Chapter 4
Adaptive Methods

4.1 Self-Organization in Participatory Research

Participatory research approaches must be seen as systems of interaction, keeping in mind ongoing processes of fostering dialogical relationships among researchers and subjects[1] through collaborative learning in a process that can have different objectives, but always must contribute toward balanced interactions in consideration of classically asymmetrical correlations. Participatory approaches must work on necessary approximations, not only as an imperative for cognitive justice but as a need to reconnect different worlds that have suffered varied fragmentations, like the conventional concentration of power and knowledge steering social exclusion, or the vast distances separating vulnerable people from complex and emergent risks due to the side effects of modernity.

Reconnecting such distant knowledge systems must be understood as necessary to attain the challenging and multifaceted contemporary problems. In that way, participatory processes are choices that can promote approximation and interaction of a myriad of knowledges and social practices, making possible structural couplings through different social actors and several organizational levels. It means at overlapping the disconnections that were established by the division in hegemonic and marginalized knowledges, which have caused a rupture in the natural property of self-organization—concerning autopoiesis, which enables self-transformation in the process of creating alternatives, interacting and changing the surrounding reality (Maturana and Varela 1992).

[1] Following Freire in *Pedagogy of the Oppressed* (Freire 2000), the term "subject" represents those who know and act, and it is in contrast to an "object," where once in the banking concept of education educators deliver knowledge to students. The freirian pedagogy is applied here conceiving the relationships among researchers and subjects, because the proposal is a process of collaborative learning, then, both actors research and learn at the same time. And the subjects are recognized for the emancipatory view in which they can transform their world, and doing so toward new possibilities of richer life experiences, individually and collectively.

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Particularly on the post-normal problems, participatory approaches must perform a fundamental role, bringing a broad range of stakeholders to critically control the relationship among science and decision-making. It can create opportunities for those that suffer huge impacts of complex consequences and uncertainties, enabling voice and possibility to decide, mainly when there is no scientific certainty on questions of high stakes, with the possibility of severe and systemic impacts.

The expectations on these concerns are very high, note that some conditioning of the mentioned ruptures has been established and reproduced over centuries. So, the results are not so fast and straightforward to attain. Actually, there must be a diversity of possible applications for participatory approaches, varying in terms of the extent of the process of interactions, or pursuing different objectives, like making a collaborative diagnosis, local problem-solving, or empowering people to have legitimate prominence and voice in more democratic structures of governance. Anyhow, what is very important to remark is that a participatory project must be carried out as a system of interactions that depends on true involvement of researchers and subjects and also must be cyclical and adaptive (List 2006; Toledo and Giatti 2014; Baum 2016). That is foundational, and for that matter, researchers must be entirely aware of their role to facilitating necessary approximations and symmetrical relationships, also keeping the disposition to constant reflections and adaptive methods, considering insights, desires, interests, and decisions on behalf of the subjects.

Projects and initiatives carried out within participatory frameworks are associated initially with the democratization of knowledge; otherwise, very frequently, such endeavors must cope with problems with determinants intrinsic to structures of power and exclusion, relationships and consequences of globalization and colonialism, and contexts of huge and tacit inequities. The acquisition of outcomes in a participatory approach in that way must request much assertiveness, commitment, and interactions in the medium or long term. In the sense of reaching democracy as a continuous pursuit, participatory approaches must be encouraged as essential for successful and legitimate representation on issues of common interest. In other words, a continuous process of social struggle to repair ongoing forces that tend to capitalize themselves on the developments and maintenance of cognitive exclusion.

On behalf of researching targets in a participatory approach, initially, I would like to mention the character of generating narratives and reflections as singular qualitative results related to the process of interaction among different social actors and the associated collaborative knowledge produced. Otherwise, the strategy of combining different research tools, as also some classical research instruments, in association with the subject's participation can result not only in objective and quantitative answer, but also in trust and reciprocity, mutual learning, and empowerment. However, considering the process of participation as a system of interactions, it is quite relevant to stress that replication is not achievable in a relation of the uniqueness of a multifactorial conditioning, reflections, and qualitative narratives produced. Such systems of interactions must be realized as singular processes of producing knowledge, a kind of new knowledge that will be relativized for the scope of intersubjectivity, anchoring the reflexive results to the view of the social

actors involved, in a specific moment of their personal histories, with current scenarios, power relations, needs, and desires. That is a process continuously humanized carried out through actions, and it really must be like this to attain the quality and reciprocity in participation.

The concept of post-normal problems seems to require new societal models to absorb and reflect on scientific production as well as to induce more dynamic, fast, and self-organizing possibilities of relations among science, society, and decision-making. Indeed, as uncertainty, rapid change, realignment of power, and chaotic behaviors characterize our age, there is a clear recognition of more compelling, adaptive ways of knowledge production. The required transition is absolutely on virtues of humility, modesty, accountability, and the indispensable recognition of living with uncertainty, complexity, and levels of ignorance (Sardar 2010). It relates to accepting new and adaptive production of knowledge through participatory processes with a level of unpredictability in the intersubjective interactions, rethinking on the classical perspective of replicability and the dogmatic and conventional normal science, which cannot be continuously applied in solving the complex contemporary issues.

The rupture with the dogma of replicability opens a window for stepping across the abyssal rupture between science and common sense. It represents an exchange that begins with the academic disposition of sharing power and then representing a stance to understand that in legitimate participatory processes, the researchers do not have to take full control of the research. In that way, a remarkable issue in my concern is to assimilate better this nature of driving an intervention without the perspective that the results must be replicable. However, on the other side, the exchange comes making it possible to receive true collaboration, to build trust through reciprocity among researchers and subjects.

All of this process is entirely related to power; hence, the lines that divide science and common sense are determinants of structures in which those who have the domain on science also have more possibility to decide or to conduct private entrepreneurship, projects, or dispossessions. In this sense, the decision on conducting participatory research is a political decision and represents a disposition to giving up power for empowering those people that are classically viewed as objects of research, turning them into subjects.

4.2 Cyclical and Adaptive Methods

The issue of establishing legitimate and dialogical involvement is what requires ongoing processes as a system of interactions, but it also can be responsible for continued production of actions, outcomes, decisions, and social and cognitive inclusion. So, how can it be the onset of a participatory project? It depends on a variety of factors, for example: how much is the concern and the motivations for a participatory project prioritized among the subjects? It can be a real and relevant problem, but maybe the stakeholders can be engaged in other problems of more

urgency, or even their perception does not match the issue argued by the researchers. The related experience of Iauaretê (Chap. 2), with the indigenous population in the Brazilian Amazon, on sanitary conditions shows that it was not a priority for them, although those people used to have significant mobilization on fighting for primary health care (Toledo et al. 2012).

Otherwise, sometimes the issue is a recognized demand presented by the subjects, even having social capital aggregated, but lack of instrumental assets to deal with the problem, like the case of the indigenous people in Ecuador, in the struggle on the environmental and health consequences due the oil industry impacts (San Sebastián and Hurtig 2005).

Both at the beginning and during the whole participatory process, social mobilization on the related problem is quite fundamental, as well as trust building and maintaining. Also, and not less relevant, there is a need for constant dialogical interaction, employing adequate language and connecting people with their visions of the world. This connection with common sense can be possible, for example, with the proposal of exploring generative themes, and the interplay among the concrete reality of the subjects and the subjective understandings (Freire 2000), which can be related to the academic knowledge as to be exposed and interpreted by the subjects.

Social mobilization towards the problem is focal for participation and can be understood as the first challenge to fostering a system of interactions. When a group of people, community, or society has the stance for acting based on a common objective or problem, then it characterizes social mobilization. Otherwise, the lack of such collective will can also be expressed within some kinds of resistance to research, an inertia of the population and low perception on common issues, and also the prevalence of low self-esteem (List 2006; Toledo and Giatti 2014). Lack of social mobilization as an initial constraint to participation seems to be more significant when the studied problem is not presented initially as a self-determination from the subjects (Cargo and Mercer 2008), as exposed in the case of indigenous of Iauaretê in Amazon, which was concerned with health care but not with the issue of water and sanitation.

After having started the process, and keeping in mind the importance of continually nurturing social mobilization, the participatory research can have its own "life" through the development of collaborative work and application of participatory tools. The system of interactions can be understood with the properties of self-organization through cyclical dynamics, aggregating various social actors (with their knowledge, expectations, desires, perceptions, and experiences), making possible their perspective of autonomy, and the possibility to interact in searching for collaborative knowledge, collective solutions, and cognitive inclusion. With this, both subjects and the system of interaction (the participatory process) possess the property of autopoiesis, which is to promote change when interacting with a problem/circumstance, at the same time transforming themselves in the process (Maturana and Varela 1992).

Cyclical dynamics in participatory research have been proposed and applied by Lewin (1946) in the 1940s, contributing to minorities' engagement in a series of subsequent planning, acting, and fact-finding. Since then, and to the current times, some contributions have been applied and collaborated to the application and

coverage of such cyclical and ongoing procedures. For instance, in CBPR, the premise of involving the subjects in all the phases of the research shows similarities in the sense of ongoing and reflexive participation within a continuum of community engagement (Wallerstein et al. 2017a, b). The proposal of adaptive and integrative governance on risks also makes a relevant contribution to highlight the need for stakeholders' participation in a cyclic and continuous process of dealing with uncertainties and complexities through collaborative work on pre-estimation of risks, monitoring and controlling, interdisciplinary estimation, characterization, evaluation, and management (Klinke and Renn 2012).

List (2006) also makes a relevant systematization of continuous phases on the progress of participatory approaches, identifying through practical experience the level of commitment and social mobilization, also indicating the search for the highest level to be pursued, which is of the proactive stance and empowerment. The expectation is that at first there are communities with low self-esteem, disperse social capital, and low mobilization to manage their collective problems, and the participatory research can gradually contribute to changing the scenario of lack of power, inaction, and disperse capacity of responses.

In the same direction, Toledo and Giatti (2014) also presents a continuing process to deal with challenges to participate in action research, ordered as follows:

1. Social mobilization, as the start or a previous stance of the subjects to act on a common problem
2. Cooperation, through the successful application of participatory tools bringing identification of the subjects with the research, making them more prominent in the process and fostering dialogical participation
3. Appropriation, addressing cognitive re-signification of knowledge through intersubjectivity, and avoiding multiculturalism, leading to authentic hybrid research and collaborative learning
4. Proactive stance, real action by empowered people, leading to prominence in search of alternatives to the lack of policies and public investments, subjects acting to protect themselves, and fighting for their rights

Still, on this last quoted text, the participatory cyclical processes can be carried out throughout a flow of participatory tools that enable direct participation of the subjects; a few examples of such tools are presented in Table 4.1 with a brief summary and references. Besides the ongoing process to be reflexive with regard on feedbacks, there are also alternative relevant interactions in the participatory processes making use of conventional scientific instruments and analytics. Such increments can be conceived as mediations (see Fig. 4.1) like samplings, environmental monitoring, epidemiological surveys, and own quantitative or qualitative analysis allowing the subjects to work together with the researchers. This kind of scientific inputs can enable a real collaborative work empowering subjects as researchers, or on the other hand, it can be a means for answering legitimate questions that come from the dialogical process. The application of conventional scientific tools can be considered as instruments of indirect participation, regardless of a significant power of promoting positive feedbacks in the dialogical process.

Table 4.1 Some participatory tools with the power of dialogical interaction

Participatory tool and reference	Summary
Talking map/sketch map (Toledo and Pelicioni 2009; Toledo and Giatti 2014)	Collective manual drawings representing subjects' contexts, to be produced by subgroups in a meeting. Participants are motivated by a leading question to discuss and work in collaboration. It is a very successful tool for initial contacts with groups opening dialog and initiating participation of people from communities, for example. At the end of the section, each one of the subgroups should make the produced map "to talk," that is to say a presentation for the whole group at the meeting, fostering discussion on the different views and discussions on the same question (see Figs. 4.2 and 4.3)
Photovoice (Findholt et al. 2011)	Involves the use of photography produced by the subjects in the sense of documenting, reflecting, and communicating on a common interest issue, and in this regard, photovoice can even provide the possibility for a dialog with policymakers strengthening engagement and a chance for social change. Subjects must produce photographs on a relevant issue, and then through workshops, it is possible to promote reflections and interactions
World café (Fouché and Light 2011)	A conversational activity to help groups to engage in collaborative dialog within critical questions. Through the application of leading questions on subgroups by hosts in different desks with questions to be answered. A process of pollination occurs when subjects (guests) exchange desks in successive rounds. A collective presentation made by hosts ends the dynamic, bringing the whole group to discuss. It is a powerful instrument for sharing information and fostering collaborative and equitable learning
River of life (Wallerstein et al. 2017a, b)	Applying the metaphor of a river, this is a tool to describe the life journey or any event in chronological order. Subjects are invited to organize into subgroups to describe an issue by the co-creation of a manual drawing through the conscious flowing description. It can be applied, for example, to describe the history of a community, or the "life" of the project, and the relationships with partnerships. Participants are also invited to a collective discussion on the drawings produced, and this is an appropriate tool for learning from each other and relating evolving processes
Venn diagrams (Mayoux 2001; Faridah Aini et al. 2017)	Participative elaboration of a social network representation associated with a given context or problem. It is useful to identify stakeholders and relationships as well as to find possible partnerships for collaboration. It can be made by a collective drawing or a scheme to be composed on the ground or even to be mounted in a wall, as in a communitarian space, then to be updated in the course of time. Different symbols or geometric shapes with respective meanings can be used, as well as relationships can be registered with the connections among different social actors. It is also useful to raise awareness on power relations and to identify the possibility to interact with relevant decisions through political engagement
Focus group (Gondim 2002; Rabiee 2004)	A technique for promoting group interactions on a topic suggested by the researcher and guided by a script of questions in similarity with an in-depth group interview. Participants are selected because of their domain on the studied issue or as representatives of the studied context. Focus groups can bring a range of ideas, feelings, and perspectives from individuals, thereby making possible collective reflection, dialog and collaborative learning, and production of answers for the applied questions. Also, it can be a resource for understanding the processes of perceptions building, taking action, and exploring social representations among human groups

(continued)

Table 4.1 (continued)

Participatory tool and reference	Summary
Culture circles (Moura and Lima 2014; Sampaio et al. 2014; Freire 2000)	Collective participation in debates through successive rounds in conversation circles on a certain issue in which it is possible to dialog with the subjects. In such a conversation, subjects express themselves and listen to others in a reflexive activity. The interactive process characterizes a cyclical investigation and an opportunity for educative liberation. This was a process of motivational experiences that grounded the development Paulo Freire's methodology dedicated to adult literacy (Freire 2018)
Community newspaper (Toledo et al. 2012)	Elaboration of a handcraft newspaper by a group of representatives of the studied issue or problem in a community. Participants must choose among different editorial positions to take part in the process of bringing reflexive contribution to the problem that must aggregate collective interests, surpassing the informative function of the product. The community newspaper can be an instrument for social action and transformation, by utilizing the participatory construction and by the process of disseminating the newspaper and discussing with the whole community on related concerns

Source: elaborated by the author

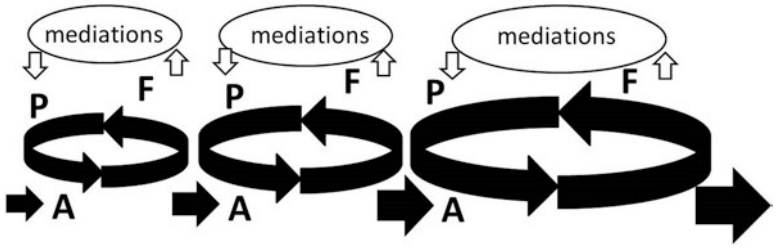

Fig. 4.1 Dialogical cyclical process of participatory research. Key: (P) - planning; (A) - action; (F) - feedback/fact-finding. Source: adapted from (Toledo and Giatti 2014)

The whole process of interaction should be open to dialog and continuous adaptation based on intersubjective outcomes and insights. Thus, to make a real dialogical interaction it is necessary to embody the process with democratic decisions regarding the subjects, and this sometimes can redirect the methodological procedures. That is one more point of necessary humility on behalf of the researchers, also conditioning the quality of sharing power with process feasibility.

There is an enormous variety of tools for applying in participatory research, and any compilation can exhaust the possibilities, even because creativity can be considered to expand alternatives and to promote adaptation of tools. The tools can be appropriately chosen on the conditions and objectives to pursue or on the characteristics of the group of subjects to be involved. Besides those presented in Table 4.1, many authors have contributed to the present compilations of useful instruments that can help to proceed with dialogical participatory projects and interventions.

Fig. 4.2 Collective elaboration of a talking map in an indigenous community in Brazil. Source: the author

Lynam et al. (2007) in a review paper presents and depicts on the effectiveness of ten different tools that have been undertaken to incorporate community knowledge, preferences, and values into decision-making in the field of natural resources management. Among them, "participatory mapping" consists in developing representations of spatial relationships among real structures and objects captured by participants and converted into sketches. This tool can be considered as similar to the presented "talking maps" in Table 4.1, but it is worth to note that among the vast diversity of tools, similarities can be quite considerable.

Oettle et al. (2014) also bring a valuable contribution related to natural resources but specifically concerned with the perspective of climate change and local disturbances that require a robust community-based capacity of responses, adaptability, and resilience. The authors also compile several appropriate tools in this sense and among them the "climate diaries" that is based on the routine of registering subjects. perceptions and observations on the local climate-related phenomena, like maximum and minimum temperature, humidity, hours of sunshine, total rainfall, and extreme events. This tool allows people to build, share, and compare their records. Another valuable tool applicable to climate concerns is "participatory water monitoring" that can encompass collaborative identification of areas prone to severe water shortage in dry seasons, also jointly with planning of emergency and collective measures for attending to critical levels of water scarcity, for instance.

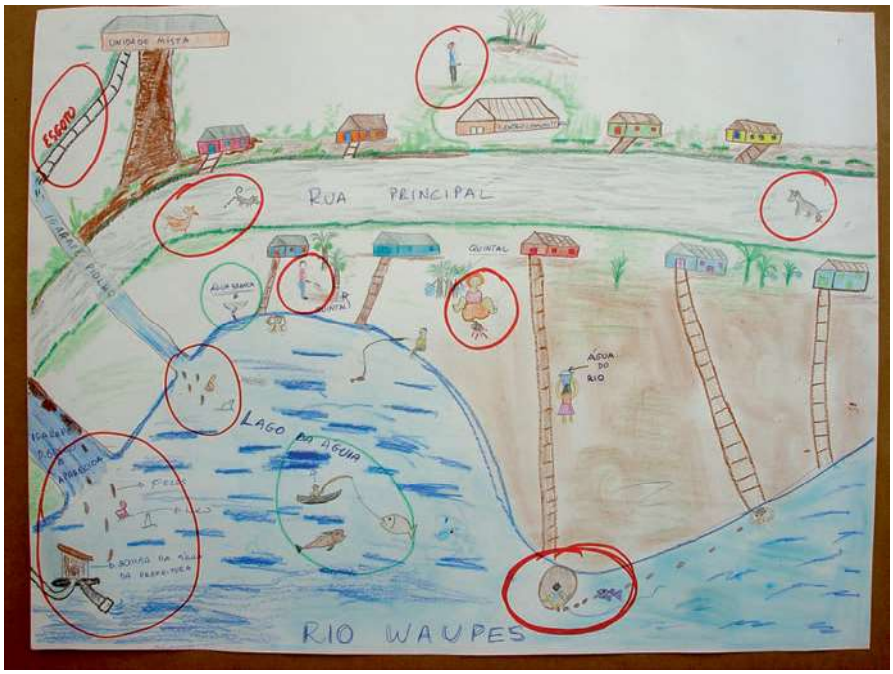

Fig. 4.3 Talking map elaborated on a leading question: what are "good" or "bad" things for health in the environment?—an indigenous community in Brazil. Note: The good things are circled in green and the bad in red. Source: the author

Participatory tools have also been applied to projects associated with the payment for environmental services and sustainability, considering the local concerns on environmental resources, economics, and social inclusion. In this sense, Faridah Aini et al. (2017) also provide an useful bundle of participatory tools dedicated to forestry and livelihoods research, like the "participatory rapid marked appraisal," that allows micro- and small-scale entrepreneurs to develop new products and to consider new customers as possible alternatives to manage forest resources and the asset of native fruit trees. Such a process allowed the consideration of gender and age-segregated groups in Malaysia, promoting freedom of expression and fostering social learning on ecological, organizational, and market-relevant aspects.

Although the objective of this book is to explore face-to-face dialogical activities, technological tools can provide insights, alternatives, and stimulate social actors to participate in activities, sometimes propitiating creativity and use of local resources and proper incentives for social mobilization. In this regard, participatory GIS can enhance the potential of community mapping as well as to making a bridge for social learning with support with a technological platform that conventionally is always in the domain of experts from academia or decision-making (de Carvalho and Giatti 2018). In Helsinki, Finland, an action research applied through participatory

GIS made possible to broadening the social participation within planning support system to the city's master plan. In order to involve residents and stakeholders since early phases, there was an initial online map-based survey (through website links). After realization of meetings with representatives with discussions on developed different geocoded visualizations for issues of interest like provision of recreational areas, public transport, cycling and walking connections, natural areas, placement for residential areas, offices, and services, all of this was in consideration of the forecast of population growth and respective consequences (Kahila-Tani et al. 2016).

Citizen science initiatives also have made some signs of progress in fostering interactions of different social actors on urban sustainability issues with technology applications and social networks. Involving young people on complex issues of the WEF (water, energy, food) nexus and disaster risk reduction, Trajber et al. (2019) made a mix methods study with local mapping, application of qualitative interviews, and the use of a bespoke mobile/cell phone "app" that allowed participants to a geocoded recording of photographs and respective daily life interactions with food, water, and energy. These interactions made possible the elaboration of a "visual web" of information and a looping approach enabling young people to co-analyze their data, co-learn, and also getting them closer to the possibility of appropriating issues related to urban planning and complex interactions, like climate change, sustainability, and their own quality of life. Also, an alternative to engage young people in a legitimate relationship with such issues that conventionally are addressed just through top-down schemes was enabled.

Besides the vast variety of tools for participatory research, there is also the possibility of adapting or merging some tools in order to find better conditions of application in consideration of the social group that is targeted, their literacy, and previous experiences with collaborative activities. In this sense, it is valid to ask: In such a frame of a diversity of tools, how about scientific rigor and quality in terms of reaching research objectives?

The answer to this question comes alongside the interpretation that participatory processes have no correspondence to the conventionally expected replicability because the whole interaction is ruled by intersubjectivity. Then, relevant criteria to follow must be the orientation of participatory research for intervention (action) and collaborative learning. For instance, Thiollent (2011) emphasizes that research action (*pesquisa-ação* in Portuguese) is characterized as empirical social research based on collaborative learning involving academics and subjects, working together in search of a possible resolution of a specific problem. For that matter, the scientific rigor must be oriented to a satisfactory production of narratives, within a process of good dialogical quality, social learning, and with progressive construction of alternatives and engagement with problem-solving on behalf of subjects' interest.

Such requisites can be much more challenging than just reproducing replicable tools and so, making necessarily great attention to the process that will be permeated the intersubjectivity and the circumstance of sharing the power of choice with the subjects on the direction of the research process. The dialogical nature of interactions represents a real engagement with the recognition that subjects' expectations

are relevant to build trust, and their perspectives on the appropriation of the research project will be determining of genuine symmetrical cooperation and co-production of hybrid knowledge. Otherwise, sometimes it will not be easy to attain a legitimate dialogical interaction when following the same direction of solving the selected initial problem. Therefore, it always remains the constant trade-off on these two dimensions of rigor in participatory research: the building and maintenance of a legitimate dialogical interaction as sharing power, and the direction of creating a collaborative pathway for action and problem-solving.

These considerations are much more related to the participatory process as a full flow instead of just to the quality of any employed participatory tool. The process will be the sequence of participatory tools applied, but always having in mind the extended results to reach, as the collaborative learning and searching for alternatives, the symmetrical interactions, and the perspectives of sharing power as to empowering people that many times are in a disadvantaged and vulnerable condition. That is a crucial aspect of proceeding with evolving mutual interactions through the application of participatory tools in a cyclical dynamic. Such a proceeding must be skilled to learn and adapt in consideration of a good quality of dialogical participation. Figure 4.1 presents the dynamics of the cyclical participatory process, which includes aspects of growing dialogicity, trust, reciprocity, and empowerment. The expected increase of such attributes is represented by the expansion of the cycles in the scheme, in reference to the process evolution carried out by ongoing actions (A), feedbacks (F—also for fact-finding), and planning (P).

The progress of participatory dialogical interactions must enable insights and demands that were not previously conceived because they result from the intersubjectivity and the cultural background of the subjects. In that way, some questionings can emerge, for example, requiring application of traditional scientific tools, as mentioned above. Besides, such demands can be related to the need to bring a different specialist to the community or to provide a course or workshop to create new local capacities. Also, such insights and demands can come as the realization of cultural activity, or a bazaar, as in the related case in Guarulhos to get cash for implementing the community garden (Chap. 3). All of these supplements to the process can be seen as mediations, and so, they show relevance in strengthening trust and reciprocity, also increasing social mobilization and legitimate engagement.

The flow of the process can be carried out in, at least, two distinct forms: the first, by combining participatory tools, like those presented in Table 4.1; second, by the development of collaborative research with the involvement of subjects in the phases of research like planning, defining and applying methods, and analyzing evidence. For participatory processes carried by participatory tools, conventional research tools (like environmental analysis, surveys) can come as mediations, thus responding to legitimate concerns of the subjects. For those processes conducted by collaborative research, distinct participatory tools can assume the role of mediations, also with the power of immediate and active participation, but promoting reflection and intersubjectivity in the flow of the research development.

As a system of interactions, the participatory process can be understood as a living organism. Anyhow, besides the metaphor, the participatory process in its

adaptability assumes an autopoietic property. Thus, it is vital that researchers be sensitive and apprehend such a feature. The process self-organizes through subjects' interactions and actions on the concrete reality, then changing itself into something different (a more robust dialogical process) in each round, increasing its desirable ongoing outcomes. The process regulating itself relates to the health of the interaction, something that must be constantly diagnosed and strengthened. Taking care of the health of the participatory process on behalf of the researchers means systematically analyzing feedbacks of the ongoing interactions. Then it relates to analyzing and solving possible conflicts, establishing co-habitation rules and ways of sharing possible benefits, attending to legitimate demands from the subjects, and building and maintaining trust.

Also, a CBPR framework presented by Kastelic et al. (2017) can help in keeping attention to the health of the process, as well as to planning or continuously evaluating the projects. That is a very flexible and adaptive framework, which consists of organizing the approach into four overarching domains: contexts, partnership processes, intervention and research, and outcomes. The model assumes the hypothesis that in any context of application, community-academic partnership grounds the partnership processes, those that will be the essence of engagement to affect and alter the "science" or the design of intervention and research. The application of this model can occur in a workshop involving researchers and subjects, and they can orient the process to the search for desired outcomes, then analyzing contexts, partnerships, and necessary interventions. On the other hand, the same model can be applied for planning and evaluating a participatory research process in successive moments, like before, during, and after the implementation of any project.

In combining different tools, sometimes researchers repeat the same tools many times; however, it can occur also by evaluating the quality of the process of interaction with particular benefits and outputs. In fact, there is a prime concern on the quality and the intent of the chosen tool. For example, focus groups started to be applied in the first half of the twentieth century, mainly for understanding the reactions of subjects to propaganda, or in the marketing field or related to organizational development. Of course, there is no problem in applying focus groups to these segments, but sometimes this kind of practice can be much more committed to the company's interests than to the subjects' needs and wishes.

However, in the sense of an application of focus group in a participatory process that searches for empowerment, collaboration, and symmetrical relationships, the quality criteria of this tool must be attached to the quality of process in order for it to be dialogical. Actually, in this sense focus groups can be adequately qualified for participatory processes because of their power to aggregate distinguishable worldviews helping to build awareness on common issues, and their perspective of fostering collective changes of mindsets and behaviors (Tanaka and Santana 2018). Among varieties of applications for this same tool, an intervention research held in Brazil on perceptions of risks of climate change and adaptation strategies made use of following focus groups on collectives of researchers, practitioners and policymakers, neighborhood leaders, and young people. This particular application among

different groups showed the possible interactive process as to demonstrate a possibility to spread the intervention within different stakeholders who are implied in risky contexts (Serrao-Neumann et al. 2013).

4.3 Integrating Uncertainties

Again on the distinctive nature of participatory research and its methodological flexibility and self-organizing adaptive feature: does it seem to be too expensive an exchange? The decision on proceeding with participatory research concerning its requisites seems to make waver on the decision of leaving the safety and autonomy of those traditional methodologies traced by objectivity and replicability. That is something to be a contentious concern mainly for those who are deciding on a participatory approach for the first time. Nonetheless, the decision of proceeding with participatory research is not a matter of choosing an alternative method; indeed, this is a decision on what kind of interaction with society the researcher wants to build. Moreover, it indicates the researcher's decision in recognition that he or she is interested in learning with the subjects, and then it shows something relevant to find more sophisticated arrangements to deal with complex issues. Participatory approaches are not better than, nor comparable with, traditional methods of research. Actually, participatory research is complementary to the relationship of academics with society, and in this regard, its objectives can be distinguishable by the collaborative results to be attained through dialogical interactions, empowerment, and a myriad of outcomes associated with the participatory process.

Also, within this nature of dynamical and reciprocal relationships, the loss of autonomy begins to make sense in a relevant and urgent flow for a new social contract with science. Such a context has been inherently characterized, for example, as the way that society sometimes has fought to get prominence in the quality control demarcation for scientific statements that raise controversies (Gibbons 1999). From this point of view, in which society must be naturally questioning the scientific production and respective high risks of consequences as emergent and unpredictable side effects, participatory research seems to be a brave and legitimate choice.

In regard to post-normal problems, there is one more worthy value of participatory research in the context of emergent complexities. Participatory approaches as being welcoming to more open and adaptive interactions are also receptive of uncertainty. Indeed, it is remarkable that researchers in doing participatory research are obligated to follow the problems wherever they adopt the interactive process (Brydon-Miller et al. 2003). Thus, although before we thought that missing the absolute control of the methods would be a high deprivation, now we can conceive that the proceeding of sharing power and being open to new forms of organization of the process (or even a legitimate self-organization in dialogical relationships with the subjects) can make possible an open structure to bring uncertainties into the method, indeed, at the core of the intersubjective interaction.

There is an appropriate analogy in this concern, as post-normal science stresses the centeredness of uncertainty. In the dilemma of assuming the limits of "normal science," good quality of information is dependent on recognition and proper management of its uncertainties. For that matter, post-normal problems require systemic and humanistic methods to incorporate dialog between stakeholders and scientists on systemic uncertainties, and collective decision on multiple stakes to guide appropriate problem-solving strategies (Funtowicz and Ravetz 1993).

The unpredictability of complex issues encounters equivalence in the method that begins as open to uncertainty in its own development. In this kind of participatory processes with a flexible and adaptive structure, uncertainty finds correspondence and acceptance instead of negligence. As stated before, uncertainties and ambivalence were always banished by modern science. The cyclical and reflexive interactions are fundamental for recognizing uncertainties from a democratic perspective, also embracing the intrinsic ambivalence from different points of view and values. With participatory research, there is an innovative way of incorporating the challenging and sometimes intentionally forgotten uncertainties and ambivalence, and this can make a different scope to reinforce the importance of opting for such an approach.

4.4 Meta-Information in Participatory Research

Qualitative empirical research has the power to produce in-depth explanations about the nature of problems subordinated to social dimensions. In contrast to quantitative methods that focus on the objectivity of data, good sampling designs, and sophisticated statistical analysis for exploring causal links, qualitative research dedicates to go further in clarifications on why those variables in causal analysis can be associated. In this sense, qualitative approaches explore narratives and a myriad of explanations of phenomena, including some of those that can be concealed from the researchers' eyes.

The argument here is that in comparison with conventional qualitative research approaches, participatory ones allow maximizing the power of explanation and also foster creating and producing new reflexive information associated with the intersubjective process of collaborative aggregation of different knowledges.

With the ongoing social learning feature, participatory approaches also bring opportunity for the emergence of innovative hybrid explanations and alternatives, new meanings, and interpretations of phenomena. The creative and reflexive asset of participatory research also induces the production of something that I have considered on the designation of "meta-information."

The Greek prefix *meta* refers to attributes of transcendence, change, and also the means of self-reflection. Thus, meta-information in participatory approaches can transcend as being produced and registered in the intersection of knowledges separated by the conventional rupture of cognitive exclusion. Accordingly, it can be related to change in a reflexive perspective. For instance, community social actors when working together in a participatory tool application can have a unique

opportunity to put their particular understandings to build different collective and robust new understandings, sometimes making possible the emergence of disruptive conceptions or questionings. Even the interaction of community members on a specific issue can make possible the appearance of data that would be unexpected within individual focus. Such processes and affluence of meta-information are not natural to occur in normal conditions as in scenarios of low social mobilization, or in circumstances of little perception of important collective problems, low self-esteem, and lack of empowerment.

Meta-information is related to transcendence, reflection, and dialogical interaction among the subjects and can be registered by the researchers with incremental power for apprehending complexity. Sometimes, it can also be useful to evaluate the quality of the dialogical interactions. Moreover, it can be associated with the production of meta-knowledge, as Avenier et al. (1999, p. 66) describes a category of "knowledge constructed over the course of the research process about the overall organization," in the case of the application of intervention research bringing together parties involved in finding organizational solutions.

Besides, meta-information can be recognized as a pattern of meta-data, in other words, related to data about data (Higgins 1999), like regarding data contents, format, context, quality, structure, and accessibility (Michener 2006). In that direction, the association with a participatory research process the meta-information can bring accounts on information at the basis of how the socio-ecological system operates, also describing essential elements like who, what, when, where, and how, everything in regard to the reflexive interactions among social actors. Therefore, such meta-information can emerge in the process and thus, it can be useful to identify the source quality and the credibility of the information that has been produced to answer the straight questions on the investigation. For example, if we are working collaboratively with urban community members on relating the history of the neighborhood creation, then a kind of meta-information can be the understanding about how people involved are legitimate to tell an authentic history (Higgins 1999). This legitimization of information can occur in the collective narrative production through the subjects' interactions and trust building, then generating plenty of qualitative evidence to the researcher.

Also, it can be worthy to explore relations of power and knowledge in a community or within a process of interaction among social actors with different attributes, like age, gender, literacy, income, or hierarchy. The refinement in the acquisition of information on the interaction can provide valuable information to care about the health of the participatory process. For example, distinguishable asymmetries concerning hierarchy can be identified and managed to avoid tensions or ruptures towards the participants.

To make a pragmatic description, it is worth to consider some fieldwork experiences. In the participatory approach held in Iauaretê, Brazilian Amazon, an adaptation of a photovoice (photo panel) helped to diagnose some relevant insights (Toledo and Giatti 2014). Indigenous people were previously mobilized to take pictures of their local livelihoods, registering relevant environmental aspects on health and disease. After with photos in the paper, they were invited to describe in panels causes,

Fig. 4.4 Mounting photo panels in Iauaretê, describing causes and consequences for problems related in pictures. Source: the author

and possible solutions to the problems showed by their own pictures (see Fig. 4.4). Spontaneously, when making presentations about the developments for the whole group in the workshops (Fig. 4.5), the subjects conducted their conversation about problems, causes, and possible solutions in Tukano language, the most popular local language. They speak Portuguese regularly, but mostly to talk to "white people" and in institutions, like the local school, local army base, and church. The researchers chose to talk among themselves in Tukano as an indicative of common interest in having a conversation to address those local relevant problems. The ongoing development of the workshop corroborated it, since after their own reflections, there were volunteer explanations in Portuguese addressed to the researchers because they did not have the domain of Tukano. This arrangement was a pattern on the sequential repetition of the photo panel in 10 local community centers in Iauaretê, as the methodology of the research project proceeded.

In this case, some circumstances allowed considering the production and registering of relevant meta-information. For instance, the attitude of speaking in Tukano was in that direction, then showing the quality of subjects' involvement in the discussion. Such behavior denoted a social mobilization on the issue. It occurred transcending the process of acquiring the information intended by the participatory tool applied, which was their narratives about causes and possible solutions for sanitary problems. The quality of debate appropriation also was corroborated by the historical

Fig. 4.5 Presenting and discussing the concerns in photo panels, interacting with the community on their own problems and reflections. Source: the author

relationship of indigenous of that region with the surrounding society, since they have a traditional protocol to interact with people of institutions, also keeping a social position called "capitão," just to proceed with these conversations. Similarly, the following attitude of explaining the previous conversation in Portuguese to the researchers brought more meta-information associated with trust and reciprocity concerning researchers that were from outside the community.

Another unusual situation to be related was carried out in the ResNexus project (see Chap. 3), working with young people in Guarulhos municipality, Brazil. When developing a talking map, the young participants were asked to sketch with the purpose of planning possible and desired improvements to the Novo Recreio neighborhood in Guarulhos. It was an exercise of approximation with urban planning in a frame of 5 years with the acquisition of data for composing the Participatory GIS. As regular in this kind of participatory tool, subgroups of about 5–6 young participants were developing their cardboard designs for the sequence of collective presentation and reflection. Then, a relevant statement emerged systematically from the subgroups, which was like "I will not be living here within 5 years." That was a claim full of meanings and perceptions, which had not been stated necessarily to answer to the applied question on planning improvements 5 years ahead.

The claim was very natural and spoken among their conversations as being young people who live in a vulnerable and peripheral urban community, deprived of opportunities, leisure, high school, among other benefits of urban centers. In telling this, they showed to recognize their conditions and the lack of local possibilities to reach a standard of living desirable for young people. In such a context, they finished the process of planning desirable benefits and made a satisfactory reflection on the talking maps considering feasible alternatives, as well as reaching a positive result as expected by the participatory tool applied. On the other hand, the statement refusing the idea of living there for 5 years remained as something restrictive for considering any perspective of searching for substantive changes in the neighborhood. That is why it is possible to consider this spontaneous statement as a meta-information with the valuable understanding that goes beyond the primal objectives, but has intrinsic importance as a determinant of the context. Such a statement transcends the proposed reflection and also, at the same time, shows fundamental conditioning that could become hidden, but emerge in the legitimate space of interaction among the subjects.

Researchers must be sensitive and prepared to capture meta-information, which can have a significant value to explore the potential of participatory research with elements of reflection, learning, and empowerment. However, it sounds that sometimes meta-information emerges almost silently or between the lines of the narratives that are produced. Most important, researchers must be attentive to the process of interaction among subjects, always registering any possible relevant manifestations or insights.

Still, in comparison with participatory research, other qualitative social approaches can provide different information and explanations about those studied phenomena. Then, joining narratives from different social actors can provide a diversity of valuable data, through subjects' knowledge, expertise, and points of view. For example, interviewing people on the relevance of climate change and health-related effects can result in a broad range of perceptions in consideration of applying to people of different countries, with different backgrounds or even supposed to be in different conditions of vulnerability due to multifactorial, climate, and health-related risks (Akerlof et al. 2010). With such an amount of data, it is possible, for instance, to compare distinct perceptions or also to encounter various understandings on the relation of climate change and health consequences.

However, it is regularly possible to reach a sum of those diversified perceptions and explanations. Analyzing the creative possibilities and accurately dedicating on participatory approaches, it is possible to confirm that the dialogical interactions result in something much more productive than a sum of pieces, since in the process of collaborative and reflexive learning "A" plus "B" can be AB and also a myriad of new meanings, reflections, and understandings.

Because of the ordinary negligence of uncertainties in the normal production of scientific statements, decision-making is also induced to conceal doubts and small or not well-estimated possibilities of failure (Funtowicz and Ravetz 1993; Ravetz 2004). When a debate involving different stakeholders occurs, as in an induced participatory interaction, it comes to disclose elements of doubt, risks, and uncertainties,

and then a legitimate condition of questioning the relationship science-decision-making emerges as a response to the conventional ruptures that isolate social actors from the debate.

The questioning process in this sense can be related to ascertaining the quality of scientific discourse production, in terms of searching for uncertainties, ambiguity, and risks of mistakes and failures in decisions. In that way, meta-information can be understood as characteristics or qualifiers of information that can affect the accurateness of decision, with a possible association with aspects of the processing and communicating the information or also situational awareness of the relevance of the variables involved (Pfautz et al. 2006). For instance, some possible questioning can be like: who studied, who funded, and how was the scientific proof produced? Alternatively, another questioning can be: what is the credible comparison between a guinea pig in a laboratory and a human being living in an urban environment to evaluate the limits for particular substance exposure? All of these and similar questions gain status of meta-information and legitimacy along the intersubjective interactions.

More than empowering people trough debating and having protagonism within decisions, this legitimate attitude of promoting participatory approaches helps to overcome the cognitive exclusion that keeps uncertainties and high stakes concealed with the possibility of systemic and emergent damages. In this regard, the appearance of contestation in such democratic debate relates to the need for meta-information as debriefing on qualifying factors of the scientific statements, and then it makes the applicability of participatory research on post-normal problems valuable. On the other hand, that is also related to knowledge democratization that implies in sharing power on taking decisions based on scientific statements that can encompass doubts, ignorance, or even conflicting interests. Notably, the cyclical and dialogical process of successive interactions involving different social actors can be understood as liberating from the oppressive context in which laypersons cannot contest scientific hegemony. However, as those laypersons have their stakes, so they also must have the power to argue on decisions permeated by severe risks. Meta-information, as identified, seems to play a role in denoting the strength of such a reflexive and dialogical participatory process.

4.5 The Process as a Product

The characteristic of merging objectives of intervention and investigation gives participatory research a variety of possible outcomes. As in researching, it is possible to answer scientific questions as well proceed with hypothesis testing. However, the meaning of investigating/researching also brings the perspective of mutual learning among different social actors to be involved in participatory interactions searching for changes. In turn of the systemic interactions provided by the cyclical and dialogical interactions, the chance of achieving concrete outcomes and empowerment expands by the possibilities aggregated or created in the process, like as finding or enhancing partnerships, exploring the creative role of social practices, or even as with the multiplier stance of the ecology of knowledge.

Kurt Lewin with his contributions on action research applied to improve organizational structures by involving different parties also delimitated aspects of multiple gains of interventions, as so, the change-inducing targeting runs alongside the process of researching one of the various forms of social action (Lewin 1947). Following other organizational appliances of action research, Avenier et al. (1999) emphasize that there can be a process of negotiation among the social actors as different interest parties. Then cross-fertilization between their possible different projects can result in another project that will be common to both parties, to be constructed as an advance in an ongoing process of constructivist conception of knowledge. This collaborative progress can bring disruptive effects for the intervention on organizations, and can produce varied forms of knowledge, some of which can be publishable in the sense of scientific production of papers, and others that can be a local knowledge of interest and applicability on the studied case. As the last, meta-knowledge - as the subjects appropriate of meta-information and - also arises in the process, offering relevant information produced and apprehended by the participants, having a fundamental role in describing attributes of the system in study and intervention.

The perspective of joining distinct interests can even be associated with the multifunctional nature of participatory research. However, in the sense of the Freirian proposals, liberation from oppression must also be taken into account as a goal to be targeted, mainly in consideration of the existence of oppressive relationships. In this concern, liberation in parallel with empowerment can also be a result of participatory processes as with the ongoing evolution of methods and the search for solving common problems (Wallerstein et al. 2017a, b; Freire 2000).

The ongoing collaborative knowledge production through participatory processes to address sustainability can engender dimensions of social learning that can also represent a relationship with distinct outcomes per se. For that matter, Wildemeersch (2007) exposes four dimensions of interrelated activities: the first is “social action” that can operate through needs and competencies presented in the social system involved, which is a means of engaging people in solving a common problem; the second is related to “reflection” and is triggered by social learning as the collective making of balances, questioning processes, norms, and values, also encompassing rational and emotional aspects; third is “communication” that can occur as a product and a benefit both inside and outside of the approached social system; and the last dimension is “negotiation” on differences of interest and limitations of the system, also interplaying between inside and outside actors and factors.

Participatory research can be seen as a work in progress, continually challenging positivist as embracing a notion of knowledge as socially constructed. The nature of working collaboratively with other social actors leads not only to community and organizational changes but also to personal changes for subjects and for the researcher. Some changes for the researcher must be with the need to reinterpret the act of researching in a different notion of objective and the surpassing of the idea of value-free approach, since deciding on proceeding with intervention means at an explicit political choice. The acceptance of values leads to the imperative of action, and in turn, knowledge emerges from doing, from the initiatives. The democratic practice of a socially engaged research sets the context in which value-free cannot

be proceeded as in natural science, and the decision on it is itself a change, but the process of change for the researcher is a rule in the ongoing development of action research (Brydon-Miller et al. 2003).

Since the process of finding generative themes with the subjects, and fostering respective coding and decoding situations, there is a reflection and production of new and collaborative knowledge. The emergence of knowledge and aggregated information, of great interest for the researchers and the subjects, means at the process as connections of the subjects' concrete world with the academic assumptions or with the perspective of policymakers. Information and knowledge transcend the relation with the problem on approach, creating bridges and approximations with particular support for cognitive inclusion and ecology of knowledge. At the same, the social learning development as a reciprocal and negotiated process contributes to finding and fostering partnerships including local competences. It leads to empowerment as well as making possible advocacy in regard to vulnerable people. The realization of vulnerable people in navigating to other scales and interacting with institutions in itself makes a singular output.

Like a process of ongoing teaching by learning and learning by teaching (Freire 2000) in participatory research, a context permeated by ignorance and uncertainty compels academics, policymakers, and subjects to continuously learn, teach, and reflect as pursuing changes by action on the concrete world. In this regard, participatory research processes have a generator potential of creative answers, knowledges, and actions.

At the beginning of a participatory research project, the researcher begins from a fragmented view of the context and related problems. Only with a dialogical interaction, there can be an opportunity to apprehend the reality from the point of view of the subjects, something that must be considered as relevant to conditioning vulnerabilities, for instance. In addition, as acquiring the notion that the world just can be understood by trying to change it (Brydon-Miller et al. 2003), we are obligated to recognize that the nature of current problems related to inequities, unsustainability, and health concerns can be associated with the fragmentation of social groups, on their knowledges and practices. In this regard, the perspective of reaching social inclusion with cognitive justice must be a horizon to research as performing collaborative engagements trying to change the contexts. Only in such processes with dialogical interactions it is possible to expect the emergence of hybrid knowledge good enough to explain the complexities and also able to be apprehended by different social actors, like subjects of vulnerable contexts, policymakers, and researchers.

The problems threatening humankind were never so connected, interdependent and with the perspective of such fast dissemination, disruptive and emergent side effects, and systemic consequences. The contemporary problems are also permeated by a high level of uncertainties and contradictions, as related to varied value judgments and respective social tensions and struggles. The changing world order is ongoing with no possible conventional interpretation, for instance, a volcanic eruption in Iceland in 2010 caused chaos in the European airline traffic, and this kind of event can quickly call the world's attention, inducing other possibilities of effects as by the economic burden of intrinsic operations (Sardar 2015). Maybe it is time for

finding back the properties of our powerful natural ability to coupling as to make more valuable our diversities of knowledges, creativity, and practices. As discussed before, the rupture characterized by cognitive exclusion inhibits possible interactions and ecologies of knowledges that would give a chance to a myriad of alternatives and subjects insertions in collaborative structures. Thus, systems of interactions through dialogical participatory research should be understood through this property of recovering our capacities for more interaction. Also, this is a liberation from oppression and ruptures that inhibit our self-organizing competences.

Considering the diversity of outcomes in participatory research, it is worthy to recognize that the participatory processes can represent a product itself. A prominent analogy in that direction is valid: the participatory process is at the same time producer and the product itself, in accordance with the autopoiesis concept. Moreover, such a production can be multiple and varied, as bringing action and transforming social contexts, allowing dialogical interactions and collaborative ongoing knowledge, enabling necessary negotiations, empowering people, overcoming abyssal cognitive exclusion, providing conditions for the emergence of reflexive scientific evidence, and also fostering constant changes and learning for different social actors, including researchers.

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