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# Measuring the effects of transdisciplinary research: the case of a social farming project

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## 1. Introduction

An increasing amount of research has focused on ways of producing knowledge that transcend disciplinary and academic boundaries and transdisciplinary research (TR) is one of these approaches.

Several reasons lie at the root of the concept of transdisciplinarity (Hirsch Hadorn, Pohl, & Scheringer, 2002): the integration of knowledge from different scientific disciplines, the transformation of the relation between science and society (Gibbons et al., 1994), and the challenge of “post-normal” science (Funtowicz & Ravetz, 1993). In addition ordinary specialised research has to tackle the challenges of daily life where societal and environmental and economic issues are intertwined in an increasing complexity. TR lies between the concepts that emphasise social interaction (Wiek, 2007) and the inclusion of values and knowledge from research (Scholz & Marks, 2001). TR in fact highlights the collaboration between scientists and non-scientists regarding specific real-world challenges. TR is open to all stakeholders focused on a mutual learning process and also involves a transition towards radical changes in knowledge and operational activities.

Due to its propensity to handle complex multi-actor processes, TR is commonly used in sustainable development (Walter, Helgenberger, Wiek, & Scholz, 2007), in particular for regional development and/or spatial planning (Robinson & Tansey, 2006) and in complex fields such as landscape and urban development, global change and sustainability research (Tress, Tress, & Fry, 2009; Walter & Scholz, 2007).

These characteristics have also made TR interesting for social farming (SF) research and projects. Social farming involves the use of resources from agriculture (plants and animals) and farms in order to reinforce social/health services within the framework of a reduction in public expenditure and a personalisation of solutions to human needs. In accordance with its main components (i.e. sectorial divides; different regulatory instruments in agriculture and in the social/health sector; changes in the operational paradigm from state/market to community based relationships; promotion of the ethical contents of products; engagement of a plurality of public and private actors with specific knowledge), research in SF is based on knowledge aimed at a mutual learning among different actors.

The new knowledge that is needed to mobilize resources from agriculture and for the provision of innovative services is demanding in terms of the actors involved, their willingness to share and to find new codes for communication, but also for the definition of new working paradigms and rules. According to transition management theory, such a process is normally organized inside hybrid transition arenas where diverse stakeholders with diverse specialisations and competencies, working with a common agenda, organise and reflect on pilot cases in order to achieve a common understanding and solve the emerging needs – personal and societal – related to the provision of social/health services. The creation of a common knowledge among actors initially equipped with diverse competencies and visions (from farmer to medical doctors, to local health institutions), and the definition of shared rules are crucial steps in replicating pilot SF initiatives and promoting its innovation (Di Iacovo, Moruzzo, Rossignoli, & Scarpellini, 2014).

SF is, therefore, a field in which transdisciplinary research and the MODE 2 of knowledge has a clear application.

As a group that has been involved in the field of SF for many years,<sup>1</sup> we decided to apply a transdisciplinary approach to building an evaluation tool for SF initiatives. The project was carried out from 2012 to 2014 and was funded by the regional government in Tuscany.

The main goal of this paper is to evaluate the TR process used in the project in order to:

- Understand whether the TR process generated “new and shared” knowledge;
- Define the strengths and limitations emerging from the TR approach and how these could be addressed in order to make this experience transferable.

Finally, the paper examines the possible use of the evaluation tool for the future development of SF.

Section 2 reviews the literature on TR, summarizing the relevant elements for our analysis. We describe the characteristics of the TR approach and examine the role of transdisciplinary for knowledge production. In Section 3 we present the context, the background and the steps involved in the research process. We also explain the main characteristics of SF and briefly introduce the project on the creation of an evaluation tool for SF initiatives.

Section 4 analyses the research process and investigates the participatory approach amongst the actors involved. We use the evaluation tool for transdisciplinary research, proposed by Pohl et al. (2010), in order to measure the network building capacity and the knowledge production process.

## 2. Transdisciplinary research as co-production of knowledge

Transdisciplinary research (TR) is used above all to tackle sustainability, both in the environmental and social fields (Bergmann et al., 2005; Pohl & Hirsch Hadorn, 2007; Wiek, 2007; Enengel et al., 2012).

The concept of “transdisciplinary” is described as a “practice that transgresses and transcends disciplinary boundaries” (Russell, Wickson, & Carew, 2008, p. 461) and as a way to “extend beyond disciplinary thinking” (Ramadier, 2004, p. 424). In transdisciplinary research, “scientific disciplines (represented by individual researchers) and sectors of the real-world (represented by individual actors) are getting interrelated and are transformed” (Pohl & Hadorn, 2008).

Although initially the publications on transdisciplinary highlighted the integration with non-academic actors as a tool of knowledge generation, contemporary theories on knowledge production focus on the inclusiveness of actors, both within and outside academia (Ziman, 2000). Scholz, Mieg and Oswald (2000) describe TR as a process of mutual learning between science and society, and Mobjork (2010, p. 866) sees transdisciplinary “as an extended knowledge production process including

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<sup>1</sup> From 1999 we started to examine the future fiscal crisis of the state and on the possible reduction in the provision of social/health services especially in rural areas, where normally the provision of services is more difficult and expensive. Our starting view at that time was that community resources were pivotal in the organisation of the local economy, especially for those rural economies based on immaterial and cultural values. In addition the belief that the organisation of social services communities normally reinforces their internal ties, especially when values such as exchange and reciprocity, besides market and state intervention, are promoted. An initial research project in three rural and mountainous areas in Tuscany was able to impact on local and regional policies and to promote the organisation of innovative services. We then started to think about the concept of social farming, based on the promotion of rural and agricultural resources in order to provide innovative services both for rural and urban populations. This was in 2002 and up to now, we have followed many development pathways of social farming in various Italian and European regions by accompanying the evolution of practices, values, norms and knowledge creation, and with the strong commitment of local public and private stakeholders.

Table 1  
Attributes of MODE 1 and MODE 2 knowledge production.

MODE 1	MODE 2
Academic context	Context of application
Disciplinary	Trans-disciplinary
Homogeneity	Heterogeneity
Autonomy	Reflexivity/social accountability
Traditional quality control (peer review)	Novel quality control

Source: Hesse-Biber [2010] and Van Lente (2008, p. 741).

a variety of actors and with an open perception of the relevance of different forms of information produced by the scientific and lay community”.

TR is pivotal in contemporary knowledge production (Mobjork, 2009), particularly in the MODE 2 concept (Gibbons et al., 1994).<sup>2</sup> The second element of MODE 2 knowledge production is transdisciplinary (Table 1). Here, scientific disciplines interact dynamically, the consensus cannot be reduced to disciplinary parts and the research results are diffused during the process of knowledge production.

As observed by Mobjork (2009), transdisciplinary as defined in the MODE 2 of knowledge production has four features:

It develops a framework to guide problem-solving;

It has its own distinct theoretical structures, methods and modes of practice (which do not necessarily depend on disciplinary knowledge);

The communication extends the conventional institutional channels and is aimed at those who have participated in the research;

It is dynamic and unpredictable as in discipline-based research.

TR builds a bridge among different aspects of scientific knowledge – produced under ideal conditions – and concrete questions of the real-world. Thus, the effectiveness of the research lies in creating the right conditions for an effective dialogue between actors in different fields (Michel, Heim, Herweg, & Breu, 2012), where different types of knowledge may be encountered equally (Pohl et al., 2010).

Partners in TR must be able to act in accordance with their role and their collaboration by following a consulting or a participatory approach. This distinction “draws upon the qualitative difference between research conducted including all kinds of actors on equal terms in the knowledge production process (participatory transdisciplinary) or having actors from outside academia responding and reacting to the research conducted (consulting transdisciplinary)” (Mobjork, 2010, p. 866).

With a consulting approach, the social actors are not included in knowledge production but are asked to react to questions presented by researchers. In contrast, the participatory approach promotes a full inclusion of the social actors in the process of knowledge production. In this case their knowledge is as valuable as the scientific knowledge. In the participatory approach, collaboration includes mutual understanding: all kinds of actors are equally competent to provide substantial knowledge to the problem in focus.

Actors sharing a common interest – even if approached from different contexts – overlap with each other. They interact, promoting knowledge sharing and learning.

Knowledge processes, especially those that transcend knowledge boundaries, need to consider not only verbal aspects of communication (the sharing of explicit knowledge) but also embedded social interactions (the sharing of tacit knowledge). This co-production of knowledge takes place at the intersection of science and non-science – the agora – a “public space in which science meets the public” and in which the “public speaks back to science” (Nowotny, Scott, & Gibbons, 2001, p. 247).

More recently (Mitchell, Cordell, & Fam, 2015) introduced the idea of transdisciplinary research and its outcome spaces. The authors moved from the pitfall of the problem-solving metaphor to propose TR as based on “problem re-solution” as a dynamic and not conclusive process where research results and clarity interact with an explicit commitment to “improving the situation” (page 90). TR research is related to “socially relevant issues” requiring “transcending and integrating disciplinary paradigms”, a specific “commitment in participatory research” in order to search for “unity of knowledge”.

Focusing mainly on the outcomes of TR, Mitchell et al. (2015) underline the importance of the strong engagement of researchers with professional and lay knowledge. This starts from motivations and values that should be made explicit, as TR is not value free, and problem resolution being informed by the preferences and the values of researchers as people embedded in society. These values are considered as the lens through which interaction with the world can be interpreted, and the boundaries of the research as well as of the stakeholders involved can be defined. Researchers should thus present their intentions, worldviews, experiences and qualifications, engagement in situations, funding arrangements, degrees of arrangements across disciplines and degrees of engagement in situations in order to clarify the results achieved for everyone involved. The researchers thus define three outcome spaces for TR related to the “improvement within the situation or the field

<sup>2</sup> The new mode of knowledge production, coined “MODE 2”, was introduced in The New Production of Knowledge (Gibbons et al., 1994). It did not replace MODE 1, but supplemented it.

of inquiry”, the generation of relevant flows and stocks of knowledge, mutual and transformational learning by both researchers and research participants to increase the likelihood of persistent change.

As a group of researchers in Pisa University we thus started by rethinking our course of action. What we present here is part of this reflection based on Pohl and Mitchell et al. contributions to work on sustainable social development in rural areas. In this paper, we focus on a specific research project on the definition of an evaluation tool for SF initiatives and we analyse the TR process in accordance with Pohl’s categories. In the conclusion we also consider the outcomes of space introduced by Mitchell in order to reflect on future research steps.

### 3. Context of the survey

#### 3.1. Social farming: a space for transdisciplinary research

Social farming is a retro-innovative (Stuiver, 2006) solution able to promote the multifunctional use of agricultural resources (plant, animals, farm spaces and relationships) in order to reinforce and enhance the health/social protection nets both in rural and urban areas. SF has an important role in a phase of welfare crisis and the increasing demand for the personalization of social/health services. In rural areas, SF can reinforce social protection by better activating community nets and the responsible participation of diverse public and private actors in this goal. Today European SF consists of a rich variety of practices, originating essentially spontaneously (especially in Italy), to offer co-therapy, social inclusion, education, vocational training, job inclusion, and civic services for a broad range of users (from people with mental and psychiatric disabilities to various categories of less empowered people, addicts, elderly people, children and families) (Di Iacovo & O’Connor, 2009; Dessein, Bock, & de Krom, 2013; Sempik, Hine, & Wilcox, 2010). These practices are often developed by different stakeholders such as private farms and/or social cooperatives and voluntary associations (the so-called third sector), but also public welfare services, and others actors linked with local areas, such as farm associations, public services for agriculture and job creation, education, and justice. All of these stakeholders normally work within a specialized framework of attitudes, knowledge, and regulatory settings at macro, meso and micro levels.

In most Western countries, modernization and specialisation arose with the organisation of the welfare system and the growing relevance of public policies linked to economic development.

The economic crisis increased difficulties in state intervention as well as the demand for alternative solutions able to ensure livelihood in both rural and urban areas. The concept of SF works in a grey zone that regards not only different competencies, but also the definition of an alternative set of values, attitudes and competences. SF is organized differently in different countries according to the characteristics of the welfare system.<sup>3</sup> In Italy due to the high public debt and the severe cuts in public expenditure, SF initiatives are not directly funded by health/social services. They are mainly based on the local capacity to define win-win solutions among responsible public and private actors able to promote and reinforce the idea of subsidiarity, the co-production of public/private economic and social values, and reinforce the principles of civic economy. This is normally based on a long iterative exchange among actors (public, private third sector), competences (agriculture, social, health, education, justice) and disciplines capable of building trust, sharing linguistic and cognitive codes, re-defining a collective shared knowledge and common vision and strategies.

Diverse actors decide to converge on an innovative topic in accordance with specific interests (i.e. in the local area, common experiences, values, but also personal, social, cultural and economic interests). The start-up of SF initiatives always conflicts with sectorial, cultural and disciplinary barriers and can normally be facilitated by transition management theories (Di Iacovo et al., 2014; Murray, Caulier-Grice, & Mulgan, 2010; Jackson, 2009; Geels & Schot, 2007; Hessels & van Lente, 2008; Rotmans & Loorbach, 2009), by organising stakeholders in an arena where they can work and share visions, strategies and goals following a specific agenda for transition. The discussion among the actors involved is normally focused on the organization/analysis of innovative practices such as pilot initiatives. In this space, researchers, practitioners and public authorities define a new framework based on new knowledge and rules, but they are also potentially able to define new shared values, attitudes and behaviours. SF can be also seen as a process of social innovation (Neumeier, 2012; Pol & Ville, 2009; Smith, Vob, & Grin, 2010; Moolaert, Martinelli, Swyngedouw, & Gonzalez, 2005) where collective learning, bottom-up approaches and practices rooted in local experiences support a process of radical change which is able to affect attitudes, practices, knowledge and policies at regional and national levels (Di Iacovo et al., 2014).

From a regulatory point of view, SF initiatives are not only based on state intervention but also on an innovative framework where the responsibility of private farms, the competences of the health and social workers, the commitment of voluntary associations, the competences of social cooperatives, and the ethics of consumers are reorganised in the perspective of a resilient and sustainable local society. In other words, SF is based on an extended concept of subsidiarity, on the idea of co-designing the local innovative services, but also on the co-production of economic and social values where the local society shifts from a perspective of individualism and profit towards a more participatory and civic attitude. Recently the Italian parliament approved a national law on social farming, thus concluding a process of codification and social promotion of the concept that lasted about 10 years and involved many actors from grassroots activists to governmental actors.

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<sup>3</sup> In Europe there are four welfare models such as North European, Anglo-Saxon, workfare in Germany and France, and Mediterranean. In each of the SF initiatives are based on the same resources but with diverse principles that affect the final outcomes.

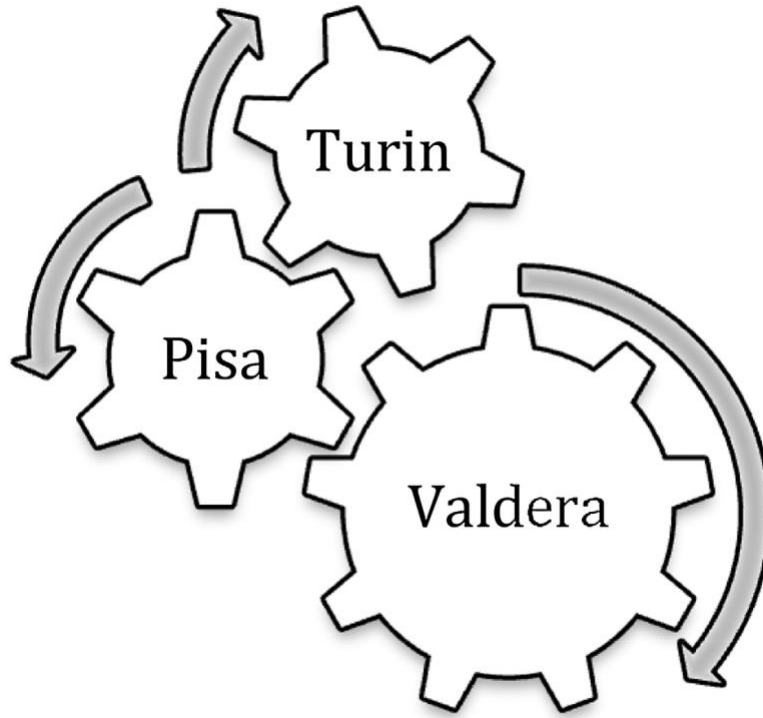


Fig. 1. The phases of the research process.

Source: our source.

### 3.2. The specific research process: to define an evaluation tool for social farming

In accordance with its commitment to building future models for social sustainability in rural and urban areas and with the increasing importance of SF in Italy and in Europe, the University of Pisa recognized an increasing demand for the definition of specific methods to evaluate SF initiatives and projects. The demand mainly came from public actors committed to the process of policy definition, as well as from practitioners in order to support their daily efforts with concrete evidence. Together with the actors with whom we were collaborated, we were aware of the complexity involved in the evaluation of practices based on a radical change in the approach to the inclusion of less empowered people in society.

From 2012 to 2014, the University of Pisa designed and managed a specific project (funded by the regional government of Tuscany) to build a method and a tool able to evaluate SF initiatives through specific indicators.

The idea was that SF initiatives impact not only on the users/participants of SF projects from different perspectives (in terms of capabilities, self-esteem, relational attitudes, social inclusion in a small or large group of users, learning and, in some cases, job participation) but might have a wider impact on the all actors involved (public health workers, services, local planning, consumers, family commitment, local social capital) and their personal or collective way of acting.

Thus the outcomes of SF can affect individuals, their families, the social capital of the community, private businesses, how professional and public attitudes are reshaped in the areas involved. As a consequence of this complexity, the evaluation of SF initiatives is by no means straightforward. Although many studies on the evaluation of social policies strictly related to welfare have been conducted, there is a lack of evaluation in the field of SF which makes research in this field valuable. In the few examples regarding SF, the evaluation was focused only on a few specific outcomes. Generally, SF practices have been evaluated by measuring the direct impact on users within the frame of traditional public welfare, while other aspects are not considered. As a consequence this has narrowed the meaning of SF and influenced its development towards more formalised interventions, where the use of plants and animals is just seen as a co-therapeutic tool. The use of traditional health indicators may be ineffective and even detrimental for SF because such indicators could underestimate important components and influence the development of SF initiatives along the wrong specialised/health path.

Hence, the evaluation design of SF practices should consider complex results due to the practical impact SF on different issues, the extent of the values promoted and the diversification of the organisational forms adopted. The design of tools able to evaluate SF outcomes – social, personal, environmental and economic – need to be understood, shared and organized by actors with diverse competences and attitudes. By considering the complexity of SF practices, in terms of dynamics, the actors involved, and individual and societal outcomes produced, we also need to consider the importance of the learning process at the basis of the evaluation system. This is crucial as the learning process can directly affect and address the

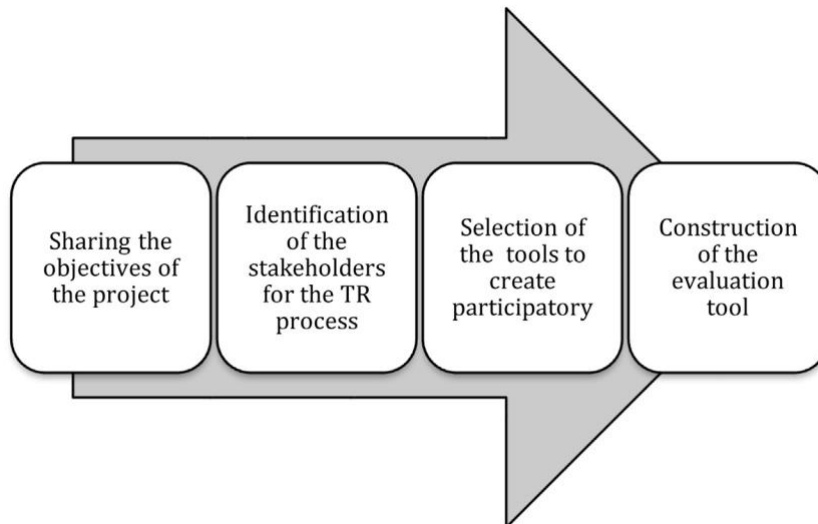


Fig. 2. The territories involved in the research.

Source: our source.

development of SF as a result of the continuous interaction between the development of new practices and their evaluation. In fact, the development of an effective evaluation system of SF initiatives, which also includes and creates self-learning, requires a rational analysis of the applied methods and an integration of tools and knowledge. The evaluation process has today become common practice in order to increase the ability of actors to learn from their experiences. Thus, in a process of collective growth, as in the case of SF, evaluation also plays an important role in the methodological support of the evolution of practices and the related networks.

From the beginning, it was also clear that this project had to involve the active participation of actors involved in SF and their complementary competences, backgrounds, sectorial memberships, work logic and specialisations, in order to improve the integration of operations, evaluations and design activities and policies. In other words, it was clear that a transdisciplinary approach was necessary. The actors involved – researchers and various practitioners – could thus share common interests, define the main objectives and ways of implementing the research, define specific tools for the evaluation exercise and reflect on the impact that such approach could have on SF practices and for the totality of the actors involved in a win–win logic.

In order to consider the diversities of local areas, the project was conducted in three different areas: Turin (in Piedmont) and Valdera and Pisa (in Tuscany)<sup>4</sup> (Fig. 1). From the initial stages of the research various actors joined the project as transdisciplinary partners. The research involved four categories of actors:

Core scientists, represented by the University of Pisa who coordinated the project, moderated the meetings (workshops, focus groups) and conducted interviews. Their competences were mainly rooted in agricultural economics and rural development focusing on participatory methods;

Scientific consultants who offered their expertise (mathematics and the social sector) in the construction of the evaluation model;

Strategic case actors with specific responsibilities. They were represented by two different actors from Tuscany (Union of Municipalities of Valdera and Health Society of Valdera). Their competences were mainly in health/social service planning);

Social cooperatives, farmers and voluntary associations—in this case competencies were quite broad, from the health sector (psychiatry, drug addiction, autism) to social inclusion and job creation, with actors from job centres and regional

<sup>4</sup> The three areas, in which the focus groups were organised, were not randomly chosen. For some years, the area around Turin has been the target of an important action of awareness raising conducted by Coldiretti (a national union of farmers) in Piedmont. This initiative affected the interest of the governmental actors in the area (i.e. the province of Turin, local health authorities, social-health groups, employment centers) and stimulated a discussion on the issue of SF among different stakeholders. Thus, following this increasing local awareness of SF, many projects were developed by actors from both the agricultural and the third sector. The area of Valdera, which is located in Tuscany, is perhaps in Italy the place where SF has held the strongest level of integration, formalization and support. This peculiarity has proactively fostered in the Valdera area the creation of an ad hoc institution called the Board for Social Farming (BSF). The BSF is a local platform for discussion between actors involved in SF processes, promoted by the "Unione dei Comuni della Valdera. This is the place where representatives of the institutions, of the civil society, the world of private enterprises and the third sector share their knowledge and plan the development of SF. The health system of Pisa is involved in SF thanks to a project called Orti E.T.I.C.I. ([www.ortietici.it](http://www.ortietici.it)) where various private and public stakeholders are working together. In the area of Pisa there is also an increasing involvement of the private sector and the third sector in SF initiatives.

Table 2

The seven dimensions of the evaluation model.

Project management	To understand the pertinence of the managerial procedures of the project of SF with the idea to improve the planning and the management by correcting possible errors
Users	To evaluate the relational skills and interpersonal capabilities acquired and developed by the users during the SF experience, the difficulties they have met, and their employment outcomes
Bearers of project	To highlight the impact that the path has had not only on the organization of the service offered but also on the social skills required to manage the service and the local community, in terms of the evolution of cultural systems
Relationship and networks	To study and evaluate the relationship of interdependence (material and immaterial) existing between different members of the network
Consumer/citizen	To measure the level of knowledge of the product obtained within the path of SF or of the services that the path of SF generates not only for the users but also for the whole community
Families	To understand and measure the level of integration and understanding between the service systems and the user's family and the outcomes in terms of social inclusion
Policies	To test and evaluate innovative ways of working and translate the SF practices in practical solutions able to bind the formal networks with the informal networks of services

Source: our source.

policies for social inclusion, but also those involved in the organisation of specific inclusive projects and farmers with technical and economic competences.

The research process was developed in four integrated phases (Fig. 2):

The research questions and aims of the project were defined with the participation of various actors involved by comparing and discussing their views, needs and expectations related to the evaluation of SF practices and its outcomes. The objectives of the project were then shared among the participants, and the research group conducted four workshops to:

Promote a shared vision of SF practices;

Start a common reflection on the local initiatives and pathways of change;

Understand through a qualitative analysis, which dimensions of the evaluation could be considered as relevant for SF practices;

Build a functional evaluation method.

Each workshop was organized as follows:

Firstly, the participants presented their activities and experiences related to SF;

Later, a structured discussion was organised among the participants in order to reflect and investigate the issue of evaluation in the practices of SF.

The University of Pisa then interviewed multisectoral experts in order to structure and consolidate the evaluation model, and to reflect on the possible dimensions to include in the model. As a result of the workshops and interviews, the team developed and proposed an evaluation model with various indicators for each dimension identified.

Various focus groups were organised with the practitioners and local case actors to discuss and validate the model. During the focus groups (organized in the three different areas), the indicators of the model were individually analysed and integrated with the participants' suggestions. The meaning and the value of each indicator were also analysed within the model. Thus, the participants proposed different weights for the different indicators.

The subjects involved in developing the evaluation model shared the idea that the practices of SF cannot be evaluated only by the outcomes of a single SF practice which, although significant, takes into account just the effects on the direct beneficiaries. There was a strong awareness of the need to consider the broader implications of SF practice in comparison with usual social/health services. In fact, SF practices have an impact on the family, but also on organisational and relational spheres, as a consequence of the link that SF practices develop with consumers/citizens and more in general within local areas by expanding their relationships and social networks. As a result, the proposed model identified seven areas (dimensions) of evaluation (Table 2). For each dimension, 10 indicators were identified. These ideas were presented and discussed with members of the regional government of Tuscany.

#### 4. Evaluation of the transdisciplinary research process

Transdisciplinary research raises high expectations. However, transdisciplinary research still needs to be substantiated by an appropriate means of evaluation. Evaluation is aimed at providing specific information for the researchers, stakeholders and the whole society which can be used to improve research projects. Transdisciplinary research is still an on-going discussion within the evaluation community. Klein even states that "evaluation remains one of the least-understood aspects"

(Klein, 2008, p. 116). In fact, there is a variability of criteria and indicators to evaluate transdisciplinary research. However, specific evaluation questions have been developed over the last few years (Bergmann et al., 2005; Spath, 2008).

As observed in Section 2, there are several evaluation tools that describe the interaction between the research project and its participants who exchange resources, knowledge, and influences. As part of a TR on SF, focused mainly on outcomes, in

Table 3

Questions to evaluate transdisciplinary research.

Broadness	How diverse are the disciplines, methods, scales of analysis and/or social actors involved?	4 kind of actors are involved: Private Enterprises (farmers, farmer associations), Actors of the third sector (Social Cooperatives, Voluntary Associations); Actor of the Public Sector (Municipalities; Social/Health Centres); Research Institutions;
		7 disciplines are involved: Agriculture and Rural Development; Psychiatry; Psychology; Sociology; Administration and Management; Job Placements; Policy; 2 scales of analysis: - Local, regional and national; - From individual needs to business activities and social/ policy integrations
	If the project has a low diversity, can it still be considered into the category of inter- and trans-disciplinary research?	The project considered has a high level of diversity amongst social/health, educational, agricultural sectors
Integration	How innovative and how suitable is the combination of disciplines and fields of expertise for the specific purpose?	The process involves different actors and disciplines to co-produce a new metric of evaluation based on sharing knowledge and experiences on rural development
	How elaborate is the approach to integration?	The high level of integration among the different actors involved was obtained through tools such as initial workshops, focus groups, and key informant interviews in order to triangulate evidences
	How balanced is the weaving of disciplines or fields of expertise?	Both the level of actors' involvement and the outcomes achieved provide evidences of the high level of integration among disciplines and fields of expertise
Reflection and learning	How elaborate is the approach to self-reflection and adaptation?	The approach to self-reflection and adaptation has been promoted towards different and integrated level of participation among actors/disciplines in a process of knowledge sharing
	How likely is the project to relate reflection and action?	Through their participation the actors increased their relationships and links. The organisation of a stronger network was useful to stimulate the development of a common planning, management and fund raising
Problem solving	How elaborate is the problem and the project's specific contribution to the problems solutions?	The passage from specialised metric of evaluation to a more integrated approach able to take into consideration multiple outcomes (social, economic, planning, relational) is highly demanding in terms of disciplines/actors mediation and negotiation of values and competences. The project was able to facilitate -on a broad territorial base- the definition of a common grid and metric able to merge and compare diverse elements involved
	How likely is the project to make a substantial contribution to problem solving?	The project was able to design a first more specific tool to address a key element in the advance of the SF pathway of change. The tool is under application in order to verify and to share outcomes in order to progressively reinforce the process of exchange of knowledge among actors and disciplines on SF
Management, social and leadership skills	How well do the management structures match and support the project's goal and combination of disciplines and fields of expertise?	The Pisa Research Group (PRG) facilitated the collective process of knowledge during the diverse steps, providing scientific knowledge, facilitating and mediating the lay-scientific knowledge integration. As an indirect indicator of the work done by the PRG can be considered the high level of reputation acquired/maintained by the group in front of the diverse stakeholders involved and the continuity in the relationships established after the process
	How do you assess the applicant's collaborative skills (open mindedness, self-reflection, dealing with changing hierarchies, ability to bear and manage tensions)?	The process was developed in an informed way to promote the shift from the sectorial vision to the integration of knowledge. The groups' participants were involved without any consideration for their hierarchical role. No actor left the arena during the process and the participation was always large and with a high level of exchange

Source: our elaboration from working paper proposed by td-Net.



our paper we decided to use the evaluation model defined by td-Net<sup>5</sup> for transdisciplinary research as it is specifically focused on the evaluation of the process supporting the TR activities. The model is based on the following 5 keys:

Broadness: evaluated in terms of the number and diversity of disciplines, methods and actors who are involved in the transdisciplinary research;

Integration: evaluated in terms of suitability and the balanced inclusion of perspectives;

Reflection and learning: evaluated in terms of collaboration, mutual understanding and learning;

Problem solving: evaluated in terms of the adequate solving of the problem and the project's contribution;

Management, social and leadership skills: evaluated in terms of the effective management structure able to match and support the project's goals and to involve actors and manage tensions.

Table 3 presents the questions, linked to each aspect, proposed to evaluate in general the TR process as well as the evidences from our research activity. Such evidences are discussed below according with the td-Net methodology.

#### 4.1. Broadness

The main characteristic of the research highlighted in this article was the high number of actors involved in the transdisciplinary process (approximately 60 including scientists, strategic and local actors) which reflect the complexity of the SF concept. Actors were involved in three different geographical areas: Turin (in Piedmont), Valdera and Pisa (in Tuscany) through the related Public Health Institutions. The areas were chosen on the basis of:

- History, expertise and complexity of the existing SF practices;
- Interest in the evaluation process within the practice of SF;
- Capacity to involve a large number of motivated stakeholders ready to contribute during the implementation period.

In addition, seven SF experts, from different disciplines, were selected at a national level to analyse the evaluation needs in SF practices and to structure the evaluation model.

As indicated in Table 3, the actors involved in the transdisciplinary process, included farmers, cooperatives, associations, practitioners from the social/health sectors, institutions, and scientists, come from different fields of competence. A gender approach was also followed for selecting the actors involved in the TR process.

#### 4.2. Integration

Different research methods were used to create integration: workshops, interviews, and focus groups. During such activities a specific attention was given to promote an effective integration amongst different expertise and disciplines to achieve an active and real contribution at the implemented transdisciplinary process.

In collaboration with the regional administration in Tuscany, four workshops were set up to promote a shared critical view of the SF experiences, start a common reflection about the need of an evaluation tool in SF and a first analysis of a possible evaluation model.

In the workshops, the actors worked jointly to identify and understand the nature of the problem, and share the knowledge of SF from different disciplines in order to define the research questions needed for the evaluation of the practices. During the four workshops, the goal was adequately described. Each workshop was organised in two distinct phases. The first one entailed the intervention of subjects involved in SF practices, such as external experts and institutions. In the second phase, the participants – thanks to the support of a moderator (University of Pisa), normally leading local development SF initiatives – were engaged in a structured discussion, with the support of a grid of questions.

After the workshops the evaluation of the practices were analysed by experts in order to triangulate evidences and to identify the possible dimensions of the evaluation tool.

The interviews were not based on questionnaires. Although identifying a set of questions would have greatly facilitated the collection and the processing of information, on the other hand the risk of a priori exclusion of a part of the problem was high.

The information was deliberately collected on the basis of the interaction between interviewee and researcher, combining the profound and specific knowledge from the specific point of view of the interviewee with the general knowledge, cross-references and indispensable "outside perspective" added by the researcher.

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<sup>5</sup> Td-Net started working for the Swiss Academies of Arts and Sciences in 2003. Td-Net was continuing the work of sagufnet, a network for transdisciplinary research of the Swiss Academic Society for Environmental Research and Ecology (SAGUF) launched at the Transdisciplinary conference in 2000. The mission of td-net is to strengthen transdisciplinary research in all thematic fields, be it in research on peace, public health, sustainability, migration, and cultural diversity or on any other socially relevant issue. Amongst other activities, td-Net organises conferences on cross-field learning and publishes case studies and methodical and theoretical considerations on transdisciplinary research.

In order to ensure integration, the results of the interviews were shared in a set of focus groups in the three areas of investigation. Focus groups can be considered as useful tools in qualitative research and are valued for the forms of knowledge and understanding that emerge from the participants.

In the focus group, which was more addressed to internal interactions, and problem analysis, research questions were structured in more detail and investigated so that diverse aspects and perspectives were integrated. Interaction among the participants led to shared ideas. Each focus group was divided into five distinct phases, in which the moderator described the work process and the goals. During the discussion, participants shared their SF understanding and, analysed and proposed new ideas, solutions and critical elements, in order to create the evaluation model. The moderator facilitated the discussion among actors from different disciplines or fields of expertise. Thus during the focus group different views and perceptions were integrated. This process was also facilitated by the previous knowledge integration that the participants had experienced during the SF project.

The crucial element of the discussion was related to the change in the evaluation metric from individual/sectorial elements to a more interconnected and holistic approach.

#### 4.3. Reflection and learning

During the first steps of the process a comparison between different actors was delayed by the presence of different cultural codes, perceptions and perspectives among actors which required mediation and the acquisition of a common language and specific skills. The collaboration of scientists and different stakeholders, which was considered crucial to the success of the project, was not immediate to achieve.

The co-production of knowledge, involving multiple cultures, developed slowly. In the process of establishing contacts among actors, constraints also emerged, associated with particular value systems related to each subject. These difficulties were partially overcome primarily by recognising the diversity of the actors and by trying to understand and learn from this diversity.

The process of knowledge creation was characterized by:

The complementary roles of the actors in setting research priorities;

Formal and informal research was both complementary and synergistic in order to develop co-production knowledge; More attention was paid to the externalization of tacit knowledge;

Collaboration between actors, with their diverse contributions, was more likely to create synergy; Actors participated throughout the whole process of joint knowledge production.

The different participatory activities during the time facilitated the reinforcement of relationship amongst actors and the establishment of stronger networks. The creation of shared values and strategies amongst diverse stakeholders has strengthened the existing governance and facilitated the development of common activities of planning, management and fund raising into the three areas. In addition a sense of belonging to the research developed in the participants and participation also led to direct access to the source of information.

#### 4.4. Problem solving

Starting from different entry points, the shared goal of the project was to define a common and innovative pathway, based on a transdisciplinary approach, to evaluate complex SF practices which are already working on the ground. In order to achieve such a goal the research group proposed and shared a methodology based on:

Collective and active participation;

Progressive exchange of ideas and opinions, implementation of a collective knowledge amongst actors, sectors and geographic areas;

Effective use of time to the shared activities.

At the end of the project a shared tool for the evaluation of SF practices was defined.

#### 4.5. Management, social and leadership skills

In the project, the management of transdisciplinary research supported actors' perspectives and facilitated negotiations.

The University of Pisa assumed three roles, also recognized by Pohl et al. (2010):

- Reflective scientist: the research managers provided scientific expertise;
- Intermediary: the research managers mediated between the different approaches and linked them to common interests;
- Facilitator: the research managers enhanced communication and promoted joint reflection towards a common understanding, as part of a learning process.

As we observed during the co-production of the evaluation model, the core scientist is less concerned with establishing and maintaining boundaries and more with defining procedural rules, enhancing mutual understanding and proposing normative orientations in order to:

- Promote organizational learning (promoting reflections and evaluations to accompany and support the project and interventions—“learning by doing”);
- Ensure dialogue and exchange among different actors and different areas of intervention;
- Facilitate the appropriation of results by stakeholders and the production of knowledge that helps to re-program the interventions and revise policies.

## 5. Conclusions and lessons learned

Since a long time, our research group is involved in different multi-sectorial processes, based on the interaction among many diverse actors and fields of knowledge, to promote rural welfare and sustainable development. Hence, from our experiences in the field it is possible to raise the following questions:

Has the transdisciplinary research resulted in various sharing processes that have generated “new” knowledge?

What strengths and limitations have emerged from the TR approach and how could they be overcome or enhanced (lessons learned) in order to make this experience transferable?

In response to the first question, the various actors involved have participated in a satisfactory way in the construction of the evaluation model. Starting from diverse perspectives the process of definition of the evaluation tool was able to mediate and integrate views, values and attitudes in a common balanced grid.

During the various meetings, the attitudes of the actors were never prejudicially contrary but were driven by a general collaborative attitude. This created a favourable environment of dialogue and exchange, based on a mutual listening and aimed at finding solutions able to integrate multiple perspectives and proposals. This positivity was exploited to create new knowledge and to find dimensions and indicators for the evaluation model that integrate different points of view and different experiences of those involved.

In such respect the transdisciplinary process was able to create:

A new common knowledge through the exchange and sharing of information and competences;

The establishment of stronger networks able to reinforce the overall process of SF enhancement towards collaboration and integration of existing experiences;

A greater capability to connect institutions, research team and public/private actors involved in SF practices in a stronger local governance able to catalyse resources, information, and consensus.

Regarding the second question, the research validated transdisciplinary approach and simultaneously highlighted the critical elements emerged. The complexity of the intervention was evident in terms of the organizational work needed to involve and to accompany all the different stakeholders during a process able to merge skills and knowledge. In this respect was crucial, the participatory management in the early stages of the work in order to increase willingness of the actors involved. It gave the idea to the various actors of following a shared agenda and methodology without any top-down decision-making. All the steps were based on a collective process of shared knowledge, according to MODE 2 of knowledge with a shared definition of problematic aspects, working hypotheses and possible resolutions.

Another strong point is related to the organisation of a structured dialogue developed during the definition of the dimensions and indicators of the SF evaluation tool. The dialogue led to a shared and multi-perspective evaluation tool, based on a new common knowledge.

However, some weaknesses emerged from the application of transdisciplinary research that should be overcome in order to successfully replicate this initiative. First of all, the need to face the complexity of the management of the transdisciplinary process beside the meta-assessment of its results. The proposal of Mitchell et al. to evaluate the space of outcomes might support and facilitate this process, and will be considered for further improvements.

Regarding SF, we have to point out as the development of an evaluation tool is far to be a research exercise. It has strong practical implication for the actors involved in these innovative practices but also to provide the evidences needed from the policy domain and to ensure the future growth of the SF concept.

As already stated the transdisciplinary process in SF was able to progressively enlarge the space of action and the collaboration attitude in the actors involved. This process has provided with broader outcome than the one expected in the project (in our case the evaluation tool). In fact, it has also facilitated the definition of a pathway of change. The direct involvement of a research group can facilitate a process of social innovation able to mediate and mobilize resources in an innovative way and can facilitate the design of new solutions to emerging needs. In both cases transdisciplinary research should be enhanced to promote new answers to crucial current questions.

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