Agricultures
et défis du monde
Collection Cirad-AFD

Living territories to transform the world

P. Caron, E. Valette,
T. Wassenaar,
G. Coppens d'Eeckenbrugge,
V. Papazian,
Coordinators

éditions Quæ

Living territories to transform the world

Patrick Caron, Élodie Valette, Tom Wassenaar,
Geo Coppens d'Eeckenbrugge, Vatché Papazian,
coordinators

Éditions Quæ

The *Agricultures et défis du monde* (Agriculture and Global Challenges) collection publishes a book every year that showcases Cirad's research into the sustainable development of tropical agricultural systems. It is co-published by Éditions Quæ, AFD and Cirad. The collection is coordinated by Cirad's Patrick Caron.

Cirad (Centre for International Cooperation in Agricultural Research for Development) is a French research centre which, in association with countries of the Global South, tackles international issues of agriculture and development. In partnership with these countries, it generates and disseminates new knowledge to support agricultural development and to inform the debates on the major global issues concerning agriculture, food and rural territories. Cirad has a global network of partners and regional offices from which it conducts joint operations with stakeholders in more than 90 countries.

Cirad
42 rue Scheffer, 75116 Paris
www.cirad.fr

AFD, the French Development Agency, is a public institution that has been working for 70 years to fight poverty and promote development in countries of the Global South and in French overseas departments and territories. AFD implements the French government's development aid policies.

With a presence in more than 50 countries and nine French overseas departments and territories, AFD funds and supports projects that improve the living conditions of local populations, promote economic growth and protect the planet. These projects concern education, maternal health, support for farmers and small businesses, water supply, preservation of tropical forests, the fight against global warming, etc.

Agence française de développement
5 rue Roland Barthes, 75598 Paris Cedex 12, France
www.afd.fr

Éditions Quæ
RD 10, 78026 Versailles Cedex
www.quae.com

 ISBN: 978-2-7592-2731-0

Version française : « Des territoires vivants pour transformer le monde »

 ISBN : 978-2-7592-2654-2

Chapter 8

The territory, at the heart of new fish-farming innovations

Olivier Mikolasek, Marc Oswald, Newton J. R. Da Silva, Lionel Dabbadie and François Henry

The extension of fish farming is rarely considered at a territorial scale. This chapter focuses on a conceptual framework used to mobilize the resources of a territory for devising new fish farming innovations. Starting from an initial formulation developed in Brazil to interpret differences in territorial fish farming trajectories, this framework will be applied to fish farming realities of West Africa. The competitive advantages of a territory depend fundamentally on its ability to construct an innovative productive organization – the local innovation system – that relies on the local specificities of the biophysical, social, economic and institutional environment (Bureth and Llerena, 1992). The local innovation system is the result of interactions between four hubs of expertise: production, science, training and funding. A specific component of the innovation process is associated with each of these hubs. Production is associated with learning, which is the acquisition of knowledge and know-how by an individual or a group; science with research and development if its priority is to produce knowledge oriented towards the resolution of production system bottlenecks; and training with impartation of skills to producers. As for the funding hub, it encompasses the evaluation process which validates and orients the choices of the technologies to be developed. To be truly effective, public action must incorporate three of these four hubs of the local innovation system: science, training and funding.

The local innovation system is considered to be the nucleus of the socio-technical network of fish farming (Da Silva *et al.*, 2009). It is constituted by individual and collective entities defined by their identities and their projects, linked to each other within a territory (Callon, 1986). The network is consolidated by expansion through translation operations (Figure 8.1) undertaken by an individual or institution. The translation aims at reconciling the statements of different groups of actors and, in particular, to resolve controversies in order to facilitate the construction of the fish farming innovation being promoted by the emerging network.

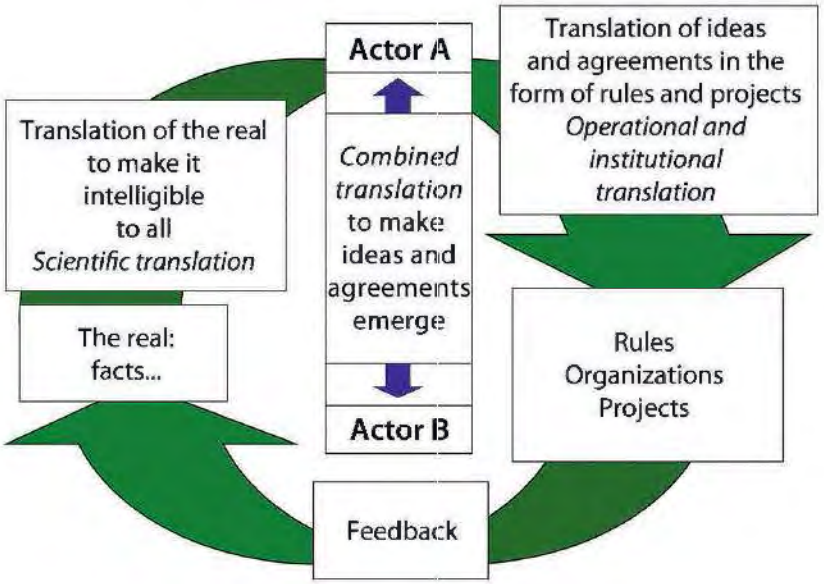

Figure 8.1. Translation cycle (Beuret, 2006).

Comparative approach to fish farming developments in Brazil

The study by Da Silva *et al.* (2009) found that the dynamics of fish farming in the Ribeira valley in São Paolo State are not as strong as those of the upper Itajai valley in Santa Catarina State (Table 8.1).

Fish farming was introduced in the Ribeira valley by Japanese immigrants in 1931. From 1984 to 1989, the State provided technical assistance, distributed fingerlings and made often irrelevant investments, such as a fish filleting factory that was still unused in 2013. In spite of this diffusionist approach, a local innovation system emerged in 1990 in Juquia municipality. A fish farmer, who had earlier been a technician-researcher, proposed a fish farming project which obtained the support of the mayor. A research unit was set up. The sector began acquiring structure. As early as 1991, a food factory located outside the territory began experimenting with making extruded food for use as fish food. The translator was this fish farmer at the heart of the local innovation system. From 1992 to 1997, the network lacked coordination and there was little proximity between the actors: sales took place outside the territory, the extruded food was made in distant cities, and the fingerlings produced in north-western Brazil were shipped in by air. Technical advice was provided by fish-food vendors who had no link to the network or its territory. The researchers conducted research without involving the network and, after 1996, the local research unit sputtered to a halt. From 1998 to 2003, the network gradually imploded. Leaders of the sector turned into fingerling traders, especially since the market had become increasingly less favourable. This situation persists until today.

In the upper Itajai valley, immigrants, mainly of German origin, started carp fish farming in 1920, introduced from back home, as a subsistence activity. In 1986, a technician from the government's research and development agency proposed a model that integrated pig and fish production. In 1994, a local innovation system

Table 8.1. Comparison of the development of the dynamics of fish farming in the Ribeira valley and the upper Itajai valley.

Characteristics	Ribeira valley	Upper Itajai valley
Land use and occupation	Indigenous population, Japanese colonization, various investors	German and Italian colonization, family farming
Territorial resources	Exogenous: extruded foods	Endogenous: pig droppings
Type of controversy	Mild: external to the territory – political Consequence: fish farming diffusionist project (1984)	Strong: internal to the territory – environmental Consequence: Establishment of rules to practice the activity (1997)
Translator	Fish farmer	Extension agent World Bank mission
Local innovation system	Juquia municipality in 1990	Agrolândia municipality (1994-1998)
Training hub	Initial training, then technicians of food manufacturers	Learning and extension agents
Research hub	Presence of a research unit Action external to the network	Research on the farms Action within the network
Funding hub	Priority for infrastructure	Funding for training and research and development
Production hub	Weak organization of producers Relationships related only to market opportunities	Strong organization of producers Relationships of cooperation, trust and market

Based on Da Silva *et al.*, 2009.

emerged in the city of Agrolândia around his activities. It was supported by the town's administration. Agrolândia producers came together in the harvesting of fish and local industrialists integrated the sector in their activities (fingerling producers, fish producers, and fish processors for the local market). In 1997, this system was blamed by an NGO that claimed that the integrated pig/fish production was leading to a proliferation of mosquitoes. In response, various actors mobilized themselves (World Bank, municipal councillors, mayors, technicians, researchers, fish farmers, NGOs), initiating a translation process. Rules were formulated to regulate fish farming practices that were acceptable to the NGO. From 1993 to the present day, Agrolândia's local innovation system is being consolidated through dissemination and replication in a large number of the region's municipalities.

Realities of sub-Saharan Africa: the case of Guinée Forestière

In Guinée Forestière (Forested Guinea), the technical reference framework was transferred from the lessons learnt from West-Central Côte d'Ivoire (Oswald, 2015). From 2002 to 2008, in several villages in Nzérékoré prefecture, the local innovation system took the form of a network of fish farmers' groups who maintained close links with the project leaders and managers. The latter encouraged scientists to get involved and facilitated frequent exchanges with administrators and financial institutions (Box 8.1). Experienced farmers from these villages subsequently helped other fish farmers get started after the project ended.

The local innovation system here has been able to derive value from the territory's own resources, i.e., the numerous lowlands used for fish farming and the know-how in rice cultivation, by profitably associating fish farming with flooded rice cultivation. The recent introduction of palm kernel crushers has made palm kernel cake abundantly available as animal feed, a development that has encouraged the establishment of pig farming and its integration into fish farming (Rangé *et al.*, 2015). Based on these dynamics, the network is being further strengthened since 2012 under the impetus of a new project, the Rice-Fish Farming Development Project in Guinée Forestière (2012-2017), and is now participating in the role of translator within this local innovation system. The project's actions are stimulating professional proximity within the network, which now includes more than 1500 agro-fish farmers, numerous local village groups and a professional organization, the regional federation, which is backed by unions in a few districts.

Recently, a controversy erupted regarding the use of exogenous but selected breeding strains, leading to a different organization of reproduction. This can be a threat or an opportunity for the network depending on how the federation, the project and government will resolve the controversy.

Box 8.1. Project intervention strategy in Guinea.

The Fish Farming Project in Guinée Forestière (1999-2008) benefited from AFD's support. The National Aquaculture Directorate, the contracting authority, has a mandate to evaluate fish-farming activities.

Implemented by APDRA – Pisciculture Paysanne (www.apdra.org), the intervention strategy is based on the men and women in farmer families, who mobilize their know-how, skills and labour, and their ability to take initiatives and assume risks. In return, the programme provides the technical information and expertise necessary – easily appropriated and with low investment cost – for setting up fish farms in the lowlands. A training and support system destined for voluntary producer groups disseminates this technique.

Several elements contribute to the emergence and consolidation of the socio-technical network:
– the participation of all families since no investment subsidies are available, the management of the ponds being undertaken by the fish farmers;
– grassroots groups, which are the driving force behind a dynamic of local innovation, make training more accessible, facilitate exchanges, gradually lower the training costs of the fish farmer and structure the sector (Grosse and Oswald, 2010);
– the integration of the association of fish farming and flooded rice cultivation into local agricultural production systems does not compete with the farming calendar of other agricultural activities (Simon and Benhamou, 2009);
– access to a large local market, with fish making up the bulk of animal protein intake in this region.

The projects' actions gradually strengthen the autonomy of the local fish farming groups which provide the main functions of facilitation, coordination, training and support.

Figure 8.2. Large and completely transplanted rice-fish farming pond.
The monk sluice can be seen in the background and, on one side, a pigsty (Gbotoÿe, Prefecture of Nzérékoré, Guinée Forestière).
© APDRA – Pisciculture Paysanne, www.apdra.org

Figure 8.3. Integration of flooded rice cultivation and fish farming.
The fish farmer will soon begin to raise the water level in his pond – while ensuring that the top of the rice is above the water – to simulate a flood. We can see the service pond where the fish for restocking is kept (Gbotoÿe, Prefecture of Nzérékoré, Guinée Forestière).
The local innovation system has been able to derive value from the territory's own resources, i.e., the numerous lowlands used for fish farming and the know-how in rice cultivation, by profitably associating fish farming with flooded rice cultivation.
© APDRA – Pisciculture Paysanne, www.apdra.org

Conclusion

The fish farming network manages the territory's resources in a wide-ranging manner: design of efficient fish farming facilities, appropriate choice of fish species, abundant supply of inputs, implementation of fish farming practices recognized as high-performance, identification of accessible markets, innovative ways of organizing and, more broadly, a body of specific expertise and know-how.

However, the example of Brazil shows that the sustainability of these local dynamics depends on their recognition by the State. The consolidation and expansion of the local innovation system constitute a same continuous process that draws its resources from the territory but can be weakened or threatened by an external entity (example of extruded food in the Ribeira valley) if it does not incorporate the network. In Guinea, the production hub, acting through local groups, has been able to prolong the growth of fish farming beyond the duration of projects. However public actions that rely on international funding do not seem to be able to integrate the three other hubs of competence of the local innovation system, despite the support of the national directorate of fish farming (Halftermeyer, 2009).

The agro-fish farming territory thus exists as a space for managing resources whose characteristics, including geographical boundaries, are shaped by its history, the local innovation system and its expansion supported by public action. This requires national policies that are able to take the competitive advantages of these agro-fish farming territories into consideration. An interface between the representation of a territory's fish farming profession and State services, and a balanced dialogue between all stakeholders would facilitate this desired evolution.

References

Beuret J.E., 2006. *La conduite de la concertation pour la gestion de l'environnement et le partage des ressources*. Paris, L'Harmattan.

Bureth A., Llerena P., 1992. Système local d'innovation : approche théorique et premiers résultats empiriques. *In: Actes du colloque industrie et territoire : les systèmes productifs localisés*, 21-22 October 1992, Grenoble, Institut de recherche économique sur la production et le développement, 369-393.

Callon M., 1986. Éléments pour une sociologie de la traduction : la domestication des coquilles Saint-Jacques et des marins dans la baie de Saint-Brieuc. *L'année sociologique*, 36, 170-208.

Da Silva N.J.R., Beuret J.E., Mikolasek O., Fontenelle G., Dabbadie L., Lazard J., Martins M.I.E.G., 2009. Dynamiques du développement de la pisciculture dans deux régions du Brésil : une approche comparée. *Cahiers Agricultures*, 18 (2-3), 284-291.

Halftermeyer S., 2009. *Construire un réseau de producteurs ruraux autour d'une nouvelle production. L'exemple du Projet piscicole de Guinée forestière (PPGF)*. Nogent-sur-Marne, Gret.

Grosse O., Oswald M., 2010. The Role of the Farmers' Group in Fish Innovation in an Extension Project's Frame. *In: Colloque ISDA « Innovation et développement durable dans l'agriculture et l'agroalimentaire »* (Coudel E., Devautour H., Soulard C.-T., Hubert B., eds.), 28 June-1 July, Montpellier, Cirad/Inra/SupAgro, available online: https://hal.archives-ouvertes.fr/hal-00521220/ (retrieved 6 March 2017).

Oswald M., 2015. Extensive Fish Farming, a Complementary Diversification of Plantation Economies. *In: Economics and ecology of diversification: The case of tropical tree crops* (Ruf F., Schroth G., eds.). Springer Netherlands, 201-224.

Rangé C., Palliere A., Ly A., Théa M., Oswald M., 2015. Market Access and Fish Farm's Density in a Sub-Saharan Rural Countryside: A Case Study of the Village of Gbotoye in the Forested Areas of Guinea. *In: 5th International Symposium for Farming Systems Design*, 7-10 September, Montpellier, available online: http://fsd5.european-agronomy.org/programme/session_w7.html (retrieved 5 March 2017).

Simon D., Benhamou J.F., 2009, Rice-fish Farming in Guinée Forestière – Outcome of a Rural Development Project, *Field Actions Science Reports*, 2, 49-56, online journal: https://factsreports.revues.org/225?lang=en (retrieved 5 March 2017).