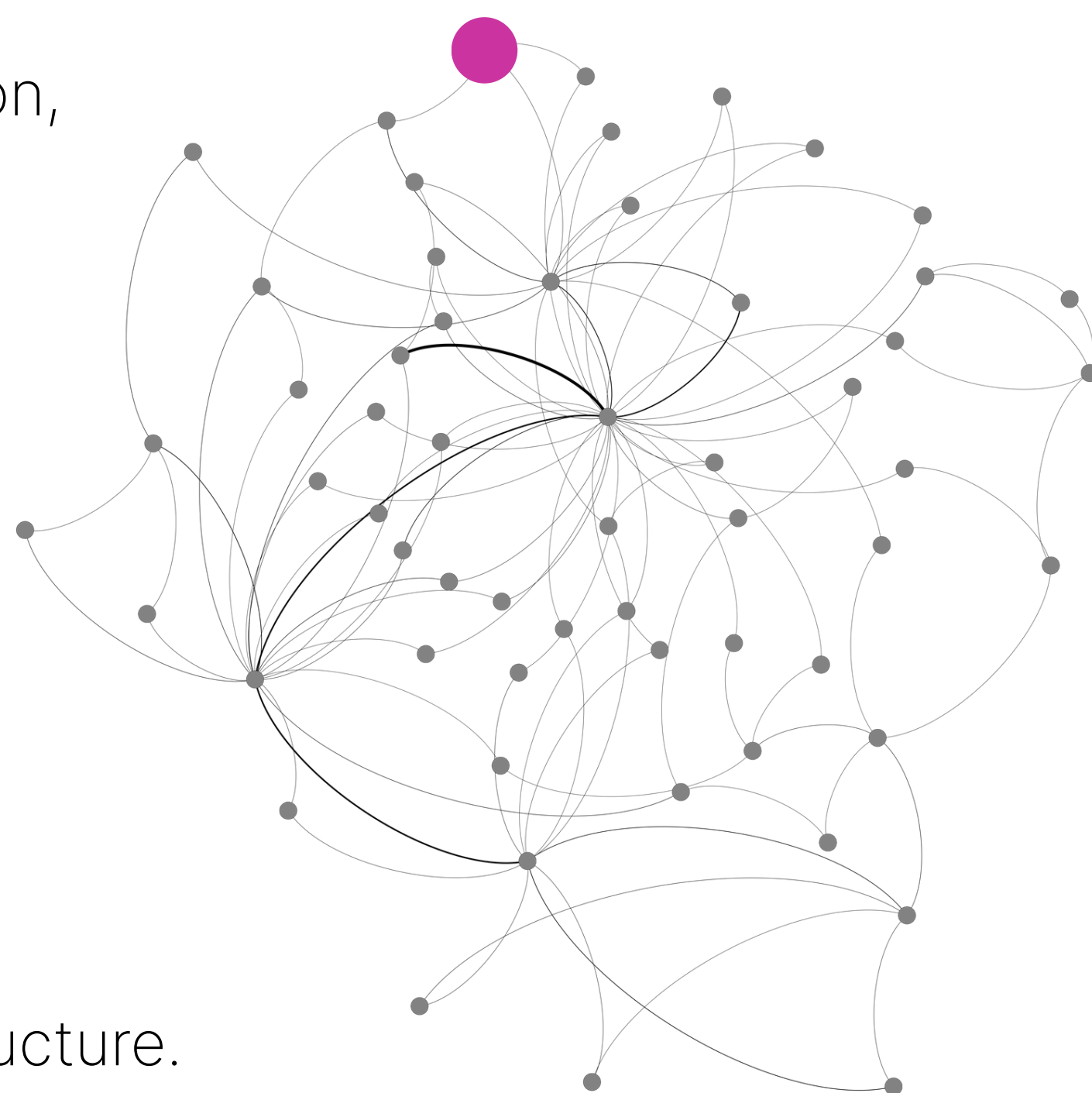
- Openness and freedom of local trade.
- Sufficiency and redundancy of critical sources.
- Representation of local trade associations.
- Trade barriers.
- Sustainable and circular economy practices.



Fishermen's protest. Puchuncaví, Chile. Photo by Lorenzo Moscia.

Local budgeting

This element assesses the efficiency and responsible management of the laws and mechanisms that enable local governments to obtain, manage, and allocate public resources. It involves the existence of regulatory frameworks and the capacity to translate resources into effective investment, particularly in critical infrastructure such as education, health, and transportation.

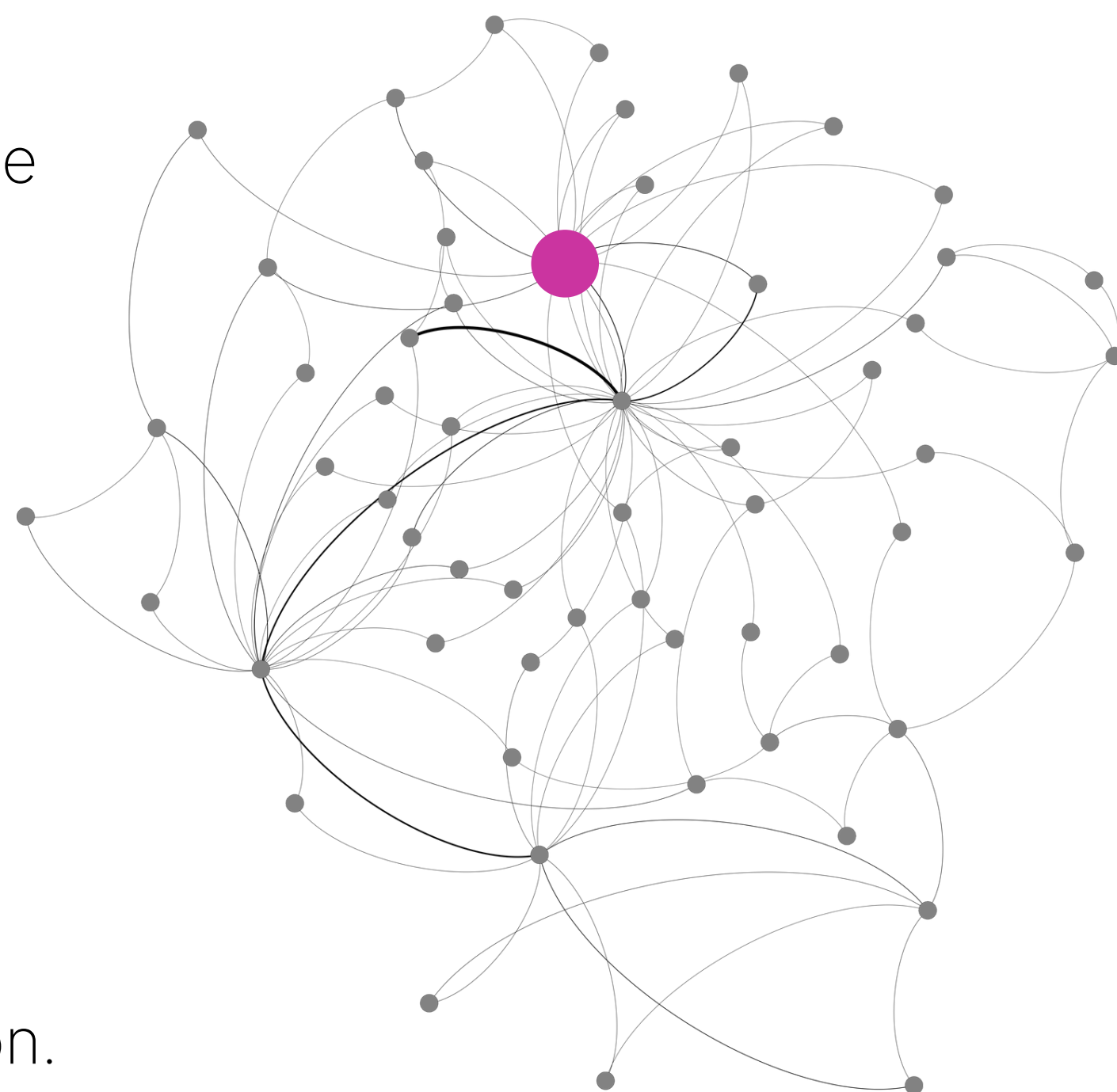


Indicators:

- Budget allocated to critical infrastructure.
- Management of resources by local government.

Economic Development Baseline

This element assesses the components related to a territory's local economy, considering indicators such as GDP per capita, employment and poverty rates, the level of informal employment, and measures of economic inequality, such as the Gini index. These indicators measure not only economic performance but also its equity, sustainability, and capacity to generate well-being for the population.

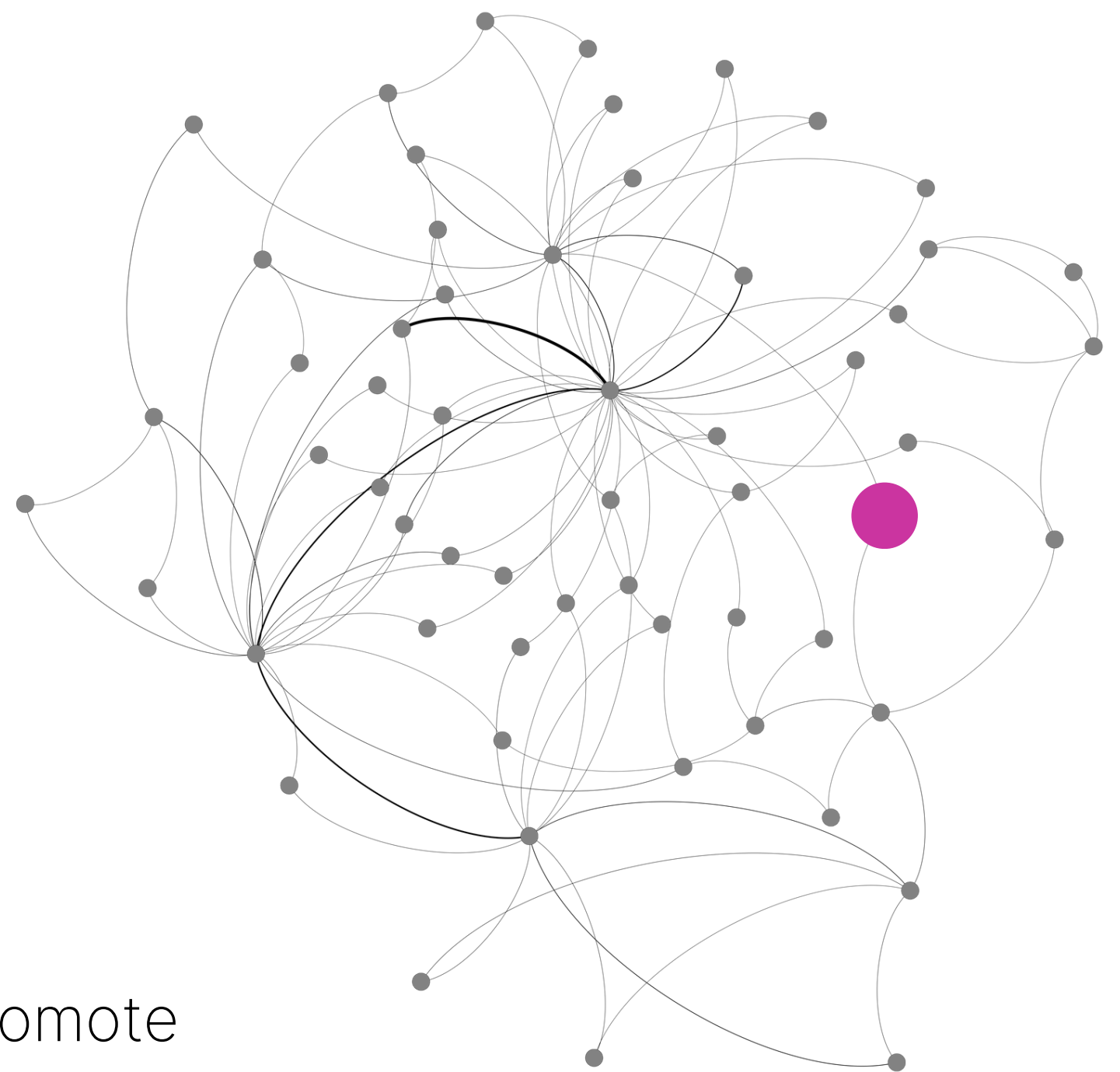


Indicators:

- Availability of tax-related information.
- Diversity of the local economy.
- GDP per cápita.
- Gini Index.
- Percentage of the population living below the poverty line.
- Percentage of the working-age population employed.

Investment Climate and Policy

This element assesses the rate of new business creation over a given period, as well as the effectiveness of collaboration between the public and private sectors to promote local investment.

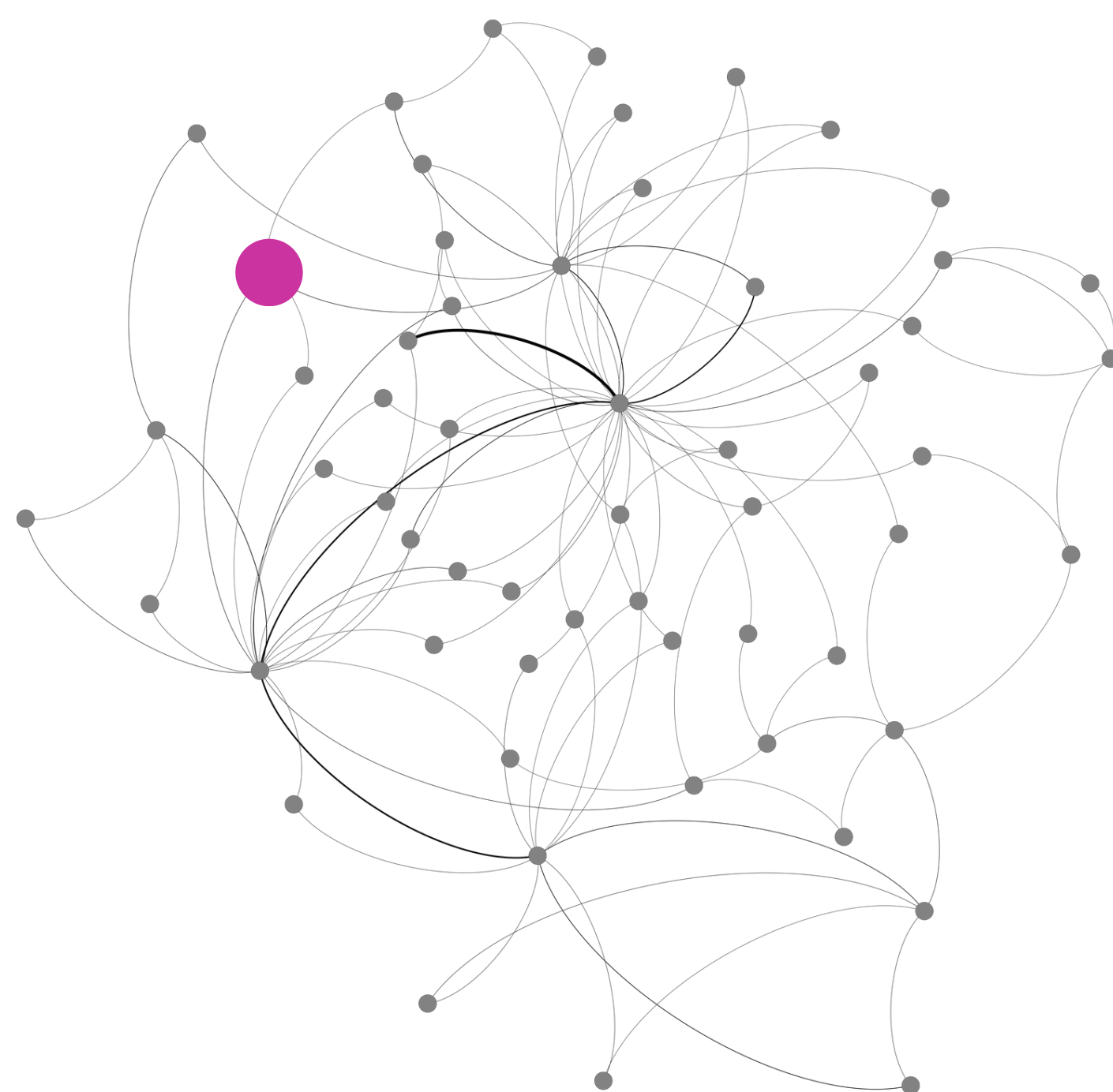


Indicators:

- Information about programs that promote entrepreneurship.
- Collaboration between the public and private sectors
- Rate of new business creation.

Banking and Financial Sector

This element assesses the operational continuity of banking services in terms of their ability to maintain critical operations such as payments, purchases, and withdrawals, ensuring secure and timely access to essential financial resources in the event of an emergency.

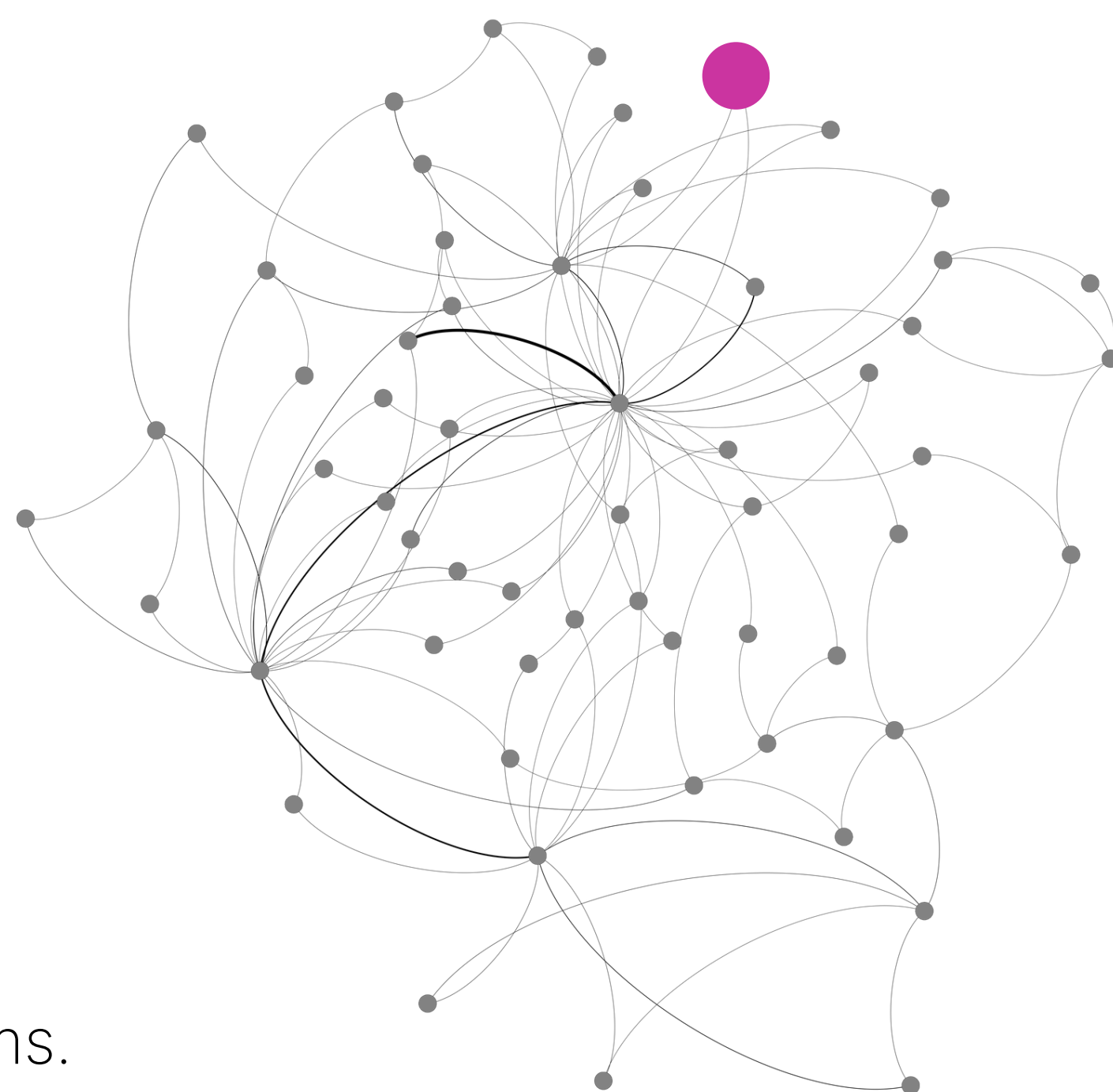


Indicators:

- Resilience and reliability of banking services.

Sanitation Access

This element assesses the population that has adequate sanitation infrastructure (sewers, septic tanks, toilets with adequate treatment), including the degree to which these facilities are designed to withstand disasters.

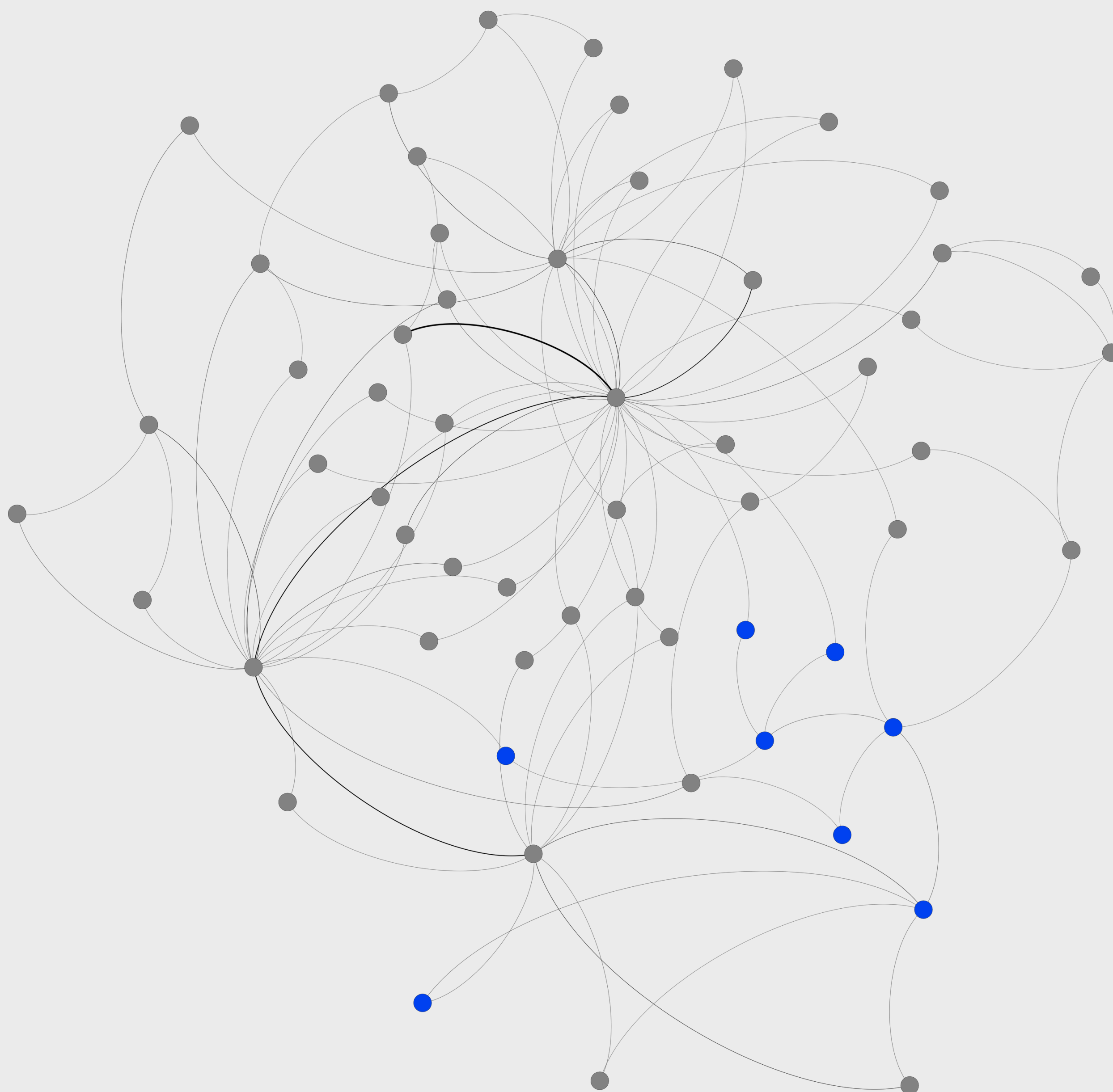


Indicators:

- Information about sanitation systems.



LEGAL ISSUES

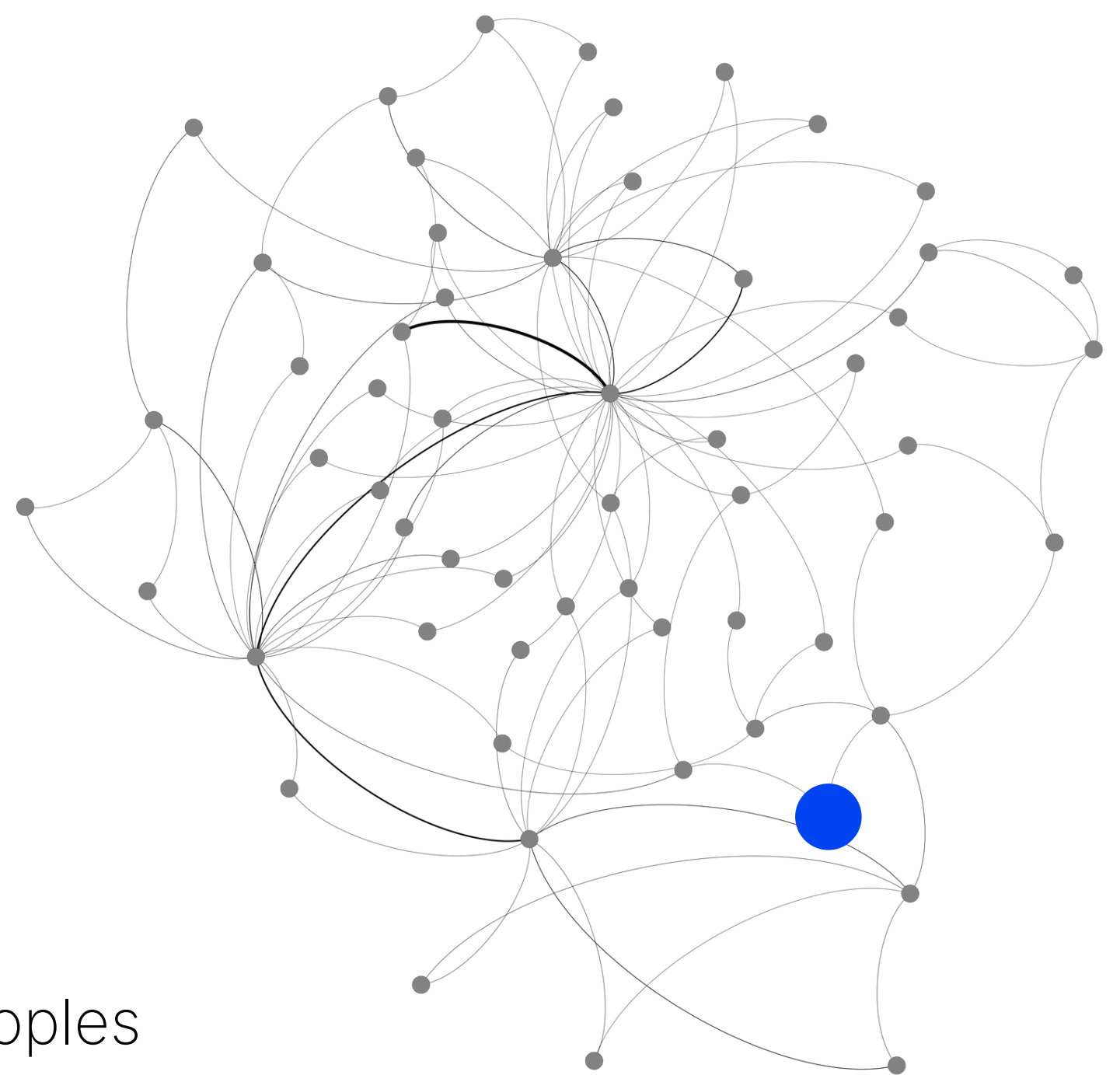


CASA Elements

- Indigenous Issues
- Property Rights and Protections
- Legal Practitioners
- Police system capabilities
- Natural Resource Management
- Land Use Policy and Ownership
- Judicial Systems
- Legal Foundations and Frameworks

Indigenous Issues

This element assesses the legal recognition mechanisms for any indigenous peoples who inhabit the territory.

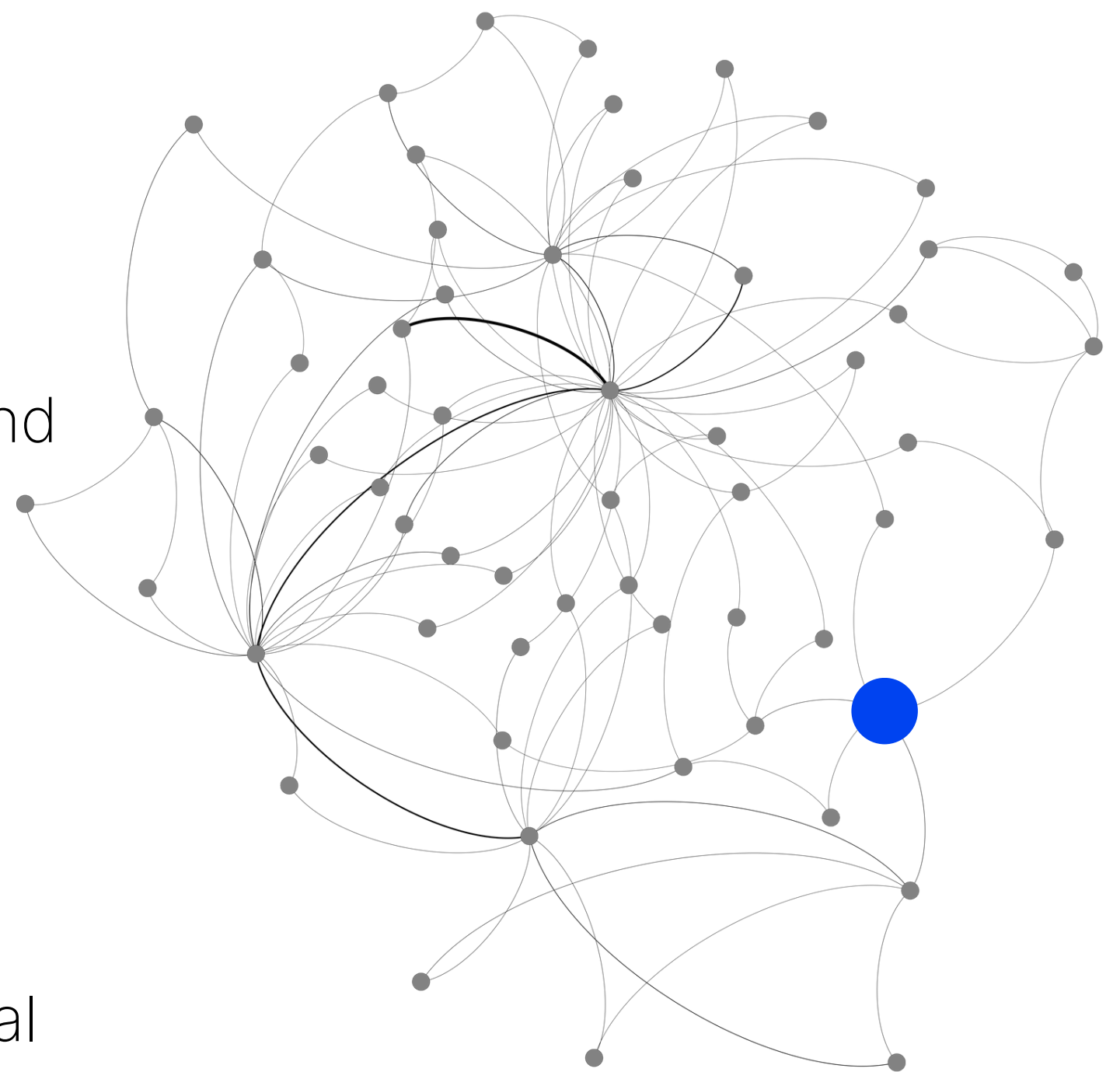


Indicators:

- Legal recognition of indigenous peoples with associated protections for land, water, language, education, and culture.
- Mechanisms for incorporating indigenous peoples into local governance or consultative institutions.
- Protection, documentation, use, and dissemination of indigenous practices and knowledge.

Property Rights and Protections

This element assesses the existence of regulations that govern and protect both ownership and equitable access to resources – including water, air, land, and minerals. It evaluates whether property rights are properly codified and whether access to water is recognized as a legally protected right. It also considers the existence of provisions that ensure a balance between the needs of the population and productive uses, preventing conflicts and promoting sustainable and fair management of the resource.

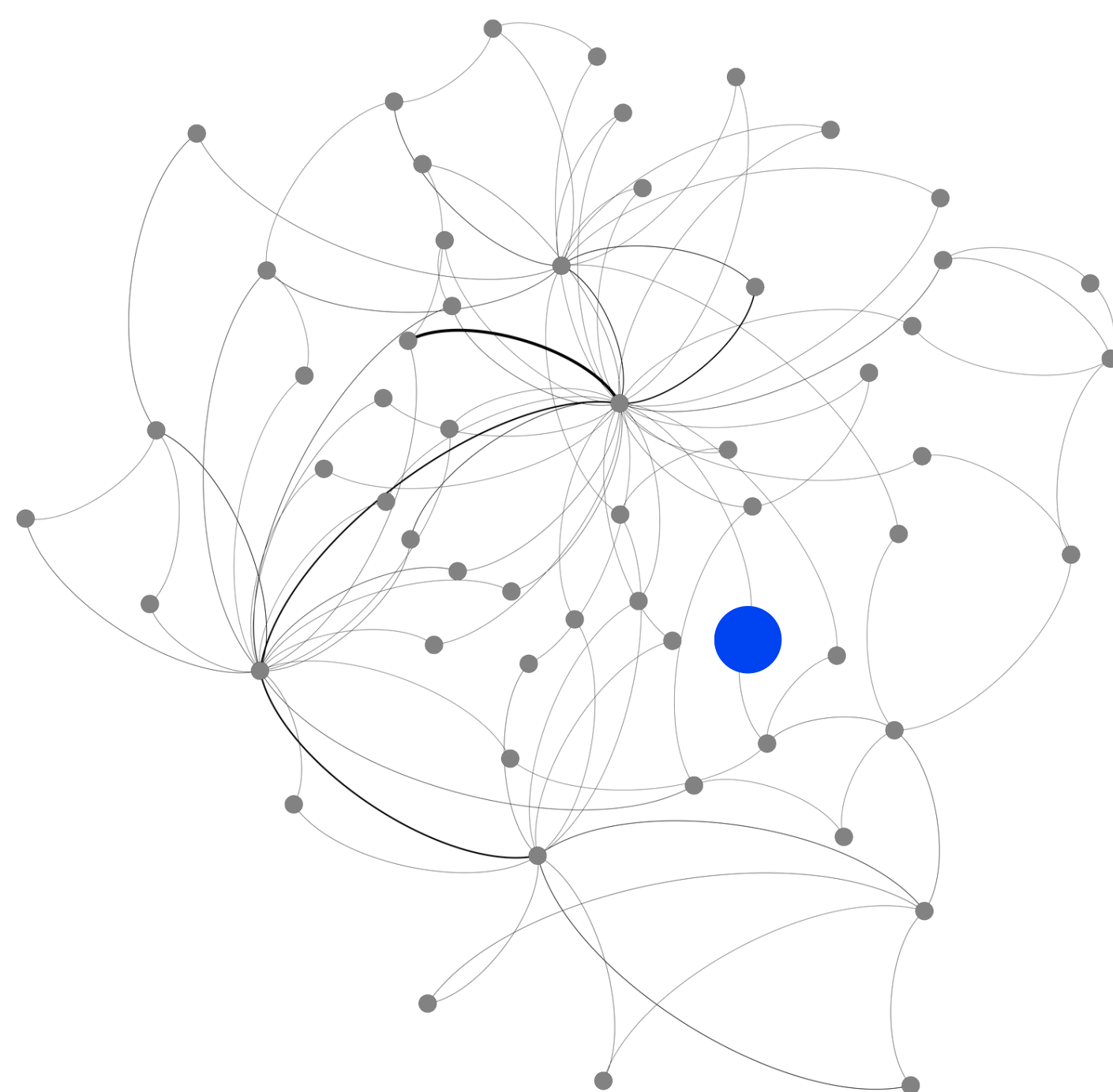


Indicators:

- Legal protection of access to critical resources, with special attention to water.
- Regulation and legal protection of property rights.

Legal Practitioners

This element assesses the availability and oversight of the territory's judicial system, considering the number of lawyers and judges, as well as the existence of mechanisms that guarantee oversight and the adequate ethical and professional performance of legal professionals.



Indicators:

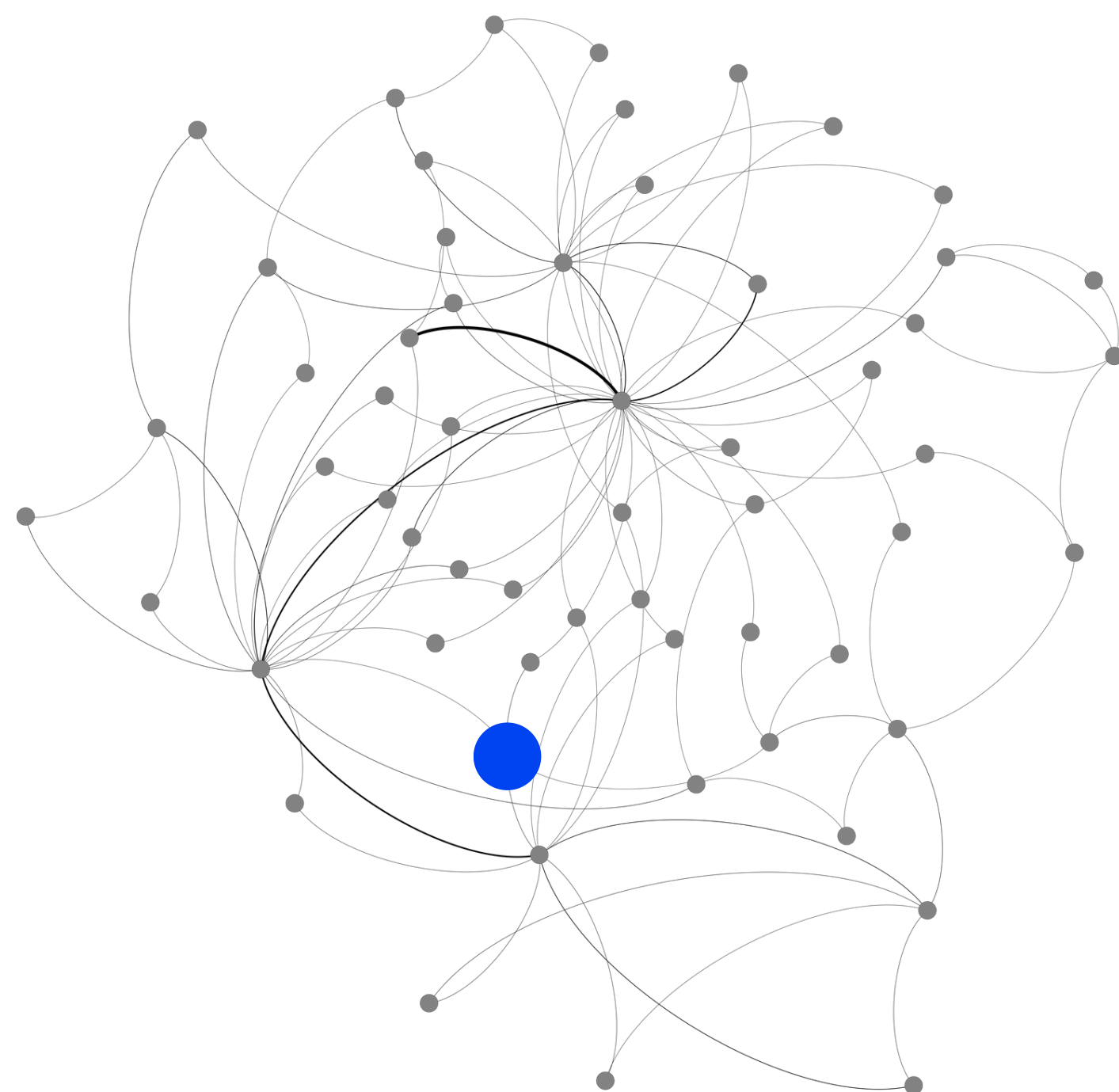
- Supervisory mechanisms for legal practitioners.
- Number of lawyers and judges.
- Cost and availability of legal services to the indigent.



Yagan demonstration. Puerto Williams, Chile. Photo by Lorenzo Moscia.

Police system capabilities

This element evaluates the human, financial, and training resources available to effectively prevent and respond to critical situations. It considers the number of local police personnel, the share of the budget dedicated to public safety, and the quality of personnel training and equipment.



Indicators:

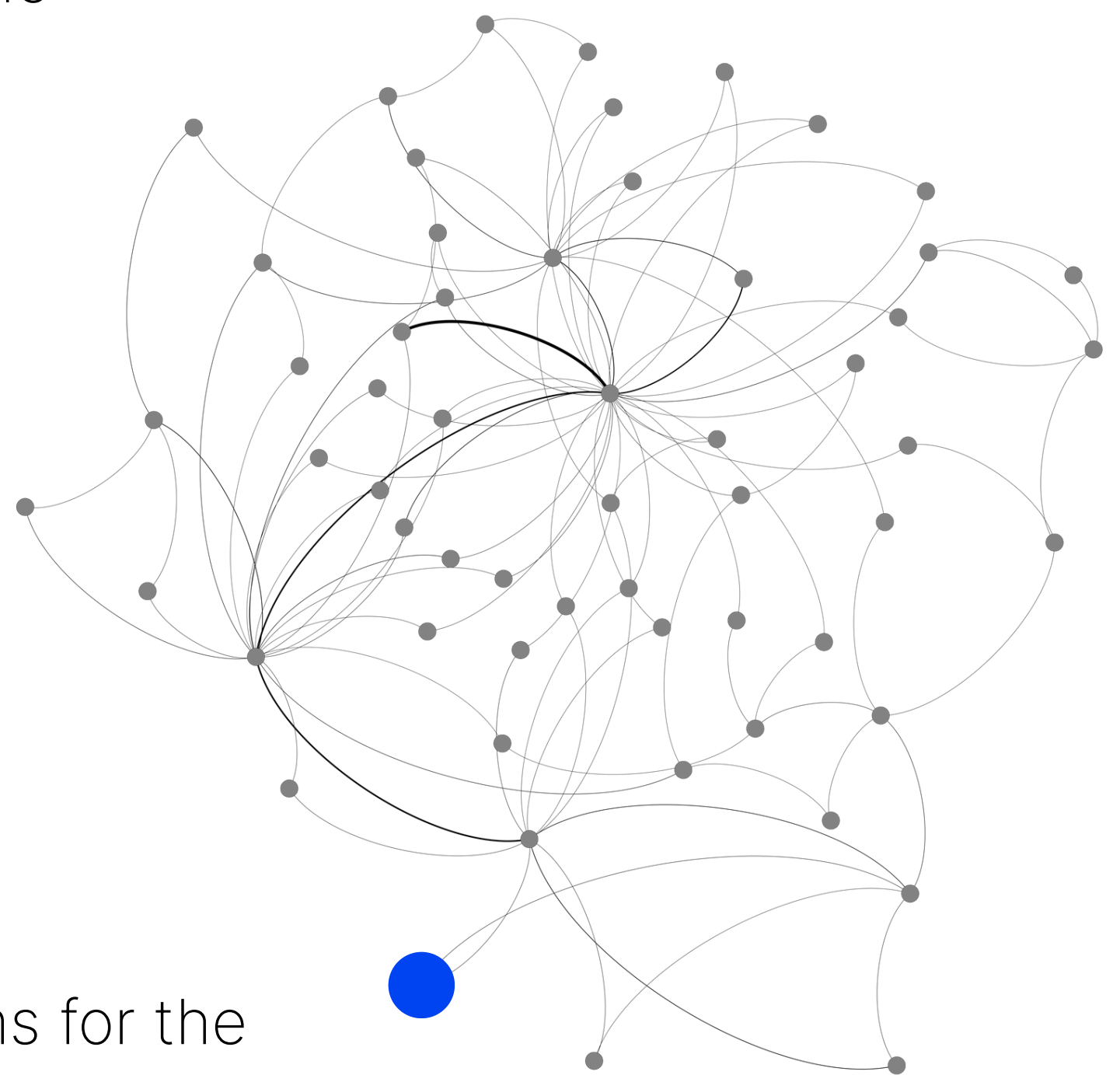
- Number of security personnel.
- Police training.
- The budget allocated to public safety.
- Purchasing processes for effective acquisitions

Natural Resource Management

This element evaluates the local government's capacity to directly manage natural resources, implement conservation strategies, and promote educational programs focused on sustainable environmental practices. It also assesses the proportion of resources under local management, the existence of active environmental policies, and the commitment to fostering citizen education on environmental stewardship and preservation.

Indicators:

- Status of civic educational programs for the management of natural resources.
- Effectiveness of conservation strategies for environmental management.
- Natural resources managed by the local government.

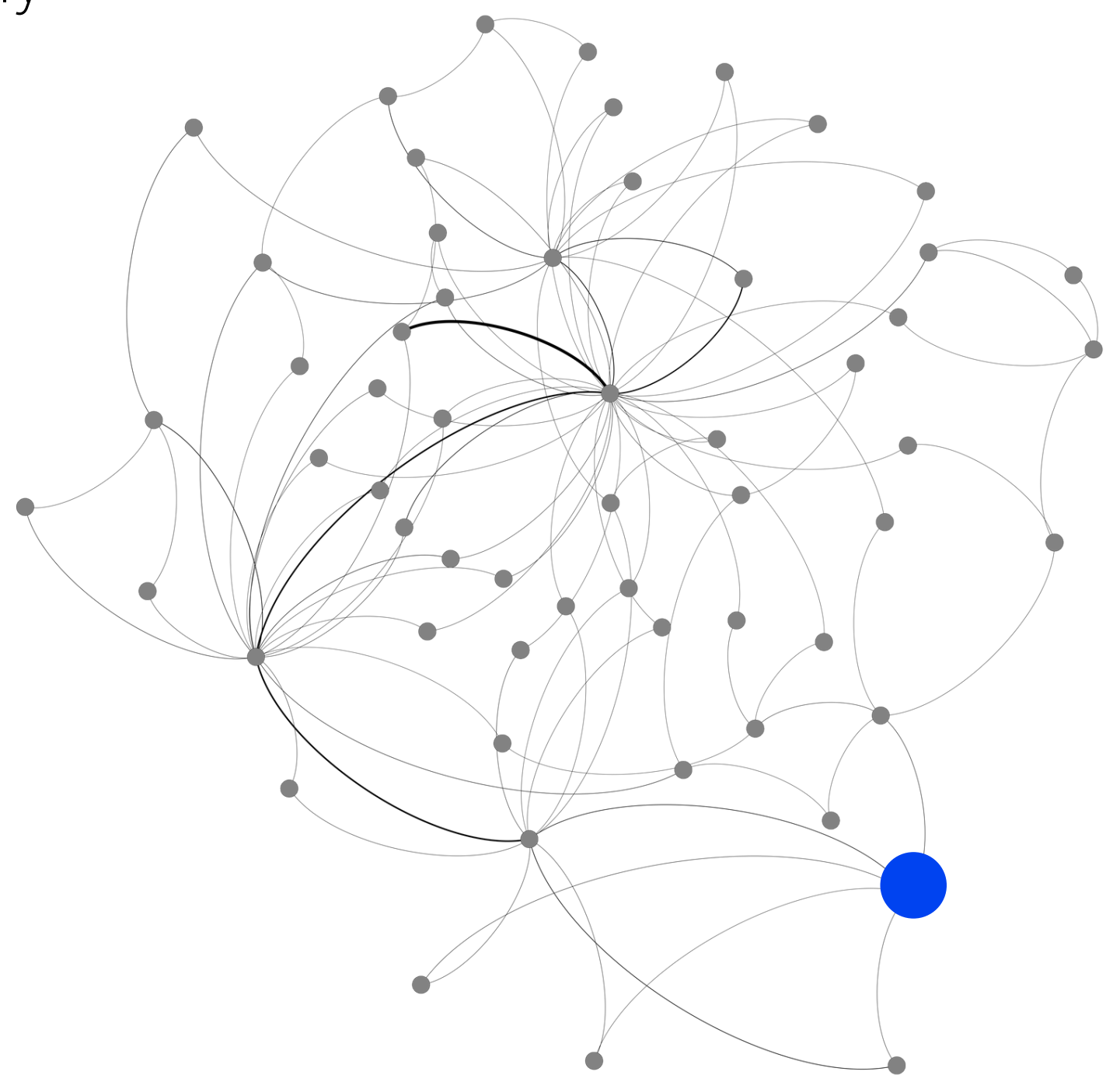


Land Use Policy and Ownership

This element evaluates the set of policies, regulations, and instruments designed to govern land use, with particular attention to the protection of vulnerable areas. It examines the existence of zoning regulations, property registries, strategies to discourage development in ecologically sensitive zones, and mitigation plans aimed at balancing human development, environmental conservation, and territorial security.

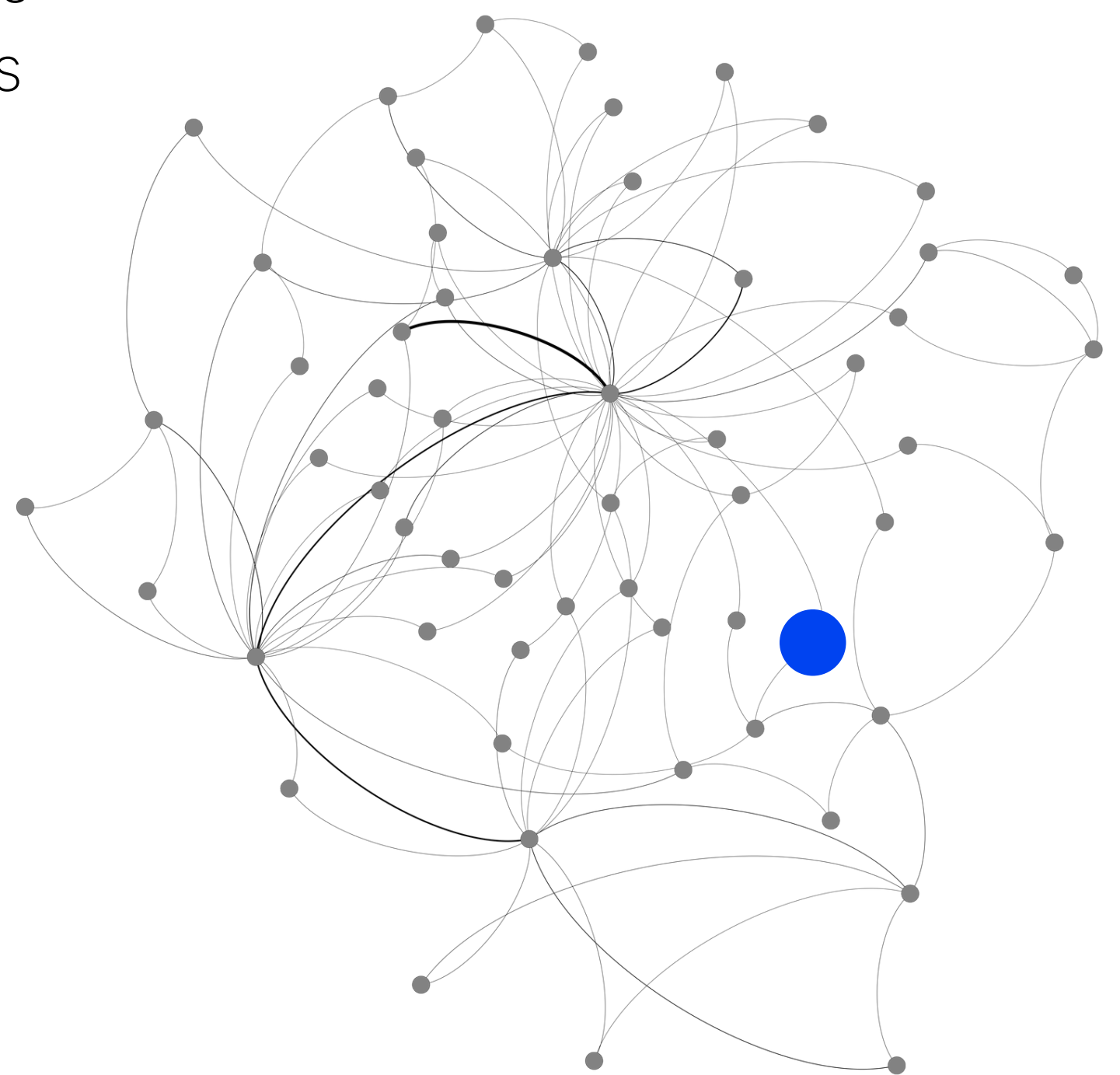
Indicators:

- Territorial planning instruments.
- Effectiveness of land registers.
- Effectiveness of land use.
- Effectiveness of plans to mitigate environmentally vulnerable land areas.
- Effectiveness of zoning policies.



Judicial Systems

This element assesses the courts' capacity to ensure fair, safe, and inclusive proceedings. This concept includes the protection and secure storage of judicial evidence, equitable accessibility of courts for people of all genders, classes, and ethnic groups, and ongoing training of judicial officials in human rights as essential conditions for strengthening public trust and the rule of law.

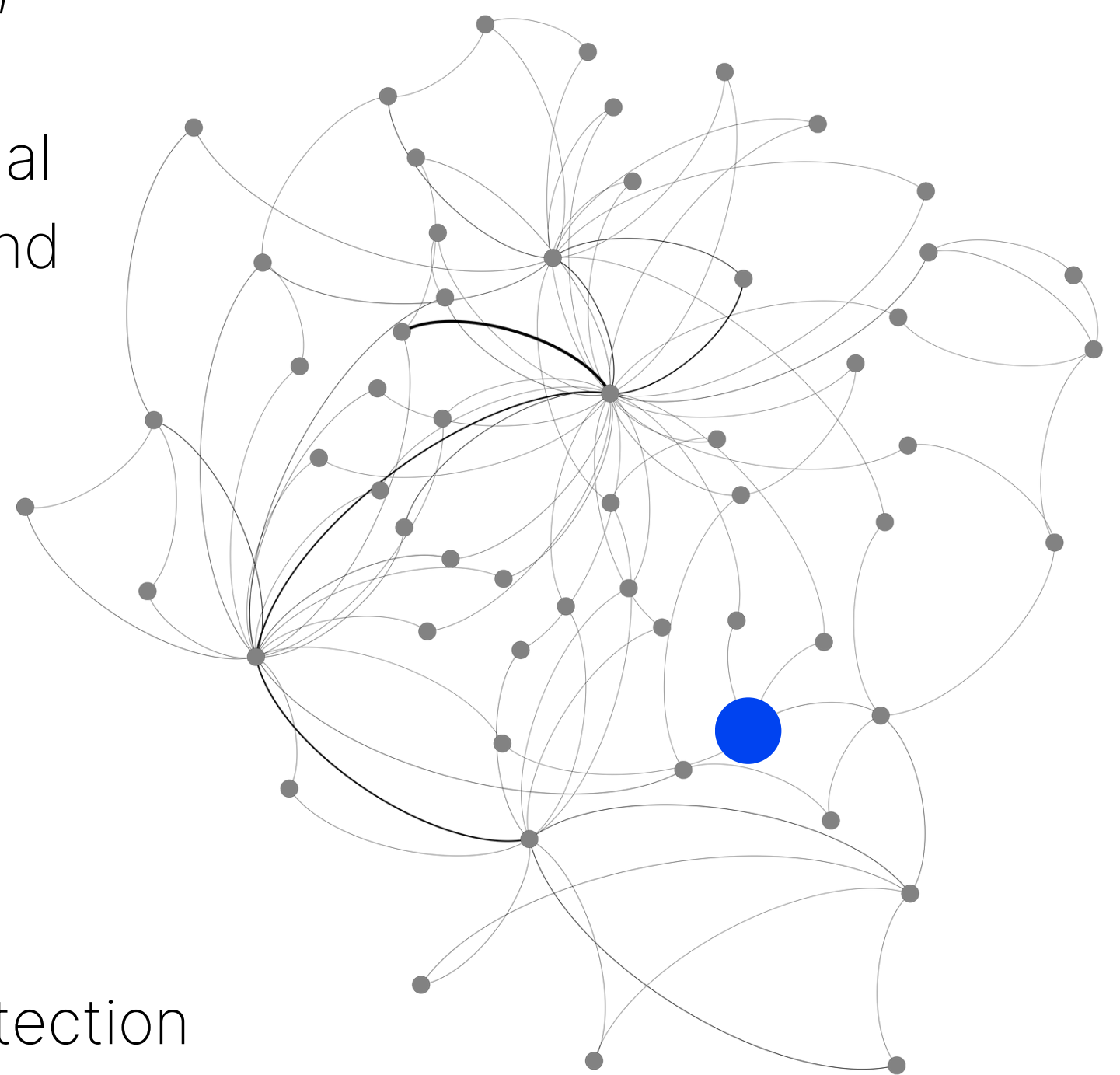


Indicators:

- Accessibility of courts.
- Resources for the judicial system.
- Protection and storage of judicial evidence.
- Training for all members of the judicial system, including on processes and record-keeping.

Legal Foundations and Frameworks

This element evaluates the body of laws and regulations that safeguard people, businesses, and the environment. Especially for the delivery of equal services —regardless of class, ethnicity, religion, gender, or any other grouping—and the protection of civil and political rights for every individual, regardless of citizenship. It assesses the strength and coherence of the legal framework to uphold justice, equity, and sustainability in the face of social, environmental, and humanitarian challenges.

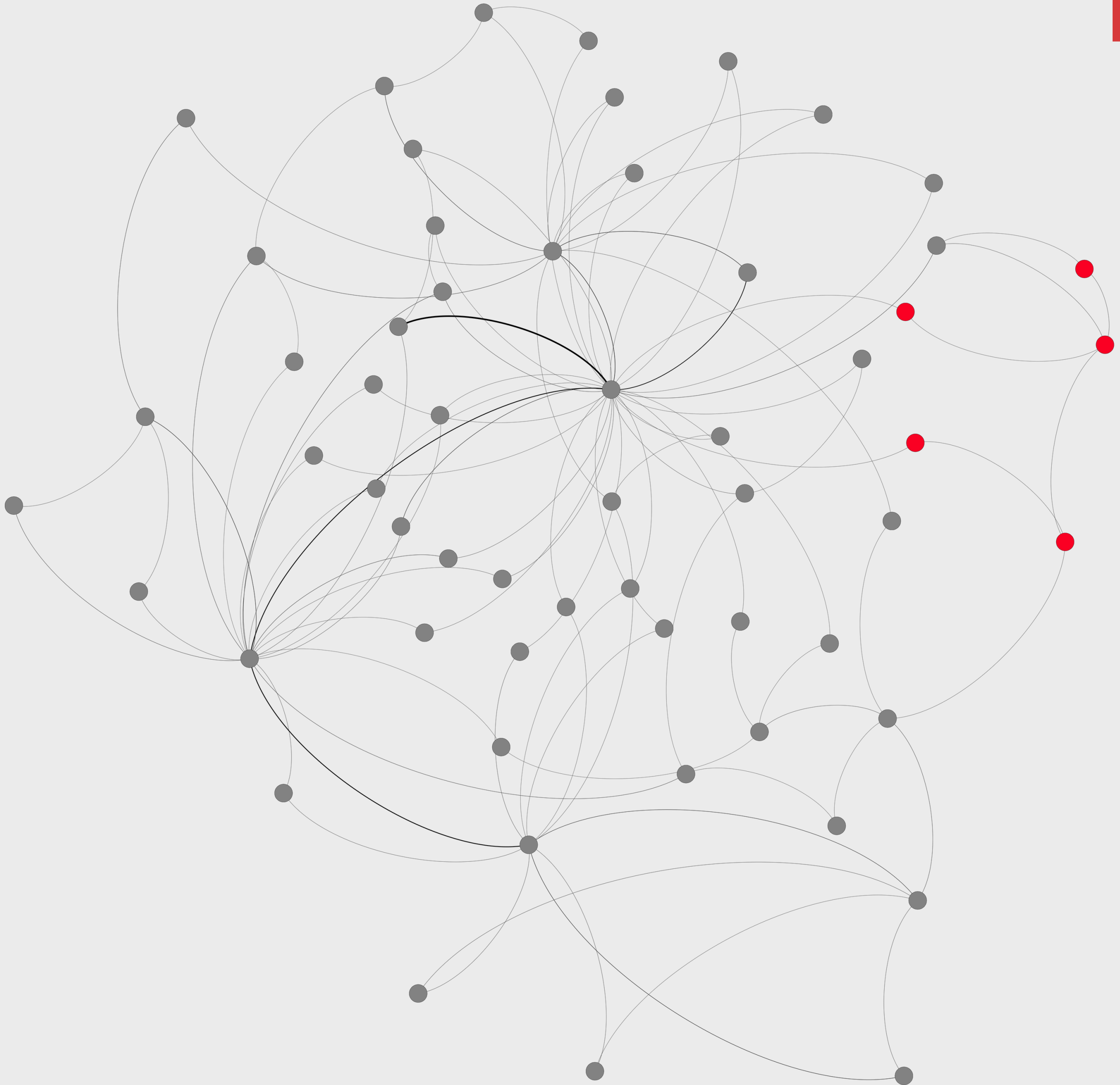


Indicators:

- Effectiveness of environmental protection legislation.
- Effectiveness of laws for civil rights.
- Effectiveness of emergency response legislation.
- Effectiveness of equality legislation ensuring non-discrimination by race, class, religion, sexual preference, economic status, or gender.

COMMUNITY EMPOWERMENT



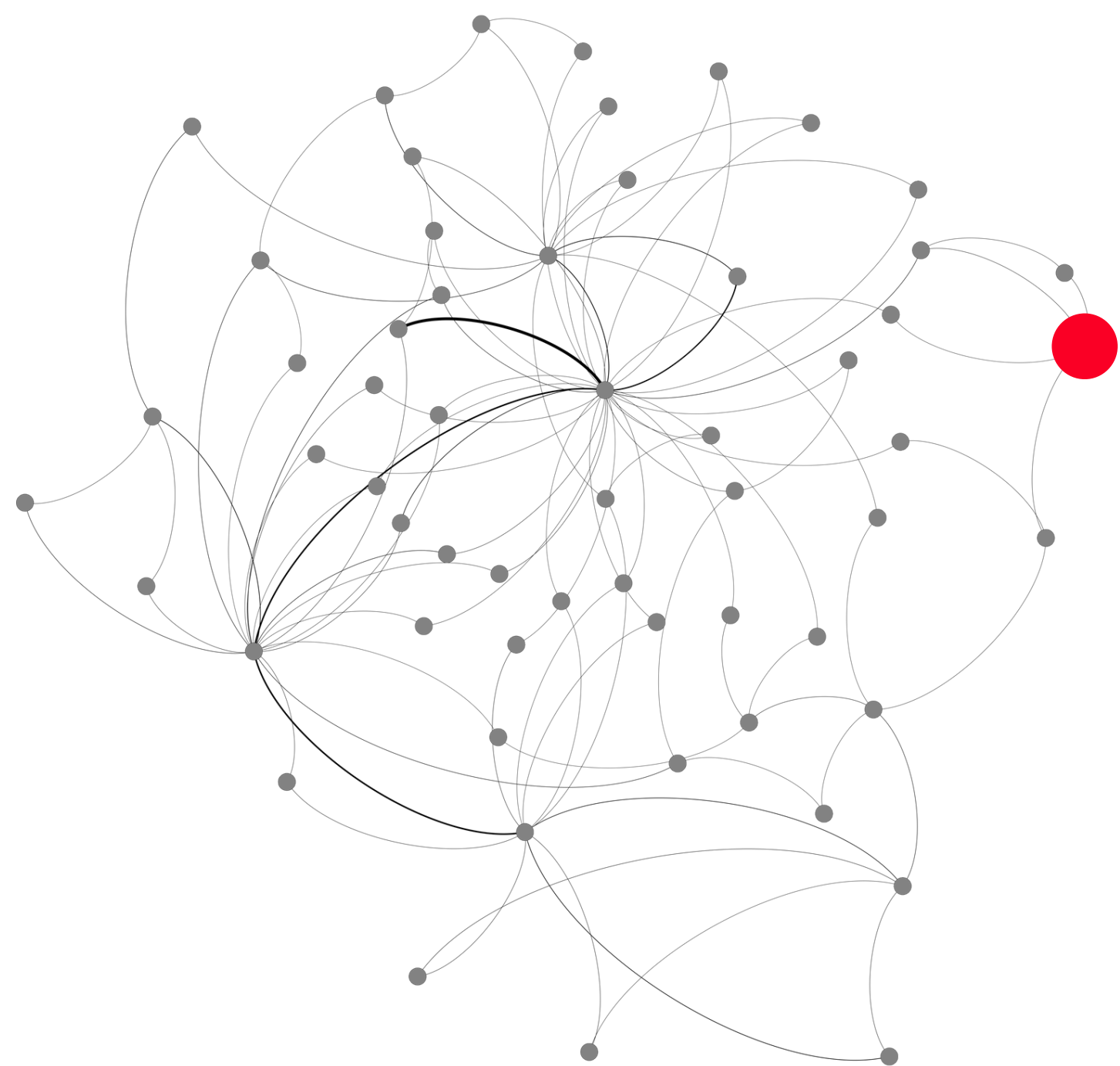


CASA Elements

- Citizen Participation
- Civil Society Organizational Capacities
- Local Governance
- Power Dynamics and Competition
- Community Rebuilding

Citizen Participation

This element evaluates the extent of citizen participation in democratic processes, taking into account the representation of community needs and interests, as well as their involvement in decision-making that directly affects them. It also encompasses the protection and recognition of indigenous and local knowledge and practices, fundamental to legitimate, resilient, and intercultural governance.



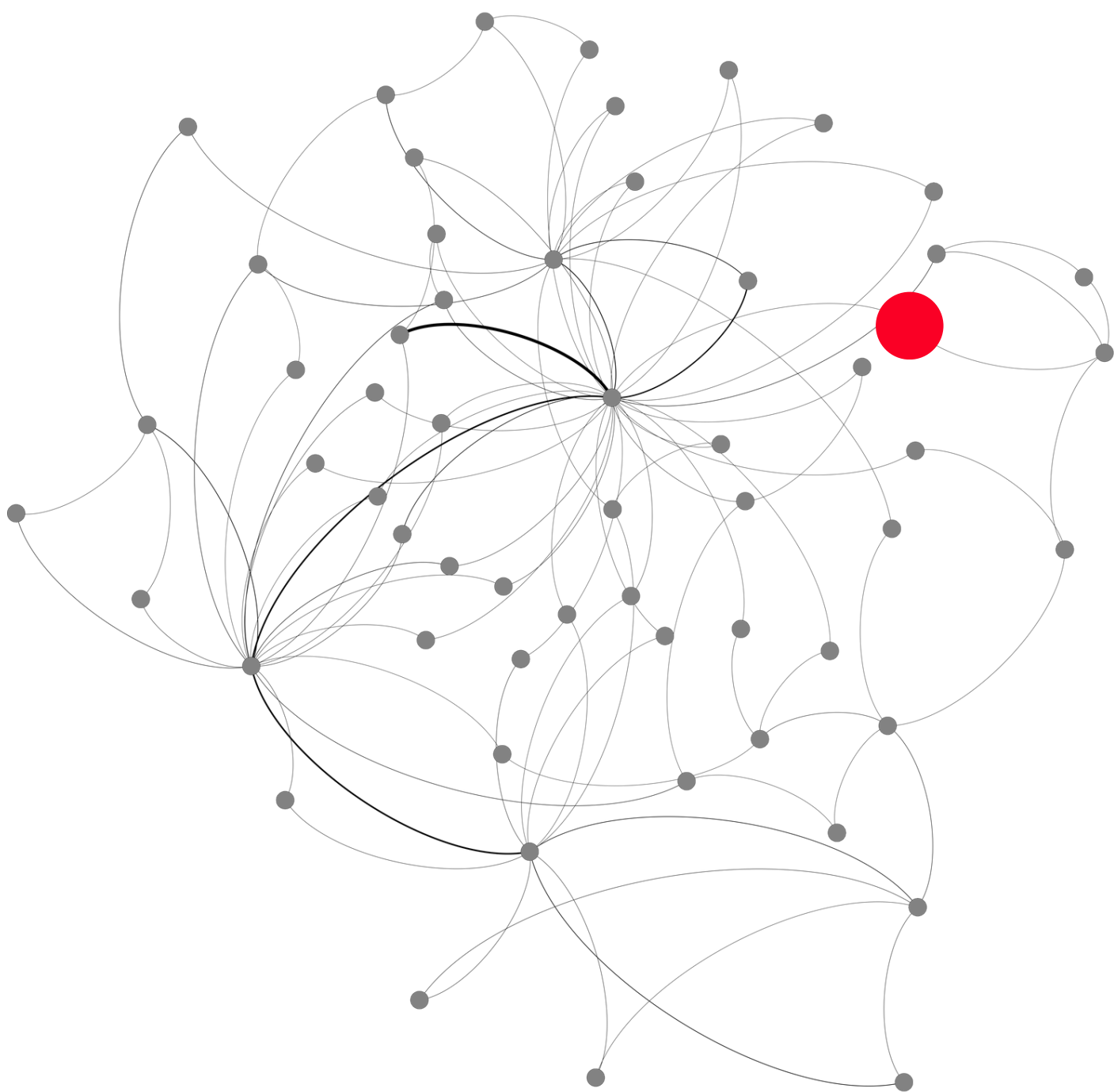
Indicators:

- Effectiveness of mechanisms to incorporate the population into relevant consultation processes
- Percentage of the population eligible to vote that voted in the last elections.



Civil Society Organizational Capacities

This element evaluates the presence and functional role of community service organizations within a given territory.

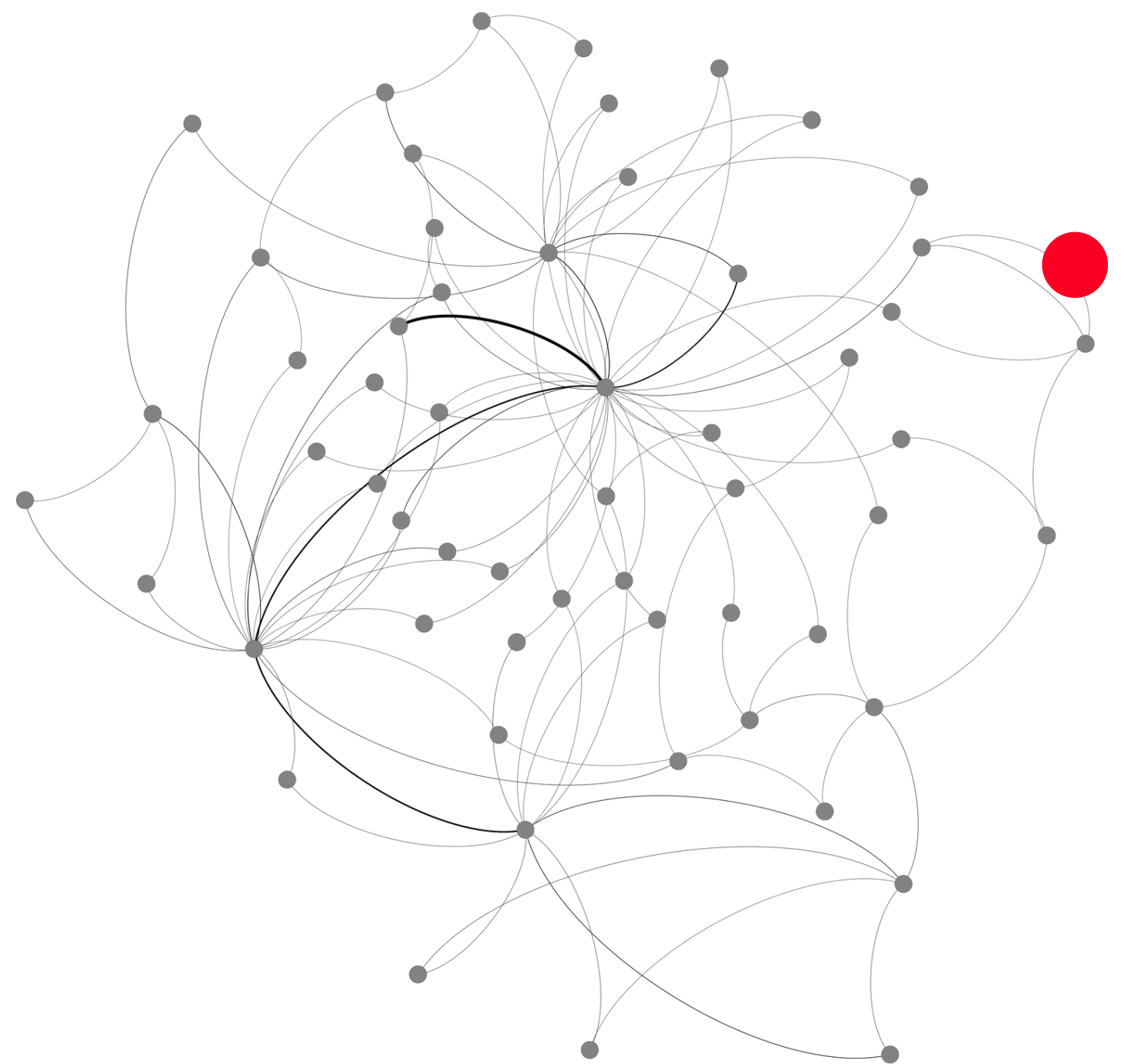


Indicators:

- Role of the community service organization.
- Number of civil society organizations.

Local Governance

This element evaluates the existence of regular mechanisms for the transition of power, the continuity of government emergency plans, and the level of citizen satisfaction with local public services. It assesses the political and administrative system's ability to deliver sustained, coordinated, and legitimate governance, even amidst change or crisis, thereby reinforcing public trust and strengthening democratic institutions.



Indicators:

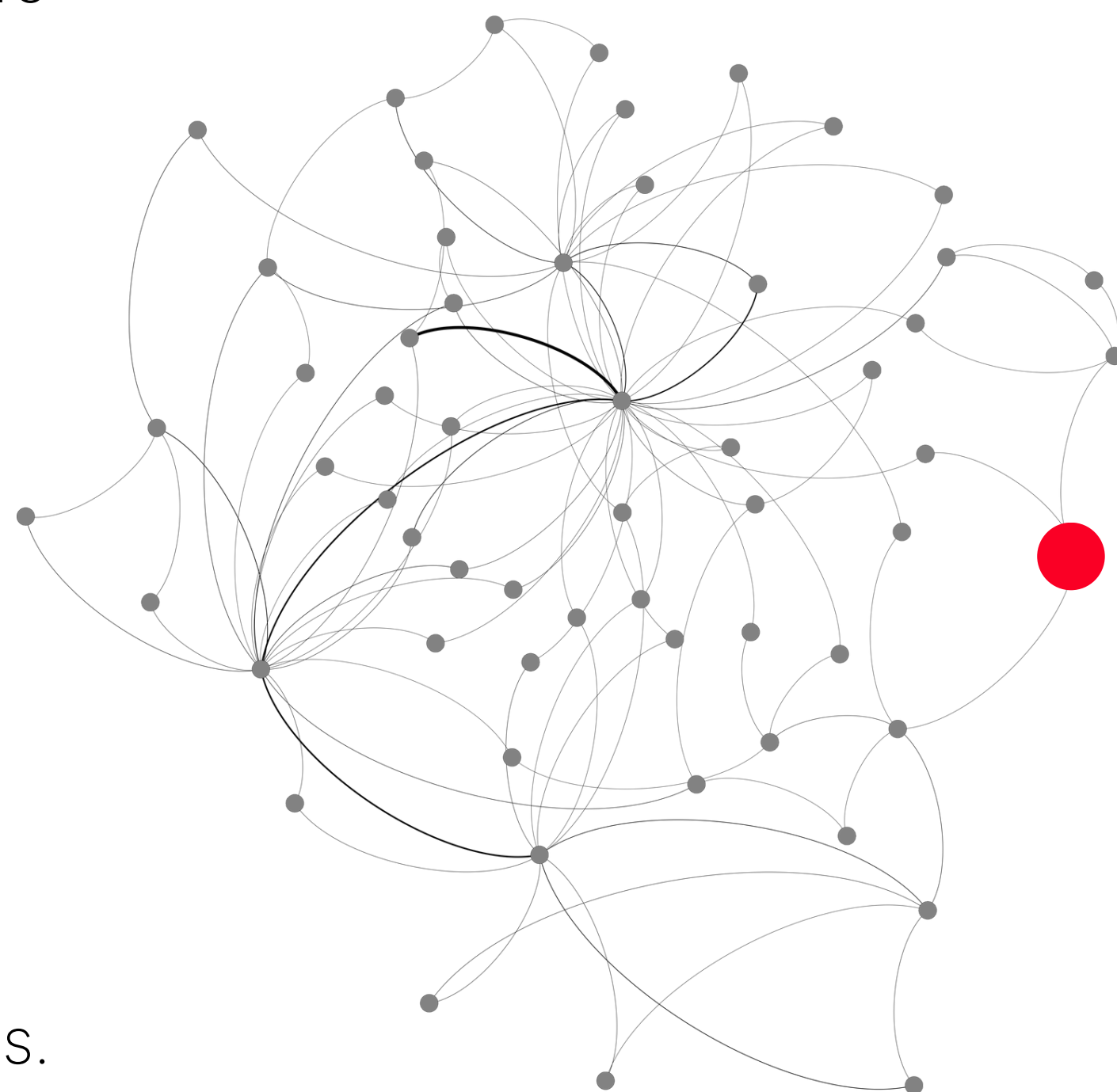
- Local elections.
- Autonomy of local authorities.
- Continuity of local government planning in the event of emergencies.
- Satisfaction with the local government.



Local boys. Punta Arenas, Chile. Photo by Lorenzo Moscia.

Power Dynamics and Competition

This element assesses the existence of multiple political parties with freedom of organization and participation in public life. It includes the alternating of power through free and competitive electoral processes, thereby giving rise to a collectively defined socio-political agenda and processes that ensure safe and effective societal continuity.

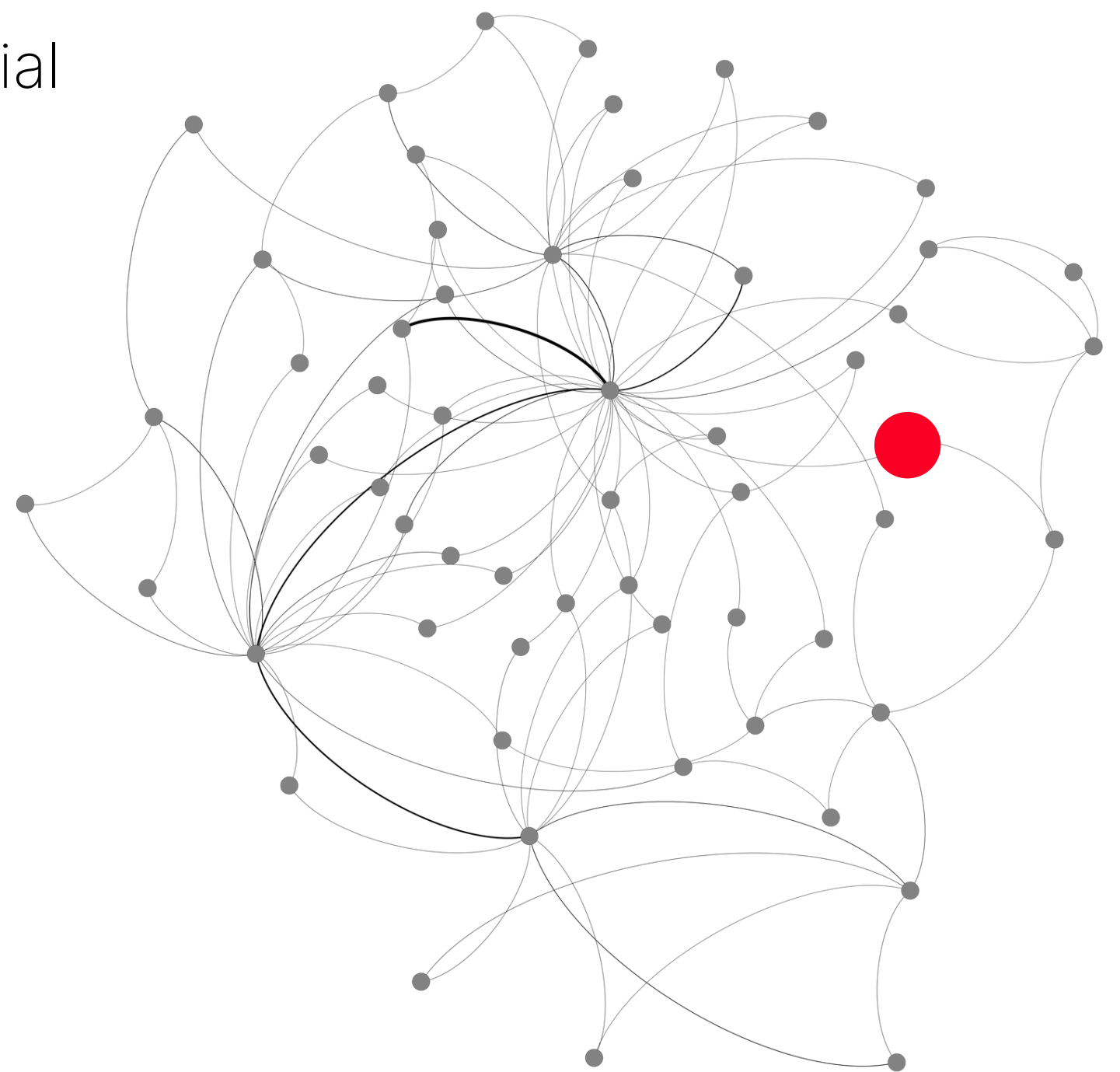


Indicators:

- Presence of multiple political parties.
- Exchange of political parties in power over time.

Community Rebuilding

This element evaluates a community's ability to recover after a crisis or disaster. This includes preserving or restoring its historical identity, fostering social reconciliation, and restoring physical infrastructure damaged by crises or disasters. It considers the presence of cultural, social, and territorial programs focused on heritage preservation, social cohesion, and emergency preparedness, as well as indicators of successful reconstruction efforts and community involvement in both prevention and recovery.

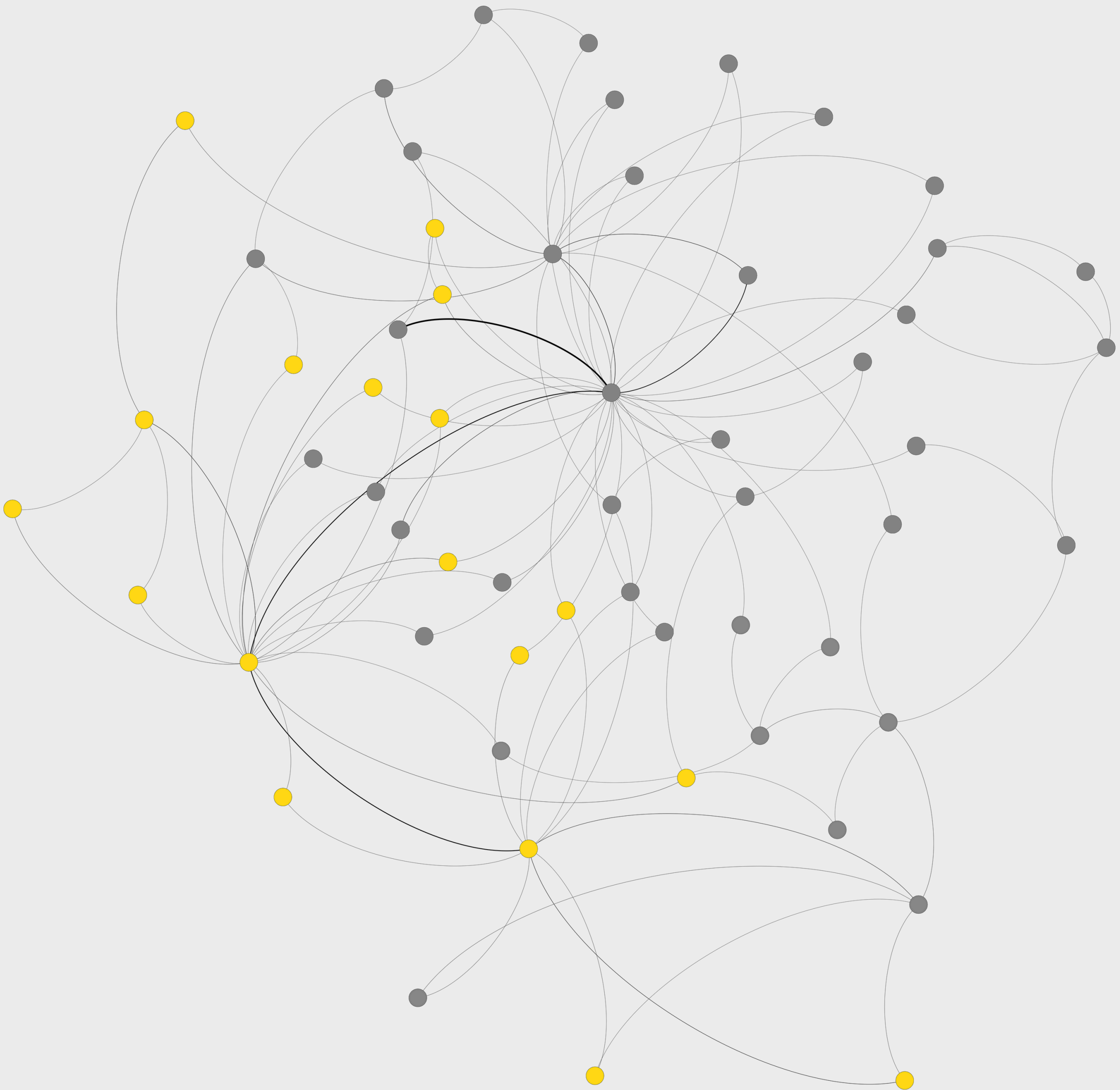


Indicators:

- Presence of community spaces.
- Effectiveness of programs and policies to revitalize areas at risk.
- Effectiveness of programs to preserve and protect local historical sites.
- Effectiveness of programs to promote social cohesion.
- Resources available for the reconstruction of damaged infrastructure.
- Citizen participation in community disaster preparedness programs..



SUSTAINABLE DEVELOPMENT AND RISK MANAGEMENT



CASA Elements

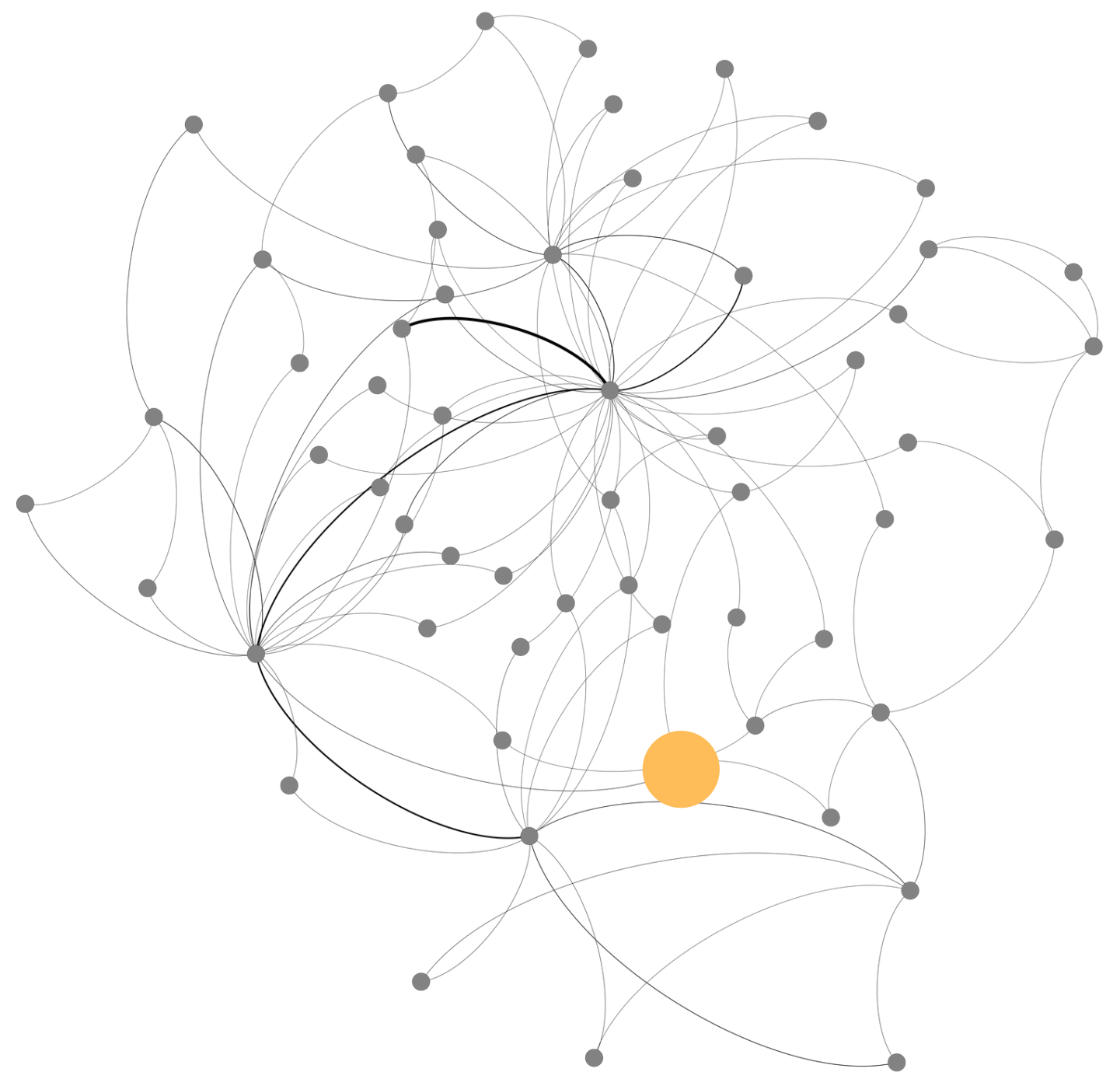
- Community organizations
- Nutritional Access
- Sustainable agricultural production
- Food Security Systems
- Transportation Infrastructure and Networks
- Sustainable Livelihood Development
- Environmental Management
- Energy Systems
- Humanitarian Relief Support
- Public Safety and Security
- Risk Assessment and Mitigation
- Emergency Preparedness and Management
- Early Warning Systems
- Data management and analysis quality
- Emergency Insurance Systems
- Public Debt Management
- Business Development
- Access to Clean Drinking Water

Community organizations

This element assesses the active participation of community organizations, especially those that integrate knowledge related to sustainability and territorial risk management, as well as the existence of spaces that promote collaboration and knowledge exchange between these organizations and decision-makers.

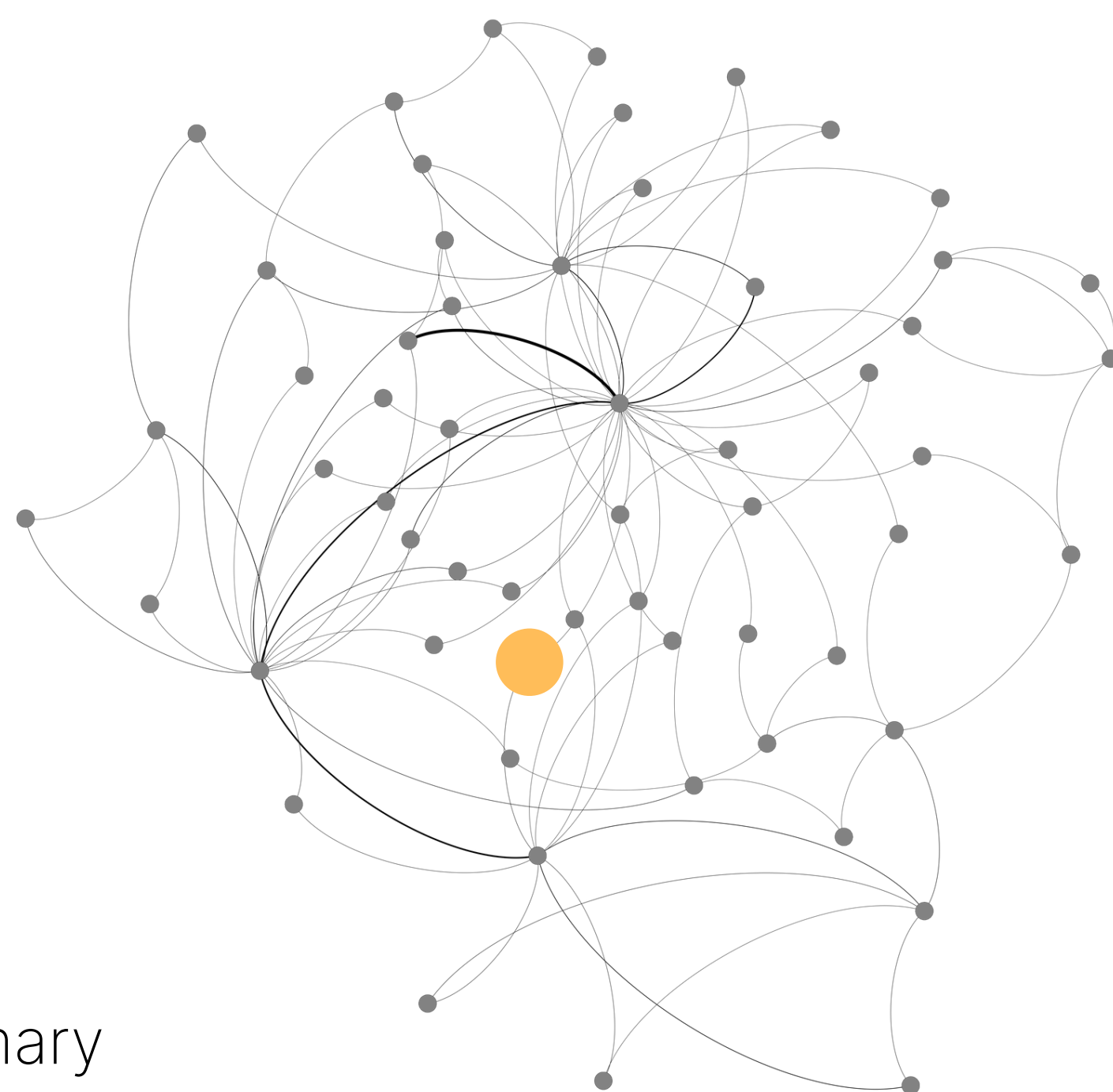
Indicators:

- Role of local events that promote interculturality.
- Number of civic-oriented organizations.



Nutritional Access

This element assesses the identification of the population's primary food source, its level of accessibility, and its quality.

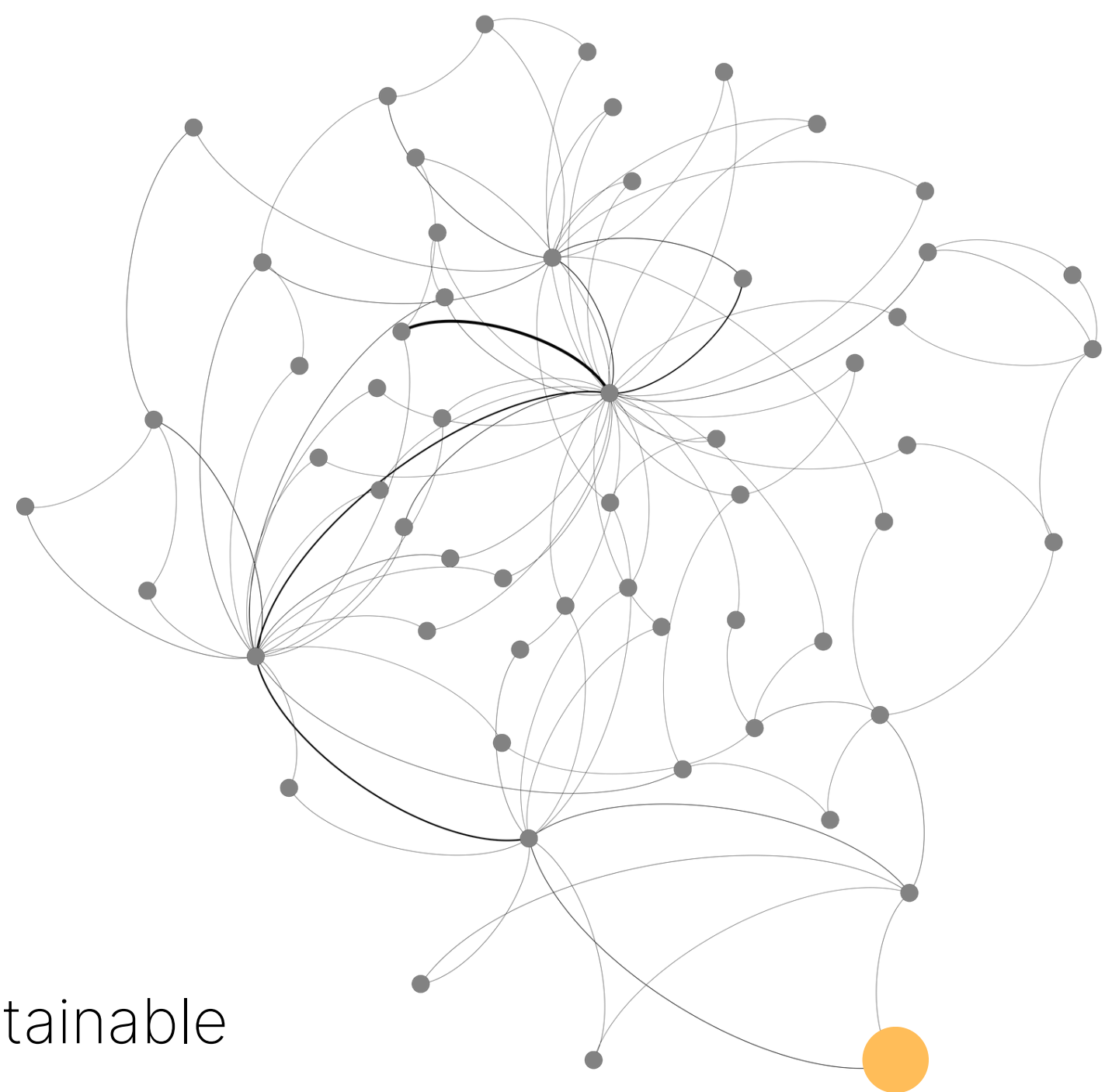


Indicators:

- Accessibility and quality of the primary source of nutrition.

Sustainable agricultural production

This element assesses the development status of livestock, aquaculture, and sustainable agriculture programs, analyzing their implementation, impact, and scope.



Indicators:

- Status of livestock/aquaculture/sustainable agriculture programs.

Food Security Systems

This element assesses the percentage of the population that is not at risk of food insufficiency or malnutrition, and how these factors are sustained over time in the territory.

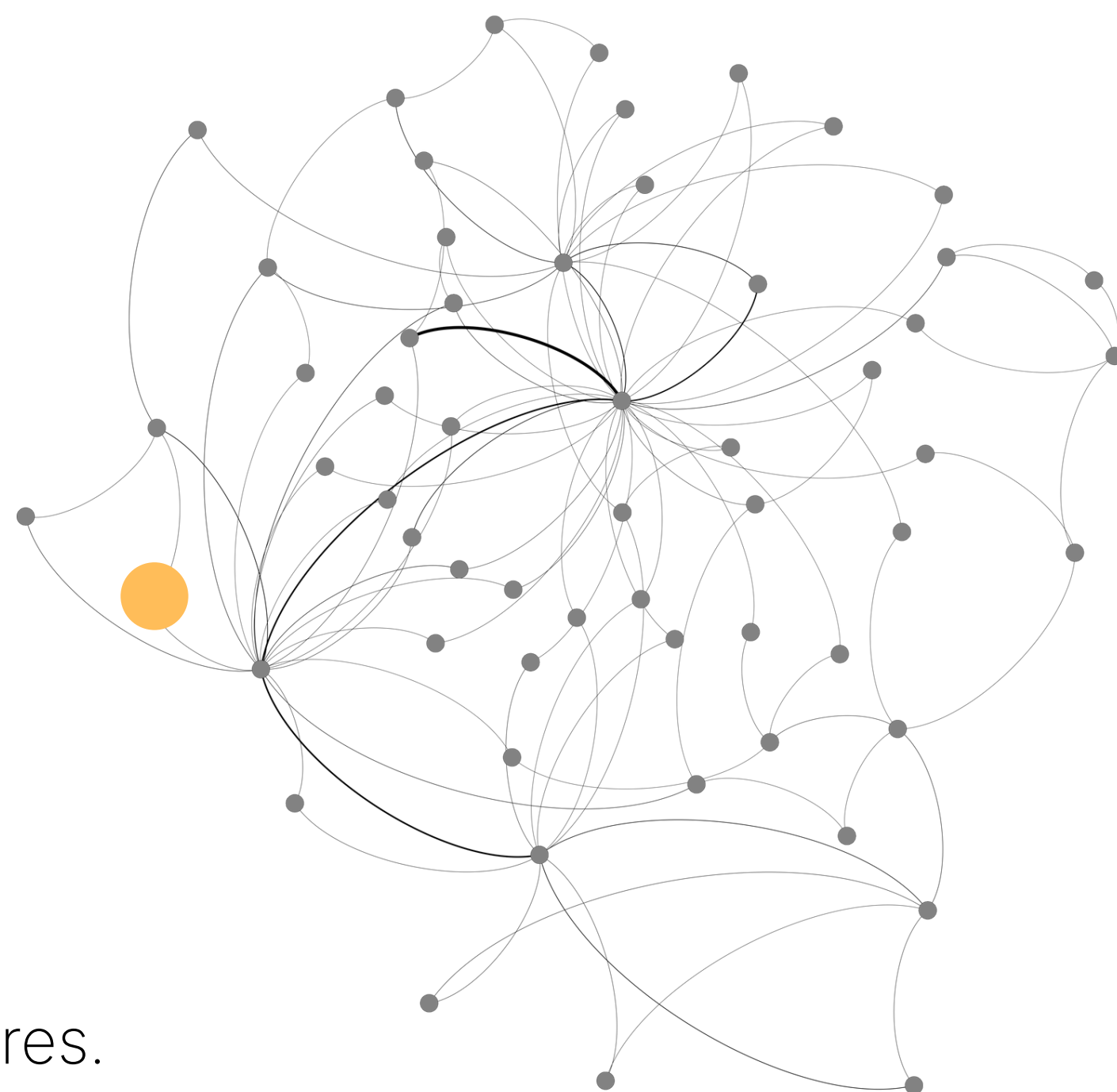


Indicators:

- Stability of food security for the population.
- Percentage of the population at risk of food insecurity or malnutrition.

Transportation Infrastructure and Networks

This element assesses the resilience, reliability, and regulation of transportation infrastructure, as well as the coverage, quality, and accessibility of the road network within a territory. This assessment includes an analysis of the percentage of paved roads, the extent of the transportation system, and its capacity to sustain mobility under both normal and adverse conditions.



Indicators:

- Regulation of transport infrastructures.
- Resilience and reliability of transport infrastructure.
- Percentage of paved roads.
- Percentage of the territory covered by the transportation network.



Airport. Puerto Williams, Chile. Photo by Lorenzo Moscia.

Sustainable Livelihood Development

This element assesses the integration of rural producers into urban markets and the use of sustainable production practices by the population and businesses, fostering inclusive and environmentally responsible economic development.

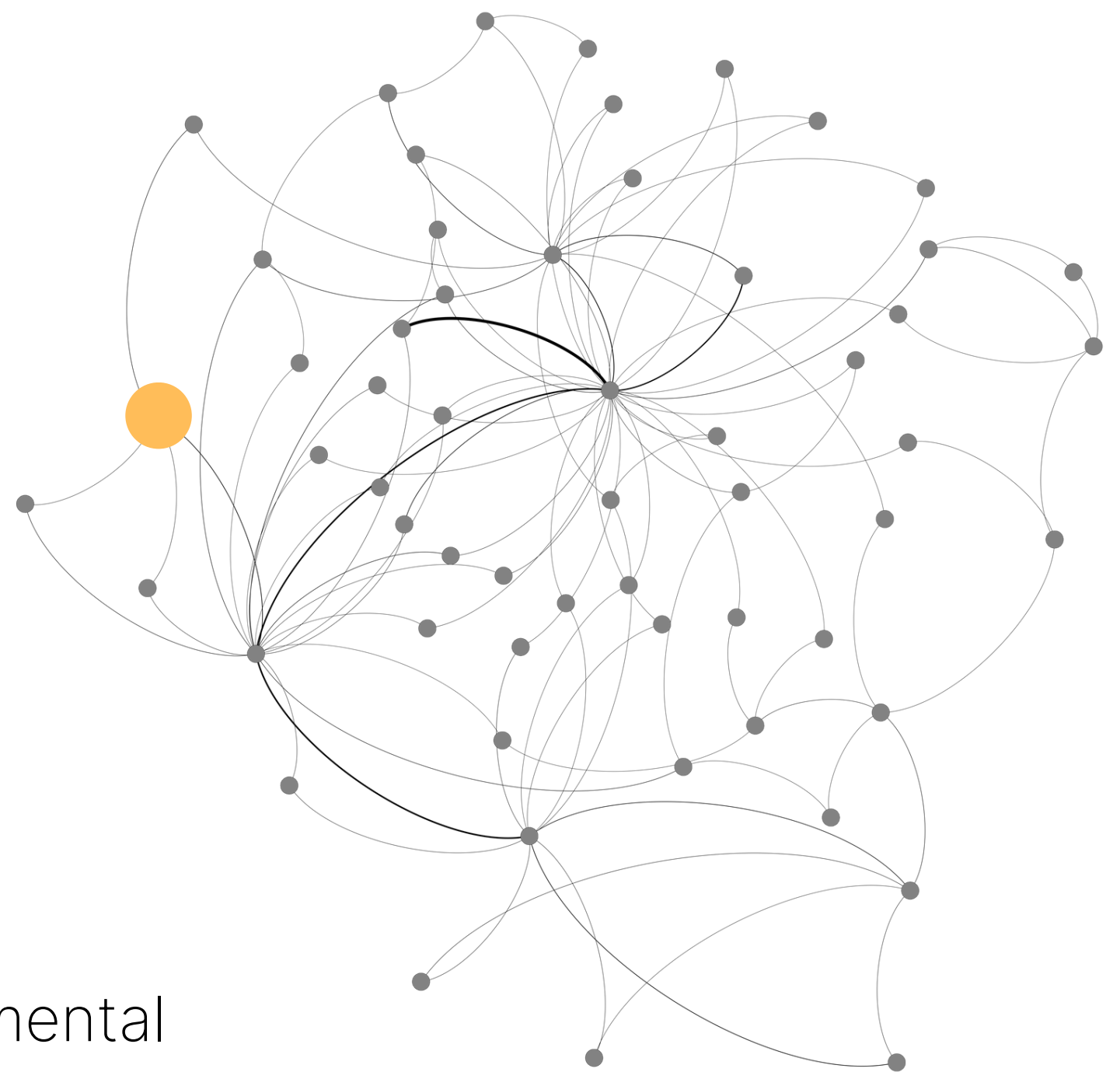


Indicators:

- Percentage of rural producers who market their products in urban markets.
- Percentage of the population that uses sustainable production practices.
- Access of rural sources to urban markets.
- Percentage of 'green' or sustainable companies.

Environmental Management

This element assesses the development of plans to address environmental issues related to climate change and seasonal variations, as well as the percentage of urban land allocated to public spaces and green areas.



Indicators:

- Status of plans to address environmental problems caused by climate change or seasonal climate problems.
- Percentage of urban land designated for public and green use.

Energy Systems

This element assesses the resilience, reliability, and coverage of energy infrastructure, considering access to electricity and the diversification of renewable sources such as solar, wind, hydroelectric, geothermal, and biogas, which are essential for the sustainability and energy security of the territory.

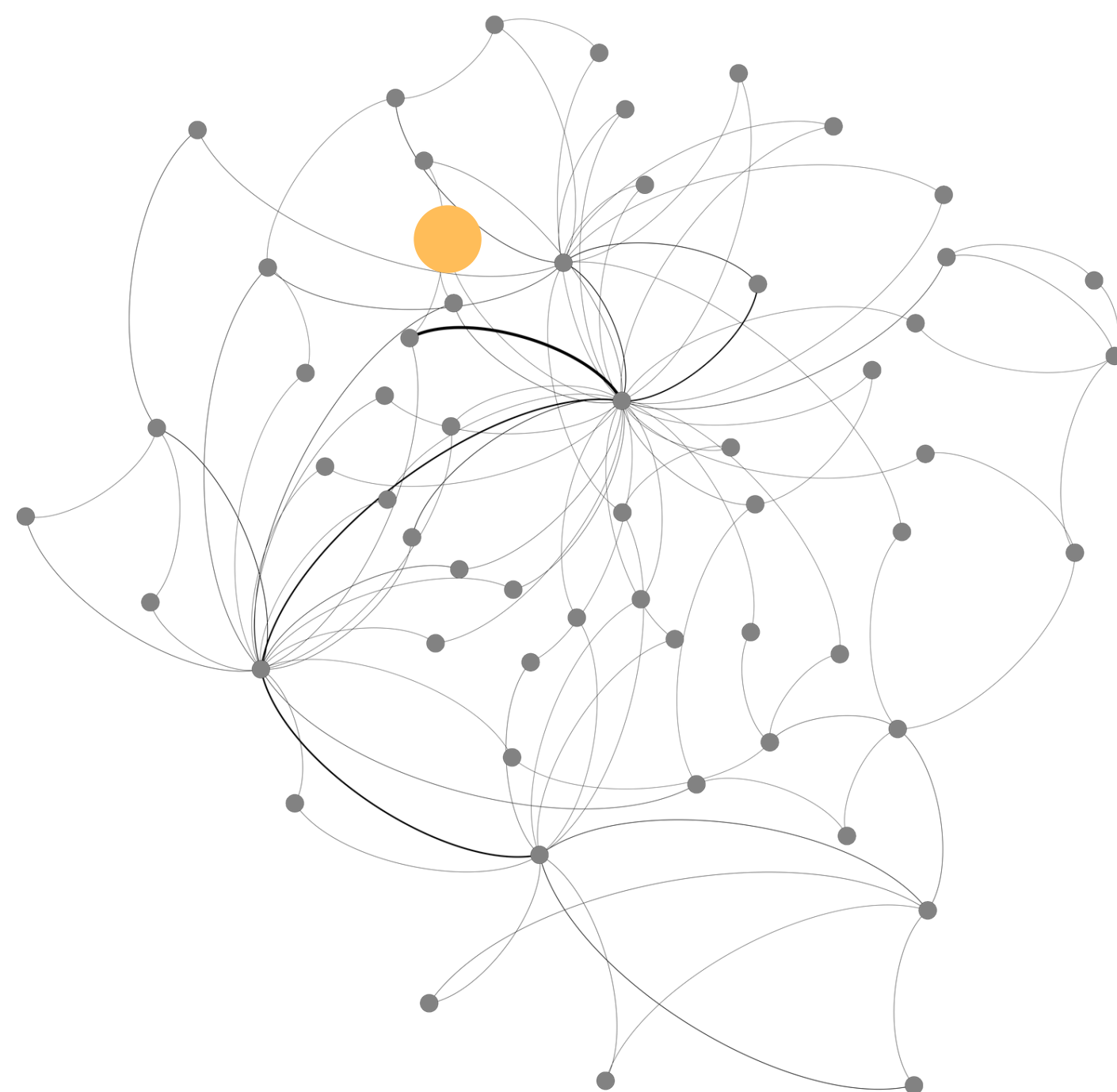


Indicators:

- Resilience, diversification, and reliability of energy infrastructure.
- Percentage of the population with access to electricity.

Humanitarian Relief Support

This element assesses the resilience, reliability, and coverage of energy infrastructure, considering access to electricity and the diversification of renewable sources such as solar, wind, hydroelectric, geothermal, and biogas, which are essential for the sustainability and energy security of the territory.

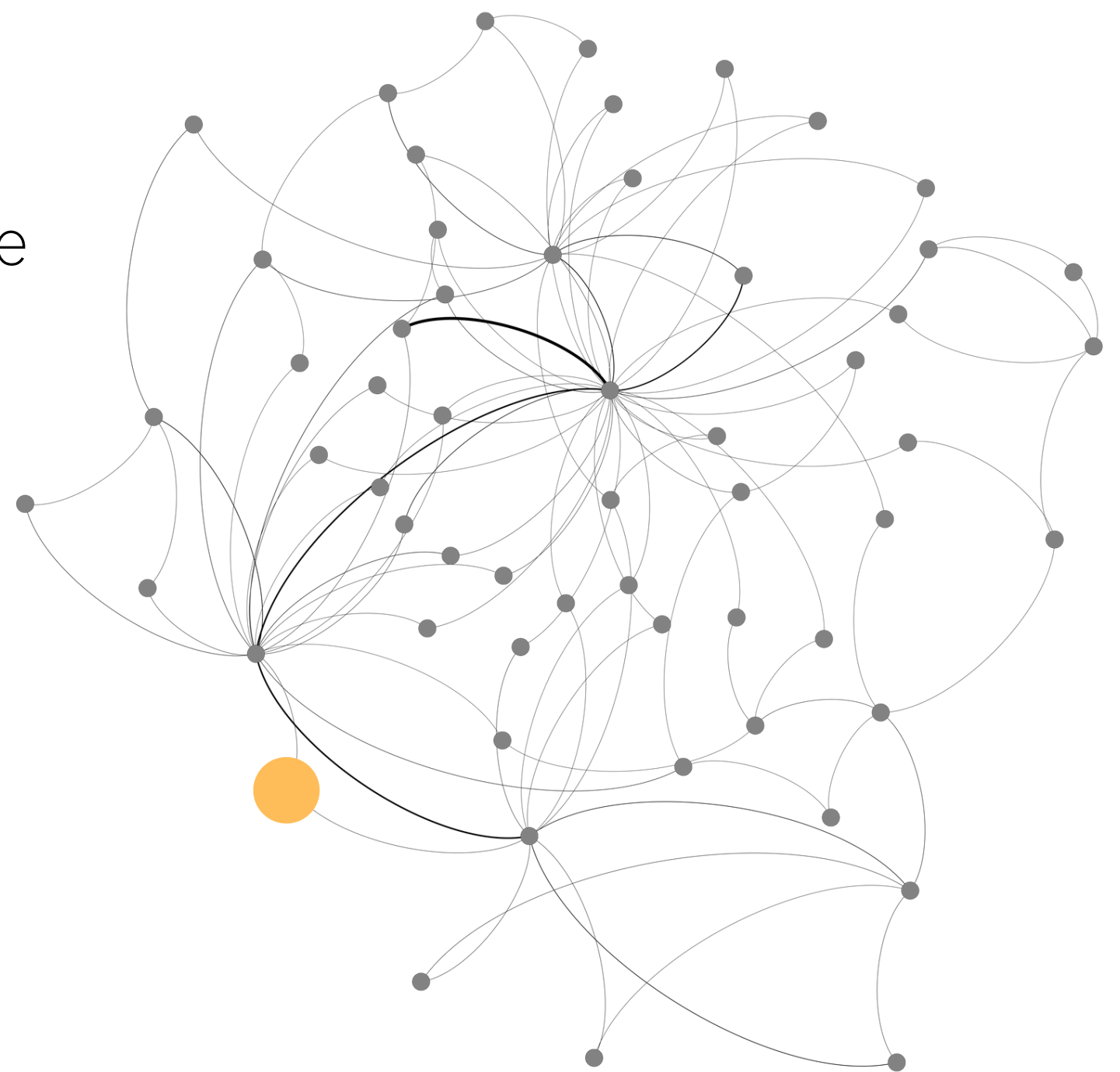


Indicators:

- Security of areas intended for aid organizations.
- Storage and distribution of local law enforcement resources.
- Effectiveness of risk assessment carried out after a critical event.

Public Safety and Security

This element assesses the institutional and operational coordination of military and civil defense forces in local contexts, considering their training, respect for human rights, subjection to democratic civilian oversight, and budget allocation. It also incorporates citizen perceptions of their legitimacy and trust, as well as their effective contribution to territorial security, measured, among other factors, by the crime rate.

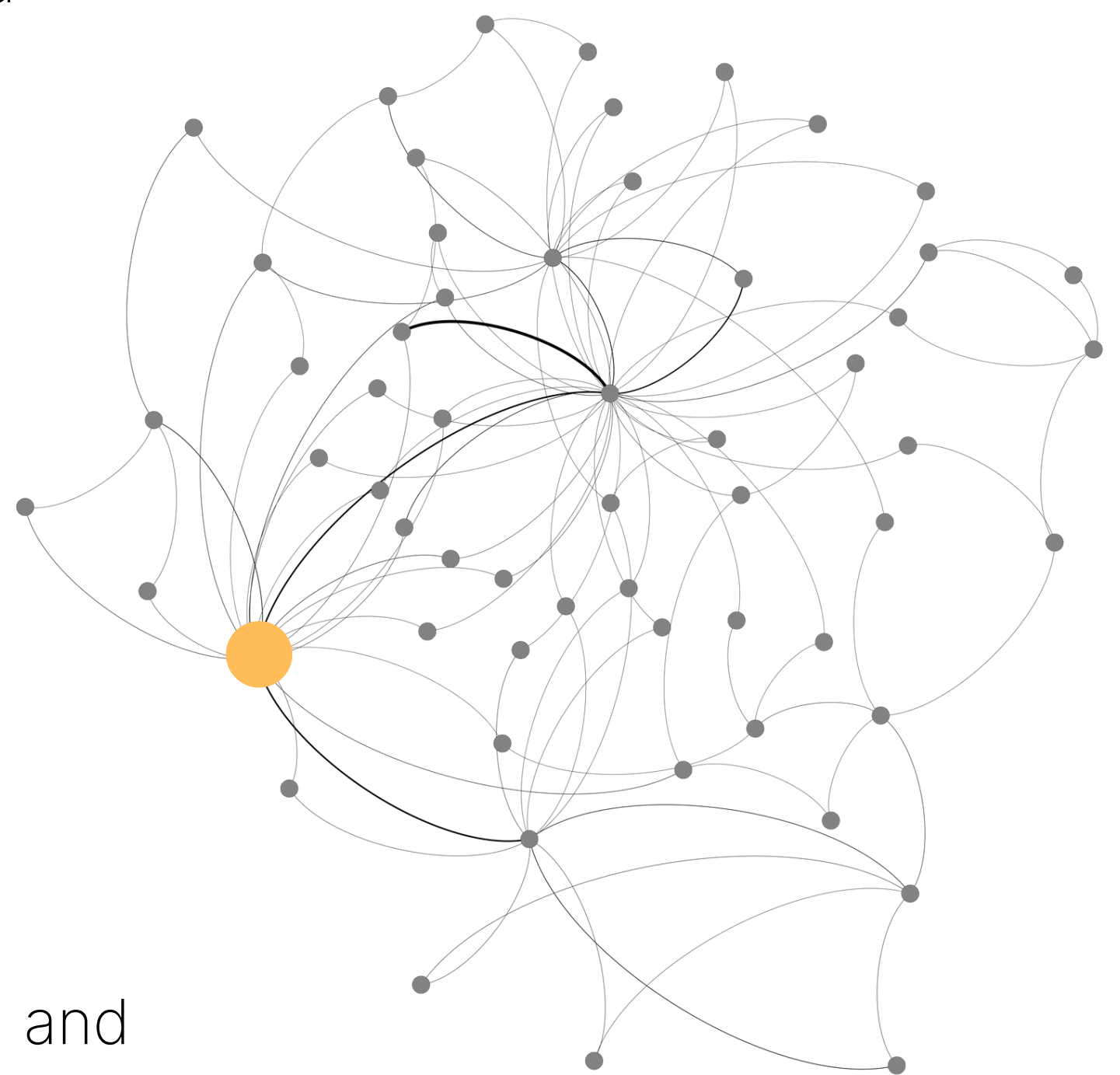


Indicators:

- Security forces and human rights recognition.
- Emergency preparedness exercises for military/civil defense forces.
- Training of military/civil defense forces.
- Respect to military/civil defense forces.
- Homicides/100,000 Inhabitants.
- Percentage of the annual budget is allocated to military forces.

Risk Assessment and Mitigation

This element assesses the existence, availability, and implementation of risk analyses, territorial diagnoses, mitigation plans, and response strategies, as well as the systematic assessment of the resilience of critical buildings and infrastructure to natural disasters, to reduce vulnerabilities and strengthen the territorial adaptive capacity.



Indicators:

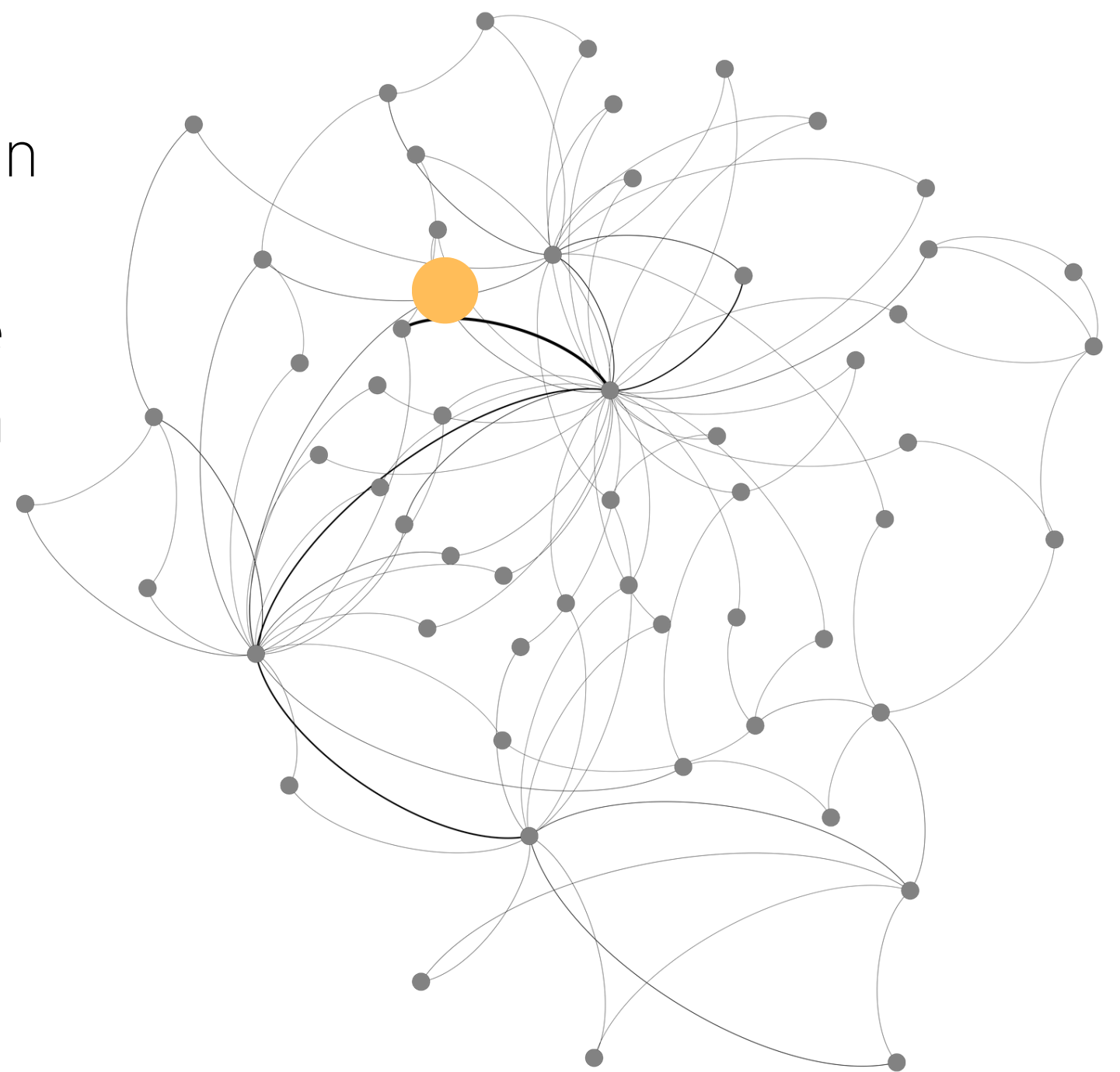
- Implementation of diagnosis, plans, and mitigation strategies to address vulnerabilities.
- Public availability of risk assessment analyses.
- Percentage of buildings and critical infrastructure evaluated for their resilience to natural disasters.



King crab fishing boat. Puerto Williams, Chile. Photo by Lorenzo Moscia.

Emergency Preparedness and Management

This element assesses the design, implementation, and evaluation of plans and actions that consider respect for human rights, the potential temporary restriction of freedoms for security reasons, and the preparedness of response units through adequate equipment, ongoing training, and regular drills. It also includes the development of plans for the relocation of people in at-risk areas and the modernization of critical infrastructure to reduce vulnerability and strengthen the response capacity to adverse events.

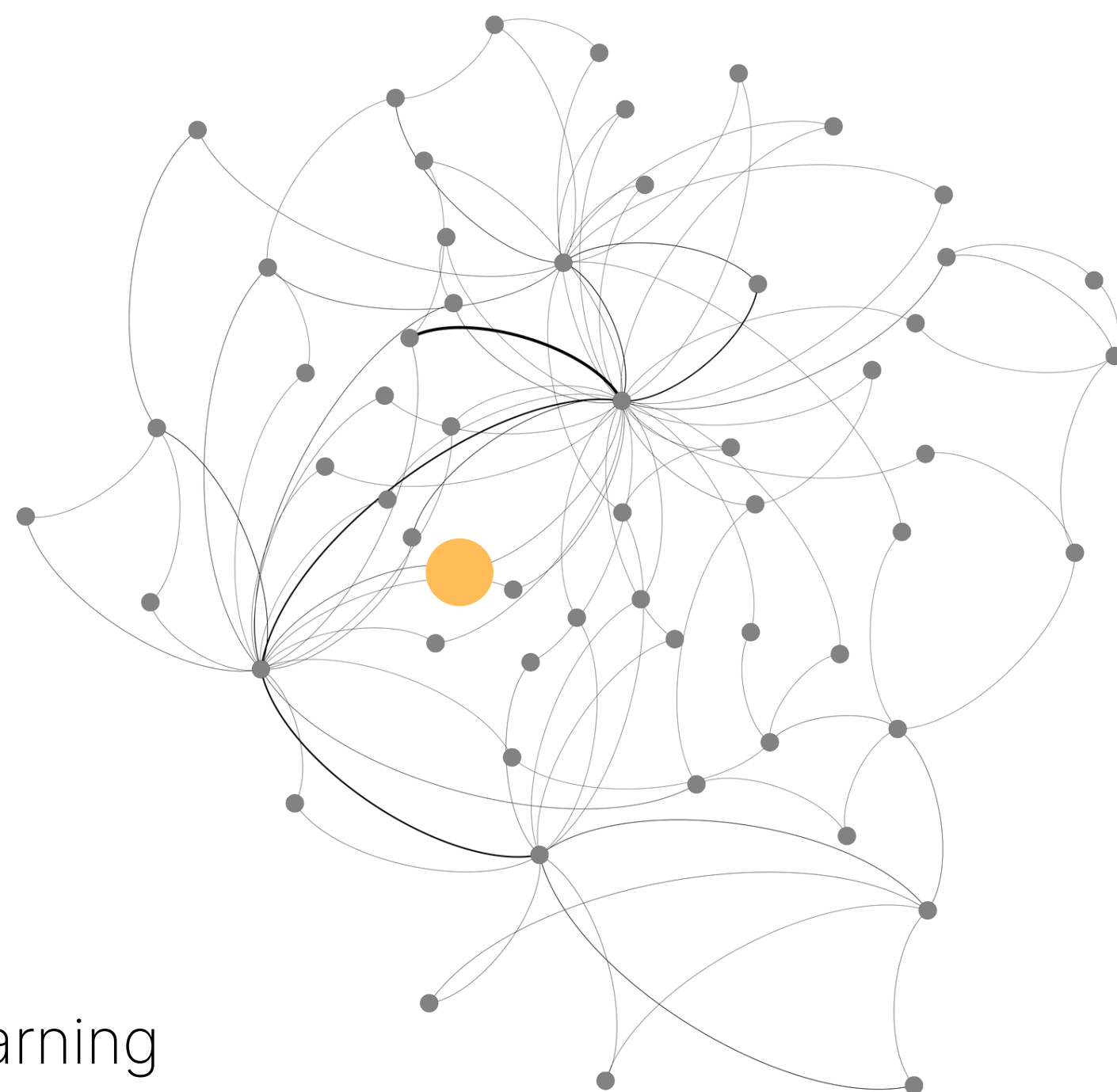


Indicators:

- Consideration of human rights.
- Emergency drills.
- Equipment quality for emergency response units.
- Training of emergency response units.
- Status of plans to modernize or modify critical elements of the infrastructure.
- Status of plans to relocate people from potentially disaster-prone areas.

Early Warning Systems

This element assesses the improvement and updating of emergency plans, the resilience and reliability of early warning systems, and the proportion of urban areas effectively covered by these systems, to strengthen the response capacity to critical events.



Indicators:

- Resilience and reliability of early warning systems.
- Improvements and updates of emergency plans.
- Early warning systems coverage.

Data management and analysis quality

This element evaluates the role and efficiency of organizations responsible for collecting, archiving, and analyzing population, production, and other records, as well as the quality of the techniques used in analyzing this data.

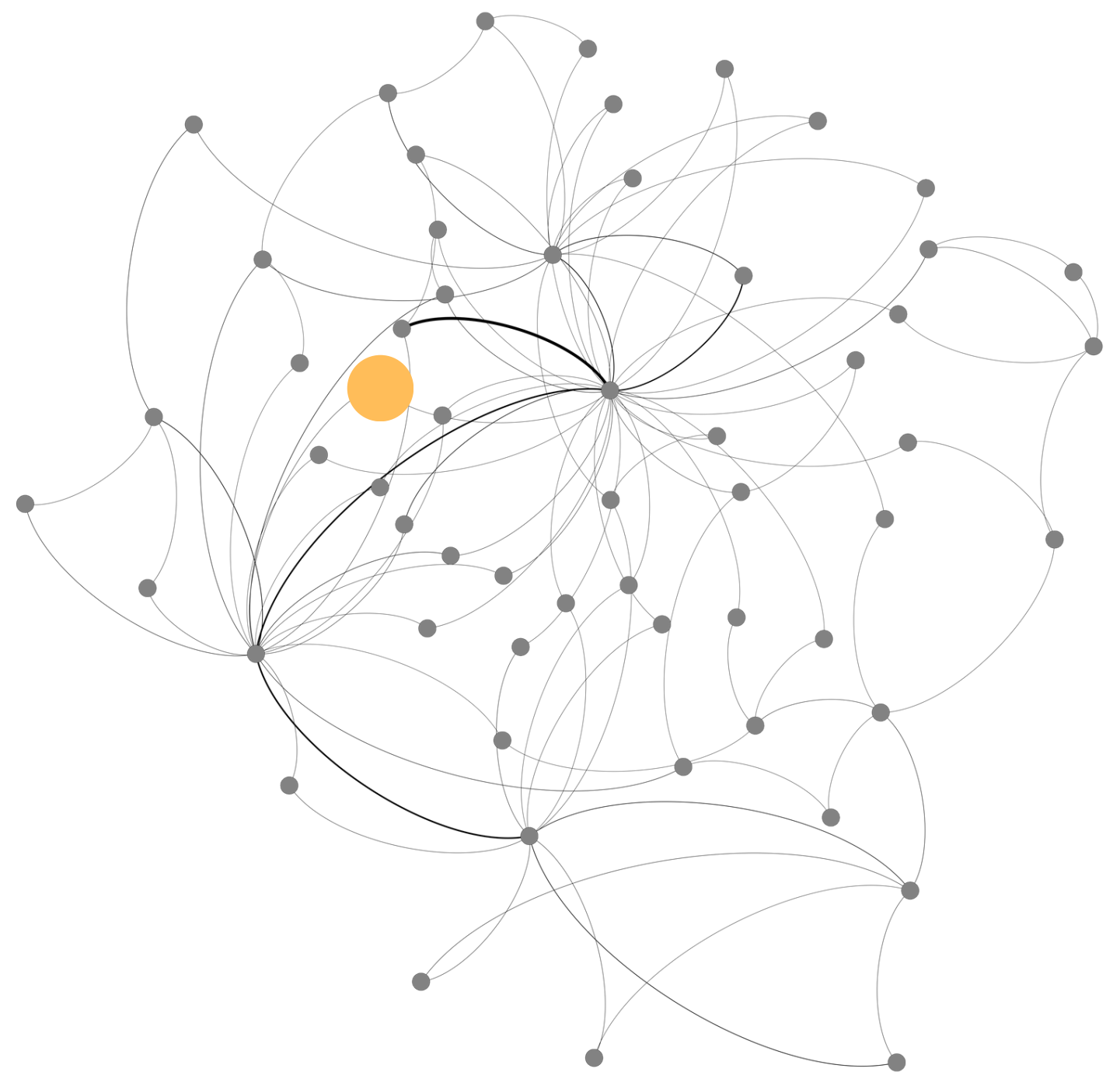


Indicators:

- Clarity and accessibility of analysis reports.
- Quality of techniques analysis of collected data.
- Role and efficiency of organizations that collect, archive, and analyze records.

Emergency Insurance Systems

This element assesses measures aimed at protecting public infrastructure through insurance mechanisms, regulating insurance markets, and ensuring the population's coverage against natural disasters.

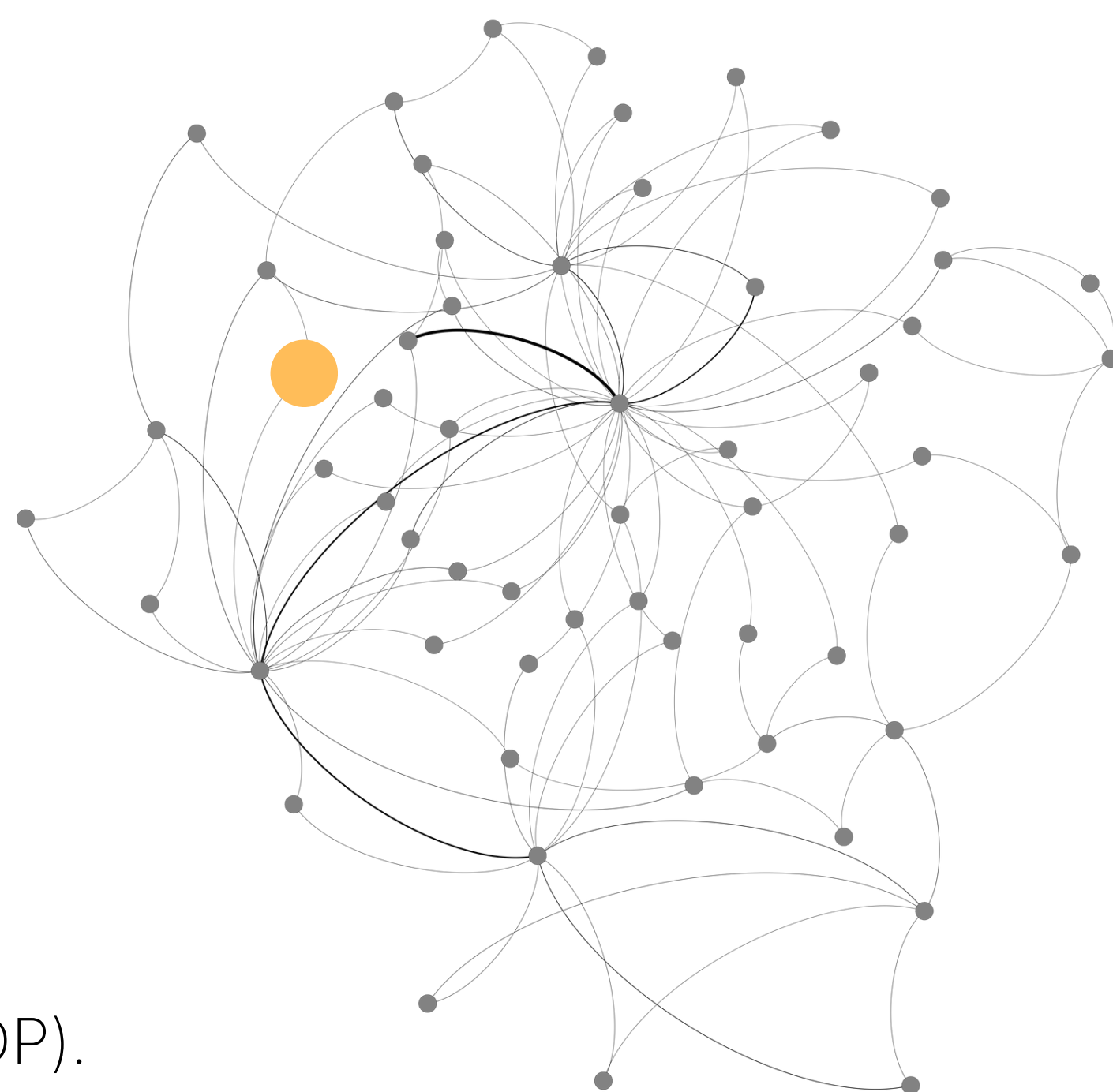


Indicators:

- Regulation of insurance markets.
- Insurance for public infrastructure.
- Percentage of the population with insurance that covers natural disasters.

Public Debt Management

This element assesses the amount of public debt assigned to each city resident, allowing for an evaluation of the local government's financial burden, its fiscal management capacity, and the impact on the economic and social development of the territory.

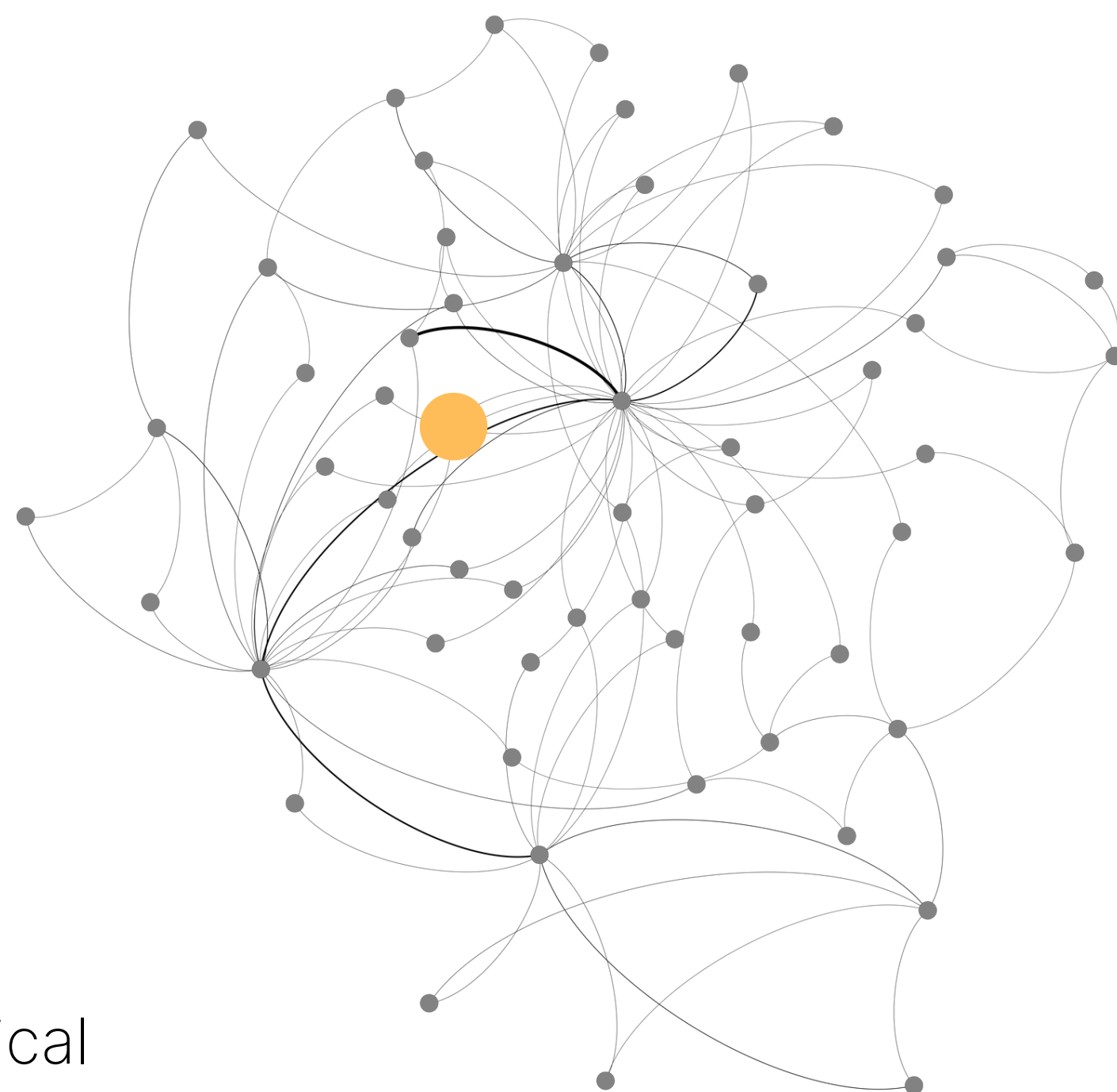


Indicators:

- City's public debt per capita. (% GDP).

Business Development

This element evaluates the presence of chambers of commerce and the role of local businesses in disaster recovery and management plans. It assesses the business sector's ability to support economic resilience, maintain operational continuity, and contribute to territorial recovery in the aftermath of crises or disasters.

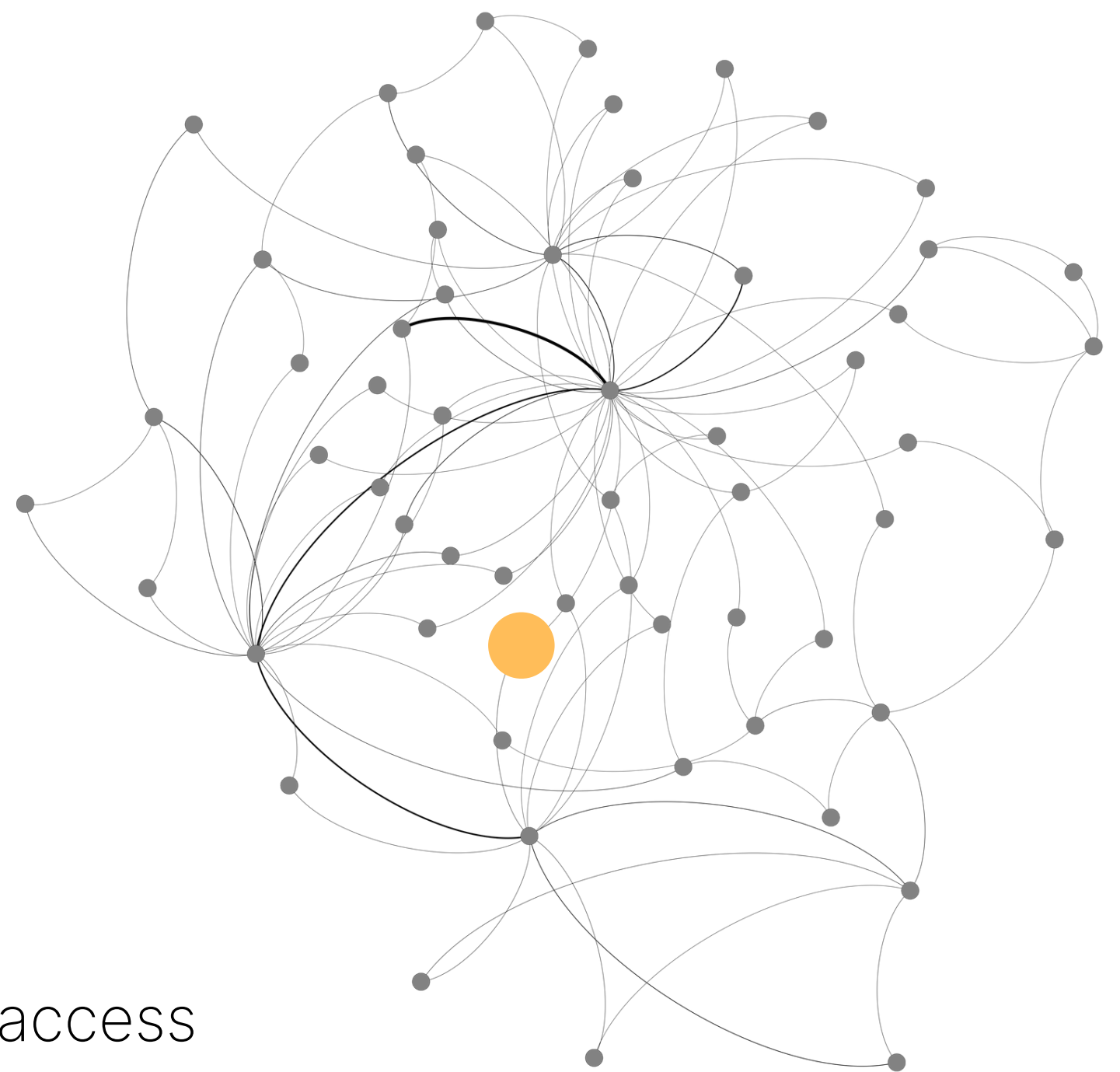


Indicators:

- Role of local businesses during critical situations.

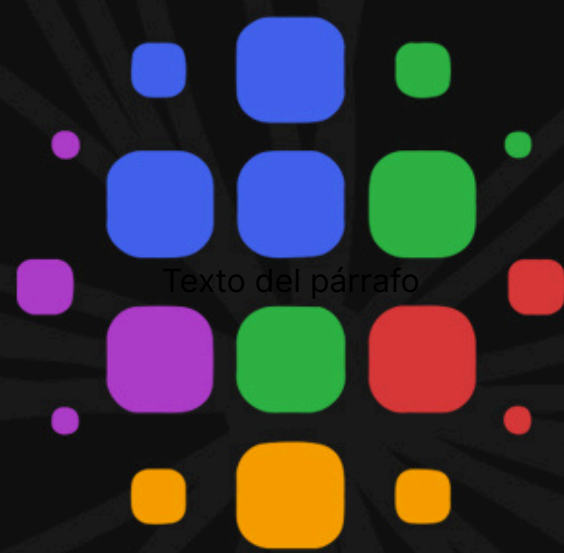
Access to Clean Drinking Water

This element assesses communities' availability and capacity to ensure access to safe drinking water, including the existence of emergency or drought storage systems, disaster-resistant supply infrastructure, and alternative supply sources. These indicators assess water security, crisis resilience, and the sustainability of water access for the population.



Indicators:

- Laws that protect the population's access to water.
- Percentage of communities with disaster-resistant water supply systems and alternatives.
- Percentage of communities with water storage systems for emergency or drought situations.
- Percentage of the population with access to drinking water.




CASA WEB TOOL USER GUIDE

Step 1: Create your account

<https://casa.futurecomplexity.com/main/en/index>

Enter the requested information and create a password.

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Create account

First Name

Enter your name

Last Name

Enter your last name

Occupation

Enter your username

Email Address

Enter your email

Password

Create a password

Retype Password

Confirm your password

Do you want to share the data that you will upload to the territory?

☐ Yes

☒ No

☐ ?

Register

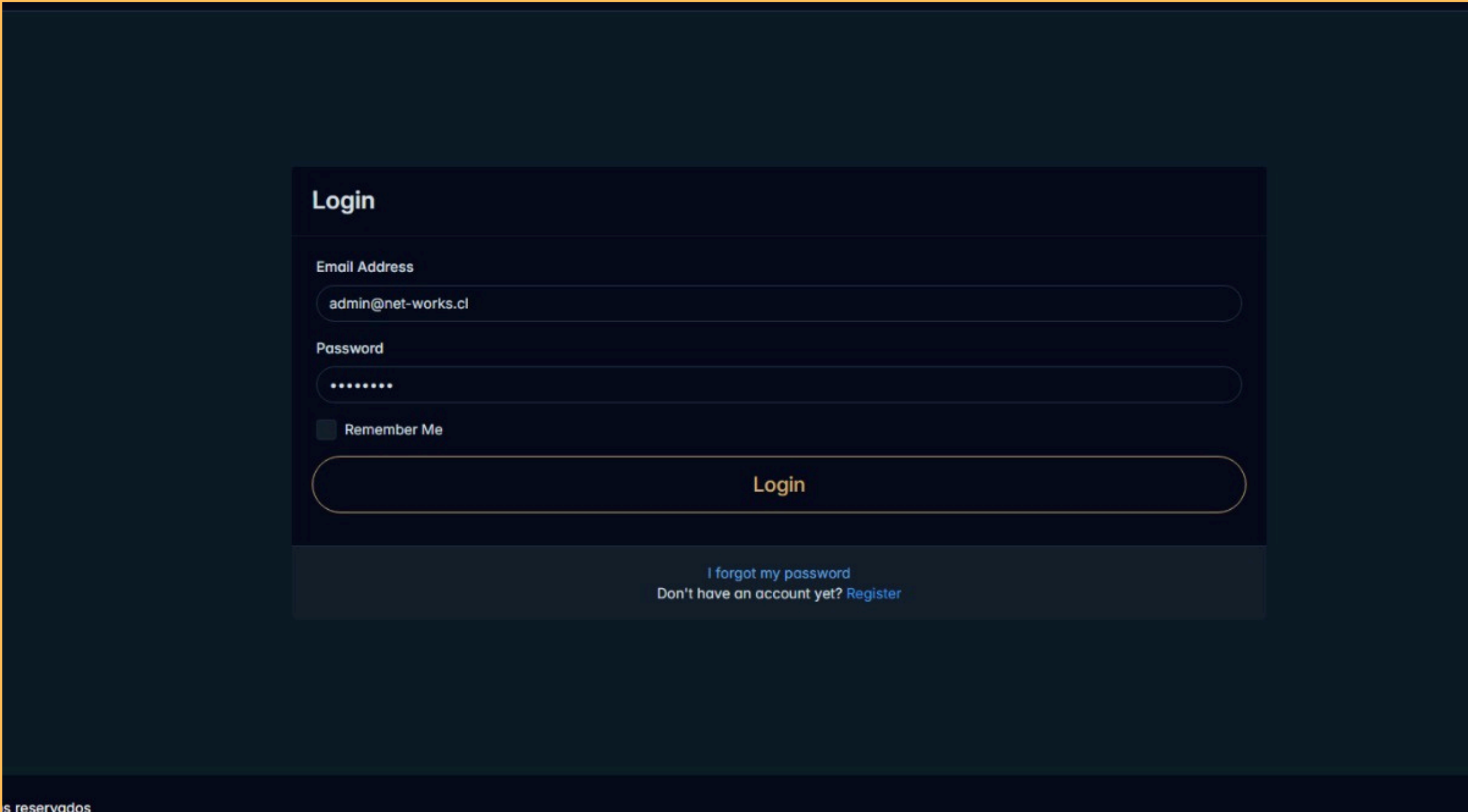
Already have an account? [Login](#)

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! Remember that you can choose to have the data you upload be public. That will allow another user to view, use, or edit it.

Step 2: Log in to the system

Using the CASA tool requires you to register in the system. This allows the data associated with the territory, as well as any results and simulations, to be protected under the User's session.

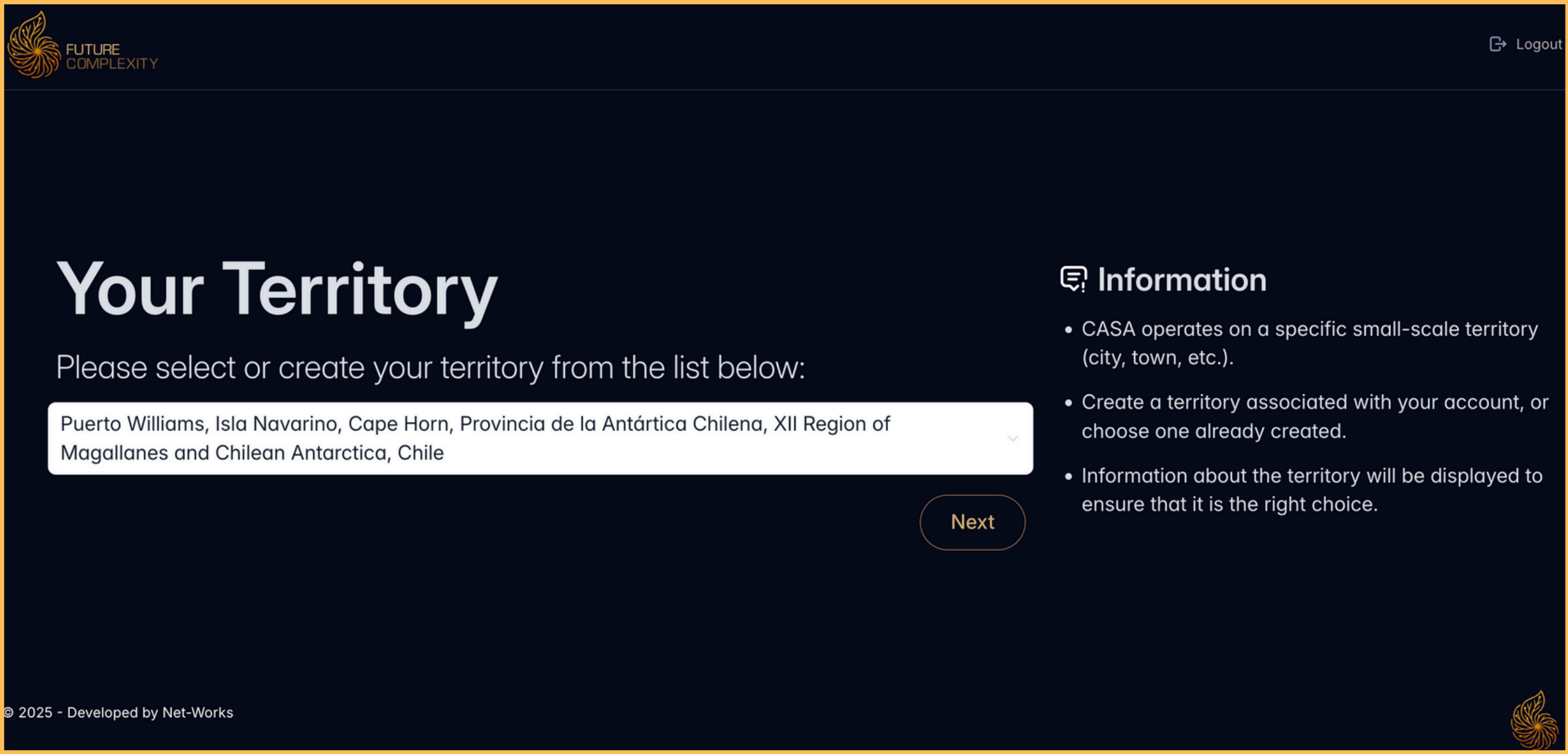


The screenshot shows a dark-themed login interface. At the top, the word "Login" is displayed. Below it, there are two input fields: "Email Address" containing "admin@net-works.cl" and "Password" containing seven dots. A "Remember Me" checkbox is located below the password field. A large "Login" button is positioned below the checkbox. At the bottom of the login form, there are two links: "I forgot my password" and "Don't have an account yet? Register". In the bottom left corner of the page, the text "s reservados" is visible.

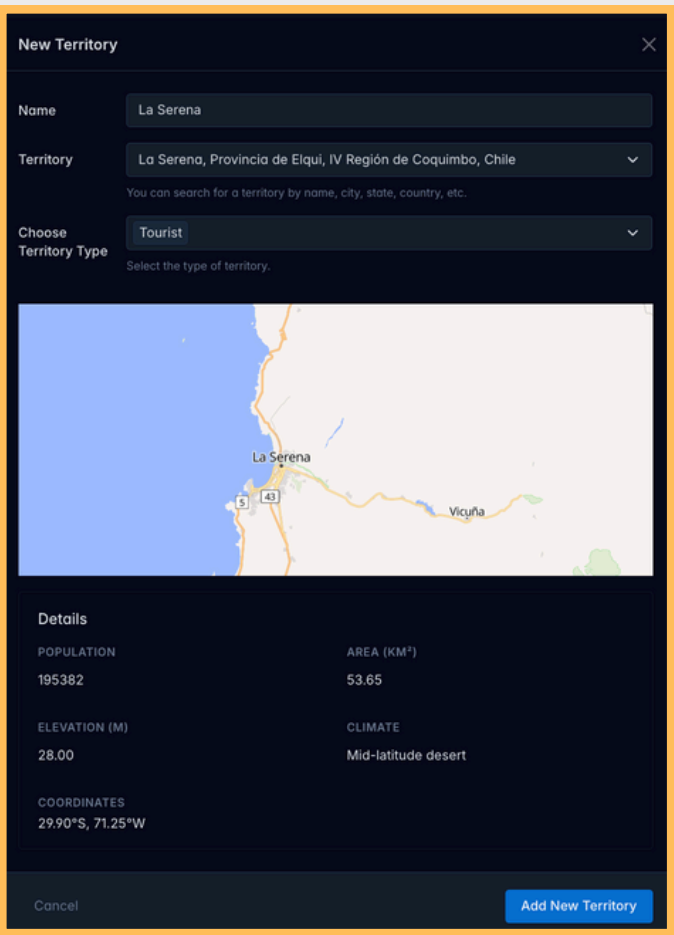
! Remember that you have the ability to make the data you upload public.

Step 3: Select or Create a Territory

CASA operates on a specific small-scale territory (city, town, etc.). Define a territory for your account as a first step, or choose one already created.



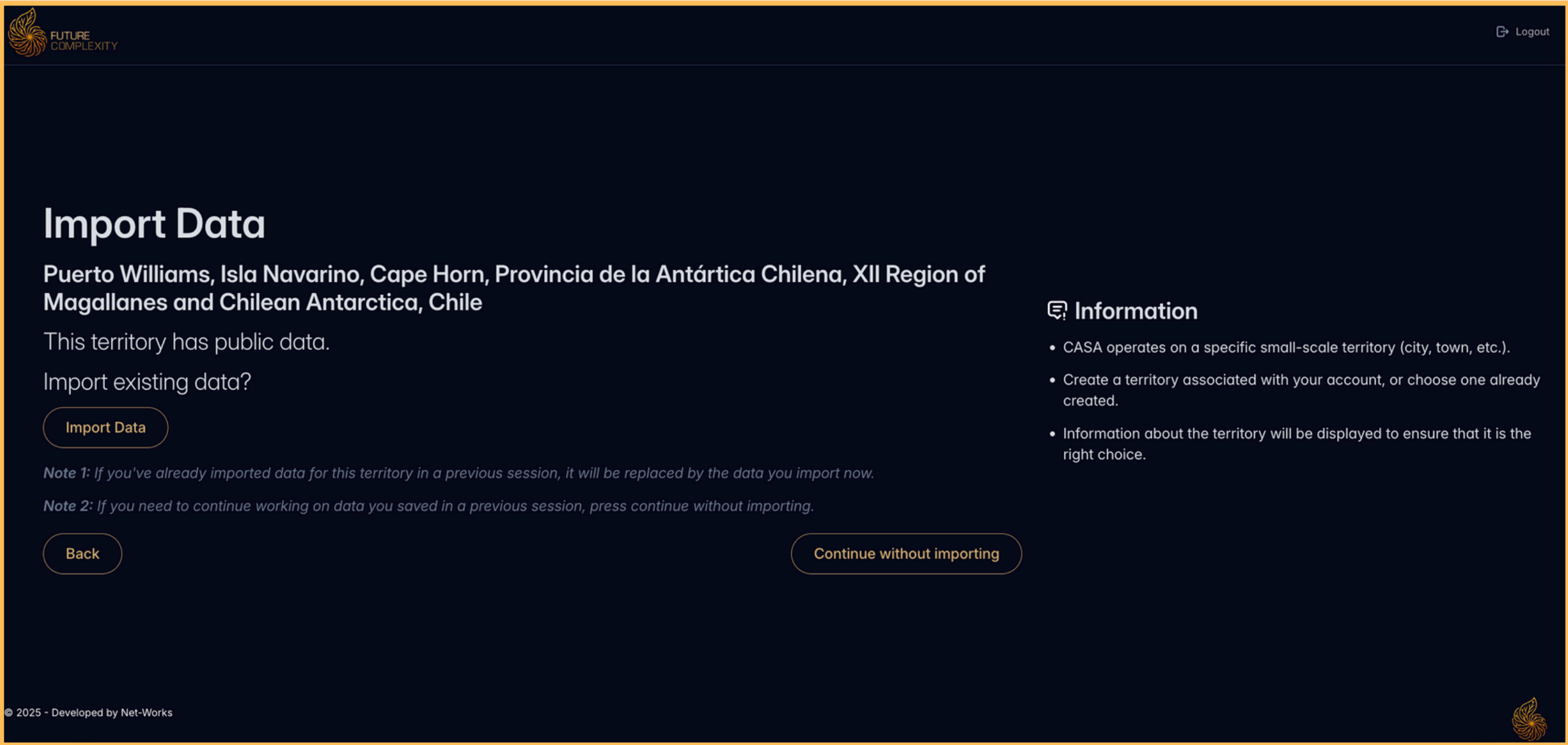
Information about the territory will be displayed to ensure that selection is the right choice. Try to choose “Preferred”.



! Important: Don't forget to characterize the **type** of territory.

Step 4: Import Data

If the territory you selected has data available for the CASA indicators, you can import them; if not, you can just **Continue**.



Important: You can Search for territorial data already uploaded by another user. If it’s useful, you can choose to import it into your account territory.

Step 5: Complete the indicators

The CASA framework is built to absorb public data. To begin filling the indicator buckets with data, you'll need to know sources for the appropriate data, the form of that data, and the reliability and completeness of that data. The quality of the information you provide is critical for the accurate and robust functioning of the tool.

Most of the indicators correspond to a qualitative assessment of a topic. Other indicators correspond to percentages, and others to quantities (e.g., number of doctors in the territory) or indices (e.g., GINI index). If you don't know the answer, you can leave that question blank.

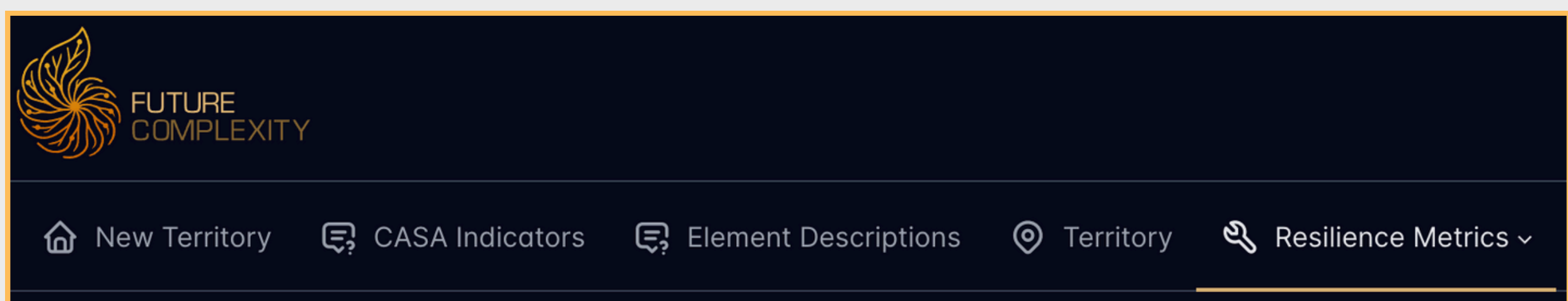
The screenshot displays the 'Questionnaire' interface for the 'GOVERNANCE AND ECONOMIC DEVELOPMENT' category, specifically the 'Public Budgeting And Financial Planning' section. The interface includes a sidebar with various categories like 'Governance And Economic Development', 'Banking and Financial Sector', and 'Sustainable Development And Risk Management'. The main content area shows a question about 'laws that allow local government to obtain resources' with a qualitative scale from 'Very Low' to 'Maximum'. Below this, there is a question about the percentage of the municipal budget allocated to critical infrastructure. A 'Summary' section shows 'Number of indicators: 2', 'Indicators without data: 1', and 'Element evaluation: 0.50'. At the bottom, there are 'Save Data' and 'Next' buttons. The footer indicates '© 2025 - Developed by Net-Works'.

! The CASA system requires that 90% of the indicators be answered to begin a mathematical analysis. Additionally, it can be helpful to other users to leave a comment about an answer. Let others learn from your experience. Also, remember to save your answers. The system allows modifications until you commit to a final answer - Save periodically.

Analysis tools

I. Analysis tools for the territory's current state of resilience

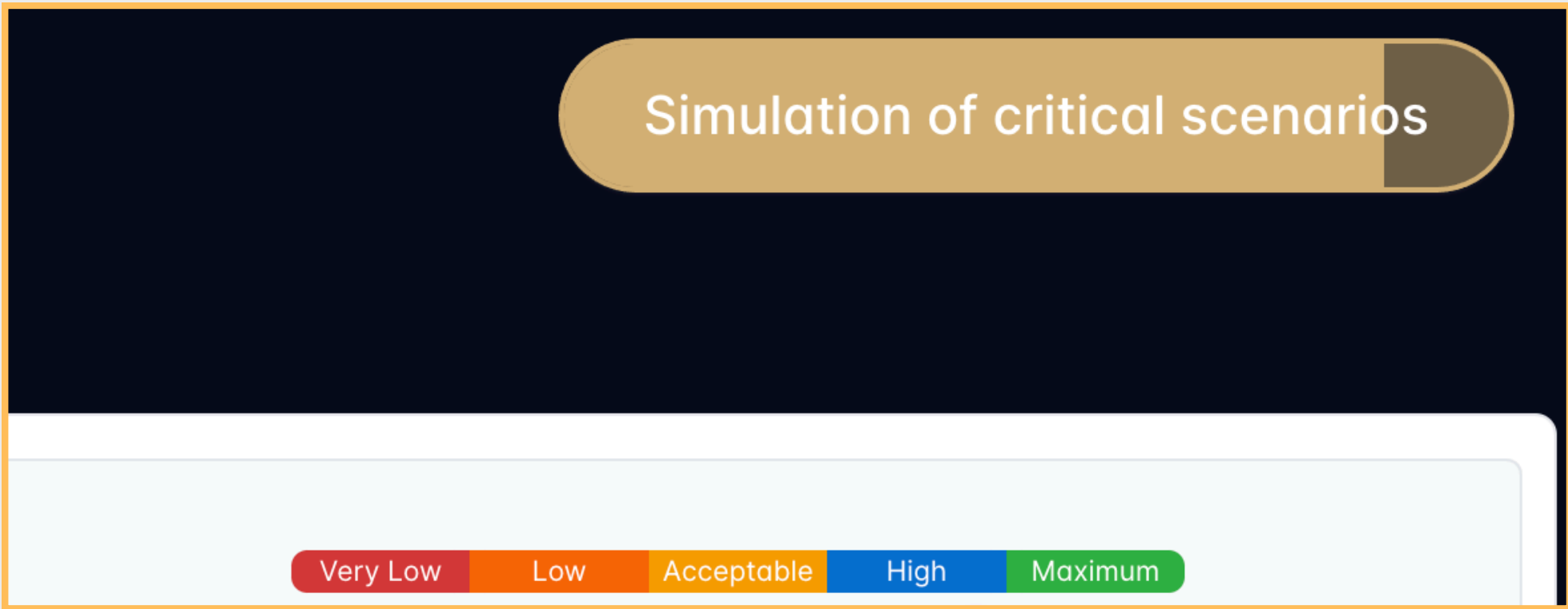
Once the territorial data has been entered, the user will have three options appear in the Resilience Metrics tab.



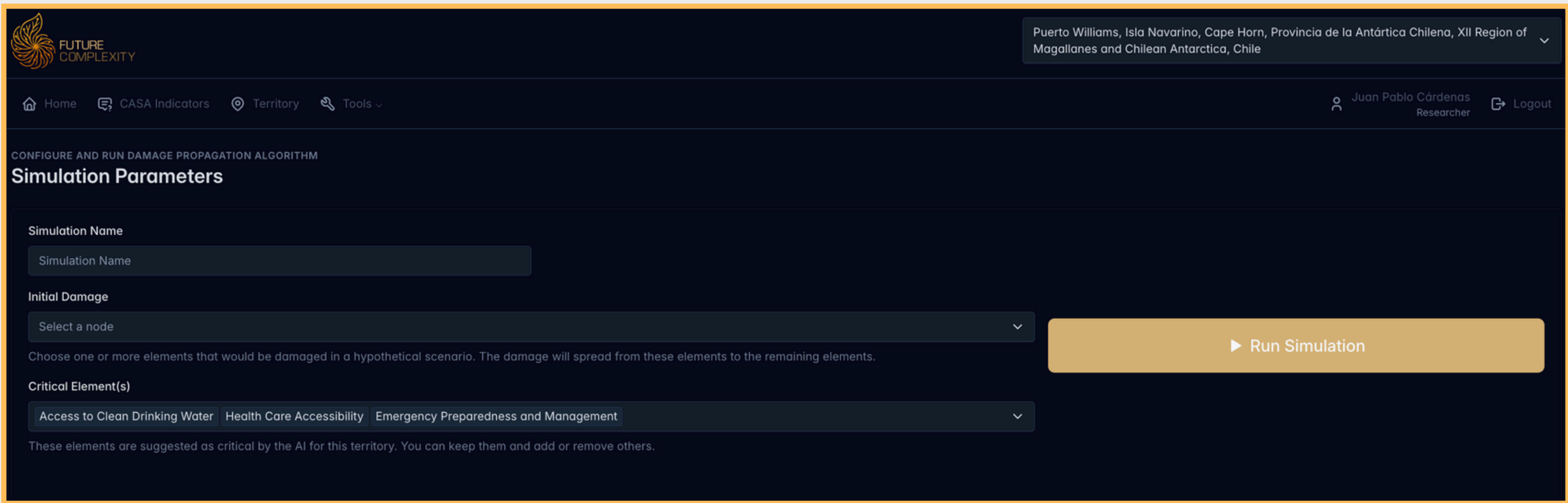
- **CASA model:** This is the network representation of the resilience capabilities discernable in each of the CASA elements.
- **Topological Resilience (TR):** This is the representation of the resilience capabilities installed in each of the CASA Superelements (polar graph) and elements (table), obtained from the systemic Analysis of Resilience (AoR).
- **Comparative TR:** This allows the user to compare two territories and their installed resilience capacities. Both territories must be created by the same user.

Analysis tools

II. Simulate Future Scenarios



Since CASA is a connected structure, where it is possible to reach any component associated with resilience from another, it is possible to simulate the propagation of damage as a cascade of events through the connections between components.



The user must incorporate simulation parameters:

- **Simulation name:** Choose a name to identify the simulation you made.
- **Initial damage:** choose one or more elements of social resilience as the initial propagation point.
- **Critical elements:** You will see the AI's suggestion regarding critical elements that may favor the spread of damage, given the geographic, demographic, climatic, and economic characteristics of the territory. You can add, delete, or change these elements.

Analysis tools

II. Simulate Future Scenarios

Once the simulation is complete, the user has three outcome options:

- **Critical scenarios:** These are future scenarios established by the AI, considering the characteristics of the territory and the *Affected Subjects* that arise from damage to elements during the simulation.
- **Model dynamics:** This shows the damage propagation on the CASA network, and the list of the principal *Affected Subjects* that appear during the simulation.
- **Critical infrastructure:** This is a geospatial representation of the automatically recognized critical infrastructure and how it is damaged during the simulation process.



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