RESEARCH IMPACT ASSESSMENT: FROM EX POST TO REAL-TIME ASSESSMENT

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1. INTRODUCTION

This paper presents an ongoing research and development project to build research management tools based on real-time impact analysis (the toolset is labelled ASIRPA^{rt}). The ambition is to use the lessons learned from ex post research impact assessment (RIA), building from the ASIRPA project which was launched in 2011 (Joly et al. 2015, Matt et al. 2017). The ASIRPA approach is currently implemented on a routine base at the French public research organisation INRA (Institut National de la Recherche Agronomique). Therefore, the project draws on lessons learned from ex post RIA and the experience of researchers and actors involved in research programming.

The aim of ASIRPA^{rt} is to design an approach and tools to help conduct research projects or programmes with the aim to amplify impacts. The challenge of the current project is to develop management tools based on a better understanding of the mechanisms that generate research impact. These tools will be coproduced with potential users (Robinson and Rip 2013).

Given the uncertainty and complexity that characterise the transformation processes linked to research activities, we do not intend to design ballistic steering tools but to produce tools to foster learning processes, coordination and reflexivity of the actors involved. Our approach takes inspiration in different streams of literature.

First, based on Kuhlman (2003), we consider that such tools should foster competences of the actors involved in research activities and research programming, as well as strengthen collective learning and coordination. Second, our general representation of transformation processes linked to research activities is inspired by innovation studies, and more precisely actor-network theory (Callon 1986) and the innovation journey (Van de Ven et al. 1999). According to these theoretical frames, the processes involved cannot be steered and planned because they generate new knowledge, new socio-technical associations and their effect depends on the progressive alignments of many heterogeneous elements. To paraphrase Van de Ven (2016), one cannot control such complex and uncertain processes, but one can still learn to manoeuvre it.

With such tools and the interactions that it can generate, we also aim at favouring exchanges between users and thus contributing to the creation of communities of practice that will themselves contribute to improving the approach.

2. STATE OF THE ART, CONCEPTS AND APPROACHES

Since the beginning of the 2010's, RIA benefits from a renewed interest (Joly and Matt 2017). Although the field is still moving quickly, we know a lot on *ex post* RIA and relatively little on *in itinere* or *ex ante* assessment. In our project, we use the expression 'real time' to signify that what matters is the design of tools for continues assessment of the transformative capacity of research and learning how to 'manoeuvre' for enhancing impact. Such tools take inspiration of *ex post* analysis and aim to enhance skills of actors involved for *ex ante* or *in itinere* conduct of research activities. Our idea is that these tools have to be designed to serve at different scales, from the project level to the programme level or any relevant cluster of projects. The landscape of RIA proposed by LERU in the context of the preparation of FP9 is relevant to our approach (Figure 1).

Impact assessment and enhancement	Ex-ante	During	Ex-post		
			short-term (end of project +1 year)	medium-term (+1-7 years)	Long-term (+7-15 years)
Call and project level	Pathways to impact statement	Follow-up/impact funding			
			Quantitative and qualitative assessment of outputs, outcomes and pathways to impact		
At the level of FP components (clusters, programmes, societal challenges, missions, …)	Description of broad expected impact by the EC in WPs, or targets to meet (for missions)	Clustering			
			Assessment of interaction and communication patterns between research and societal context at the level of clusters or programmes		
			Synthesising projects		

Fig. 1: A general overview of research impact assessment landscape
Source: LERU (2018)

If we consider the different approaches and tools available (Table 1), 'theory of change' and the various tools designed for its implementation are widely used. However, most of these tools poorly deal with complexity and uncertainty of research process. Moreover, design thinking may help to stimulate creativity and tools for co-design are well adapted to involve potential users in the innovation process. However, such tools do not take into account explicitly the growing information. Hence, process analyses such as ANT and innovation journey approaches are our best candidates. However, this does not exclude taking advantage of other approaches/tools where relevant.

	The impact path	The complexity	The uncertainty
Processual Impact pathway + + Complexity + + + Uncertainty + + +	Analysis dividing the process into sequences Joint study of the configurations of the different variables (actors, etc), sequences, drivers (mechanisms), and bifurcations (turning points)	In social phenomena, causal relations are not constant, the results are unpredictable. Relational, technological and temporal complexity	Time is a structuring dimension of the action that generates lock-in. Different types of uncertainty. Control of Innovation: learn to navigate in a set of possible future
Examples of tools that are affiliated with the approach	FORTH innovation expedition Constructive Technology Assessment and tools to animate participatory workshops		
Theory of change Impact Pathway + Complexity ++ Uncertainty +	Allows an analysis of the configuration of the actors and the context If the nature of the intervention is predefined: expand the logical steps towards the objective of the programme according to a fairly linear approach (logframe).	Is suitable for complicated: takes into account the context, past experience, logical assumptions, between actions and between production of the results and achieving the objectives Requires a consensus of actors on the general theory to be tested.	Formative dimension of the evaluation: learning based on experimentation, coordination of expertise, creation of relationships and common foundations to achieve a consensus Takes into account a finite number of possible futures.
Examples of tools that are affiliated with the approach	LogFrames ; Logical frameworks with inventory of the conditions necessary for the impacts Participatory Impact Pathway Approach (PIPA) ; Vianéo Approach		
Innovative design Impact pathway Complexity + Uncertainty + + +	Design process: define concepts C and knowledge K and characterise the operators necessary for the passage from C-space to K-space (expansion logic) Methods that do not explicitly consider the phases of the impact pathway (e.g. generalization)	Concepts are tiered to reduce complexity. New concepts must stimulate the production of new knowledge: the expansion of knowledge and concepts The identities of objects and their ecosystems are not fixed.	The unknown is an engine for defining new design parameters. The techniques AND functions of the objects to be conceived are unknown; and objects and their ecosystems have a variable identity.
Example of tools affiliated with the approach	Creativity Workshops: TRIZ an Creative Problem Solving on problem solving ; STUR method on analysing strategic partnerships ; CCAID method on the research-action-participation…. : KCP workshops : tools from the IDEAS network		

Table 1: A first overview of approaches and tools available for real time assessment

3. SKETCHING OUT THE ASIRPA (RT) APPROACH

3.1. WHAT DO WE DRAW ON? THE MAIN LESSONS FROM EX POST RIA (ASIRPA PROJECT)

The lessons learned from *ex post* RIA play a crucial role in building the real-time approach. The "impact pathway" is the core concept of the ASIRPA approach. We adapted this traditional framework (Douthwaite 2003) and shifted from a quite linear input/output analysis to an approach where:

- the process is divided into phases that are qualitatively different but that do not necessary follow a linear sequence;
- taking our inspiration in ANT, the dynamics are related to translations that allow to create new links between different elements (both human and non-human) and to transform and extend socio-technical associations;

- we do not primarily consider 'inputs' but what we call "productive configurations", a concept that aims at taking into account both the organisational complexity of the research activities considered and their embedding in a wider context;
- we focus on two key elements: (i) the role of intermediaries that play a key role in the dynamics of key translation processes; and (ii) the generalisation or scaling up/out, a phase that is often quite problematic.

The main lessons identified were the following:

- The complexity of the genesis of impacts, generally produced by a set of activities rarely brought together in a single project;
- The importance and diversity of configurations of actors and material resources that produce impacts;
- The identification of critical points along the impact pathway, with a special role of intermediaries and the process of generalization;
- The transformations of the network of actors during the process (an adoption network is generally different from a design network)
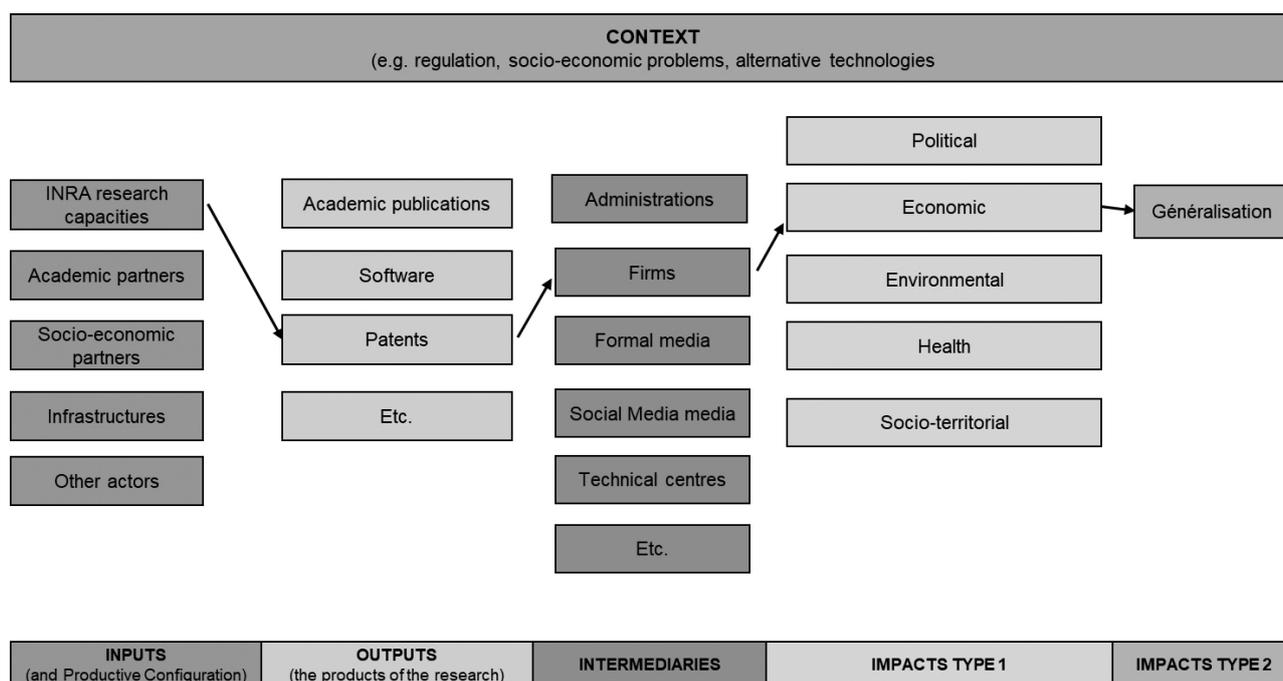
CONTEXT
(e.g. regulation, socio-economic problems, alternative technologies

INPUTS (and Productive Configuration)	OUTPUTS (the products of the research)	INTERMEDIARIES	IMPACTS TYPE 1	IMPACTS TYPE 2

Fig 2: The impact pathway recast in the ASIRPA approach

- The role of the external context which can have facilitating or blocking effects, and open or close, sometimes suddenly, windows of opportunity
- The existence of 4 types of impact paths with different properties and effects;
- The long temporalities of the impact (20 years on average between the initiation of research and the first impacts, with important variations).

3.2. THE CONCEPTS

Research and innovation projects are characterized by high levels of complexity and uncertainty. Acknowledging these essential characteristics, the real-time evaluation approach aims to strengthen the capacities of the actors and the dynamics of collective action, thus drawing on two traditions:

- Developmental evaluation (Patton 2016) which informs and guides innovation and development actions that take place in dynamic and complex environments;
- Strategic intelligence (Kuhlman 2003) which aims to strengthen coordination and collective learning.

Moreover, the approach is attentive to the creativity of the actors and to serendipity. While it is necessary for the actors involved to be able to construct a theory of change, i.e. to form an image of the targeted transformations, to represent the impact paths, to identify the critical factors, etc., it is essential that the steering tools allow great flexibility and adaptability. The representation of the process at work is based on the analyses of the innovation journey. Basically, innovation is seen as

a sequential, uncertain, complex and singular process. Nevertheless, knowledge of this process helps to identify facilitating and blocking factors. This knowledge must make it possible to design tools to manage the tension between a top-down direction and bottom-up explorations (Mazzucato 2018). The identification of the targeted transformations and the construction of an *ex ante* impact path must feed into explorations that may have many sources of surprise and that can lead to revising the targets (what Robinson 2009 has described as a reflexive strategy articulation support system). These tools should enable collective learning to be monitored; lessons (and data) from experiments should be collected and analysed.
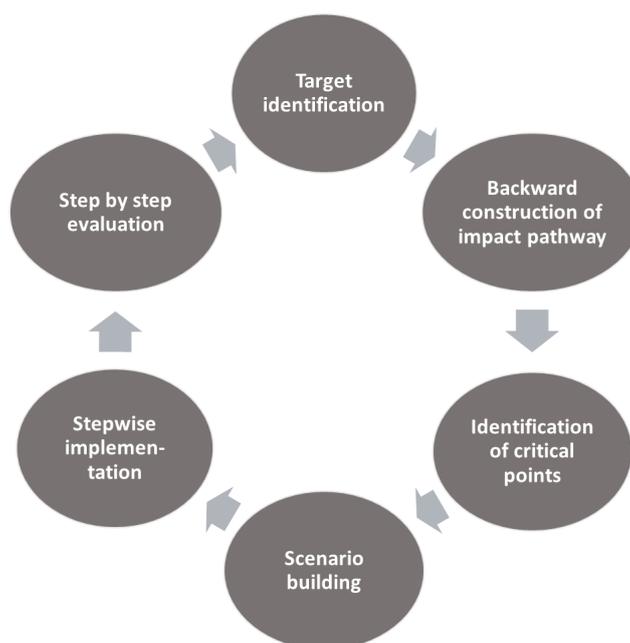
3.3. THE PROPOSED APPROACH

The real-time evaluation process is based on an iterative model whose main lines can be outlined as follows.

1. TARGET IDENTIFICATION

What are the anticipated transformations that justify commitment to research? What are the different issues involved in these transformations? What is the magnitude of these transformations in the 5 dimensions of impact?Who are the potential users? How will they be interested in/affected by the transformations?

It should be noted that, given the uncertainties inherent in research, this target often constitutes what may be called a "rational myth": an objective in which we must believe but which we know from the outset is likely to change to a greater or lesser extent.

Fig 3: A first representation of the proposed approach

2. CONSTRUCTION OF THE IMPACT PATHWAY BY BACKWARD INDUCTION

Who are the key actors and mechanisms involved in the mainstreaming process? What are the blocking and facilitating factors?

Which intermediaries (organisations, technical objects, devices) will enable implementation by the first users?

Who are the knowledge-producing actors? what are the adjacent projects (ongoing, completed, in gestation), by whom are they carried out? what are the complementarities and competition between these projects?

3. IDENTIFICATION OF CRITICAL POINTS

What are the critical points associated with the different stages of the impact path? On whom do they depend?

What are the influences of these critical points on the envisaged process?

4. SCENARIO CONSTRUCTION (SCRIPTS - STEPS, BIFURCATION)

Taking into account the main elements above, construct the main scenarios of the project (or group of projects), with the main stages, critical points, bifurcations.

From this, deduce the main meeting points and the anticipated follow-up elements.

5. STEP BY STEP DECISION AND IMPLEMENTATION

6. EVALUATION AT EACH STEP AND NEW LOOP

This iterative model is constructed and used by the project manager or program manager, often supported by project engineering specialists. It is usually the result of a collective design, with the teams involved and, as necessary, with external partners and potential users. These interactions are based on tools accessible on an online platform.

Essential point: this is a sequential approach. The aim is not to resolve all the questions from the outset but to conduct a process in which the main stages, qualitatively different, are analysed and scattered by internal or external information gains from the project.

The principle is to identify the elements necessary to improve research contribution in the present sequence, bearing in mind the uncertainty about the future. This distinguishes this approach from traditional applications of theories of change. The sequential approach takes seriously the uncertainty, the gain of information during the process (on the state of the art, on the environment, because of relational learning, etc.) and the need to privilege flexibility and adaptability.

At each stage, we seek to optimize the approach by taking into account uncertainty and flexibility. For example, regarding the application of genomic selection methods to the estimation of the genetic value of bulls in milk cattle, proof of concept will be sought before making irreversible development investments; this requires developing a productive configuration to combine quantitative genetics, sample collection and high throughput sequencing skills. The proof of concept being done, we can enrol actors from the sectors who will be involved in the co-development of standardized techniques. For each project, it is therefore necessary to set a transformation objective and to determine the sequence of the main stages qualitatively different. This results in the determination of control points, which leads to the construction of project monitoring dashboards that are very different from the performance indicators generally used in change theory applications.

4. IMPLEMENTATION

ASIRPA[rt] uses a co-design strategy. We have formed a group of c. 15 experts who represent potential users, with strong experience in the coordination of big research projects (e.g. European H2020 projects) or coordination of research programmes of clusters of activities. This working group will be involved in the following process:

1. **Workshop 1**: User representatives are invited to share their experience (skills, possible tools...) in real time and express their needs;
2. Creation of the prototypes of tools;
3. **Workshop 2**: the prototype is proposed to the participants, the tools are selected, adapted or, collectively designed;
4. The methodology and its tools are tested by participants on pilot cases supervised by the ASIRPA team;
5. **Workshop 3**: Feed backs on first use, collective learning

After this first pilot phase, tools will be further developed and their use will be generalised.

5. CONCLUSION

Such an intervention research project is a major opportunity to both develop new knowledge on process approaches of research and innovation activities and contribute to key transformations along the ambition to address major challenges.

In the current context, where research impact is a major stake, this project runs the risk to strengthen managerial practices that cherish short-term efficiency, probably at the price of long-term inventiveness. A key challenge of the project is to find ways to articulate directionality and creativity, to favour a good balance between exploration and exploitation. Our choice is to interact strongly with actors who are directly confronted with research coordination issues, in order to strengthen their skills and competences with the hope that we will succeed in transforming, or at least managing, the contradiction between directionality and serenpidity.

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