

Synthèses

Innovation and development in agricultural and food systems

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Ludovic Temple and Jean-Marc Touzard, editors
Afterword : Gaël Giraud



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Table des matières

Couverture

Innovation and development in agricultural and food systems

Introduction - Reviving perspectives on innovation in agriculture and food systems

Innovating to survive in the contemporary world

Including agricultural innovation in societal debates

Analysing innovation as a multidimensional process

Studying and supporting innovation in agriculture

Structure of the book

Bibliography

Part 1 - Renewing agricultural approaches

Chapter 1 - A history of innovation and its uses in agriculture

Chapter 2 - Agricultural and agrifood innovation in the 21st century: maintaining, erasing or reshaping its specificities?

Chapter 3 - Agricultural research and innovation: a socio-historical analysis

Part 2 - Forms of innovation in agriculture and the food sector

Chapter 4 - Agroecological innovation: mobilizing ecological

processes in agrosystems

Chapter 5 - Social innovation through short food supply chains: between networks and individualities

Chapter 6 - Innovation, a precondition for the sustainability of localized agrifood systems

Chapter 7 - Territorial innovation in the relationships between agriculture and the city

Part 3 - Providing support to the actors of innovation

Chapter 8 - Designing and organizing support for collective innovation in agriculture

Bibliography

Chapter 9 - Action research in partnership and emancipatory innovation

Chapter 10 - Co-designing technical and organizational changes in agricultural systems

Chapter 11 - Advice to farms to facilitate innovation: between supervision and support

Chapter 12 - The ComMod and Gerdal approaches to accompany multi-actor collectives in facilitating innovation in agroecosystems

Part 4 - Evaluating the effects of innovations

Chapter 13 - The abattoir, from the factory to the farm. Ethics and morality in the dynamics of innovation in agrifood systems

Chapter 14 - Evaluating the impacts of agricultural innovations

Chapter 15 - Evaluating impacts of innovations: benefits and challenges of a multi-criteria and participatory approach

Chapter 16 - Simulation tools to understand, evaluate and strengthen innovations on farms

Afterword - What types of innovation for sustainable agriculture?

What technological avenues?

Financial environment

Biodiversity and the commons

List of authors

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© Éditions Quæ, 2018

ISBN ePub: 978-2-7592-2960-4

Éditions Quæ
RD 10
78026 Versailles Cedex



www.quae.com 



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Chapter 14

Evaluating the impacts of agricultural innovations

AGATHE DEVAUX-SPATARAKIS AND SYLVAIN QUIÉDEVILLE

Summary. Since the 2000s, researchers engaged in innovation processes are having to respond to the demand of donors, national research and development agencies and civil society that their research should be open to evaluation. In order to meet this demand, agricultural researchers have to use tools and methods to help them determine the effects of their proposals, not only at agronomic level, but also on the economic, social and environmental dimensions. This chapter presents the different evaluation methods that can be used, as well as the trade-offs to be made in order to choose the approach that is most appropriate for the innovation under study and for issues raised by the evaluation. Two case studies on the use of methods to evaluate the impact of research, conducted as part of the ImpresS and Impresa projects, are presented and discussed.

Since the beginning of the 20th century, many studies conducted by researchers in the field of agriculture have included rigorous evaluations of the impacts of innovations they propose (Fisher, 1926). These evaluations have focused almost exclusively on the innovations' agricultural impacts, but researchers today have to use evaluation methods that can also predict the social, cultural and economic impacts of their innovations. Since the beginning of the 2000s, donors, international organizations, and national research and development agencies have expressed their preference to fund innovations that have been partially proven on the field, i.e. evaluated positively as to their initial agricultural and social impacts (Naudet and Delarue, 2007; Evaluation Gap Working Group, 2006).

This new evaluative imperative is compelling agricultural researchers to adopt evaluation methodologies that conform to international standards, and which are similar to methods used in the evaluation of public programmes and projects. As a result, there is a shift from a scientific evaluation of a project's agricultural effects towards an evaluation as defined by the Organization for Economic Co-operation and Development (OECD, 2002), 'The systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results. The aim is to determine the relevance and fulfilment of objectives, development efficiency, effectiveness, impact and sustainability.'

Even though agricultural research is backed by a substantial body of programme-evaluation methodologies (Shadish *et al.*, 1991; Weiss 1972; Patton, 2001), the application of impact assessment methods to sometimes complex innovation processes raises specific methodological challenges. Consequently, several agricultural research institutes, in France and elsewhere in Europe, have undertaken research projects for developing adapted evaluation approaches. Three such projects are: Analysing the Impacts of Public Agricultural Research (Asirpa), undertaken by the French National Institute for Agricultural Research (INRA); Impact of Research in the Countries of the South (ImpresS), undertaken by the French Agricultural Research Centre for International Development (CIRAD); and the European project Impact of Research on EU Agriculture (Impresa) which brings together several institutes, including the Research Institute of Organic Agriculture (FiBL)^[45]. These initiatives have the common challenge of developing approaches, tools and mechanisms capable of understanding and determining the impacts of these innovation processes on society.

This chapter first presents the evaluation methods, tools and instruments used in areas other than agricultural research, but which can be useful for it. Then we compare two innovation evaluation approaches studied in the ImpresS and Impresa research projects. Finally, we will discuss the takeaways from these two experiences.

►► How to choose an evaluation method?

In order to understand the issues surrounding a methodology to evaluate innovation impacts, we must first present the range of evaluation methods and the issues that each one of them raises.

Evaluation: a range of practices

‘Evaluation – more than any science – is what people say it is; and people currently are saying it is many different things’ (Shadish *et al.*, 1991). This definition from American academics testifies to the difficulty of understanding evaluation, a difficulty explained by the multiplicity of reasons for using evaluation, by the varying degree of openness to different actors in the evaluation, as well as by the diverse uses of its results.

Why evaluate?

A first objective that justifies evaluation is to produce information relevant to planning a project or a process. This type of evaluation is conducted *ex ante*, i.e. before the intervention. This involves estimating the impacts of a future intervention, of building scenarios that will help choose between different options and of anticipating the potential risks in the intervention’s implementation so that it can be appropriately fine-tuned. It also involves understanding the mechanisms through which the intervention can produce the intended impacts.

A second objective is to identify areas for improvement for future interventions. This concerns the generation of knowledge about the intervention’s processes and mechanisms that hinder or enable its smooth conduct and the production of impacts. This type of *ex post* evaluation can be carried out after the intervention

mechanism has been implemented, with a view to fine-tuning and improving future interventions. It can also be conducted *in itinere*, i.e. during its implementation, in order to evaluate the achievement of the initial intermediary effects, identify the strengths and weaknesses of the intervention, and make the necessary adjustments as soon as possible. This type of evaluative approach requires the resources and capability to comprehend the causal mechanisms involved. Unlike a monitoring mechanism, which can also be set up during the intervention, the evaluation not only examines the logic and the relevance of the assumptions guiding the intervention, but also the way in which it fits into its environment.

The third objective is accountability, i.e. the need or requirement to be accountable for the action undertaken as part of the intervention, with regard to the expectations of the entity that commissioned the evaluation. We can investigate the efficiency of the action (measured by the ratio between the results obtained and resources expended), its usefulness (does it meet the needs of the beneficiaries?), its effectiveness (are the objectives attained?), as also its coherence (link with other mechanisms) or its relevance (is this the best solution to solve the problem identified at the outset?). Of course, the answers to these questions can also be responses to the second objective presented above. The diagram below (Figure 14.1) presents these different evaluation criteria and the dimensions concerned.

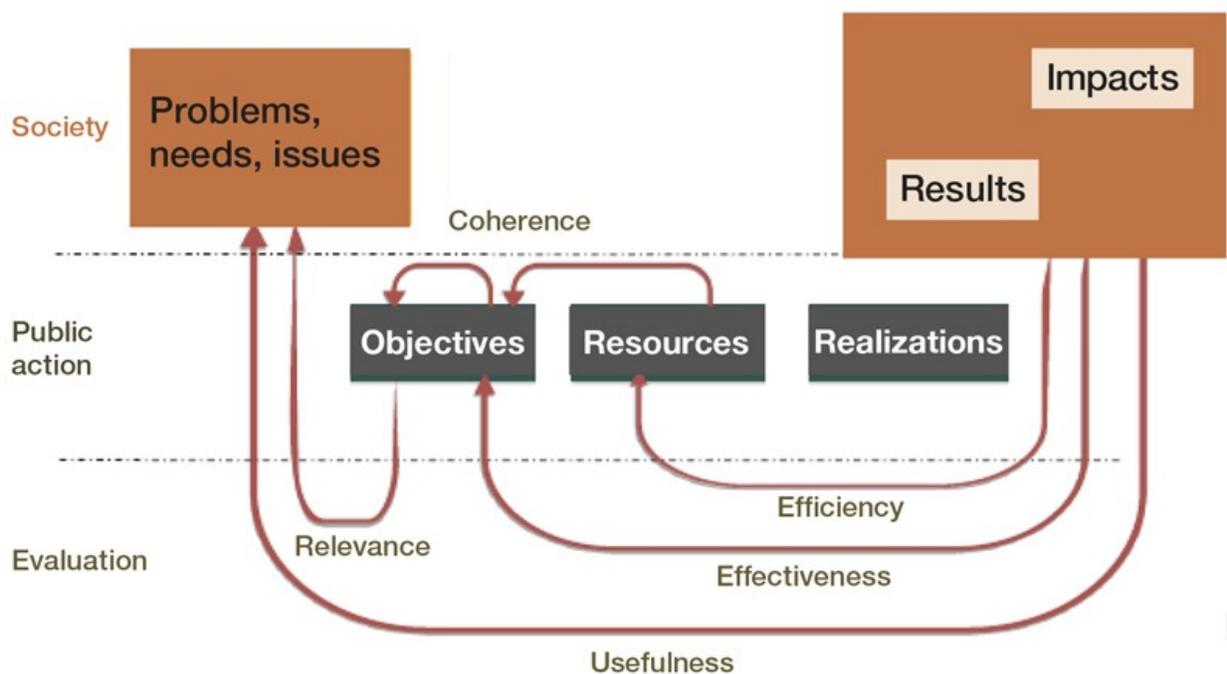


Figure 14.1. Evaluation criteria and dimensions concerned (source: Quadrant-Conseil).

For example, when an evaluation question is meant to determine the production of results in terms of resources, it becomes part of the efficiency criterion.

The same evaluation can meet several of these objectives. Thus, a results-oriented evaluation may also seek to understand the nature of the processes that influence the course of the action in order to make adjustments to it. It is also possible for the same intervention to provide for three evaluation periods: first, estimating the impacts *a priori*, then undertaking a mid-point evaluation in order to correct the implementation and finally comparing the final results to those expected through an *a posteriori* evaluation.

Evaluation, for whom and by whom?

Evaluation methods can also be distinguished on the basis of the different kinds of actors participating in them. An evaluation can be conducted either by a person belonging to the institutions implementing the intervention that is being evaluated, or by external persons. External evaluators are usually preferred for result-oriented evaluations, whereas internal evaluators (usually better placed to identify intervention issues) are favoured for learning-oriented evaluations (Conley-Tyler, 2005).

The team responsible for conducting the evaluation can also involve other actors in the process, such as funders, supervisory bodies, field workers, direct or indirect beneficiaries of the intervention, or even other citizens. There can be several degrees of participation characterized by the ‘breadth’ of the evaluation (representing the diversity of actors) (Table 14.1) and its ‘depth’ (representing the role played by each actor in the evaluation) (Baron and Monnier, 2003).

Table 14.1. The five levels of ‘breadth’ of participation in an intervention’s evaluation.

‘Breadth’ of the evaluation	Evaluation participants
Level 1	Those who commissioned the intervention that is being evaluated and its main operators (for example, donors and researchers)
Level 2	Level 1 participants + those actually implementing the intervention (for example, research partners and technicians)
Level 3	Level 2 participants + direct beneficiaries (for example, agricultural producers experimenting with or trying out the innovation)

Level 4	Level 3 participants + indirect or potential beneficiaries (for example, producers located in the same area as the experimenters, and potentially impacted by the intervention)
Level 5	Level 4 participants + members of civil society or their representatives

The evaluation is said to be managerial, or co-produced, when the breadth of participation remains at level 1 or 2. It can be seen as participatory when the breadth reaches level 3, with direct beneficiaries starting to participate in the evaluation activities. However, it is necessary to distinguish simple consultation from actual participation. The fact of taking the opinion of actors into account when collecting data, through interviews or questionnaires, does not constitute a participatory dimension *per se*. For evaluation to be truly participatory, the concerned actors must contribute directly to one or more evaluation activities.

Baron and Monnier (2003) identified the following evaluation activities:

- defining evaluation issues and questions;
- validating the evaluation method;
- managing the evaluation work;
- analysing and interpreting the evaluation data;
- formulating recommendations based on evaluation results.

Depending on the requirements, the evaluation team decides on the ‘depth’ of the participation; it may choose to assign different evaluation activities to different groups of actors. In order to encourage the appropriation of the evaluation results, it is advisable to include the actors who will be their future users. They must at least be part of the bodies managing the evaluation, or even participate in defining the evaluation’s questions and scope (Patton, 1997). It is only when actors of level 3, 4, or 5 (Table 14.1) are involved in defining evaluation questions or issues, as well as in all of the evaluation’s tasks, that we can speak of an empowerment evaluation (Fetterman *et al.*, 2015).

The issues presented above are common to all evaluation procedures. We now present those that are specific to the evaluation of the innovations’ impacts of.

The specificities of evaluating the impacts of innovations

On the one hand, the evaluation of impacts consists of assessing qualitatively or quantitatively the long-term changes resulting from the innovation. On the other, it can confirm that these changes are attributable to the innovation and not to other causes. The effects of the innovation may be positive or negative, direct or

indirect, expected or unexpected.

Consequently, an evaluation of impacts requires the use of methods to analyse the relationships between the innovation and the observed effects. Two approaches are suitable for this purpose: first, an attribution analysis, comparing the results of the innovation to a counterfactual scenario and, second, a contribution analysis, which breaks down the innovation process into different stages, and then verifies and clarifies the causal links from each of these stages to the observed changes.

Methods to demonstrate impacts using a counterfactual scenario

These evaluation methods use a demonstration protocol based on the comparison of two situations, one with the innovation and the other without. Such an approach is known as an attribution analysis. The methodological challenge is to ensure the two groups are as similar as possible, consisting of units that we want to observe (for example, individuals), which are used for comparison, so that they are only differentiated by the innovation's presence or absence. The counterfactual scenario, i.e. the situation without the innovative intervention, is then comparable to what would have been the situation of the group being evaluated should it not have participated in the innovation.

The counterfactual group can be reconstituted by the evaluation team in a quasi-experimental manner, using statistical methods such as matching methods for internal or external comparison groups or the double difference method. It can also be reconstructed through modelling, to obtain a modelled counterfactual situation (SFE, 2011). Comparison groups can also be randomly constituted from among the potential beneficiaries of an innovation to be implemented, some of whom are included in a test group which will actually be affected by the innovation, with the others being included in a control group, which will not be affected and will serve as a counterfactual group, as part of a random assignment experiment (Duflo, 2005).

This type of demonstration is adapted to simple innovations whose dissemination is based on the technology transfer model. It requires the innovation to remain stable over time and also not need major adaptations when implemented by actors on the field (Devaux-Spatarakis, 2014a). These

innovations may be termed ‘tunnel-type’ programmes, in the sense that they follow a simple linear causality, and are little affected by the intervention of the actors (Naudet *et al.*, 2012).

Methods to demonstrate causality through a contribution analysis

This second approach is based on the breaking down of the innovation process and an analysis of the different causal links involved. This is a contribution analysis (Mayne, 2001). It theorizes the link, not between an effect and a single cause, but between an effect and a set of causes, each of which cannot alone cause the final effect, but whose synergy with the other causes is likely to create the effect in question (Befani, 2012). In fact, the innovation being evaluated is only one contribution, among others, to the observed change. The challenge of the evaluation is to quantify the extent to which the innovation has contributed to the observed changes and to describe the manner in which it has done so.

Such an assessment is part of the ‘theory-driven’ family of methods. This approach breaks down the innovation into a succession of hypotheses on the changes it should engender among the various actors, hypotheses that are examined during data collection for the evaluation (Devaux-Spatarakis, 2014b). This key analysis tool can be called the theory of change, the logical impact diagram or the impact pathway (Douthwaite *et al.*, 2003). It helps explain and provide information not only on the innovation, but also on its interaction with different actors and the influence the context has on it.

This approach is adaptable enough to be used for evaluating the impact of complex innovations, whose deployment is accompanied by evolutionary processes, especially as a result of the actors’ involvement. It shows the various hypotheses underlying the innovative intervention and identifies the critical points pertaining to the interactions between the various actors participating in the innovation.

There is therefore no standard evaluation method. The evaluation’s objectives, the role that one wants to assign to the different actors and the type of innovation process under study has to be ascertained before the general approach and the associated tools can be chosen for the evaluation (Table 14.2).

Table 14.2. Choice of impact evaluation approaches depending on the type of innovation to be evaluated.

Characteristics of the innovation and adapted evaluation approaches	Simple innovation or technology transfer	Complex innovation system
Innovation process	New technology, practice or standard, whose implementation is controlled by the initiators	Technology, practice or standard constantly subject to adaptations by the actors who adopt it
Innovation actors	Defined in advance and monitored throughout the implementation	Evolving during the innovation's implementation
Innovation goals	Defined in advance	Can be redefined as and when required during the innovation's adaptations
Evaluation approaches	Experimental or quasi-experimental methods	Approaches based on the theory of change (impact pathway)
Method of demonstrating causality	Attribution analysis	Contribution analysis

►► An evaluation approach for complex innovations

The contribution analysis approach for the evaluation of complex innovations is illustrated by two case studies concerning agronomic research from the ImpresS and Impresa projects. A comparison of the approaches used in these two cases will help draw conclusions on the methods, tools and instruments for evaluating the impact of agricultural research.

The ImpresS project^[46] (Impact of research in countries of the South), led by the French Agricultural Research Centre for International Development (CIRAD), aims to develop and implement an impact evaluation approach to promote an impact-oriented culture within this institution. This involves, on the one hand, determining the impacts of innovations supported by CIRAD and its partners in the countries of the Global South and, on the other, to produce knowledge on the role of the research community in these innovative processes in order to help improve interventions. Thirteen case studies, spanning a range of innovations, were carried out in 2015 and 2016.

We will briefly present here one of these innovations, concerning the implementation of the '*Vales da Uva, Goethe*' geographical indication for wine

produced from the Goethe grape in the state of Santa Catarina, in southern Brazil, from 2004 to 2014^[47], starting from the preparation of the dossier to apply for the recognition of the geographical indication, up until the marketing of wine under this appellation.

The Impresa project^[48] follows the same type of approach, but with a few differences. The project's general aim is to measure, evaluate and understand the impacts of all types of European agricultural research activities. Part of the project involved the study of the complex causalities of the impact pathway starting from the research activities to the development of agricultural innovations, and then to the effects on society. We illustrate this approach using the example of the transition to organic rice systems, as part of a research programme for the deployment of organic farming in Camargue, France, initiated in 2000 by the French National Institute of Agricultural Research (INRA) and its partners. It was a matter of addressing the dilemma between, on the one hand, the need to produce rice to desalinate the soil and thus help sustain agricultural activity in the territory and, on the other, the obligation to reduce the environmental impacts of rice production.

These evaluations relied on a participatory approach and brought together the innovation's direct and indirect beneficiaries (i.e., levels 3 and 4, respectively, in the 'breadth' of participation, as defined in Table 14.1).

Recreating the impact pathway of the innovation in a participatory manner

These two evaluation approaches used a causal analysis, by way of a reconstruction of the impact pathway, starting from the intervention of the research community to the impacts on the innovation process and, subsequently, on the beneficiaries and on society. The impact pathway is represented graphically in Figure 14.2 and shows the causal process of the innovation.

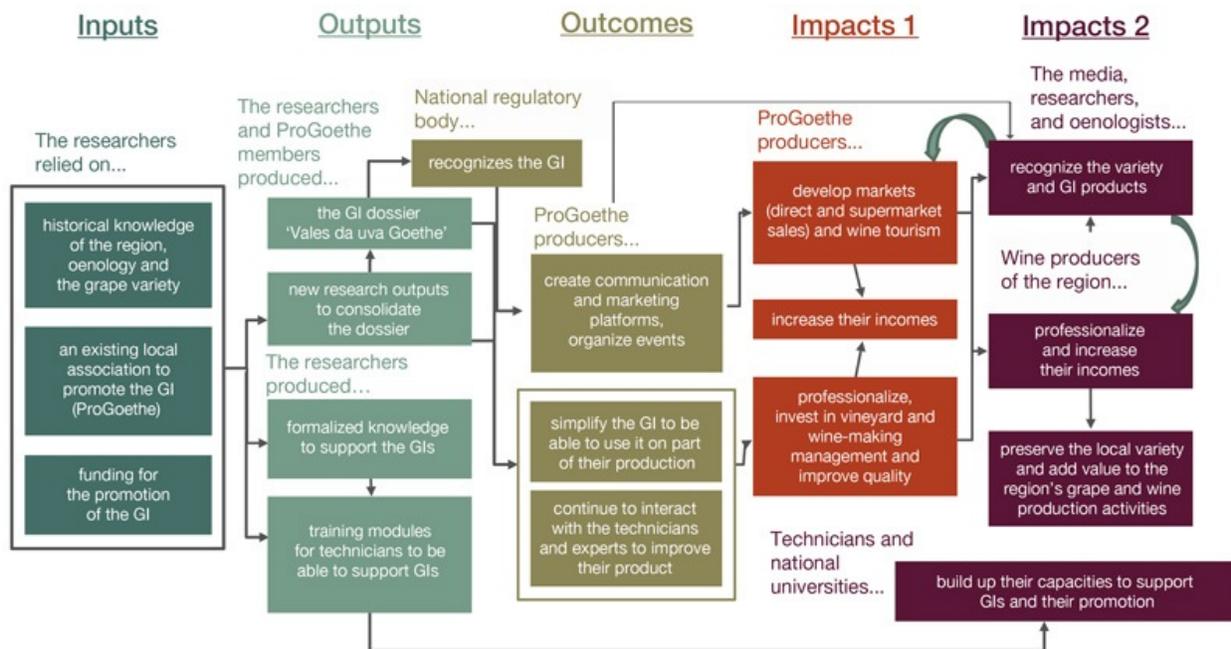


Figure 14.2. Impact pathway of the 'Vales da uva, Goethe' geographical indication innovation (drawn with Claire Cerdan's research team).

In the ImpresS approach, the evaluation of the impact begins with a participatory workshop for all the actors of the innovation in order to trace the innovation's chronological narrative and to highlight some of the lesser known parts of the process. Based on this workshop, the evaluation team can draw up the impact pathway which depicts the causal relationships of the innovation.

This impact pathway shows:

- the resources used by the research community (inputs);
- the products of research activities (outputs);
- the appropriation and transformation of outputs by the producers who are members of the association for the promotion of the geographical indication (GI ProGoethe), especially into socio-technical mechanisms (outcomes);
- first-level impacts on actors interacting with the research community (GI ProGoethe members);
- second-level impacts on other actors who are the indirect beneficiaries of the innovation, such as the other producers in the region who are outside the ambit of the geographical indication.

All the complexity of the impact pathway resulting from the innovation's dynamic and non-linear processes is disentangled. The impact pathway shows that the innovation process is complex, involves multiple actors, and is

composed of multiple causalities that can interact with each other.

As part of the evaluation of the Camargue organic rice programme, the impact pathway of the research programme was reconstructed and drawn in a participatory manner with the various actors during a workshop^[49] (Quiédeville *et al.*, 2017). The participants first identified the different changes pertaining to the transition to organic farming in Camargue since 2000. They then sought to define how, when, and where these changes occurred. Subsequently, they drew the impact pathway, taking into account the complex and dynamic nature of the innovations concerned. A specific focus was to understand the nature and intensity of the links between stages, in order to better determine the role of the research undertaken. In addition, an analysis of the social network made it possible to examine the real role played by different research institutes in the transition to organic agriculture and, as a result, validate the actors' statements (Quiédeville *et al.*, 2018).

In order to establish the extent to which impacts are attributable to the innovation on the one hand, and to the intervention of the research community on the other, it is necessary to triangulate information from different sources. This involves a combined analysis of documents, statistics and existing studies (constituting secondary data), as well as conducting surveys using questionnaires, individual interviews or collective interviews.

Identifying and measuring the impacts

The evaluation based on the impact pathway requires specific work to identify and measure the innovation's impacts. The two approaches selected as examples are exploratory and participatory in order to help identify the impacts of the innovation process. In the evaluation in Camargue, the impacts were primarily revealed through individual interviews. In the evaluation of the geographical indication in Brazil, the participatory workshop brought together different actors and beneficiaries of the innovation, who worked in small groups to identify impact descriptors, i.e. the effects of the innovation – as the workshop participants perceived them – on their activities and their environment. These impacts can be positive or negative, expected or unexpected. They can be supplemented by the impacts expected by the research teams, for example, such as biodiversity preservation (as in the case of Camargue). In Brazil, the actors noted an unexpected impact of the geographical indication on the local economy

as a whole, extending to well beyond the known producers using this geographical indication, which thus gave another dimension to the initial innovation.

Once the impacts are identified, the evaluation team looks for suitable indicators. To do so, it can rely on a study of the literature, and also look at the impact descriptors formulated by the beneficiaries. For example, in Brazil, in order to estimate the impact of the geographical indication on the professionalization of artisanal and colonial wine producers, the indicators chosen were the change in the quality of the wines, as judged in local competitions; the number of visitors to the wine festival organized in 2015 for wine with the '*Vales da uva*, Goethe' geographical indication; and the change in direct and total sales by producers of wine labelled with this geographical indication.

Once the indicators are decided upon, the evaluation team collects data to quantify them and to estimate the extent to which the identified impacts are indeed verifiable in the field.

►► Feedback on the role of evaluation in understanding innovation

An improved understanding of the causal mechanisms of innovation processes

These two case studies enrich our understanding of the innovation process, including of the underlying causal processes. The impact pathway tool makes it possible to organize the information, and more importantly, to better understand the causal relationships between research outputs, their appropriation and adaptation by other actors and, finally, the impacts they produce. It also makes it possible to determine the cause of the observed impacts, and thus to distinguish between those resulting from the innovation being studied or its environment and those attributable to other programmes.

A detailed analysis of the impact pathway also helps determine when and where research plays a key role in the innovation process. In the case of Camargue, it was the statements of actors during the workshop that helped formulate

hypotheses on the innovation process, starting from the beginning of the research programme and going up to the impacts. These hypotheses could then be confirmed, or refuted, by the evaluators (process tracing), on the basis of official documents, actual observations made on the ground, the statements of actors from individual interviews, statistics, as also an analysis of the social network to discern any changes in relationships between individuals and/or institutions. In the case of the geographical indication in Brazil, the evaluation team considered that the work on the impact pathway made it possible to impart a coherent structure to all the activities of different actors of the innovation. This tool also helped determine the activities through which the actors in the field had appropriated – or had been unable to appropriate – the outputs of the research teams (Cerdan, 2016).

In order to make the analysis more rigorous, the evaluator can also look for possible alternative explanations for the different causalities of the impact pathway (their correctness can also be verified by process tracing). This in-depth analysis of the impact pathway, on the basis of the attributability of the impacts observed to the innovation, compensates for the lack of comparison with a control group (Mayne, 2001). This analysis can, however, be further strengthened, as in the case of Camargue, with the help of questions to be asked during individual interviews, such as: ‘If activity X of the programme had not taken place, what would have happened?’ These questions help determine the counterfactual situation, i.e. the situation without the intervention of research activities, would have been. In the same vein, the actors were asked to estimate the importance of each identified event on the impact pathway, in relation to their influence on the events that followed. This helped us to better understand the role and contribution of the research activities to the innovations, as also the contribution of these innovations to the impacts on the beneficiaries and on society.

Usefulness of the evaluation for innovation actors

These approaches for evaluating impacts have been a source of learning for the research community and other innovation actors. Workshops to present the findings and conclusions were organized in both case studies, providing actors with an opportunity to comment on the results of the evaluation.

In the case of Camargue, the evaluation of the research programme helped

identify factors that facilitated or hindered the farmers in the transition to organic farming. The actors were also able to express their desire that scientific experiments be conducted in closer collaboration with farmers for improving their effectiveness. Furthermore, the evaluation revealed that researchers were too optimistic about the adoption and use of their research by the beneficiaries. It showed that while the research had positive effects, its influence was not very significant since other important factors (institutional framework, economic and political factors, etc.) also played a role. The research community has begun to take these elements into consideration. For example, the French National Institute for Agricultural Research and the French Rice Centre have initiated deeper discussions on how to work together with farmers and involve them more in defining goals and in implementing research activities, especially in terms of experimenting with agricultural practices.

In the Brazilian case, the evaluation opened avenues for reflection on the establishment of new geographical indications. The phase of appropriation and transformation of research outputs by the other actors emerged as the most critical moment for the production of impacts. Following this assessment, the research team plans to adopt a new approach to promote future geographical indications, by working more closely with producers, especially in the creation of various tools such as simplified guides for those involved in the creation of geographical indications. It is also planned to apply the ImpresS evaluation method to ongoing projects for registering new geographical indications, for an *in itinere* evaluation, focusing specifically on the risks and opportunities to be considered during the development of the innovation.

►► Conclusion: moving towards a culture of impact to favour the learning process of the research community

A variety of methods, tools and instruments are available to the researcher to evaluate the innovations in which he participates. A suitable method can be chosen only after defining properly the scope and goals of the evaluation as well as its openness to the actors of the innovation in question. It is also necessary to examine the nature of the innovation process itself before evaluating the impact of an innovation. Furthermore, one has to ensure that the method chosen for the evaluation is adapted to the innovation process being studied.

Complex innovation processes call for an approach based on the reconstruction of the impact pathway and the study of causal links. The impact pathway can also help build consensus amongst actors on the innovation process, identify the causal links leading to the impact, structure the collection of information on impacts, and encourage the different actors in acquiring knowledge and know-how. The challenge then lies in using the acquired knowledge and in leveraging learning in order to guide action. Promoting an impact culture in research institutions is not just about providing reports to the management of these institutions. It can help in an improved planning of research to target the impact. It can also favour a learning process for researchers in reviewing their practices so that they can better support innovation processes.

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Chapter 15

Evaluating impacts of innovations: benefits and challenges of a multi-criteria and participatory approach

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Summary. To support actors to migrate to more sustainable food systems, multi-criteria evaluation tools are required to explore the effects and impacts of technical and organizational innovations. In this chapter, we present two possible constructions and uses of such tools: the first involves support for