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Twists and turns of interdisciplinary work in research projects: which conditions and achievements?

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Introduction

Hello everybody. I will like first to thank Marie H el ene and Jaap who invited me to this session and asked me to address the question of “how interdisciplinary work can be fruitfully achieved?” which is a challenge indeed to which I am far from having any general answer. I will modestly propose some threads which I consider as important ones in order to overcome some difficulties

Dire les difficult es

But let me first present myself a little bit. After working in extension projects in Africa and in France, I was hired at INRA in the so called SAD Department. The specificity of this Department is that it is a mix of various disciplines such as agronomy, animal science, ecology, geography, sociology, economy, management science, etc. sition and innovation processes in farming systems and food systems towards sustainability. I do not want to describe further this department, but just wish to quote that although interdisciplinarity is at the core of the department, it is always a struggle to achieve it concretely!

I have been trained as a plant scientist (agronomist) but completed my PhD in cognitive ergonomics. This double training certainly influenced my ability and willingness to develop interdisciplinary work. But I am convinced that this is not the only way to be open to other disciplines! Most of my research work was developed as a cognitive ergonomist in strong interaction with both agronomists, plant breeding scientists and sociologists or management scientists, less with animal scientists with all the spectrum it covers. So this presentation is mainly based on the work I carried on crop management rather than on livestock management I hope nevertheless that I will be able in this presentation to link it enough to your own experience.

Multi, inter, trans disciplinarity?

First I would like to clarify my way to use these terms :

Multidisciplinary work is seen as needed when we recognize that a single discipline will not be able to address questions such as the one you address in the Feed a gene project or in the Saphir one. Indeed, we all admit that disciplines do not have the same way to divide what is seen as a complex problem, or what some call a wicked problem, an ill-defined problem

So, we call for various disciplines which we assume will shed some light on different dimensions of a research object. For example, if I well understood the projects you are in, the various disciplines represented in the project will contribute to “an efficient livestock production” or to “effective vaccine-based strategies”.

In fact, in multidisciplinary work, most of the time, we assume that the object can be divided into sub-components which a given discipline can better address. The relations between these sub-components are stated at the beginning of the project and each can worked separately on a sub-component and the synthesis of the results will occur at the end, according to the way the relations were built at the start of the project.

In interdisciplinary work, an issue is to acknowledge that each discipline has its own point of view of the object as a whole, and its own way to develop its inquiry on the object. It is assumed that such inquiries are not necessarily consistent and might result in a lack of ability to make links between the various obtained results. Interdisciplinarity in my view requires a higher common understanding of the way each discipline develops its inquiry on the object and operate reductions in order to build scientific knowledge.

Finally, in transdisciplinary work, non-scientists contribute to research project, as it is recognized within the project that they carry inquiries on the object which are important to take on board in order to fully address the questions which are shared by them and the scientists. Some of the projects I was involved in were indeed transdisciplinary work.

So these distinctions being made, I will focus on interdisciplinary work and some of the issues related to it which I find important to address in an interdisciplinary project.

Problem framing

It is interesting to note that in both projects, you point the need for efficiency or effectiveness. I But I view such a formulation as quite open, it is to say that it is framed in a way which enables the various disciplines to discuss their contribution to it. It is a first important point. How to frame the problem in an open way, and how do the various disciplines are invited to discuss the way to frame the problem. For example, when agronomists involved in technology development (for example decision support tools) ask me to collaborate with them to support technology transfert, they frame the problem in a way which is

not acceptable for me. Indeed, in the field of ergonomics we analyse how technology are TRANSFORMED by their users in the course of their action. So the question is not transfer and training, the problem for me is how to co-develop the technology and the activity of the users so that they manage to still perform their work effectively without health problems. So we need to discuss and find a way to frame the problem so that we can work together about technology development and use. We have to find a way to bridge our respective disciplines and to reframe the problem so that our collaboration can be fruitful.

Value sharing

I am sure that you all admit that by pointing efficiency and effectiveness, the problem is formulated in a goal driven way which draw a horizon to the work which you carry. But how did you, or do you still discuss, about what effective and efficient means?

My view is that efficiency and effectiveness are related to values that underlie the way we decide what is efficient or effective. And discussing about values is important in interdisciplinary work from my point of view. Let me take an example from my own experience. I work on transition towards agroecology with agronomists and ergonomists in order to support advisors in their work with farmers around the reduction of pesticides use. And we discussed about what we considered useful to produce in terms of support. Some of us said: we need to provide methods and tools and to train advisors in their use. Some others said : we need to support in designing new interaction situations which have the potential to increase farmer ability to design low pesticide cropping systems". If you look at these two positions, the first one is driven by values regarding the role of science which to offer robust methods and regarding the urgency to achieve the reduction of pesticides. . The second one is driven by values which refer to long term empowerment it is relevant to develop research in order to create the conditions for continuous development of the ability of both advisors and farmers to address new issues (now use of pesticide, tomorrow climate change and trade-off between various sustainability issues which are also moving ones). It is a bit like the Chinese proverb: don't give a fish, teach how to fish. It was important to clarify this in order to balance the way we will work together on developing support to advisors and farmers.

A need for awareness of our collective and respective reductive worldviews

in the introductory abstract, it is written *Livestock production is an essential component of a sustainable food supply*. This is an assumption or a claim which the collective involved in the project share I guess.

First point : This is a way to define the “problematic situation” which you address. Why do I call it a problematic situation? Because you, as a consortium, choose to cut into the real world and to reduce its complexity in order to start working. Indeed by saying “is an essential component of sustainable food supply” you don’t take on board in your way to define the problematic situation all the discussions which currently take place about the place of meat and other animal products in our diet for ethical, environmental, also reasons. Nevertheless, far from me to discuss this choice, I just wish to point here that such a claim close some options which will not be addressed in the project. So we all operate a first reduction when defining the problematic situation and framing the problem.

This is a first reduction which was done collectively I guess. But other reductions occur when we start to build hypothesis and protocols in order to develop robust knowledge within our respective disciplines. These second reductions are driven by the core hypothesis of each discipline (or some of its contributors), by the methods each discipline has developed to produce facts and proofs. These second reductions characterize the way each discipline builds its own inquiry about the problematic situation. My experience is that it is important that participants to an interdisciplinary project accept to question and even renew their way to conduct inquiries on the object, to adopt some of the proposals made by other disciplines, in order to better integrate the diversity of inquiries.

Let me illustrate this with the project we build with agronomists and plant breeders to build new tools for assessing interactions between crop genotype and environment at the end of the 90’s. The problematic situation was: how to make better use of the information collected in cultivar assessment networks to optimize the size of these networks and choose cultivar which fit to the market? A common object of inquiry was crop genotype and environment interactions. But plant breeders considered crop genotype x environment as a residual in their model and tried to find the cultivar for which the residual was minimized. Agronomists claimed that it was useful to analyse the interaction in order to better identify the way a given cultivar reacted to various environmental conditions. They use models of yield elaboration and connect the obtained yields

to limiting conditions (water stress, nitrogen stress, heat pick...) occurring in the environments. I look at the way various stakeholders perform their own analysis of crop genotype and environment in their own organization (plant breeding firms, applied research institutes, cooperatives, millers, etc..) and what for (to select new cultivar, to choose the cultivar to develop, to identify the cultivars which can be used for bread production, etc.).

I can not develop this too far, but it meant that we did not seek for the same information, we did not give the same room to what was done by the various users, we did not develop the same understanding of what for how cultivar assessment is performed. To develop a new assessment tool, we had to combine our respective methods, and to accept to be challenged. For example, agronomists and plant breeders said : why do we need to know what stakeholders value and do now as we propose them to integrate newknowledge which is now available ? So discussions took place in order to identify a protocol which enable us to collect relevant information for the plant breeders and for agronomists while we also manage to simulate new ways of assessing cultivars within the diversity of STH working conditions (their organization, their drivers, their own constraints on information gathering and analysis, etc).

But to achieve this, I see two conditions

Being reflexive on the way we balance between robustness and social relevance in our respective disciplines

If interdisciplinarity implies to accept being challenged by other disciplines, it means that we need to be reflexive about the assumptions which we usually take for granted in a given disciplinary community. And I believe that such a reflexive stance means to discuss our respective way to balance between academic robustness and social relevance. academic robustness refers to the way a given discipline share assumptions and methodologies. Social relevance refers to the ability of the produced knowledge to overcome the problematic situation which was at the start of the research process. Interdisciplinary work open new insights and perspectives, and starts to question the assumptions made or the methodologies used. But how can this be achieved without being reflexive on our own way to be part of a disciplinary community, on our own ability to discuss the “taken for granted” assumptions and methodologies, on how to bring in my disciplinary community the hybridization which I experience in interdisciplinary work? Such a reflexivity means to master the debates which take place in our respective disciplines, but also to be aware of those which take place in the

disciplines with which the interdisciplinary work takes place. This means that collective reflexivity might become a key element in the process of interdisciplinary work. How such reflexivity can be organized?

Developing intermediary objects

My experience is that overcoming the reductions we all need to do, and being collectively reflexive is facilitated by building a common intermediary artefact (it can be a model, an experimental device, a mock-up, a shared protocol) which can support the discussions between the different disciplines on their way to grasp the object of inquiry and on their way to balance robustness and relevance while building interpretations on a set of data collected through this inquiry

If I develop further my example about cultivar assessment. As a collective, we had then to decide how we can take on board the different points of view which each of us developed through the lens of one's discipline. Furthermore, we had to decide how to work with the various stakeholders, e.g. those who use cultivar assessment in their work. We had discussion on how to combine statistical tools. But we rethink the kind of statistical tools with a trade-off between what is required to have enough statistical power, to enable identification of limiting conditions and what is possible for stakeholders to collect in their respective organizations. We define protocols to conduct interviews which enable to capture the working contexts but also the way statistics and models were used up to now. We proposed collective working sessions between plant breeders, agronomists and STH based on cultivar assessment as performed on by the STH on their own databases which were not as complete as those mainly used by scientists.

Developing these shared protocols enable us to build a compromise between all our requirements to be able to make robust inferences in our respective disciplines in relation to our respective ways to reduce the complexity of the object but also to be able to produce relevant knowledge as our methodology tries to support the discussion between different worldviews and to connect them to the ones of the STH. The methodological device acts as a common intermediary object. Common as it was not just the combination of our respective ways to collect data, but a new device which was kind of a compromise for each of us, and intermediary because we were able to use this device to put some light on our way to interpret differently the data collected and then find some issues to identify how to balance collectively between robustness and relevance in our respective way to produce knowledge

Conclusion

Let me conclude here...in my presentation I propose some key dimensions to take care of during interdisciplinary work : Problem framing and value sharing, awareness about collective and disciplinary worldviews, collective reflexivity on the reduction we operate, intermediary objects as tools to support discussions among the participants about their worldviews and their way to balance between robustness and relevance.

I also point out that this means some kind of attitude from the participants : awareness on the assumptions and methodologies which are taken for granted in their discipline, curiosity for the ones which underlie other disciplines, willingness to challenge the balance between robustness and relevance in their discipline, willingness to engage in the development of intermediary objects and the discussions they necessarily imply to become useful for problem framing, value sharing, collective reflexivity, scientific debates about the best way (at a given moment) to balance between robustness and relevance in the light of the problematic situation which is addressed in the project.

I see then the role of the project leader as a knowledge broker, e.g. as someone who can offer the conditions which will enable the debates among f the participants about their worldviews and their way to instrument the problematic situation in relation to such worldviews. As a broker, he or she has a key role in supporting the development of intermediary objects as means to promote such debates. He or she has a key role in supporting collective reflexivity which also means to create opportunities to check the way the problem was framed and to share values in order to see how they have eventually changed. But knowledge brokering can also be distributed among the participants if all the participants share the need to fulfil some minimal requirements in order to achieve interdisciplinary work.

I often use this representation (schéma utilisé lors des JDD) in order to discuss with master and PhD students about the notions I introduced here.

Please now, let us discuss such a proposition which is not put down in record permanently, but is just a personal reflection based on my own experience and some other narratives (for example as presented in the NSS journal) or

epistemological work (for example the one of Leo Coutellec on the plurality of science or the one of Isabelle Stengers on science as practice).
