Which path does the transfer of science follow in the iCASP network and how does it lead to change in organisations?

View of Ouse, Yorkshire, UK. Photo credit: Environment Agency

The Yorkshire Integrated Catchment Solutions Programme aims to translate environmental science into concrete solutions for land and water management, generating environmental, social and economic benefits to the Yorkshire region. iCASP fulfils this mandate through the establishment of a multi-stakeholder process connecting researchers and potential research users, and the promotion of integrated catchment management. A key part of this approach relies on fostering exchanges of science and interactions among science providers and catchment actors. This can stimulate ideas and innovations in sustainable management of catchment resources and creates impact from research. For this process to be successful, it is necessary to understand the direction of the flows of information among actors and their impact. By reflecting on its "operational system" and the efficiency of the model it promotes, iCASP has examined how information flows shape impact from research within its science-policy network composed of research institutes, government agencies, civil society organisations, and private sector actors engaged in regional land and water management.

This document presents the results from a baseline study, which captured the state of the network before the development of iCASP. A follow-up survey will be conducted at the end of the programme to establish how iCASP has influenced the flows of information and identify changes as a measure of iCASP impact.

What did we do?

We used the Social Network Analysis (SNA) method to visualise the network of iCASP actors and the flows of scientific information within that network. We sought to answer: which mechanism and path does the transfer of science follow in the network? How does it lead to, and shape, change in organisations?

SNA is a survey-based tool to investigate interactions between actors and social dynamics within specific policy domains, including how flows and network configurations influence the spread and adoption of change.

Social networks allow us to represent how participants are connected with each other. We conducted SNA with organisations engaged with land and water management in Yorkshire (*see Table 1*) to establish how the nature of flows of scientific information across organisations leads to impact (*see Text Box 1 for background information on this*). We conceptualised **impact as change in organisations** at three levels:

- **increased awareness**
- **operational change**
- **strategic change**

Table 1: SNA participant organisations (25)

Type	Sector (n)
Public organisation	Education, Research (6) Regulator (5) Park - nature management (1) Council (1)
Businesses	Utility (1) Consultancy (3)
Non-Governmental Organisation (NGO)	Environment / conservation (6)
Hybrid organisation / Partnerships	Multi-stakeholder-forum with businesses, public organisations, NGOs (2)

Text Box 1 - Impact from research and the role of information flows

Creating impact from research relies on a transformational process of science into something useful for, and beneficial to, someone. This requires the research to be accessible and understandable to potential users, and to foster a learning process. Enabling that process relies on producing change in domains like awareness, attitude, behaviour, and policy; and consequently on an effective sharing of information and knowledge between science, policy, and practice interfaces, which is a key component of the mechanisms through which impact materialises. The purpose and direction of flows of information are useful indicators of how meaningful and impactful the research is to others and how far it benefits them. The relevance of examining the role of networks that policy actors form to understand how impact from research can be shaped is further justified by the fact that other factors like institutional arrangements and capacity to implement change influence the possibility of organisational change. Interactions and knowledge flows are particularly important in the domain of environmental management, as they enable regular updates of knowledge to address changing conditions and uncertainty, helping to promote common understanding of the problem and capacity to design suitable responses.

What did we find?

We distinguish the view of the providers from the view of the receivers, in order to identify organisations that generate and those that experience change from using science (*Text Box-2 for information on network representations*)

More than half of organisation reported that they provided scientific information to others. Public research institutes (purple nodes in Figure 1) are the most important providers.

Views of providers captures the intended purpose of providing scientific information (ie the change they intend to induce in others). Views of receivers reflects the reported use of the scientific information, and therefore the reported organisational change

Two organisations including a regulator (*orange node in Figure 1*) are the major targets for scientific information provision and for change. Most organisations (88%) indicated that they receive scientific information from others. One of the regulatory organisations is recognised by the others as a major provider (*orange node in Figure 2*), and also plays the main role in transferring scientific information to others. The main **brokers of scientific information** (see definition in Text Box 2) impact others across all levels of change

Text Box 2 – Our Social Network Analysis (SNA)

Nodes represent organisations. They are connected through different relations, either one way: an organisation provides scientific information to another, or two-ways: an organisation provides scientific information to another and vice-versa. The number of organisations' outgoing relations help to identify "**central" organisations** in providing information to others, which occupy advantageous positions and are well placed to shape the process of change. The bridging capacity of an organisation to connect other pairs refers to the extent to which it plays the role of "**knowledge broker**" and facilitates information flows.

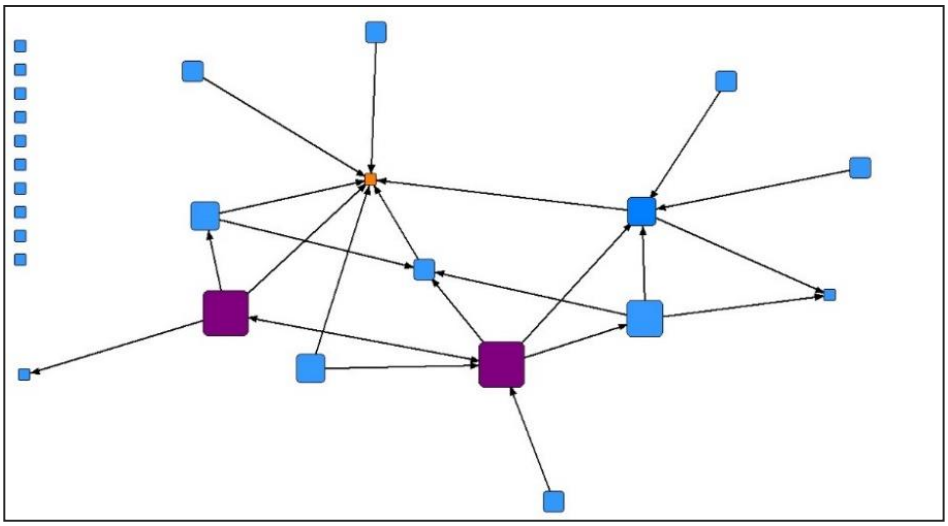

Figure 1: Provision of scientific information from the perspective of providers. Node sizes are proportional to number of outgoing relations. Purple nodes - research organisation, orange node – one of the regulators, blue node - others

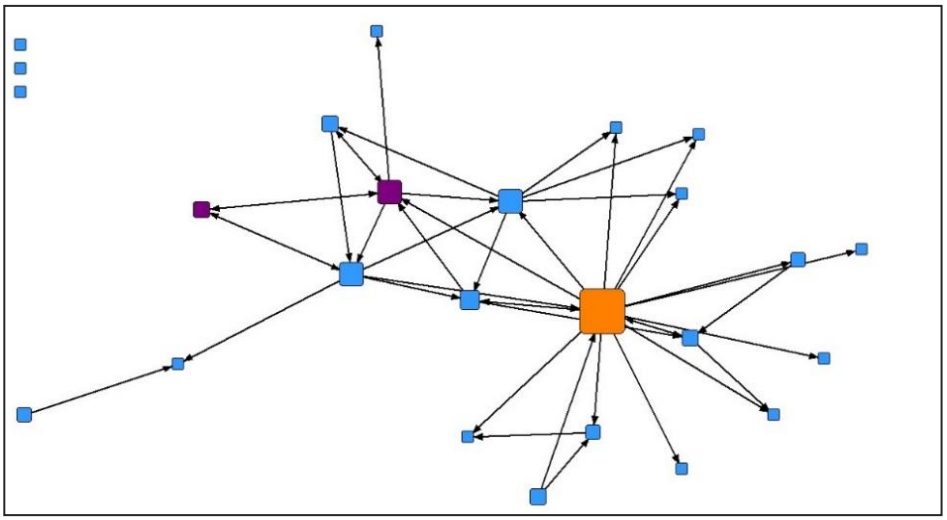

Figure 2: Provision of scientific information from the perspective of Receivers (node sizes proportional to number of outgoing relations). Purple: research organization; Orange: one of the regulators; Blue: others

- **Providers and receivers have different views on to whom and by whom the information is provided.**
- **Scientific information does not go directly from providers to recipients. The impact**

delivery mechanism is mediated in two steps, through brokers: 1) from public research institutes, through public regulators, and to a lesser extent other actors like a utility and environmental NGO, who impact the main regulator across the three levels of change, which in turn, 2) impacts numerous other policy actors in the network

- **In Yorkshire, regulatory bodies are the major knowledge brokers.**

We analysed whether intended organisational change translates into reported change:

- **For each of the three levels of changes, intended impact does not often transform directly into reported impact.**
- **However, impact also occurs via unintended routes across all three levels of change within organisations.**

We also looked at the exchange of general information (*Figure 3*) to contextualise exchange of science. Most organisations maintain either formal information exchanges among each other (58.2%) or many maintain both informal and formal exchanges (35.0%). While we find the usual prospects for the popular organisations with which to exchange general information and brokers, we also note the role of more peripheral organisations (partnerships) in connecting others. All organisations that reported an actual change from using science entertain formal exchanges with others (in addition to informal exchanges).

Informal exchanges refer to the sharing of information, documents and reports by email or phone, at workshops or meetings. Formal exchanges refer to exchanges occurring as consultancies, commissioned work, secondments or joint research projects.

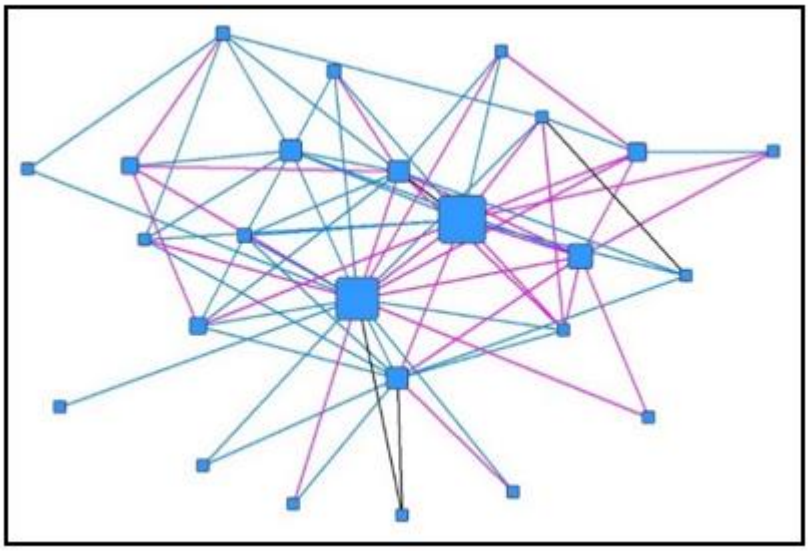

Figure 3: Exchanges of general level information (nodes sizes proportional to capacity to connect organisations); informal exchange = grey; formal exchange = blue; multiplex: both informal and formal exchange = pink lines

- **Information exchanges based on formal agreements could lead to stronger relations than informal exchanges, facilitating organisational change. Smaller organisations have a role to play in fostering the exchange of science.**

Last, we assessed whether organisational characteristics affect the capacity of organisations to generate and facilitate impact from research. First, the presence of a regulatory power is likely to lead to higher reception of scientific information from others. Second, organisations having a wider operational scale than Yorkshire are more likely to reach a higher number of organisations within the regional network in providing scientific information. Notably, we find no significant effect of

regulatory power (or operational scale) on capacity to bridge science. This shows that other (smaller) organisations should not be underestimated in their role of brokers.

Key result

This study provides an understanding of how information flows in science-policy networks can explain reach (i.e. number and range of organisations reached by science) and significance (i.e. level or magnitude of the organisational change) of impact from environmental research. For the iCASP network, organisations occupying central positions facilitate the transfer of science and influence the level of impact achieved. Yet, effectiveness of the flows of information and impact generation is highly dependent on knowledge brokers (among which public regulatory bodies play a critical role), that enable connecting agents with others. Moreover, impact intended by science providers does not often transform directly into impact as reported by the receivers of the scientific information. However, impact also occurs in unintended ways across three levels of change within organisations.

Note: the results are place-based, i.e. specific to the network and to the region, and field specific (environmental science), meaning that the shaping of impact is partly conditioned by the boundaries of the analysis.

What can be learnt from this?

The implications of these results for practice are as follows:

- Effective sharing of science that leads to impact depends on the presence and ability of brokers that are in contact with the organisations producing change in others. Brokers are key to the process of converting research into impact. Besides facilitating information flows, they have potential to improve mutual understanding and facilitate capability building among actors they help connect. In iCASP the regulator organisations are the main broker.
- (Smaller) organisations in the network contribute to others knowing about each other's activities and receiving regular updates, creating social capital and trust. They could be key agents in facilitating science-based interactions.
- Optimising the type of change induced in an organisation could gain from enhancing communication further and increasing transparency in terms of specific needs/requests of information, and how existing information in the network can meet those.
- The higher number of reported impacts as compared to the intended ones across the highest levels of change indicates that the use of science may lead to impact, while the reach and significance are broader than expected. This stresses the importance of a programme like iCASP to help reveal the actual impact of science, and enhance it.
- The legacy of such a network depends on a continuous learning process among actors, which will contribute to increasing our social capital, mutual understanding, cooperation in decision-making, and the design of suitable solutions and interventions.

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If you find this report useful, we are keen to hear your feedback and how you used it: icasp@leeds.ac.uk

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