## **Appendix 3:** Results

### 1.1. Key drivers and core processes of wetland restoration initiatives in Belarus

At the overview level, each case comprised an inter-connected system (Fig. 4) consisting of three sets of key drivers: a) the institutional environment and regulatory system, b) adequacy of leadership, and c) the wetlands ecosystem itself; and five core processes, relating to the adequacy of 1) plans, 2) support, 3) inputs, 4) activity rates, and 5) learning and knowledge processes. Sections 4.2 – 4.6 unpack the dynamics of each of the core processes and relationships with drivers.

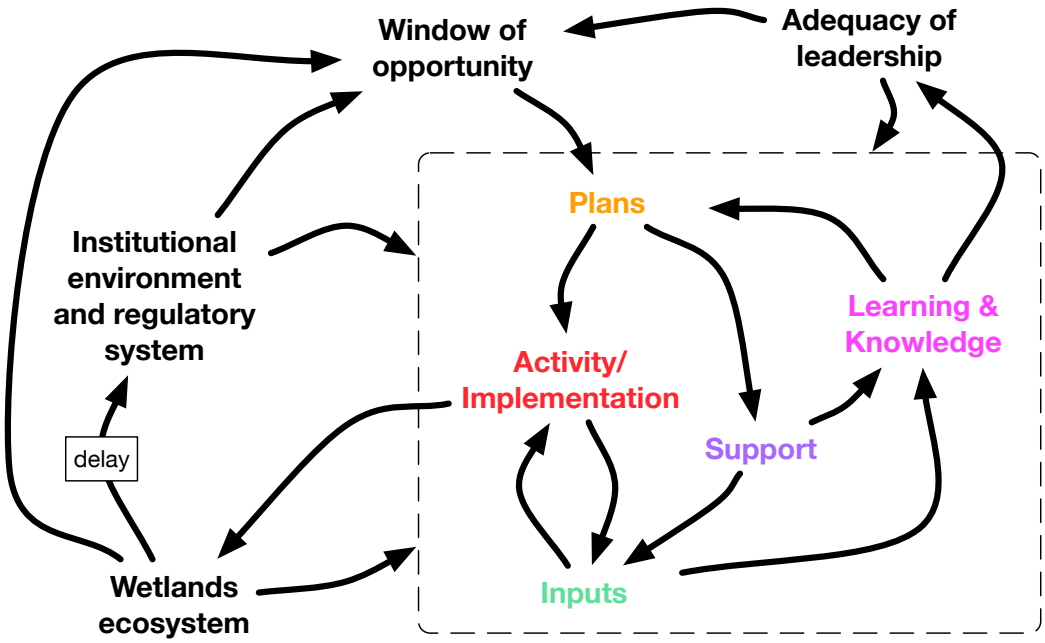


*Figure 4 (from main paper). An overview level CLD, synthesising the core dynamics of studied wetland restoration initiatives in Belarus. Three sets of drivers triggered windows of opportunity and subsequently influenced five core management processes (in dashed box). Arrows connecting directly to dashed box indicate the influence of a given driver on multiple processes within the box. Figures 5 – 9 unpack the dynamics of each of the core processes and relationships with drivers.*

Interviewees frequently referred to historical institutional legacies, regarding the Soviet Union, its dissolution, and subsequent rapid changes in land use. Soviet-era land-use practices and mis-management were identified as a primary cause of the generally deteriorated state of many natural wetlands. Key economic drivers, such as lack of state funding for ecological initiatives, were linked to the continued fallout of the post-Soviet transition. Soviet-/ transition-era policies were also identified as underlying rural depopulation trends, which impacted local livelihoods

and availability of relevant knowledge. Such legacies underscored a variety of contemporaneous drivers (e.g. focus on domestic energy security) leading to the development of plans in each case.

Interactions between these legacies created windows of opportunity triggering sustainability initiatives, and shaped the main thrust of key long-term objectives. For example, Soviet drainage and land-use regimes led to catastrophic bog fires when combined with intentional fire-setting behaviours among local peoples to reduce tick abundance. The scale and frequency of these fires became a call to action. The apparent failure of initial state-based responses, such as investment in fire-fighting infrastructure, provided opportunities for fire prevention through hydrological restoration.

The ability to perceive these windows of opportunity required specific educational and professional backgrounds, personal interests and value systems, and employment status. Project initiators were all situated in decision-making capacities (e.g. director of NGO, chief engineer, etc).

## 1.2. Adequacy of plans

*Adequacy of plans* (Fig. 5) encompassed a spectrum of formal and informal documents and processes, intended for either internal and external use. According to interviewees, adequate plans included *clear, well-prioritised objectives*, and *novel ideas and innovations*, and were developed through iterative *planning processes*. Adequate plans integrated broad sets of *knowledge* (e.g. regarding problem urgency, or financial requirements and opportunities), and were able to sufficiently identify and mitigate *perceived risk*[1].

[1] Results regarding knowledge and risk are presented separately in subsequent sections.

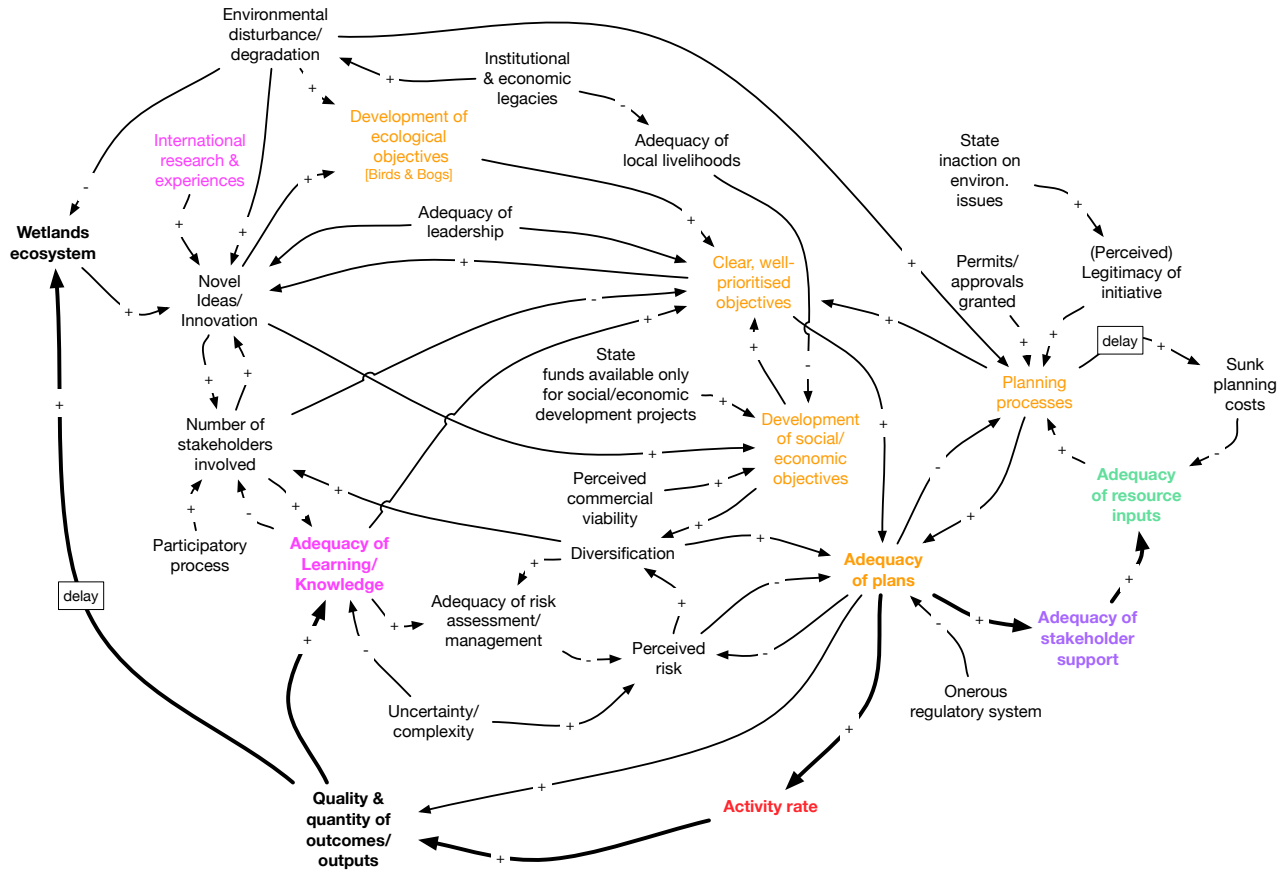


*Figure 5 (from main paper). Sub-model unpacking the causal dynamics influencing the Adequacy of plans for wetland restoration initiatives in Belarus. Core processes are in bold. Coloured non-bolded variables represent specific concepts unpacked from within respective core processes. E.g. Clear, well-prioritised objectives is a facet of Adequacy of plans. Thick lines represent links between core processes. Several variables recur throughout Figures 5-9, representing points where core process dynamics link together in an integrated model[2].*

### 1.2.1. Clear, well-prioritised objectives

Cases Bogs & Birds were initially driven by a set of *ecological objectives* focused on restoration and sustainable management of degraded wetlands ecosystems. These were subsequently expanded to encompass *social/economic objectives*. Case Berries focused initially on achieving the latter, although well aware of the importance of a functional ecological system as a basis for material inputs into his production system. Interviewees stated that the inclusion of social and/or economic objectives was an important factor to provide clearer *alignment with the objectives of other key stakeholders* (Fig. 5), especially state authorities at various levels, who were perceived by interviewees to strongly prioritise socio-economic development. Very few

[2] Result CLDs here represent artificially disconnected parts of an interconnected system, separated diagrammatically for the convenience of the reader in accordance with the core processes identified. However, a fully interconnected model is diagrammatically inefficient for the purposes of this article.

*state funds*, or other forms of state support, were available for initiatives with solely ecological aims. Objectives were therefore developed and framed in terms of positive outcomes for *local livelihoods*. Explicit socio-economic rationales were also highly prioritised by other stakeholders, e.g. small businesses.

#### 1.2.2. Novel ideas and innovations

A keen motivation to innovate or seek novel solutions to complex challenges was a personal characteristic of *leaders*. *Novel ideas* (Figs. 5, 6 & 8) were often inspired by components of *wetlands ecosystems*, e.g. the abundance of species or natural materials. Otherwise, *international research and experiences* were an important source of novel ideas, which attracted the involvement of other stakeholders, provided the basis for diversification strategies, and stimulated cross-sectoral collaboration. The iterative development of objectives and the input and/or limitations of various *stakeholders* also provided a frame upon which further ideas and innovations were constructed.

> "We have already started two production lines, and are now looking for an opportunity to use the remaining swamp biomass. We are already considering a new project, in which the main issue is the sustainable use of the biomass." [Case Birds]

#### 1.2.3. Iterative planning process

*Planning processes* (Fig. 5) concerned the development of strategic and operational objectives, and identifying the knowledge and input requirements, processes and organisational structures necessary to achieve these. In all cases, planning was a dynamic, iterative process changing over time as new ideas, knowledge, stakeholders and inputs came to hand. For example, changes in governmental *regulatory systems* necessitated plan revisions. However, planning was highly dependent on *adequate resource inputs*, primarily human and financial resources. Thus, whilst all interviewees suggested that iterative planning was important to incorporate new knowledge and adapt to changing circumstances, they also identified an unwillingness amongst stakeholders to continue to revise plans if significant time and other resources had already been spent developing them. As such, a *sunk cost* effect effectively set in, limiting further planning.

Planning was generally undertaken by the initiating organisation, before plans were presented to key stakeholders, usually government authorities, for approval. In some cases, permissions were required prior to the commencement of planning. As such, the *perceived legitimacy of the*

*initiative* was an important factor in greenlighting *planning processes*. For example, the leader for case Bogs petitioned government authorities to be allowed to develop a management plan for Jeĺnia wetland. Subsequent governmental permission recognised the NGO as responsible for coordinating plan development, although further permits were required to approve the plans for implementation. In cases Bogs and Birds, planning processes were often highly bureaucratic, including formal *participatory processes*. The roles for stakeholders in such processes varied. Central authorities provided an important source of *knowledge* in terms of data. Public involvement, however, was essentially cosmetic, providing little or no real contribution to planning processes. Planning in Case Berries, on the other hand, had become less formal and/or more unilateral with time, as partnerships with state authorities were wound down for a variety of reasons, e.g. privatisation of state-owned land, elimination of state-fixed prices on confectionary planning, etc.

> "In the early stages, when prices were regulated, we were directly dependent [on the authorities]… Today we handle everything ourselves. The only thing is: we are very strictly controlled by the state." [Case Berries]

## 1.3. Adequacy of stakeholder support

*Adequate support* (Fig. 6) of external and internal stakeholders was essential for the provision of a wide variety of essential *permits and approvals*. The degree of dependency on stakeholder support varied across the cases. The leader for case Berries, for example, perceived a considerable degree of self-sufficiency, albeit remaining dependent on permissions. Both leaders for cases Birds and Bogs expressed a greater need for stakeholder support, partly due to an increased exposure to regulatory requirements, and also for *inputs* (especially financial).

### 1.3.1. Cultivating relationships with governmental decision makers

The support of lower-level authorities was influenced by support from above. For this reason, the *support of key governmental decision-makers* was crucial. The support of such individuals was also important to the initiative's *brand visibility*, indirectly driving additional support, or quelling potential opposition.

> "I quickly found support in the chief engineer at the Institute of Nutrition. He became enthusiastic about the idea and we began to develop a serious production line." [Case Berries]

"We have very good relations with the Ministry. [Senior official] has a Ph.D., worked at the Institute of Experimental Botany. He understands all these issues and is interested in what we are doing. He is a fisherman and owns a house in the village so it is very easy to work with him. And among all other Ministries, all of our novelties and innovations are perceived with great appreciation and interest." [Case Birds]

"The word from the Ministry means a lot at the district level…Vice Minister [name] supported us and said that it was necessary to save Jeĺnia. They never refused to support… [Former NGO Director] convinced him. It was fast." [Leader for case Bogs]

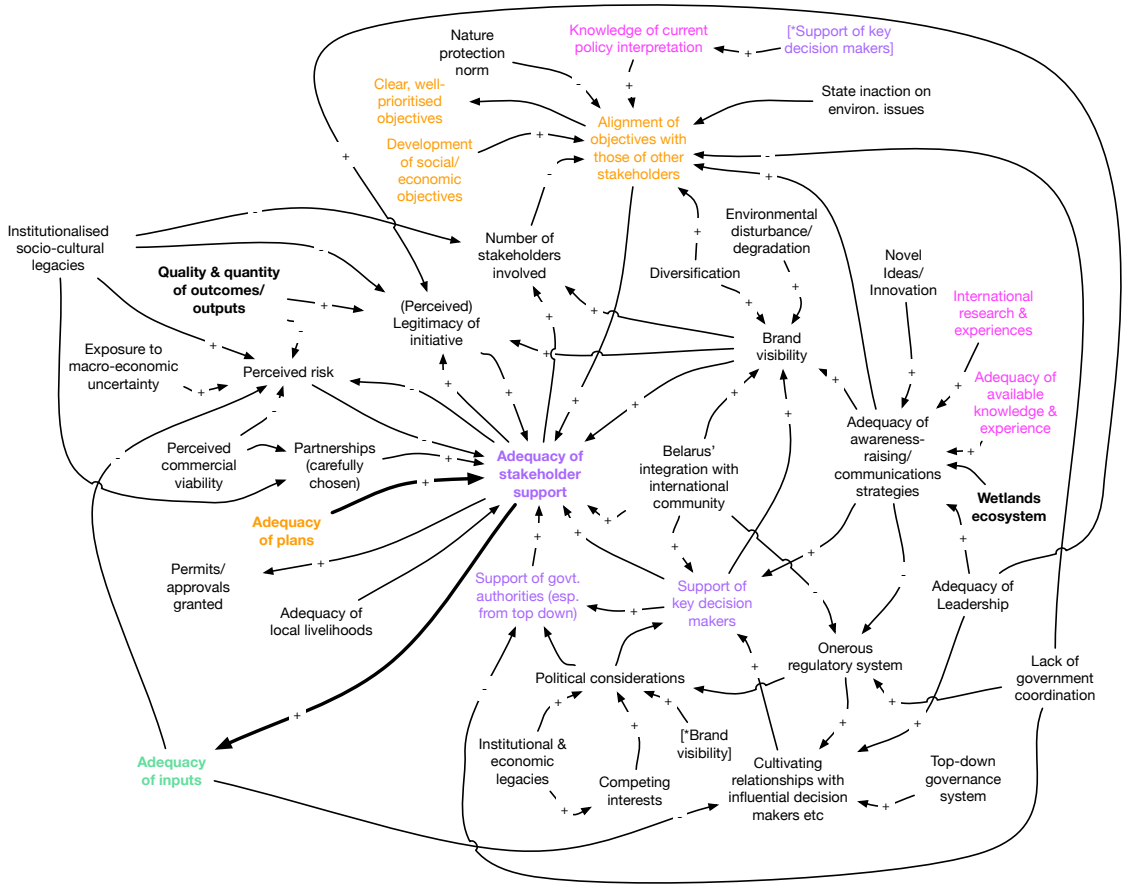


*Figure 6 (from main paper). Sub-model unpacking causal dynamics influencing Adequacy of stakeholder support, which is partially disaggregated in this diagram to clarify key dynamics relating to the support of two important stakeholder types, government authorities and key decision-makers. Whilst other drivers of support, e.g. brand visibility, or legitimacy of initiative, also influence these sub-concepts, these relationships are not explicitly represented here, for the sake of diagrammatic clarity and to avoid double-accounting.*

*Cultivation of personal relationships with influential decision-makers* was an efficient means to leverage support from lower instances without expending resources convincing each of them. In addition to imbuing *legitimacy*, the support of a higher government authority effectively limited the risk exposure of lower bureaucratic instances. Importantly, personal relationships

with key decision-makers provided valuable *knowledge of current interpretations of policies* and strategies, so that plans and objectives could be aligned to secure inputs and/or permissions. However, personal relationships were not always a guarantee of continuous support. Key decision-makers were also influenced by a range of *political considerations,* including a spectrum of socio-economic development challenges and the objectives of *competing interests*, e.g. resource extraction lobbies. Political considerations also captured a broader set of political dynamics e.g. inter-agency envy or embarrassment. *Brand visibility* and the *adequacy of awareness-raising/communications strategies* were also factors identified as influencing the support of central authorities and decision-makers.

The identity of key decision-makers differed amongst the cases. Although government authorities were always important, interviewees identified a temporal aspect, stating that who was key depended on the development phase of the initiative. Following price deregulation of the confectionary industry, The leader for case Berries perceived no further need of contact with upper echelons of power. The leader for case Bogs stated that rather than one single key decision-maker there was a chain of relationships among key individuals that was important to maintain, including the initiating person, the minister for natural resources and environmental protection, the CEO of the main sponsor (Coca Cola), and the director of the NGO.

#### 1.3.2. Alignment of objectives with those of other stakeholders

The leaders for all cases stated that support was highly influenced by the degree to which objectives aligned with those of a given authority, or other influential stakeholders, and by extension with those of the individual persons representing that authority.

> "We can't do anything without the authorities, because they regulate everything. It was difficult in the 1990s, but their orientation has changed: now it is important to develop the business sector. Our company is like a business card for the district. Now we don't have problems with the authorities." [Leader for case Berries]

Leaders for all cases identified cross-sectoral benefits resulting from their initiatives. The leaders of cases Berries & Birds positioned themselves, from opposite directions, at a science-industry nexus, in order to develop innovation-based collaborations. The leader for case Bogs identified a complementarity of resources and requirements amongst various actors.

> "We [NGO] have ideas but lack resources. The government has no money and no ideas. UNDP have money but no ideas. Coca Cola needs PR. For the little money they invest into Jeĺnia, they would never receive this kind of PR anywhere else." [Leader, case Bogs]

However, a general lack of policy coordination and integration across different sectors was perceived to lead to conflicting objectives amongst government authorities, who otherwise operated within tightly restricted fields of action. Thus, a greater *number of stakeholders involved* presented a potential barrier to *alignment*, increasing the difficulty to identify potential "win-wins".

According to interviewees, most stakeholders conflated environmental projects with *nature protection*, which was perceived as helpful in terms of providing regulatory controls to curb *environmental degradation* (Fig. 9). However, the "protection mentality" of some stakeholders was said to restrict management alternatives and the freedom of projects to identify, innovate and frame novel "win-win" solutions.

> "Any restrictive actions must be accompanied by real economic activities that sustain nature conservation." [Case Birds]

Support at the local level, in terms of residents, land users and local authorities, was strongly influenced by the degree to which planned activities might improve *local livelihoods* (Figs. 5&6). Active *awareness-raising and communication* efforts were tailored to highlight goal alignment and to more generally shape perceptions by managing *brand visibility*.

Despite having little power, interviewees remained wary of agitating local rural residents. Support in several instances across the three cases was characterised by the lack of opposition, from local residents or authorities.

> "In contrast to many other districts, neither the local population nor the local authorities were indifferent…I do not remember anybody strongly complaining." [Leader, case Bogs]

#### 1.3.3. Brand visibility and communication strategies

*Brand visibility* (Figs. 6, 7A & 7B) referred primarily to the visibility of initiative-driven activities, outcomes and products, and of the organisation chiefly responsible for planning and implementation. Additionally, it related to the visibility of underlying environmental problems

stemming from wetland degradation. Brand visibility was an important driver of *legitimacy* and *stakeholder support*.

On the downside, greater *visibility* had implications for political considerations, potentially agitating stakeholders with alternate agendas or *competing interests*. Visibility was also said to attract *rent-seekers* (Fig. 7B) and raised the stakes of failure or other negative outcomes.

The *adequacy of public awareness-raising and communications strategies* were instrumental in growing brand visibility. *Available knowledge and experience* as well as *adequate leadership* were important factors in the development and implementation of these strategies (Fig. 6). Active communication of initiative-derived knowledge established the profile of the initiative in new forums and with other similar organisations.

Unique selling points were central to communication and awareness-building. To this end, *international research and experiences* helped counteract the habituated blindness of locals to identify unique aspects of the ecosystem, e.g. abundance of charismatic species, or its consumer-friendly benefits, e.g. wild foods. *Novel ideas and innovative approaches*, e.g. circular economy, also provided useful talking points and grabbed attention.

> "We always get help and support, because the aquatic warbler is on everyone's lips. We came to the swamp and saw an old lady asking: Guys, do you know that the aquatic warbler appeared here? Yesterday, the chairman of the district executive committee asked: How is the aquatic warbler? It's very helpful to have this targeted flow of information to create mutual understanding and solve problems." [Leader, case Birds]

The degree to which Belarus sought to *integrate with the international community* was identified as an important driver of *international support* and *brand visibility*. International actors were often engaged as formal partners, e.g. as donors and/or co-organisers, or otherwise as informal sources of support and other inputs.

> "The international level is reached through research programs. Many foreign experts come and praise us…Jeĺnia is involved in exhibitions…Even our Parliament wants its members to see Jeĺnia. It's visible enough and there's interest in it." [Case Bogs]

International norms were said to exert soft-power influence on environmental and other norms at the national level, and the ratification of international agreements to influence national *regulatory system* reforms. However, a field of tension was identified regarding national

identity contra international influence, which in some instances also led to suspicion and/or rejection of international norms and practices.

#### 1.3.4. Perceived legitimacy of initiative

*Support*, especially from key stakeholders, had an important legitimising influence for organisations and activities. "All our organisations cooperate well with the authorities. Otherwise they would not exist." Leader, case Bogs

Legitimacy provided a key source of agency, and in turn had a mutually reinforcing influence on support. The *adequacy of leadership* was an important determinant of *perceived legitimacy*, providing a knowledgeable, solution-oriented face for the organisation. Delivery of planned *outcomes/ outputs* and increased *brand visibility* were usually commensurate with increases in perceived legitimacy. Legitimacy was also affected by perceptions of the initiative as a good "corporate citizen", e.g. providing a good workplace, making appropriate social contributions (Fig. 7B).

> "We employ 20-30 people. We always pay salaries on time and provide adequate working conditions…We have no problem providing holidays, we're competitive, and people see that we are successful. This becomes a turning point in peoples' consciousness." [Case Berries]

A set of *institutionalised socio-cultural legacies* (Fig. 6), including distrust of private enterprise and NGOs, often negatively coloured stakeholders' perceptions. Interviewees perceived these pervasive attitudes to pose obstacles to support-building due to the many ways in which they, in addition to impacting legitimacy, shaped *perceptions of risk* and *conflict* (Fig. 6).

#### 1.3.5. Perceived risk

Risks identified by interviewees included adverse changes in natural (e.g. weather or climate), technical (e.g. due to inadequate knowledge), financial (e.g. macro-economic turbulence), and governance (e.g. regulatory) systems. Whilst interviewees generally attempted to curtail exposure to some identified risks, e.g. *macro-economic uncertainty*, they considered other risks to be unavoidable and attempted to manage these by preparedness and timely decision-making.

Risk was also a perceived quality. *Perceived risk* (Figs. 5, 6 & 7A) was partly a bi-product of a set of *institutionalised socio-cultural legacies* encompassing fear of change and/or reprisal, unwillingness to engage, an anti-business climate, a culture of indifference/passivity, lack of

open society, and 'tall poppy syndrome'. Fear of state reprisal ensured, for example, that interviewees assiduously maintained a non-partisan political stance in plans and activities. This extended to the *careful selection of potential partners*, to ensure the absence of untoward political affiliations or association with politically sensitive sentiments.

> "We try not to go into politics. Our Central Council may reject joining with any political organisations or unions in case it is dangerous for our organisation." [Leader, case Bogs]

*Adequate inputs* (especially financial resources and fixed capital), the *commercial viability* of planned activities, and demonstrated delivery of expected *outcomes and outputs* were all suggested to reduce *perceptions of risk*, especially those related to production-based initiatives.

> "The private sector is weak and there are few business people." [Case Berries]

Interviewees devised innovative solutions to risks associated with inadequate inputs. For example, the leader for case Birds established a non-profit organisation to provide initial knowledge and capital inputs, as well as coordinating planning and implementation, in order to reduce the initial risk exposure of private local partners. These partners were expected to assume greater responsibility for management activities and expenses once commercial viability was established.

> "Next year we will look for money to buy a [reed-processing] machine and help business people to develop in this direction. New technology and new businesses are unpredictable. People are afraid to take loans, so they need help. That is, we must give them a fishing rod, bait and fish and even more – they will get salaries until the project is going. And later, – 'fish yourself!'" [Leader, case Birds]

## 1.4. Adequacy of inputs

Inputs referred to a variety of financial, material, human, and technological/ fixed capital resources (Figs. 7A & 7B). *Support*, including partner organisations, was a key determinant of input adequacy, which was also heavily influenced by the *scale of planned activities*.

### 1.4.1. Financial resources available to initiatives

*Financial resources available to initiatives* was a key input, enabling other inputs and thereby *activity rates* and delivery of *outcomes/outputs* (Fig. 7A). Interviewees referred to two main sources of financial resources, *donor funding* and internally-generated *sales revenue*. *State*

*funds* were scarcely available, and then generally only to projects with a clear social/economic dimension.

Some co-funding opportunities were available, whereby successful applications could be leveraged for supplementary funds. Indirect state funding was available for certain activities in the form of subsidies or tax exemptions, e.g. for energy production equipment. *Loans* were also a potential source of funds, but interviewees considered these relatively inaccessible due to the high cost of credit in Belarus and other constraints e.g. *exposure to macro-economic uncertainty* in currency markets.

Case Bogs was heavily reliant on support from a variety of donors, including international NGOs, multinational corporations, and some government agencies. Efforts at self-financing in Case Bogs were otherwise focused on fund-raising activities (e.g. large-scale tourist events), which were subsidised by donors. Earlier plans for the development of a value-added production company based on wild foods had failed to eventuate. *Donor-funding* – especially from international donors – increased regulatory exposure, creating a heavy *administrative burden* (Figs. 7A & 7B). Strict controls regarding international financial transactions required long and paperwork-intensive *permitting* processes with uncertain outcomes, and with no access to these funds before permissions were granted. Interviewees perceived this as one means by which state authorities exercised control over NGOs. Other examples included the sudden freezing of bank accounts and highly disadvantageous taxation rules for NGOs. Donor-funding also had a potentially negative feedback on the *perceived legitimacy of the initiative* (Fig. 7B), which leaders for cases Birds and Berries connected with financial self-reliance. All organisations were expected by authorities to make a variety of social and charitable contributions. However, interviewees indicated that donor-funded NGOs were more likely to be subject to *rent-seeking* behaviour (Fig. 7B). Internationally-funded initiatives were suggested as being especially targeted, and increasingly disincentivised, by such behaviour.

> "Permissions are required for many things…We don't have the right to spend [funds] if the authorities don't permit it. We need to register. That is, the Ministry should approve. Otherwise we have to give the money back [to donors]. Even if you have money, you still need support of the authorities." [Leader, case Bogs]

> "To ask for money from the Ministry all the time is not trustworthy…Economics is a very, very important part of any environmental project." [Leader, case Birds]

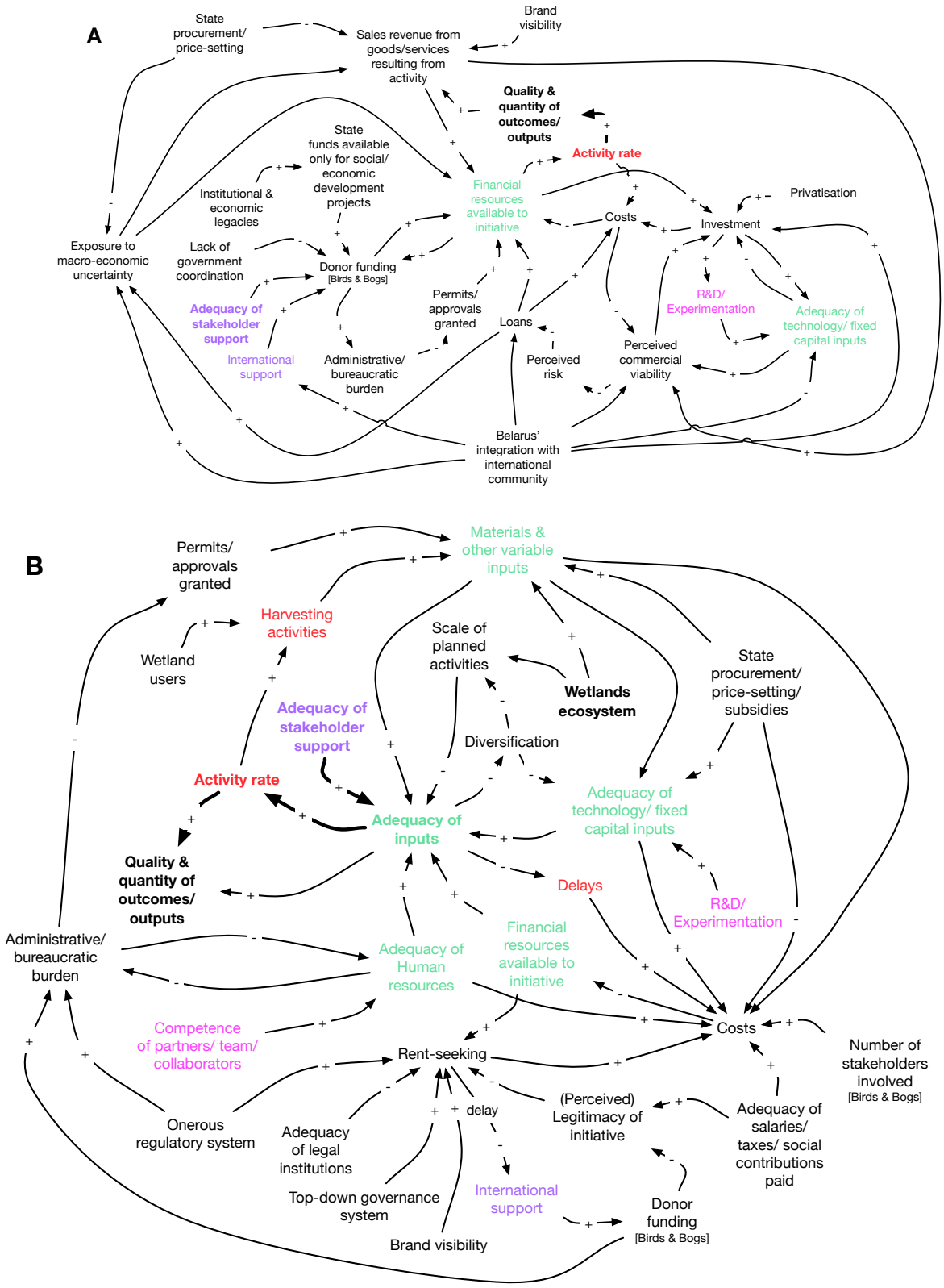


*Figure 7A & B (from main paper). Sub-models unpacking causal dynamics influencing Adequacy of inputs for wetland restoration initiatives. Inputs are disaggregated into four main types: Financial resources, Technology/ fixed capital, Human resources, and Materials and other variable inputs. Fig. 7 is separated into two sub-models simply to reduce diagrammatic complexity and aid reader comprehension. Links from support to the various disaggregated types of inputs are aggregated into one main link in B.*

In addition to donor funds, the leader for case Birds sought to develop a circular economic model, with *sales revenues* iteratively financing a loop of sustainable harvesting activities and material production. *Sales revenues* were the prime source of financial resources in Case Berries. Profits were partly re-invested into internal research and development (*R&D)/experimentation*. This was influenced by the values of the leader for case Berries regarding "good business" (e.g. financial self-reliance), the dangers of debt, and a strong belief in continuous improvement through learning. Deregulation of *state price-setting* on confectionary allowed the leader for case Berries to set his own sales prices, although these remained constrained by domestic purchasing power. State price control of other inputs exerted indirect control over potential revenues.

#### 1.4.2. Materials and other variable inputs

*Materials and other variable inputs* (Fig. 7B) refer to various materials harvested from wetlands and utilised in value-added production chains, but also to natural capital used in other initiative-driven activities e.g. cranes for bird-watching tourism. The quality and abundance of these inputs depended on biophysical aspects of the *wetlands ecosystems* themselves and/or the rate of *harvesting activity*, where applicable. In some cases, harvesting was conducted by the initiative. Otherwise it was dependent on other users, e.g. berry pickers. *Permits* were required to acquire materials and other variable inputs, e.g. berries from wholesalers. *State procurement/ subsidies* were important for the provision of inexpensive electricity and sugar for Case Berries.

#### 1.4.3. Adequacy of technology/ fixed capital inputs

The inherent properties, quality and abundance of case specific material inputs determined whether available *technology/ fixed capital inputs* were adequate (Fig. 7B). *Diversification* could lead to multiple uses of the same capital, but often led to the need for additional inputs.

> "There are a lot of nuances building a technological chain along three biomass lines, which must be used in different directions. The major problem is always – money." [Leader, case Birds]

For Cases Berries & Birds, *investments* in production technologies, equipment and other forms of fixed capital (Fig. 7A) were seen to improve efficiency, optimise processes, minimise *delays* and hasten production of *outputs*, which could in turn be sold, or otherwise marketed, to recruit new financial revenues. The *perceived commercial viability* of an initiative was an important

factor motivating investment. The realisation of technology/capital *investments* added to stakeholders' perceptions regarding *adequacy of inputs*, further reinforcing perceptions of commercial viability. However, operational and investment *costs* relating to these inputs also drained *financial resources*.

*Privatisation* (Fig. 7A) of previously state-owned fixed capital provided the opportunity for the leadership of case Berries to own the factory and production processes outright. This investment reduced dependence on state support, a move that the leader for case Berries perceived as central to his ability to implement his own plans and objectives.

The institutional *integration of Belarus with the international community* also provided opportunities, e.g. access to potential markets for wetlands-derived products. Participation in international markets could, however, necessitate expensive upgrades to technical processes to meet new norms and standards. As such, whilst formal access to international markets incentivised capital investment, inadequate capital stocks constrained market participation.

#### 1.4.4. Adequacy of human resources

In most cases, *human resources* (Figs. 7B & 8) referred to internal team members or those of partner organisations although volunteers also provided important contributions in Case Bogs, e.g. providing a low-cost substitute to otherwise unavailable *financial* and *capital inputs*. Human resources provided important *knowledge and experience*, but were often drained by an endless stream of *administrative/ bureaucratic* paperwork, resulting from an *onerous regulatory system*.

> "Almost every year between 2007 and 2014 we organised volunteer labour camps. About 50 dams were built and repaired… It was only possible to do by manual labour, as small, specialised excavators did not exist in Belarus at that time." [Leader, case Bogs]

### 1.5. Activity rate

Many activities (Fig. 9) were, directly or indirectly, aimed at increasing the number of *wetland users*, and/or the creation of local *employment opportunities*, and thus had important impacts on the *adequacy of local livelihoods*. Some use-based activities involving *active management* measures, e.g. clearing vegetation, were obstructed by passive management requirements associated with *nature protection norms* or were restricted by other governmental *regulatory systems*.

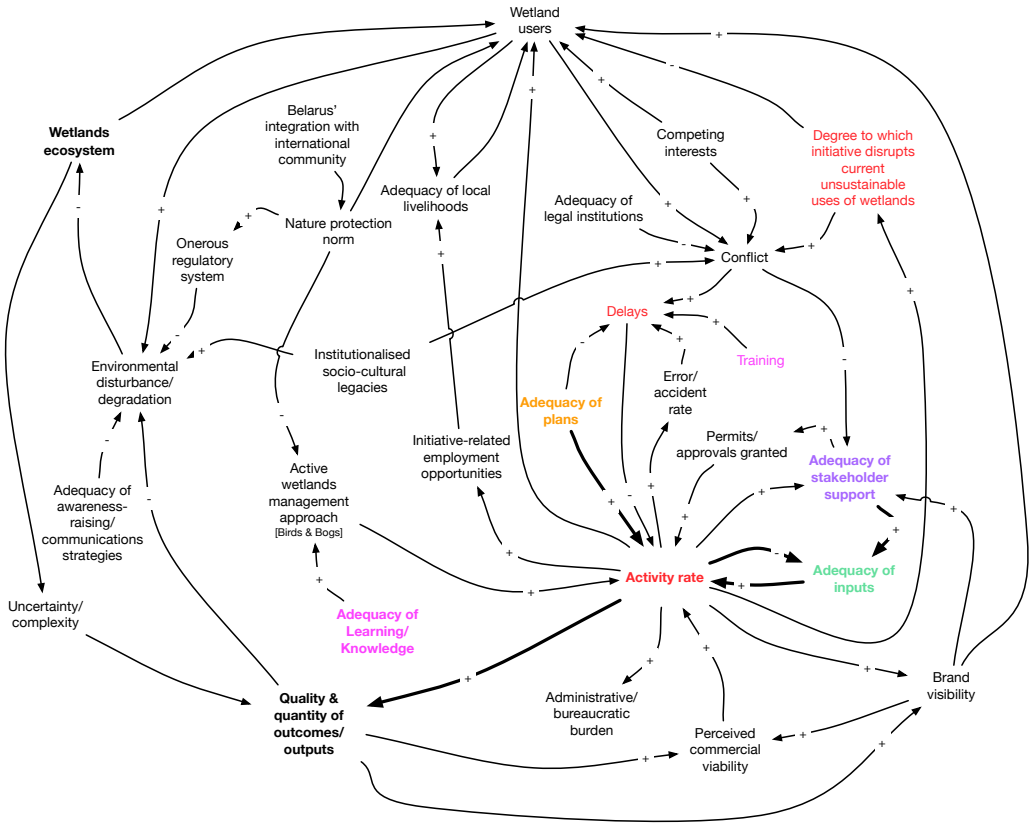


*Figure 9 (from main paper). Sub-model unpacking causal dynamics influencing the Activity rate of wetland restoration initiatives in Belarus. Entrenched socio-cultural legacies of indifference and carelessness regarding the negative impacts of some users on wetlands were identified as a driver of environmental disturbance & degradation. Leader for all three cases sought therefore to shape public attitudes through a variety of direct awareness-raising and knowledge dissemination activities, and/or through indirect use of power, e.g. refusing to purchase unripe berries in order to affect change in picking behaviours. Brand visibility also influenced the number and types of users.*

> "The reserve gladly helps fishermen because it earns money for the reserve…But this causes anxiety because they bring garbage and the danger of fires, and disturb the birds." [Leader, case Bogs]

Adequate *planning* and *knowledge* reduced *delays* (Figs. 8&9) due to e.g. *training* requirements, *errors and accidents*, or *conflicts* regarding other, generally deleterious, wetland uses. This latter encompassed large- and small-scale *competing interests*, e.g. peat mining, illegal fishing/hunting, or commercial berry picking. Conflicts were exacerbated by the degree to which *local livelihoods* depended on disrupted uses, and also by *socio-cultural legacies*, which caused implementing organisations to be perceived as meddlers. Conflict risked *support*. The leader for case Berries perceived *legal institutions*, commercial courts in particular, to

provide a generally fair arena for conflict resolution and redress, even in cases involving local authorities.

#### 1.5.1. Feedbacks to support

*Activity rate* and *outcomes/outputs* led to multiple direct and indirect feedbacks on *stakeholder support* (Figs. 6, 8&9), including that of state authorities and key individual decision-makers. High quality outcomes and various kinds of activity promoted *brand visibility*, leading to increased support, and thereby *inputs* and/or *permissions*. In some cases, successful outcomes led to the adoption of new standards and procedures, and to invitations for initiative representatives to participate in *regulatory system* reform processes. These feedbacks were often slow. Activity was also seen as a means to directly derive additional support, by way of exposure to new contacts and networks. According to leaders from cases Birds and Berries, profits – as evidence of commercial viability – were an important motivator of *activity*. For this reason, these leaders preferred private sector partners over state actors. "Proof of concept" loops occurred as a result of a feedback from *outcomes* to *commercial viability*.

> "Experience shows that it is better to work with businesses. They don't receive money from the state. They understand that how much they earn depends on themselves, and are therefore active." [Leader, case Birds]

## 1.6. Adequacy of learning and knowledge

*Adequacy of available knowledge & experience* (Fig. 8) was conceptualised as a clear understanding regarding problem scale, current interpretations of relevant government policies and strategies, key factors, system requirements, and potential solutions. Existing knowledge was accessed in a number of ways – from knowledgeable *human resources*, e.g. *experts/specialists*, *competent staff* and *leaders*; from formal sources such as national and international research organisations and databases; from informal sources such as excursions to analogue firms/ initiatives, dialogue with other organisations who had relevant experiences. As such, access to existing knowledge could be obtained through *support* mechanisms, or was otherwise a factor of adequate financial resources.

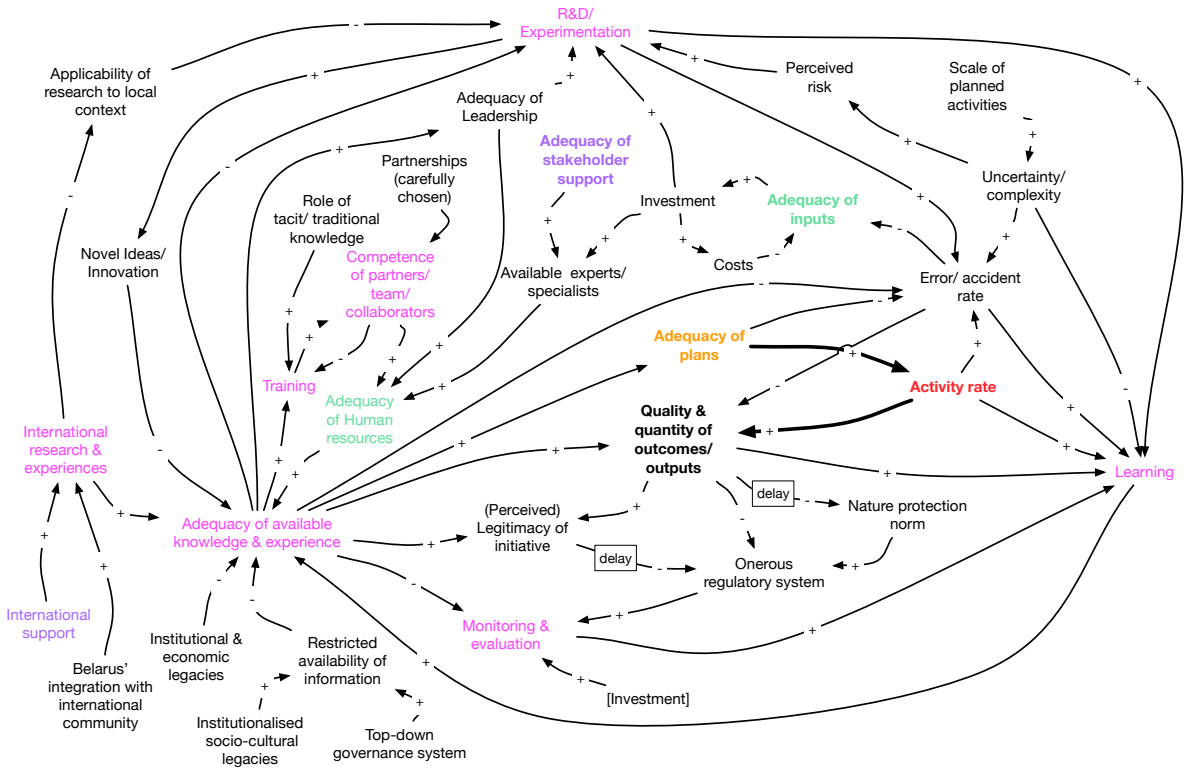


*Figure 8 (from main paper). Sub-model unpacking causal dynamics influencing the Adequacy of Learning and Knowledge for wetland restoration initiatives. Learning and knowledge/experience concepts are disaggregated in this sub-model in order to clarify causal pathways. These concepts are otherwise aggregated together in the other sub-models.*

### 1.6.1. Learning

Interviewees were clearly personally motivated by a desire to learn and to find innovative solutions to difficult management problems. Initiatives therefore adopted multiple modes of ongoing *learning*, and were keen to ensure the transfer of knowledge to *partners, staff, collaborators* and other key stakeholders through *training* and *communication strategies*. Training was especially important in activities involving a high degree of *tacit or traditional knowledge*. *Investment* in active learning processes (e.g. *R&D/experimentation*) and *activity rates* were important determinants of learning processes. Delays, e.g. due to *errors and accidents*, whilst occasionally costly, were viewed as valuable learning opportunities. Experimentation was typically fused with implementation *activities* – i.e. learning by doing – with both balanced by identical feedback control from *available inputs* (primarily funds). However, learning by doing was complicated by factors of *uncertainty and complexity* (e.g. false positives/negatives, imperceptible causality).

*Perceived risk*, in part due to uncertainty/complexity, was a key motivating factor for investments in R&D and experimentation, as was *leaders*' beliefs regarding the long-term value of R&D for commercial enterprises. Learning also resulted from *monitoring and evaluation* efforts, often a *regulatory system* requirement. Leaders for cases Birds and Bogs suggested that compliance with regulatory documentation requirements provided a wealth of material for knowledge sharing and awareness-raising across NGO networks and to other interested parties.

#### 1.6.2. Availability of experts and specialists

*Experts and specialists* were highly respected by interviewees as essential knowledge inputs. In some instances, specialists were employed as team members or consultants, whereas in others they were merely supporters who were persuaded to contribute without charge. *Costs* associated with retaining experts could otherwise be prohibitive. *Investment* in their services was often on an ad hoc basis.

> "We didn't have a lot of money to fully explore this [hydrological] issue… We have only $4000. We cannot say: 'please, do the hydrography of the marshes.' We say: 'please, tell us what to do first.'" [Leader, case Bogs]

#### 1.6.3. International research and experiences

The *integration of Belarus with the international community*, particularly regarding *international research* collaborations, was perceived by interviewees to have improved knowledge availability (Fig. 8). However, interviewees acknowledged limitations regarding the direct *applicability of international research to local contexts.*

> "[UK] bogs have quite different problems… they do not have convex bogs, they have blanket bogs. That is why their experts do not know what to do [here]." [Leader, case Bogs]

#### 1.6.4. Knowledge-driven feedbacks

Along with feedbacks to support and regulatory system reform mentioned above, initiatives used knowledge dissemination feedbacks, via *awareness-raising and communication strategies* (Fig. 6), to influence stakeholders in the wider system – e.g. political leaders, the general public, consumers. However, initiatives differed in their approach to dissemination of internally-generated knowledge. The leader for case Berries sought patents to protect innovations and

intellectual property arising from investments in R&D. The leader for case Bogs, on the other hand, sought to disseminate project-generated learning as freely as possible.

> "As a result of the project, the government adopted a policy which stipulates that at the end of its economic life our project area must be turned back into a peatland and not into a reservoir or forest as used to be the case." [Leader, case Birds]

> "We see a goal that we want to achieve in other territories in Belarus. We are moving authorities, donors and the Academy of Sciences in this direction, [by] shaping opinions…Gradually people change and their knowledge grows." [Leader, case Bogs]