



**HAL**  
open science

## **Enhancing capacities for sustainability transition policy design: Lessons from French pesticide reduction plans**

Viviane Trèves, Mourad Hannachi, Jean-Marc Meynard

### ► **To cite this version:**

Viviane Trèves, Mourad Hannachi, Jean-Marc Meynard. Enhancing capacities for sustainability transition policy design: Lessons from French pesticide reduction plans. *Agricultural Systems*, 2025, 223, pp.104175. <10.1016/j.agsy.2024.104175>. <hal-04803908>

**HAL Id: hal-04803908**

**<https://hal.inrae.fr/hal-04803908v1>**

Submitted on 26 Nov 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons CC BY 4.0 - Attribution - International License

# Agricultural Systems

## Enhancing Capacities for Sustainability Transition Policy Design: Lessons From French Pesticide Reduction Plans

--Manuscript Draft--

<b>Manuscript Number:</b>	
<b>Article Type:</b>	Research Paper
<b>Keywords:</b>	pesticide reduction; lock-in; policymaking process; policy capacity; management science; sociotechnical transition
<b>Corresponding Author:</b>	Viviane Trèves, PhD Université Paris-Saclay FRANCE
<b>First Author:</b>	Viviane Trèves, PhD
<b>Order of Authors:</b>	Viviane Trèves, PhD Mourad Hannachi, PhD Jean-Marc Meynard, PhD
<b>Abstract:</b>	<p><b>CONTEXT</b> Public policies are key levers to support transitions towards sustainable agri-food systems, especially in the presence of a lock-in. To better design public policies, one important challenge for policymakers is to improve policy design processes, while ensuring an active participation of stakeholders.</p> <p><b>OBJECTIVE</b> This article is aimed at identifying elements that limit policymakers in managing suitable collective policymaking processes for sustainability transitions.</p> <p><b>METHODS</b> We studied the collective elaboration of the French pesticide reduction plans. Pesticides policies are particularly complex because of the presence of a lock-in around these chemicals. To do so, we built a narration of the policy process organized by policymakers, based on semi-structured interviews and an analysis of the grey literature. We then reflected on what policymakers need to better manage a policy process to overcome the lock-in around pesticide use, using the “management situation” concept.</p> <p><b>RESULTS AND CONCLUSIONS</b> Our results show that to design transition policies adapted to a lock-in situation, policymakers need to develop four types of interdependent “policy capacities” (skills and resources): capacities to support collective sensemaking about the implications of the lock-in, to co-design interdependent and multi-level instruments, to co-design suitable implementation structures and to ensure learning. These results highlight an issue of adaptability and dynamic capabilities in public organizations.</p> <p><b>SIGNIFICANCE</b> Our results provide concrete proposals to improve policy processes for transition policies aiming at systemic transformations in the agri-food sector: there is a need to develop new methods, tools, analytical resources and training programs for policymakers, to support the development of the policy capacities identified. These results also suggest several avenues for future action-research between public management, systemic agronomy, sustainability and design sciences.</p>
<b>Suggested Reviewers:</b>	Nathalie Raulet-Croset raulet.croset.iae@univ-paris1.fr  Niklas Möhring nmoehring@ethz.ch

	Markus Vinnari markus.vinnari@helsinki.fi
	Susana Borrás sbo.ioa@cbs.dk

# 1                    **Enhancing Capacities for Sustainability Transition Policy Design:** 2                    **Lessons From French Pesticide Reduction Plans**

3  
4 Viviane Trèves\*, PhD: [Viviane.treves@agroparistech.fr](mailto:Viviane.treves@agroparistech.fr)

5 Mourad Hannachi, PhD: [Mourad.hannachi@inrae.fr](mailto:Mourad.hannachi@inrae.fr)

6 Jean-Marc Meynard, PhD: [jean-marc.meynard@inrae.fr](mailto:jean-marc.meynard@inrae.fr)

7  
8 UMR SADAPT, INRAE, AgroParisTech, Université Paris-Saclay.

9 Campus Agro Paris-Saclay, 22 place de l'Agronomie, 91120 Palaiseau, France

10  
11 *\*Corresponding author*

## 12 13 **Abstract**

### 14 15 **CONTEXT**

16 Public policies are key levers to support transitions towards sustainable agri-food systems,  
17 especially in the presence of a lock-in. To better design public policies, one important challenge  
18 for policymakers is to improve policy design processes, while ensuring an active participation of  
19 stakeholders.

### 20 21 **OBJECTIVE**

22 This article is aimed at identifying elements that limit policymakers in managing suitable  
23 collective policymaking processes for sustainability transitions.

### 24 25 **METHODS**

26 We studied the collective elaboration of the French pesticide reduction plans. Pesticides policies  
27 are particularly complex because of the presence of a lock-in around these chemicals. To do so,  
28 we built a narration of the policy process organized by policymakers, based on semi-structured  
29 interviews and an analysis of the grey literature. We then reflected on what policymakers need  
30 to better manage a policy process to overcome the lock-in around pesticide use, using the  
31 “management situation” concept.

34 RESULTS AND CONCLUSIONS

35 Our results show that to design transition policies adapted to a lock-in situation, policymakers  
36 need to develop four types of interdependent “policy capacities” (skills and resources):  
37 capacities to support collective sensemaking about the implications of the lock-in, to co-design  
38 interdependent and multi-level instruments, to co-design suitable implementation structures and  
39 to ensure learning. These results highlight an issue of adaptability and dynamic capabilities in  
40 public organizations.

41  
42 SIGNIFICANCE

43 Our results provide concrete proposals to improve policy processes for transition policies aiming  
44 at systemic transformations in the agri-food sector: there is a need to develop new methods,  
45 tools, analytical resources and training programs for policymakers, to support the development  
46 of the policy capacities identified. These results also suggest several avenues for future action-  
47 research between public management, systemic agronomy, sustainability and design sciences.


48  
49 **Graphical abstract**

50

### Enhancing Capacities for Sustainability Transition Policy Design: Lessons from French Pesticide Reduction Plans



- Public policies are key levers to support transitions towards sustainable agriculture
- Pesticide reduction policies need to be systemic to overcome lock-ins
- In liberal democracies, policymakers must ensure the active participation of stakeholders to policy formulation processes

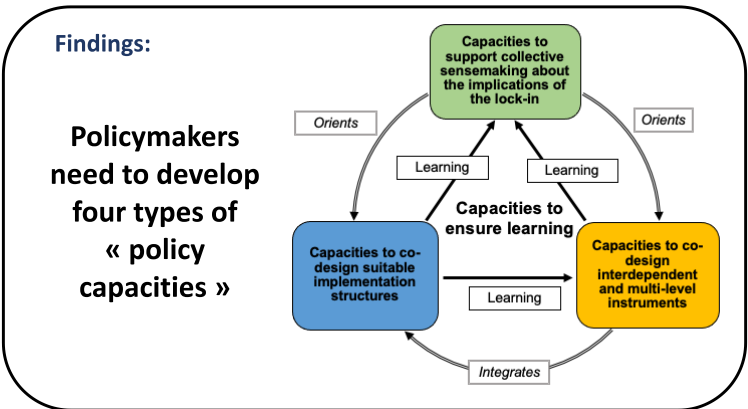
**What are the elements that limit policymakers in managing suitable collective policymaking processes for sustainability transitions ?**

**Case study:** 

The formulation of the French pesticide reduction plans (2007-2021) aimed at a -50% in pesticide use

**Theoretical framework:**  
« Management situation » concept (Girin, 2011)

**Data collection:**  
 Grey literature  
 26 semi-structured interviews



51

52

53

54

55 **Keywords:** pesticide reduction; lock-in; policymaking process; policy capacity; management  
56 science; sociotechnical transition

57

58 **Highlights:**

59 • Pesticide reduction policies are particularly complex because of the presence of a lock-in  
60 around these chemicals.

61 • This article aims at identifying elements that limit policymakers in managing suitable  
62 policymaking processes for pesticide reduction.

63 • Our results show that sustainability policy processes are not adapted to systemic  
64 transitions characteristics.

65 • Policymakers need specific policy capacities for sense-making, systemic instruments  
66 design and implementation.

67 • We highlight an issue of dynamic capabilities in the public sector.

68

69

## 70 **1. Introduction**

71

72 Public policies are a key lever to support transitions towards sustainable agriculture, and one of  
73 the main challenges for research in this field is to identify ways to support policymakers to improve  
74 the efficiency of sustainability policy design. Prior research has illustrated the importance of both  
75 policy instruments and policy processes, as policy processes influence the choice and content of  
76 instruments (Howlett et al., 2009; Voss and Bornemann, 2011; Jordan and Turnpenny, 2015;  
77 Kivimaa and Kern, 2016; Rogge and Reichardt, 2016; Howlett and Mukherjee, 2018).

78

79 Developing better designed policymaking processes requires careful consideration of the  
80 characteristics of the policy area concerned (Mukherjee and Bali, 2018). For sustainability  
81 transitions, the literature highlights several characteristics that need to be taken into account  
82 (Köhler et al., 2019):

- 83 • Transitions are a collective phenomenon: they correspond to the transformation of a  
84 sociotechnical system, which can be defined as “*a collective of stakeholders, their networks,*  
85 *their practices and knowledge, the technologies they use, their collective representations, and*  
86 *the standards and rules they adopt*” (Meynard et al., 2017 – from Rip and Kemp, 1998).
- 87 • Supporting a transition involves defining multidimensional actions, which integrate the spatial  
88 dimension (from the local to the international level), the position in relation to the dominant  
89 sociotechnical regime (niche, regime, landscape – Geels, 2002) and the various links in a  
90 system.
- 91 • Transitions are often hindered by lock-ins that excludes breakthrough innovations that are not  
92 compatible with the dominant sociotechnical system (Kuokkanen et al., 2017). This system is  
93 stabilized by the interdependencies among its components, the alignment of its standards and  
94 the difficulty of acting on material artifacts and networks (Geels, 2004; Belmin et al., 2018).  
95 This implies that the transformations of the different links of the system must be done in such  
96 a way as to allow their co-evolution and avoid blockages of one part by another.
- 97 • Transitions towards sustainability present a strong “normative directionality”: the targeted  
98 objective integrates better health of the considered ecosystems.
- 99 • Transitions present a high level of uncertainty and multiple controversies: There are numerous  
100 possible transition pathways, with uncertain feasibility, and the desirability of any particular  
101 pathway can be contested by the multiple actors involved.

102

103 In liberal democracies, policymakers must be able to take those elements into account while  
104 managing a collective policy formulation process. Since the end of the XXth century and following  
105 claims from civil society, liberal States have evolved to make policymaking more collaborative  
106 and transparent. Today, especially in the environmental sectors, public policies must be designed  
107 – to a certain extent at least – with the active participation of a wide variety of stakeholders  
108 (Lascoumes and Le Galès, 2012; Bali and Ramesh, 2018).

109

110 Policymakers must therefore organize collective design processes capable of effectively  
111 harnessing the complexity and systemic aspects of sustainability transitions. This article aims at  
112 identifying elements that limit policymakers in doing so in the agri-food sector, in order to propose  
113 ways to address these limitations.

114

115 To do so, it seemed most appropriate to start from a detailed study of practices of policy makers.  
116 We therefore based our analysis on a case-study: the elaboration of pesticide reduction plans in  
117 France. Public policies on pesticides give a perfect example of the difficulties developing public  
118 policies that act at the sociotechnical system level, because of the central place occupied by these  
119 chemicals in Western cropping systems. In several countries, a lock-in phenomenon has been  
120 highlighted around pesticides (Wilson and Tisdell, 2001; Vanloqueren and Baret, 2009; Lamine  
121 et al., 2010; Kuokkanen et al., 2017; Magrini et al., 2018; Oliver et al., 2018). Achieving significant  
122 reduction therefore requires a radical redesign of production systems simultaneously at the level  
123 of farms, territories, sectors and markets. It thus requires public policies that induce coordinated  
124 changes of the different actors of the system, in order to prevent the transformation of one part of  
125 the system from being blocked by another (Guichard et al., 2017; Kuokkanen et al., 2017; Mörhing  
126 et al., 2020). In France, reducing environmental and health nuisances associated with the use of  
127 pesticides has been a public policy objective since 2007, when the country set an objective of  
128 reducing pesticide use by 50% over 10 years, “if possible”. To achieve this goal, the State  
129 developed the Ecophyto plans with a high level of stakeholder involvement, but those did not  
130 achieve a reduction of pesticide use on the territory (Government of the French Republic, 2020).

131

132 We analyzed the elaboration of the Ecophyto plans between 2007 and 2021 to identify elements  
133 that public managers would need to improve policymaking processes and formulate plans able to  
134 overcome the lock-in. In the rest of this article, we first present our theoretical framework (part 2),  
135 and then, detail our case selection and methods (part 3). In part 4, we show how collective

136 policymaking was managed in Ecophyto (part 4). We then identify missing elements that hindered  
137 the State's ability to manage the creation of a transition plan (part 5). Based on this analysis, we  
138 formalize three pillars for improved policymaking processes and the corresponding capacities  
139 required to do so in the cross-sectional discussion (part 6). We conclude in part 7.

140

## 141 **2. Theoretical Framework**

142

143 While Policy Sciences have developed several approaches to analyze policy processes, such as  
144 the phase, the stream or the rounds models (Teisman, 2000), we looked for a framework that  
145 would specifically address the collective aspects of contemporary policymaking and would be  
146 prescriptive on the fundamental elements needed to manage such a situation, to help us draw  
147 operational recommendations. We therefore mobilized the "management situation" concept  
148 brought forward by Girin (2011).

149

150 A management situation is a situation where collective action is made *manageable*. It is a  
151 situation where "participants are united and must accomplish, in a determined time, a collective  
152 action leading to a result submitted to an external evaluation" (Girin, 2011):

- 153 ● The participants in a situation are both active in achieving the result and affected by the  
154 external evaluation. Other actors can contribute to the situation without being affected by the  
155 evaluation, in which case they are not considered participants (Girin et al., 2016).
- 156 ● The idea of "result" does not imply that there is collective adherence to the objective:  
157 each participant may have their own reasons for participating (obligation, opportunity, etc.), but  
158 the obligation or intent to achieve the result dominates and unites the actions of the collective.
- 159 ● The notion of evaluation highlights that achievement of the result is not defined by the  
160 collective itself but responds to external criteria.
- 161 ● A management situation can be composed of several nested sub-situations. These are  
162 generally linked together by the creation of delegations.

163

164 At the start of a management situation, participants face strong uncertainties about the actions  
165 to be taken. They initiate a "process of inquiry", which is a sensemaking process (Weick, 2005)  
166 aimed at creating knowledge to reduce uncertainties (Journé and Raulet-Croset, 2008). The  
167 inquiry does not correspond to a revelation of the attributes of a system but rather to the actors'  
168 construction of their vision of this system and its means of management. The confrontation of  
169 the participants' subjective interpretations (e.g: what levers for reduction are really realistic or

170 desirable?) allows progressive simplification of the problem and the emergence of compatible  
171 interpretations. “Compatible interpretations” are interpretations that may differ but are sufficiently  
172 close that the participants can work together to achieve the result. The compatibility is therefore  
173 subjectively perceived by the participants. This simplification allows the translation of the  
174 collective interpretations into actions.

175

176 The management situation concept can be used as a tool for analyzing the evolution of the  
177 constituent elements of a situation to be managed, in particular when the latter presents strong  
178 uncertainties (Journé and Raulet-Croset, 2008; Charrier et al. 2020). It is relevant for Ecophyto,  
179 as the participants had to collectively define the means of reducing pesticides despite strong  
180 uncertainties on the levers to be used.

181

182 This concept is applicable to transition public policies and sheds unique light on them, for four  
183 reasons. Firstly, policymakers in liberal democracies are confronted with the need to manage  
184 collective policy processes. Secondly, the significance of the uncertainties and controversies  
185 around a transition makes it useful to use a management perspective where the starting point is  
186 defined as an indeterminate situation, and where understanding of the actors is built as it goes.  
187 The importance of the “inquiry process” in the management situation concept is therefore  
188 particularly adapted to our question. Thirdly, the normative objective of a transition  
189 (sustainability) echoes the notion of result of a management situation: even if actors have  
190 subjective understandings of the problem, collective action is directed toward a result that can  
191 be assessed. Finally, the pragmatic roots of Girin’s concept invites us to closely analyze the  
192 micro-level, operational actions that policymakers take to give life to the policymaking process.

193

### 194 **3. Methodology**

195

#### 196 **3.1. Case selection**

197

198 The policymaking process that we analyzed started in 2007, when France set an ambitious  
199 target of reducing the use of pesticides by 50% over 10 years, which the State embodied in the  
200 “Ecophyto Plans” (Ministry of Agriculture and Fisheries, 2008; Ministry of Agriculture and  
201 Fisheries and Ministry of Ecology, Sustainable Development and Energy, 2015; Government of  
202 the French Republic, 2019). The first version was launched in 2008 and revised in 2015 and  
203 2019. To elaborate those policies, the State positioned itself as the manager of a collective

204 action through multi-actor processes. The plans consisted of a wide mix of public policy  
 205 instruments, some binding, others aimed at training, research or support for the actors (table 1).  
 206 However, despite several years of implementation, and even if the numbers have been  
 207 decreasing since 2017, the use of pesticides increased in France by 13,8% in three-year  
 208 average between the periods 2009-2011 and 2018-2020<sup>1</sup> (Government of the French Republic,  
 209 2020 – fig. 2). The literature studying the weaknesses of the Ecophyto plans have criticized their  
 210 lack of sufficiently binding or incentivizing instruments, but also their failure to take into account  
 211 the presence of a lock-in by mostly targeting farmers, their advisors, and, in a later phase,  
 212 distributors (Guichard et al., 2017; Aulagnier, 2020; Dufour et al., 2021) (table 1).

213  
 214 We selected this case for multiple reasons. Pesticide reduction policies are particularly  
 215 interesting because of the lock-in that has been identified around these chemicals in Western  
 216 cropping systems, which require instruments inducing system-wide transformations. France is  
 217 one of the few countries to have established such an ambitious policy objective early on, with a  
 218 focus on pesticides quantity reduction rather than risk management and incremental change.  
 219 The need for multi-level radical change was acknowledged early in the French policy process  
 220 (Butault et al., 2010), which suggests that the limitations to developing relevant policy  
 221 instruments did not arise because of a lack of understanding of the systemic aspect of a  
 222 transition. Furthermore, it allowed us to benefit from a historical perspective on a policy that was  
 223 kept under various governments and evolved over time. Lastly, in France, the State is an  
 224 important actor in the agri-food sector, the Ecophyto plans had relatively substantial funding,  
 225 and the policy benefited from a reasonably important place in the political agenda. Policymakers  
 226 aimed to develop a process that allowed for a high degree of customization (Howlett and  
 227 Mukherjee, 2018). This setting enabled us to analyze tools, processes and organizational  
 228 routines used by policymakers to manage collective design processes for sustainability  
 229 transitions, rather than being limited by potential constraints such as human or financial  
 230 resources, or policymakers' legitimacy.

231

Main instruments	Description	Main actors targeted	Method of delegation
------------------	-------------	----------------------	----------------------

---

<sup>1</sup> In 2019-2021, the use of pesticides came back to its original level of 2009-2011, in three-year average, if you consider the most recent preliminary data from 2021.

<b>Ecophyto 1</b>			
DEPHY farm network	Network of pilot farms accompanied by a technical adviser, with the aim of reducing the use of pesticides and developing new technical references	Farmers and agricultural advisory services	<ul style="list-style-type: none"> <li>- Strategic steering committee made up of representatives of the actors involved in Ecophyto</li> <li>- Operational steering committee hosted mainly within a public organization representing and advising farmers (Chambers of Agriculture France)</li> </ul>
'Certiphytos' phytosanitary certificates	Training allowing the obtaining of an individual certificate, compulsory for all professionals using, advising or marketing pesticides	Farmers, professional user of pesticides, agricultural advisory services	<ul style="list-style-type: none"> <li>- The training courses were delivered by competing private organizations. Programs were defined by regulation, and could be controlled by the administration (Ansaloni, 2017)</li> </ul>
Plant Health Bulletin	Free information bulletin on phytosanitary pressure around a crop in a given region, based on a network of observations, and aimed at avoiding phytosanitary treatments not justified by the presence of pests.	Farmers and agricultural advisory services	<ul style="list-style-type: none"> <li>- Creation of a regional committee for epidemio-surveillance, chaired by the president of the regional chamber of agriculture and bringing together agricultural organizations and the State administration</li> <li>- The regional State administration verified that the decisions taken were in conformity with those taken at the national level.</li> <li>- The data was collected and analyzed by various agricultural organizations (Aulagnier, 2020)</li> </ul>

Fee for Diffuse Pollution	Levy on the sale of pesticides used to finance the actions of the Ecophyto plans	Farmers	<ul style="list-style-type: none"> <li>- Levies were taken by the agency in charge of biodiversity and managed via the Water Agencies.</li> <li>- The allocation of funding within the Ecophyto plans was validated by the stakeholders, grouped within the Advisory Governance Committee – which would be abolished in 2016</li> </ul>
---------------------------	--	---------	---

***Ecophyto 2 (additions compared to Ecophyto 1)***

Pesticide Saving Certificates	Certificates aimed at obligating distributors of pesticides to promote the implementation, on farms, of actions recognized as enabling the reduced use of pesticides. Each practice is linked to a quantified level of product savings, and distributors must achieve a certain level of savings defined at the national level. The financial penalty originally provided for was subsequently removed.	Distributors (cooperatives and trading companies)	<ul style="list-style-type: none"> <li>- The recognized actions were defined by a committee of technical experts led by the National Institute of Agronomic Research, on the basis of proposals that could come from the actors</li> <li>- The distributor obligation levels were defined by agents from the Ministry of Agriculture (Aulagnier, 2020)</li> </ul>
-------------------------------	---	---	---

***Ecophyto 2+ (additions compared to Ecophyto 2)***

Advising/sales separation	Organizations that provide providing advisory services to farmers on pesticides use are prohibited from selling pesticides, and vice versa. Organizations who chose to keep their sales activities could still advise farmers on alternative products to pesticides.	Cooperatives and trading companies	This instrument is a regulatory one. It was managed directly by agents from the Ministry of Agriculture. Those agents worked both at the national level and in local representations of the ministry.
---------------------------	--	------------------------------------	---

233 Table 1: Main instruments of Ecophyto 1, 2 and 2+ plans, main actors targeted by those  
234 instruments and their terms of delegation (excluding substance prohibition) These instruments  
235 were deemed to be central to the Ecophyto plans on the basis of (i) the extent of their  
236 financing relative to the total financing of the plans or (ii) the importance given by the actors  
237 during the interviews or within the gray literature.

238

### 239 **3.2. Data collection and analysis**

240

241 To collect data, we carried out semi-structured interviews with the actors involved in the  
242 construction of the Ecophyto plans. To identify the first informants, we analyzed archives and  
243 articles and conducted several exploratory interviews. We then proceeded according to a  
244 snowball approach, with each actor indicating other actors to contact. We continued the interviews  
245 until no more new information emerged and we had saturated the diversity of actors involved. The  
246 differences in the number of interviews by category of actor mainly resulted from the variation in  
247 the size of the structures and the difference in the number of people in charge of the Ecophyto  
248 plans who have succeeded one another within the same structure. In total, 26 semi-structured  
249 interviews, lasting a total of 37 hours and 20 minutes were conducted and transcribed. Our work  
250 is based on these interviews (table 2) and a corpus of secondary data made up of written archives  
251 on the Ecophyto plans (appendix A).

252

253 The collected data was first coded inductively with the Nvivo® software. We followed the  
254 principles of Grounded Theory (Corbin and Strauss, 2014) to identify patterns and recurring  
255 themes and select our theoretical framework (Kinniburgh, 2023): the “management situation”  
256 concept (Girin, 2011). The codes were then grouped into higher-level categories based on this  
257 “management situation” concept and interviews were deductively coded another time using those  
258 categories. Examples of codes used for the higher-level categories are “Difficulties to manage the  
259 inquiry process”, “Absence of collective sense-making”, “Definition of the result”, “Generation of  
260 ideas for instruments”, or “Difficulties with implementation”. To avoid memorization and social  
261 desirability biases (Butori and Parguel, 2010), we used the principle of data triangulation (Flick et  
262 al., 2004). We then mobilized the data through a narrative approach (Dumez, 2016) on the  
263 development of Ecophyto plans. The narrative approach is a qualitative methodology (Dumez and  
264 Jeunemaître, 2005; Dumez, 2016), which consists of building stories with a starting point, a final  
265 state, sequences that have relatively homogeneous dynamics building the pathway between the  
266 two, and tipping points that initiate transitions between sequences. Narrative approaches can be

267 used on heterogeneous data (quantitative data, grey literature, interviews, etc.) to analyze a  
268 process over time. To build a rigorous narration, one needs first to establish descriptive and multi-  
269 dimensional chronologies to verify if one event has occurred before another and can therefore  
270 have caused it. Then, based on the data collected and its analysis, one can draw a narrative  
271 diagram highlighting the starting and final points, the sequences and the tipping points (fig. 1) to  
272 support the narration.

273  
274  
275

Type of actor	Number of people interviewed
Ministry in charge of agriculture	4
Ministry in charge of the environment	2
Research institutes and technical institutes	7
Agricultural advisory organizations	5
Environmental NGOs	2
Organizations representing agricultural companies (pesticides companies and cooperatives)	4
Agricultural union and political figures	2
Total	26

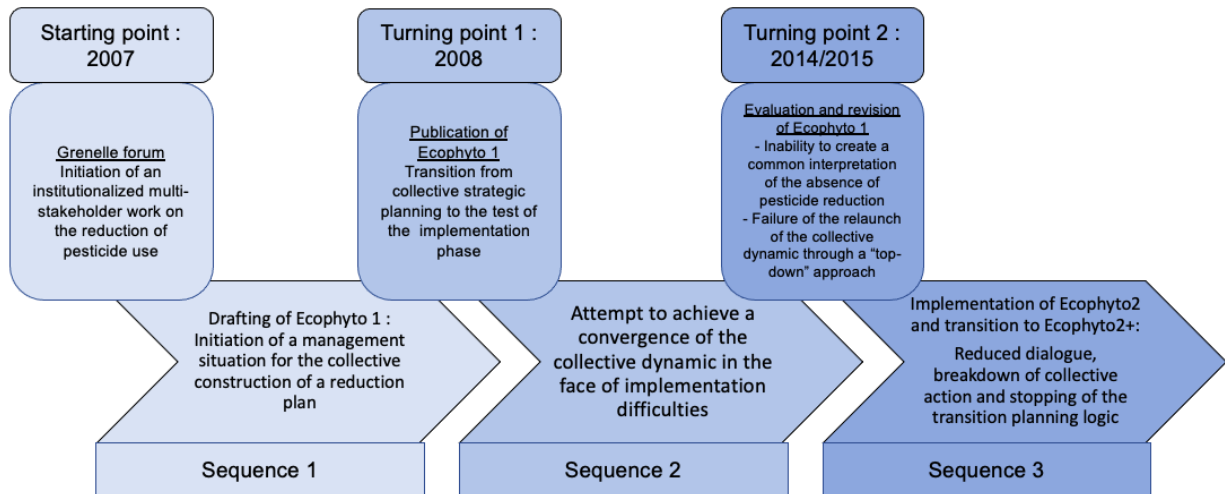
276  
277  
278

Table 2: Number of people interviewed according to the type of structure

## 279 **4. Results**

280  
281  
282

The overall dynamic of the Ecophyto plans is summarized in fig.1.



283

284 fig.1: Narrative diagram of the evolution of the management situation for the transition toward  
 285 pesticide reduction

286

287

288 **4.1. Analepsis: Increased focus on reducing overall pesticide use**

289

290 Since the 1980s, the use of pesticides has faced increasing criticism for its environmental and  
 291 health impacts, gradually leading to significant controversies (Pellissier, 2021). In order to  
 292 contribute to the debate, in 2005, the National Institute for Agronomic Research (Institut  
 293 National de la Recherche Agronomique or INRA) produced a report on the impacts of pesticides  
 294 (Aubertot et al., 2005), which defended the need to and the technical feasibility of reducing the  
 295 overall use of phytosanitary products. Far from ending the controversies, the publication of the  
 296 report highlighted the differences of opinion between actors. On the one hand, professional  
 297 agricultural organizations – technical institutes, the majority union, the main advisory  
 298 organization, cooperatives and industry representatives – opposed any significant reduction  
 299 target and criticized the methods used in the study. On the other hand, environmental NGOs  
 300 and actors in the Organic Agriculture sector, were supported by several INRA researchers.  
 301 Although these two groups were not completely homogeneous, this disagreement regarding the  
 302 feasibility and desirability of an objective of global reduction of the use of pesticides constituted  
 303 a dividing line which would be maintained over time.

304

305 In an attempt to strengthen the arguments in favor of reducing pesticides, ministries  
 306 commissioned a new report from the INRA in 2007, entitled "Ecophyto R&D" (Butault et al.,

307 2010), with the objective of identifying the techniques available to enable farmers to ambitiously  
308 reduce the use of pesticides.

309

#### 310 **4.2. Starting point – Initiation of an institutionalized multi-stakeholder situation**

311

312 In 2007, following pressure from civil society, the newly elected President, Nicolas Sarkozy,  
313 organized the Grenelle Environment Forum – a broad consultation process on environmental  
314 issues (Boy et al., 2012). This culminated in setting an objective of "*reducing the use of*  
315 *pesticides by 50% over 10 years, if possible*". A 50% reduction was seen by the NGOs and  
316 INRA researchers as the approximate level where it becomes necessary to radically redesign  
317 farming systems, in a way that would also facilitate meeting other sustainability goals. The  
318 wording "*if possible*" was added following pressure from agricultural organizations (Guichard et  
319 al., 2017).

320

#### 321 **4.3. Sequence 1 – Initiation of a management situation for the collective**

##### 322 **elaboration of Ecophyto 1**

323

324 It was in this context of actor division that the administrative departments of the Ministry of  
325 Agriculture had to ensure the drafting of a plan for the operationalization of the Grenelle Forum's  
326 objective. Anxious to preserve the multi-actor dynamic resulting from the Grenelle Forum, the  
327 Minister of Agriculture, Michel Barnier, launched an operational committee, called the "Paillotin  
328 Operational committee" after its chairman, which brought together all the stakeholders to  
329 collectively develop the national plan and initiated the management situation. The participants  
330 actively engaged in the Operational committee tasks, which was seen as a constructive place to  
331 work despite fundamental disagreements (table 4, verbatim 1a, 1b)

332

333 To equip the process of inquiry and in order to create compatible interpretations of the objective,  
334 the policymakers of the Ministry of Agriculture mostly mobilized scientific and expert reports and  
335 presentation that were debated within working groups. The orientations of the "Ecophyto R&D"  
336 study were adapted to shed light on the "possibility" and the conditions of achieving the Grenelle  
337 Forum's objective, and thus legitimize it (Aulagnier, 2020). However, this mode of exploration  
338 failed to convince the agricultural world, which did not accept the results of Ecophyto R&D  
339 (Butault et al., 2010). In their eyes, the report did not sufficiently detail the concrete implications  
340 of the objective of 50% reduction over 10 years for each link of the agri-food systems.

341

342 To translate this exploration into concrete actions, the collective was not totally free in their  
343 choices. As early as November 2007, when the Paillotin Operational committee's work had not  
344 yet started, the Minister of Agriculture had already mentioned the centrality of 3 instruments:  
345 research and development, training for farmers, and strengthening the pest surveillance  
346 networks (Aulagnier, 2020), hereby reusing old ideas of public action (table 4, verbatim 2) and  
347 excluding any strong regulatory or economic incentive tool. Within these boundaries, the  
348 participants proposed ideas coming out of the working groups or of their respective structures.  
349 The plan proposed by the Paillotin Operational committee detailed and expanded on the  
350 elements proposed by the Minister and added a few aspects to it, such as the creation of  
351 monitoring indicators or a communication component.

352

353 One of the main instruments, the Plant Health Bulletin, a bulletin alerting farmers to  
354 phytosanitary pressure in their regions (table 1) was a recycling of agricultural warnings, an  
355 instrument that pre-dated the plan. The Bulletin was not designed for the Ecophyto plan.  
356 Instead, the Ecophyto plan was a funding opportunity for it (Guichard et al., 2017; Aulagnier,  
357 2020; Interviews).

358

359 The DEPHY network of innovative farms (table 1) constitutes an exception in the way it was  
360 designed and is therefore considered by many actors to be the major innovation of the Ecophyto  
361 plan (Barbier, 2017). The DEPHY network was the result of a long design process by INRA  
362 researchers, commissioned by the Ministry of Agriculture (Butault et al. 2010). Nevertheless, the  
363 temporal objective (achieving a 50% reduction over 10 years) was not sufficiently taken into  
364 account in the design process: the designers of DEPHY tried to develop an instrument that  
365 could support pesticide reduction, without assessing the time it would take to reach its goal and  
366 adapting the instrument with this temporal constraint in mind (table 4, verbatim 3).

367

368 The Paillotin Operational committee's proposals took the shape of a consensual, but weakly  
369 binding plan. Without proper exploration tools of the entire implications of pesticides reduction  
370 for all actors of the agri-food chain, the committee also failed at taking into account the presence  
371 of a lock-in, and therefore mainly targeted farmers and their advisers (Guichard et al., 2017).  
372 They did not account for the effects of their practices' interdependence with other links in the  
373 sociotechnical system, such as cooperatives or agro-industries (table 1).

374

375 Despite diverging opinions within the group, the plan was validated by all the participants.  
376 Indeed, numerous proposals seemed to go in the right direction for the NGOs (table 4, verbatim  
377 4). Those proposals were mostly non-binding, and some represented significant funding  
378 opportunities for agricultural organizations, encouraging them to stay in the discussion  
379 (Aulagnier, 2020).

380

#### 381 **4.4. Turning Point 1 – The implementation test**

382

383 The Ecophyto 1 plan was published in 2008 and largely incorporated the Paillotin Operational  
384 committee proposals. The first years were dedicated to operational implementation of the plan.

385

#### 386 **4.5. Sequence 2 – Search for consensus in the face of implementation difficulties**

387

388 The ministry set up numerous working groups to monitor the plan components and discuss the  
389 points of disagreement that persisted, in particular regarding the most controversial aspects: the  
390 possibility and desirability of reducing the use of products, and the definition of appropriate  
391 monitoring indicators (Aulagnier, 2020). These working groups were appreciated by the various  
392 participants for their ability to provide spaces for discussion and mutual acquaintance for people  
393 who did not normally work together (agricultural and environmental actors in particular) (table 4,  
394 verbatim 5). However, little by little, the limits of collective action started appearing. Despite the  
395 density of the discussion arenas, policymakers were not able to reach an agreement among the  
396 participants. The slowness of this process weakened certain participants' confidence in  
397 collective action (table 4, verbatim 6).

398

399 Moreover, the richness of the discussion spaces also made them difficult to follow and led to the  
400 fragmentation of the plan. Certain participants, especially NGOs, lacked the resources to be  
401 present in all of the working groups. The "Ecophyto system" gradually became more and more  
402 complex. The Ministry of Agriculture, due to insufficient dedicated human resources and a  
403 desire to involve stakeholders, delegated a large part of the implementation to different actors  
404 (table 1). For each important instrument, groups of varying composition made operational  
405 decisions impacting the functioning of the instruments themselves. Full monitoring of  
406 implementation was almost impossible (table 4, verbatim 7) and it reinforced the fragmented  
407 aspect of the plans. There were few links between the different instrument management groups,  
408 which could then evolve over the course of the discussions without necessarily seeking

409 convergence with the others (table 4, verbatim 8a, 8b).

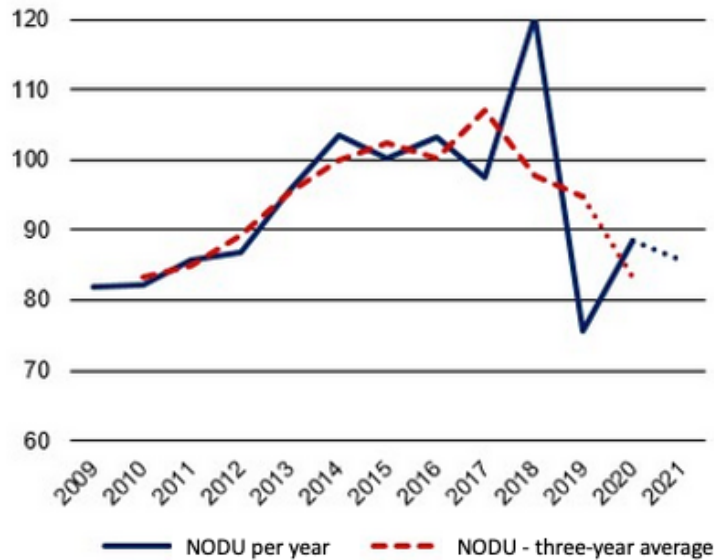
410

411 These delegations had another effect: the ministries sought to use this mode of operation to  
412 enlist the actors from the dominant regime in the process, and ensure their commitment (table  
413 3, verbatim 9). In France, agricultural organizations have a significant influence and agricultural  
414 policies have historically been carried out on a “co-management” model (Aulagnier, 2020). This  
415 structuring allowed the delegated actors to acquire a certain power over the shaping of the  
416 instruments for which they were responsible. They were thus sometimes able to attenuate the  
417 objectives set out in the plan. Ansaloni (2017) shows, for example, that the private actors in  
418 charge of training sometimes redefined the content of Certiphyto phytosanitary certificates (table  
419 1) to avoid presenting alternative techniques to pesticides. Our interview with a member of a  
420 technical institute, who considered the -50% goal as too ambitious, led to a similar conclusion  
421 (table 4, verbatim 10).

422

423 As the implementation started, it slowly became apparent that the 50% reduction goal would not  
424 be achieved as rapidly as had been hoped (fig. 2). Nonetheless, the policymakers were unable  
425 to generate compatible interpretations among the participants about the underlying reasons for  
426 why pesticide use did not diminish. Indeed, the main indicator was the NODU (fig. 2). It was  
427 designed to follow the national evolution of pesticide use, to assess the failure or success of the  
428 plans. It did not give indications on the evolution of farmers’ practices, neither depending on the  
429 region, nor on the cropping system. There were no indicators or processes developed to create  
430 adequate knowledge allowing actors to explain the evolution in the use of pesticides (table 4,  
431 verbatim 11a, 11b). The environmental actors saw the lack of reduction as a lack of will on the  
432 part of the agricultural profession and proof of the need to take more drastic actions. The  
433 agricultural organizations saw it as illustrating what they expected: the objectives set were  
434 unattainable and should be modified. The latter also defended that the plan’s indicators did not  
435 give a realistic view of the significant efforts made by farmers. This lack of compatible  
436 interpretations reinforced the existing divisions within the collective.

437



438  
 439 Fig. 2: Evolution of pesticide use in the agriculture sector in France (NODU in million ha).

440 Source: French Ministry of Agriculture and Food, 2022

441 NODU is the official indicator created to monitor the Ecophyto plans and follow pesticide use in  
 442 France. It is calculated from sales data of pesticide distributors and corresponds to the  
 443 theoretical surface that would be treated yearly with pesticides at the maximum approved  
 444 doses. Preliminary 2021 data are shown in dotted lines on the graph.

445  
 446 The Ecophyto process then continued to deteriorate little by little, but the actors remained  
 447 involved. In 2012, a new minister of Agriculture, Stéphane Le Foll, started a new exploratory  
 448 process to identify new possible policy instruments (Ministry of Agriculture, Food and Forestry,  
 449 2012). He commissioned several reports, in particular on agricultural extension, taxation or  
 450 Pesticide Saving Certificates (table 1).

451  
 452 **4.6. Turning Point 2 – Evaluation and revision of Ecophyto 1: Failure to regain**  
 453 **momentum through “top-down” management**

454  
 455 In 2014, an overall evaluation of the Ecophyto 1 plan was launched and lead to a shift in the  
 456 design process of the new Ecophyto 2 plan. The ministries adopted a more “top-down”  
 457 approach of consultation and drafting within the administrations. The inquiry process was no  
 458 longer entirely carried out by the actors in the management situation, but was taken over by the  
 459 administration. To give political weight to the evaluation, the administration asked a deputy to

460 take charge of the work. Rather than supporting a collective inquiry process like in the first  
 461 Ecophyto working groups, the deputy consulted with all the stakeholders separately, conducted  
 462 field visits and consulted the expert reports previously commissioned. His work also had an  
 463 assumed political dimension (table 4, verbatim 12). His report (Potier, 2014) served as a basis  
 464 for officials from the Ministries of Agriculture and the Environment, who joined the management  
 465 of the plan, to draft an initial version of Ecophyto 2. Nevertheless, the departments of the  
 466 ministries were constrained by the financing already committed for Ecophyto 1. It seemed  
 467 difficult to stop financing the positions and major actions of the first plan (table 4, verbatim 13).  
 468 They then consulted the stakeholders again.

469  
 470 In terms of policy instruments, the work conducted by the deputy only suggested a marginal  
 471 modification of the plan. Even though he concluded that the first plan had failed, he proposed to  
 472 maintain its main instruments while strengthening certain targeted aspects (Potier, 2014 – table  
 473 3).

474

<b><i>Main policy proposals in the Potier Report for the revision of Ecophyto plans</i></b>
Reinforce the consideration of human health protection aspects: protection of users, local residents, consumers...
Act at the Common Agricultural Policy (CAP) level to ensure that it supports Ecophyto objectives.
Better take into account sectoral and territorial specificities within the plan
Reinforce constraints on actors of the value chain others than farmers: implement a proposal coming from an INRA report (Guillou et al., 2013): the Pesticide Saving Certificates (table 1), which initially aimed to financially compel the distributors of pesticides to support alternative solutions.
Significantly increase the taxation of pesticides.

475 Table 3: Main changes of the Ecophyto plan proposed by the Potier report (Potier, 2014)

476

477 These proposals highlight two notable evolutions. First, a desire to display greater political  
 478 voluntarism by mobilizing instruments that are both symbolic and economically structuring  
 479 (taxation and CAP), and activating binding instruments (Product Savings Certificates).

480 Secondly, the greater consideration given to human health protection aspects shows a desire to  
 481 broaden the plan, despite the criticisms made that it was already excessively large and weakly  
 482 prioritized. One can see this as a failure of the management of the policymaking process to

483 maintain focus on the plans original objective: the redesign of cropping systems was initially  
484 seen as the direct technical translation of the 50% reduction objective. In this report, it became  
485 one lever among many. Indeed, it emerged from our interviews that several actors, especially  
486 certain administrative agents or members of professional agricultural organizations, had  
487 analyzed Ecophyto 1 as a failure of the vision of change through the profound redesign of  
488 cropping systems. This gave more weight to their vision of a need for an incremental  
489 transformation based on risk reduction and improved product use efficiency, without radical  
490 change in practices – even though this would not facilitate reaching the policy objective.

491  
492 Most of the recommendations in the report were taken up by the ministries, except for the most  
493 divisive points, the CAP and taxation. They also delayed the objective of reduction to -50% in  
494 2025. These choices, as well as the top-down procedure implemented, prevented relaunching  
495 the collective dynamic. Although the actors saluted the work of the deputy and the balance in  
496 consulting the various stakeholders, it did not make it possible to draw compatible  
497 interpretations of the sources of the failure, nor to identify consensus-generating ways to move  
498 forward. Moreover, his report constituted an ambiguous conclusion that satisfied no one. The  
499 “alternative” actors were in search of in-depth transformations of the plans, actions on the CAP  
500 and relaunch of ambition. The actors of the dominant regime were still opposed to the objective  
501 of reduction and put off by the introduction of financial constraints through the Pesticide Saving  
502 Certificates.

503  
504 The attempt to establish Pesticide Saving Certificates also reflected a desire to extend the  
505 targets of public action to actors other than farmers and their advisers, in order to establish a  
506 broader movement within the sociotechnical system. Nonetheless, by focusing on cooperatives,  
507 many actors of the lock-in – e.g. processing industries – were still not taken into account.

508  
509 **4.7. Sequence 3 – Implementation of Ecophyto 2 and transition to Ecophyto 2+:**  
510 **breakdown of collective action**

511  
512 The collective dynamic was further weakened by the elimination of several governance bodies,  
513 which the administrations considered to be ineffective. This was the case, for example, of the  
514 steering committees of each axis of the plan, or of the governance advisory committee, whose  
515 purpose was to have Ecophyto expenses collectively approved. This transformation was

516 experienced as a reduction in transparency by all the participants and a deterioration in the  
517 collective work (table 4, verbatim 14 and 15).

518 In 2019, the government published a new version of the plan, the Ecophyto2+ plan.  
519 Administrative management was further extended by integrating the Ministries in charge of  
520 health and research, which, for the participants, further burdened the organization of meetings  
521 and degraded governance by increasing the number of actors and ministers to coordinate. Little  
522 by little, the action of the collective was transformed by the simultaneous reduction of  
523 workspaces and the increase in the usage of binding instruments. While Ecophyto meetings  
524 were not neglected, they were no longer considered spaces for dialogue. Some agricultural  
525 organizations stepped up their action to oppose attempts at coercion. For example, they asked  
526 the Council of State, the French supreme court for administrative justice, to cancel the Pesticide  
527 Saving Certificates in 2015 (petitions nos. 394696 and 395225 of December 28, 2016 to the  
528 Council of State). In an almost symmetrical mechanism, in 2018, NGOs did the same for  
529 decisions deemed too unambitious on the creation of non-treatment zones near homes (Council  
530 of State, 2019). The importance of bilateral meetings between stakeholders and the  
531 administration was reinforced (table 4, verbatim 16a, 16b). After the election of President  
532 Macron in 2017, the movement away from Ecophyto working groups was reinforced. President  
533 Macron made numerous important decisions, such as the ban on glyphosate (Macron, 2017),  
534 and the ban on companies offering both the sale of pesticides and advisory services on plant  
535 protection strategies, which constituted an election promise and further undermined the  
536 perception of the plan as a coherent strategy by agricultural actors. The advising/sales  
537 separations for example complicated the implication of cooperatives in the DEPHY network as  
538 well as their understanding and acceptance of the Pesticide Saving Certificates instrument  
539 (table 4, verbatim 17).

540 The Ecophyto2+ plan mainly aimed at integrating those decisions that were not formally  
541 included in the Ecophyto processes. More than a place of strategic thinking and planning,  
542 “Ecophyto” became a tool for gathering actions taken on pesticides independently, and  
543 continued to lose legitimacy.

544

#### 545 **4.8. Epilogue: Blocking and abandonment of collective transition management**

546 The slow degradation of the governance and the legitimacy of the plan led to a situation where  
547 collective action was blocked. Even though the Ecophyto plans and the societal dynamics since

548 2007 made it possible for the discussions to progress, and only a few actors were now opposed  
549 to the idea of a need to reduce the use of pesticides, policymakers did not manage to continue  
550 to support the construction of compatible interpretations of the situation between participants.  
551 On the contrary, the gap between positions had widened. Agricultural organizations sought to  
552 build an image of actors driving a “pragmatic” transition (table 4, verbatim 18). However, they  
553 were still opposed to a significant reduction objective, in-depth modification of cultivation  
554 systems, or the use of binding public action instruments. Environmental NGOs were becoming  
555 more radical and tending more and more towards demands for a pure and simple ban on the  
556 use of pesticides (table 4, verbatim 19).

557 The use of these products had still not reduced significantly compared to the beginning of the  
558 plans (fig. 2).

559

		<b>Illustrative verbatim</b>	<b>Type of actor</b>
1	a	“I remember that it was [...] a very positive and very mobilizing way of working that was trying to attract people no matter what. [...] no one had left, no one had slammed the door.”	Representative from an environmental NGO
	b	“What I found interesting in [...] the Ecophyto plan, which was really innovative in terms of method, was already to work together with all the stakeholders”	Former employee of an agricultural union
2		“To make an action plan to reduce the use of pesticides, [...] there will be a training component, a research component, and a monitoring or experimentation component [...] it's not completely revolutionary either, it's something that comes to mind quite quickly. [...] in all the plans that I know of, [...] there is always a training component and a research component.”	Policy-maker from the Ministry of Agriculture
3		“Are we going to be able to get there in ten years, is that enough, shouldn't we act somewhere else? We didn't discuss all that in part 2 [of the Ecophyto R&D report, which proposed a structuring of the DEPHY instrument].”	Researcher who participated in the writing of the Ecophyto R&D report
4		“And we discussed a lot of things, point-by-point where everyone gave their opinion [...], so that interesting things and ideas on what to work on came out of it. [...] there were really only a few things in the end on which we did not agree at all.”	Representative of an environmental NGO
5		“At the beginning of Ecophyto [...] I saw the meetings, the rooms full of people to discuss the allocation of funding. So, there was truly a discussion with the stakeholders. In their diversity, which is normal. [...] I spoke a lot at the time with [an environmental NGO] and other actors...”	Representative of an agricultural union
6		“[The objective of agricultural organizations opposed to the 50% reduction objective] is always to try to demonstrate that doing without chemical compounds is not possible today [...] But although it is acceptable at the very beginning of the process, it is less so [after 13 years]”	Representative of an environmental NGO

7		“The system was absurdly complex. There were a lot of groups that were created as a result for implementing the Ecophyto plan. We were a small team, so we couldn't be everywhere.”	Representative of an environmental NGO
8	a	“In fact, that was really the teaching of Ecophyto 1, an operation without any transversality in fact: each component led its own life, and there were meetings of deputy directors once or twice a year to say what they had done in each axis of the plan.”	Policy-maker from the Ministry of the Environment
	b	“The whole governance of the Pesticides Saving Certificates is done independently of Ecophyto. [...] It was presented as a separate subject from the plan. And the other examples that I gave, it was a bit similar. “Certiphytos” phytosanitary certificates, for example. [...] Formally, all of this is well integrated into the plan. It's part of the plan, but I had the impression that these instruments could live on their own anyway.	Policy-maker from the Ministry of Agriculture
9		“The option [taken] was to say: we are going to ask the agricultural world to take charge and get themselves moving. [...] And so it was: finance the chambers of agriculture so that the chambers of agriculture would carry the Ecophyto policy.”	Policy-maker from the Ministry of the Environment
10		“We trained Certiphyto trainers. We trained them to the principle of Integrated Pest Management [...]. [But] we are convinced that we can do 20%, we are not going to tell people we can do 0%. [...] We did not avoid the idea of system change, but we were both highlighting techniques for fundamental economies, up to the possibility of really changing the system and really reducing phyto quantities”	Employee of a technical institute
11	a	“The agricultural profession really had changed its practices in terms of the use of phyto products in recent years. And it did not understand that just that could not affect the NODU. And in terms of the explanations that the Ministry of Agriculture could provide, it was a bit of a disappearing act, because we didn't really have an explanation for the increase of the NODU.”	Employee of an organization representing agricultural businesses
	b	The question was “Why does it not work? [...] We could not link this to practices. And then manage to link this to usual cropping systems: what is the molecule used for? If a molecule is highly used, is it because it	Policy-maker from the Ministry of Agriculture

		is absolutely necessary on one crop [...] or it is because it is used a little bit everywhere? We did not explore or systematized this kind of questions"	
12		"What must be remembered is that politics takes control of the report, and of the methodology. [...] Should we go see the ladybug manufacturers, or rather a potato field in Pas-de-Calais region [...] there is a political dimension [...] We have not been in the most resistant regions, but instead we have been to see pioneers [...]"	Policy-maker who took part to the Potier evaluation
13		"We were very constrained by the fact that we were structurally financing a number of positions, and that Ecophyto 2 was neither an opportunity nor an excuse to eliminate positions that were financed via the regional chamber of agriculture, for example. Since we would lose the support of the [national assembly of chambers of agriculture] for the plan."	Policy-maker from the Ministry of Agriculture
14		"We no longer had the impression of being involved. We were consulted, of course, we were continually consulted. But there was no longer any impression of working together, of working with the other actors"	Representative of an environmental NGO
15		"We had moved a long way from an enrichment of public policy by the stakeholders. [...]. The absence of discussion meetings also meant that we could drift apart in terms of points of view [...]. So, it was gradually the administration alone that made its choices..."	Employee of an agricultural union
16	a	"Everything happens in bilateral exchange, [...] there is no longer a common space where we can discuss this all together [...] if I compare the part of my position that is to support elected officials on these subjects, before I accompanied them a lot more at collective meetings than at bilateral ones."	Employee of an organization representing agricultural companies
	b	"Today, unfortunately, we are more staring blankly at each other and through judiciary appeals to the Council of State. I have known another time, I regret a little."	Employee from an organization representing pesticides companies
17		"The advising/sales separations is a bit complicated to understand because [...] before [cooperatives] were distributors and could give advices to farmers, so if we are not allowed to give advisory services, while we	Employee of an organization representing agricultural

	need to reach our Pesticide Saving Certificates goals, how do we reach those goals? [...] This is complicated and not always well understood by actors on the field. [...] Those who sell phyto products can only give advices on alternative practices [...] and that leads to an odd advice [...] because this is not how a farm works.”	businesses
18	“[...] In 2012 our position was the classic position of the agricultural world: we use products which are authorized [...] we felt increasing difficulties at the farmers level [...]. In 2017 we organized a meeting with our network [...] to dare to talk about pesticides. What we felt was a real discomfort of the farmers’ side because of the media coverage of the topic, the comments made by their neighbors [...] This led to a big shift in our position: The phyto products are authorized, we use them in conditions that respect the rules, and by being attentive to our environment. Let's look for and identify alternative solutions to change and be fully in the ecological transition.”	Employee of an agricultural union
19	“After ten years, we haven't seen the results of the Ecophyto plan, so... [...] the position is no longer -50, it's zero phyto: we have to go toward the complete cessation of using pesticides. [...] the positioning is radicalized completely”	Representative of an environmental NGO

561 Table 4: Illustrative verbatim from interviewed stakeholders

562  
563  
564  
565  
566  
567  
568  
569  
570  
571  
572  
573  
574  
575  
576  
577  
578  
579  
580  
581  
582  
583  
584  
585  
586  
587  
588  
589  
590  
591  
592  
593  
594

## **5. Findings: What do policymakers need to better manage a policy process to overcome the lock-in around pesticide use?**

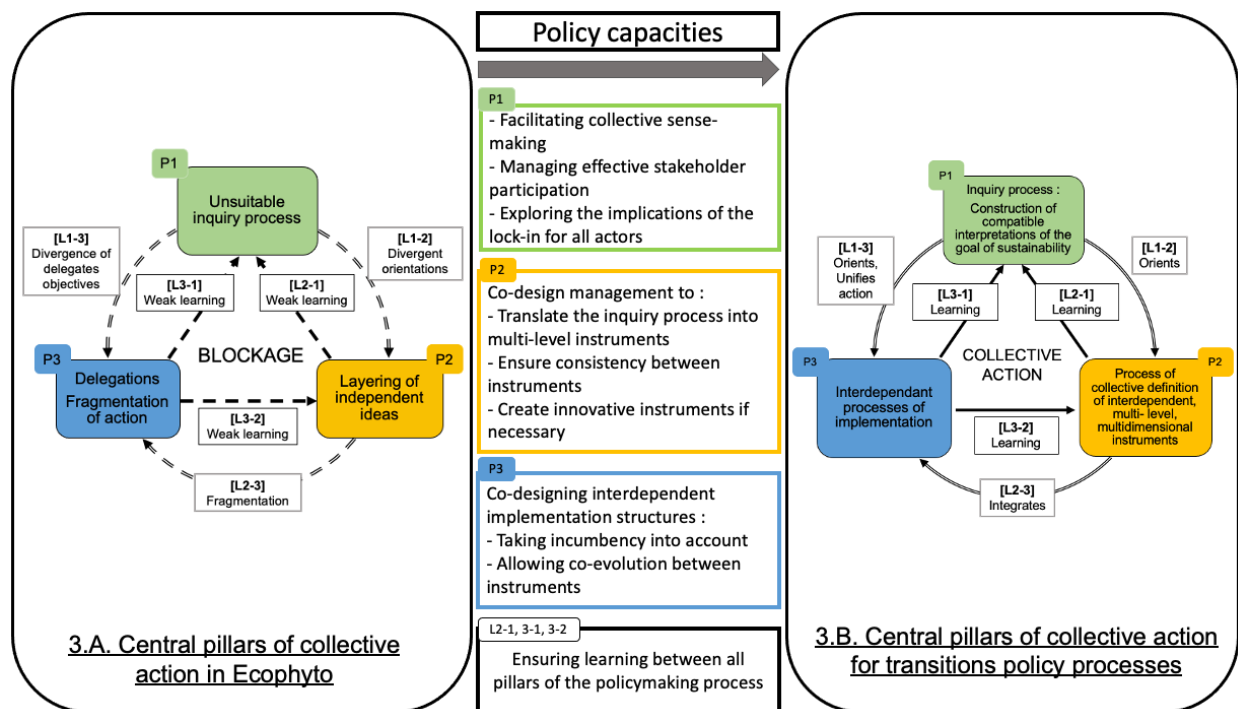
Reaching a -50% reduction in pesticide use in a few years might be a difficult – maybe impossible goal, but analyzing the Ecophyto plans still allows us to reflect on what policymakers need to improve the management of policy processes to make them better suited to such an ambitious goal and have greater impact. Indeed, the policy processes that we described resulted in plans that were unlikely to transform the French agricultural sector in the short timeframe set in the policy objective. Studies have highlighted that they lacked sufficiently binding or incentivizing instruments and failed to account for the presence of a lock-in (Guichard et al., 2017; Aulagnier, 2020; Dufour et al., 2021). The analysis of Ecophyto's history reveals that this unsuitability of the policy instruments already finds its roots in the policy process itself.

Through the analysis of the narration, it appears that the core components of a “management situation” (participants that have to achieve the result, the presence of an external evaluation, a result and timeframe, the reunions of the participants) were present. The Ministry had created a rather transparent process with indicators to assess whether the collective had reached its goal or not. It was also allowed by the presence of formal evaluating bodies (e.g: The Potier report or the Court of Auditors). Participants were involved in the process, even if it was at different levels and varied with time, and their reunion was, overall, not a problem. These last points degraded towards the end of the situation, along with the deterioration of the governance, but this was more the result of the overall dynamic deterioration than a problematic starting point.

Our results show that the main issues of the policy process rather lay elsewhere: the policymakers struggled to manage three interdependent processes of the management situation (fig. 3-A):

- 1) The processes of inquiry, which did not allow collective sensemaking and the construction of compatible interpretations of the goal of sustainability ([P1]);
- 2) The processes of collective instruments definition, which did not take the lock-in into account ([P2]);
- 3) The implementation processes, fragmented and poorly interconnected, which hampered the

595 possibilities of mutual adaptation between instruments ([P3]).  
 596  
 597 All these highlight issues in terms of policy capacities, which can be defined as the set of  
 598 interconnected “skills and resources – or competencies and capabilities – necessary to perform  
 599 policy functions” and which are needed at the individual, organizational and the system levels  
 600 (Wu et al., 2015).  
 601  
 602  
 603



604  
 605 **fig. 3: Policy capacities to enhance collective action management for transitions policy**  
 606 **processes**

607 [Left] Diagram 3.A. - describes the blocking elements for each of the pillars of collective action in the  
 608 Ecophyto processes (P1, P2 and P3) and their interconnections (L).

609 [Right]: Diagram 3.B. - describes the central pillars of collective action for transitions.

610 The arrows representing the links (L) in each diagram are numbered to match the numbers of the  
 611 pillars to which they are connected (e.g.: L3-2 connects pillar P3 to P2).

612 New policy capacities are needed to allow policymakers to go from the type of policy process  
 613 characterized by diagram A to diagram B.  
 614

615 **5.1. A need for capacities to manage the inquiry process (IP1)**

616

617 The inquiry process is a sensemaking process where participants aim at creating compatible  
618 interpretations of the situation - i.e. interpretations that may differ but are sufficiently close to  
619 allow the participants to work together. In Ecophyto, this namely meant understanding the  
620 determinants of pesticide use at the different levels of the lock-in, to identify levers to act on.

621

622 Our results show policymakers lacked adequate capacities to enable actors to build compatible  
623 interpretations of the situation. In Ecophyto, they supported the inquiry process with two main  
624 levers: collective discussions within working groups, with researchers and experts, and experts  
625 support through the production of reports. These levers did not allow the creation of compatible  
626 interpretations of the situation between participants. Agricultural and environmental actors did  
627 not manage to agree on the legitimacy of the policy objective, its feasibility, or the instruments  
628 that could be used. Two specific features of the inquiry process explain this:

629 • The main tool for exploring the implications of the objective set was the technical-  
630 economic modeling of the Ecophyto R&D report (Butault et al., 2010), which induced a form of  
631 technicization of the debates. More political questions (Under what conditions is it desirable to  
632 reduce pesticides? For whom? etc.) were not made sufficiently explicit and debated. The  
633 implications of the goal for each type of actor were not detailed.

634 • The learning opportunities from the different phases of the policy process were  
635 inadequately managed (fig. 3-A L3-1; L3-2; L2-3). Action definition and implementation could  
636 have brought knowledge to the inquiry process: on participants values or visions, levers and  
637 barriers to action within the agri-food system, problems in policy instruments design, etc. These  
638 learning opportunities were hindered by the lack of suitable analytical tools. In Ecophyto, the  
639 analytical tools for obtaining feedbacks from action mainly took the form of evaluation reports  
640 and monitoring indicators. There was no exploration of tools for analyzing the *causes* of the  
641 persistence of pesticide use, per crop or per region (see section 4.5.). The differences of  
642 interpretation on the developments under way in the agricultural world therefore persisted. In  
643 addition, the multiplicity of working groups and the fragmentation of the implementation  
644 prevented the collective to have a global overview on Ecophyto and collectively learn from P2  
645 and P3.

646 All in all, this shows that policymakers did try to facilitate collective sensemaking, but did not  
647 mobilize suitable tools or processes to do so. The ministerial organizational routines were not  
648 adapted to the needs of the collective sensemaking process, and policymakers lacked  
649 capacities to propose alternative routines.

650

651 In addition, this failure to explore the implications of the goal of sustainability was coupled with  
652 an absence of consideration of the lock-in, which limited the collective ability to redefine the  
653 problem in the inquiry process. The notion of lock-in was present from the beginning of  
654 Ecophyto, namely in the Ecophyto R&D report (Butault et al., Volume VII, p. 38). Nevertheless,  
655 the 1<sup>st</sup> plan favored the “cropping system” concept, relatively isolated from the sociotechnical  
656 system into which it was integrated.

657

658 The failure to consider the lock-in can be explained in several different ways. First of all, it  
659 appears that the “forgotten” links of the system were mainly those presenting the strongest  
660 political stakes (the CAP) or concentrating the most power (agro-industries). However, it also  
661 appears that analyzing the lock-in at the level of the sociotechnical system was not part of the  
662 ministries’ organizational routines: those were more focused on changing farmer’s behaviors or  
663 supporting the development of new technologies or practices (see verbatim 2). Exploring the  
664 lock-in implications would therefore have needed new capacities.

665

666 Finally, policymakers struggled to manage stakeholder participation in a constructive way.  
667 Faced with the difficulties of the 1<sup>st</sup> plan, the ministries gradually limited the existing spaces for  
668 dialogue among actors by turning to a more “top-down” management (see sections 4.6. and  
669 4.7.). To define the actions of the 2<sup>nd</sup> plan, and because some policymakers considered the  
670 collective processes to be ineffective, they favored consultation over co-construction, while  
671 seeking to increase the constraint on the agricultural actors, without success. This top-down  
672 management did not make the actors’ claims disappear, but rather led them to use other  
673 arenas: bilateral discussions with people at high levels within the ministries hierarchies, or  
674 recourses to legal authorities such as the Council of State. This resulted in a blockage of the  
675 management situation and prevented the sharing and learning that could have facilitated the  
676 construction of compatible interpretations and relaunched collective action (fig. 3-A – L2-1 and  
677 L3-1).

678

679 **5.2. A need for co-design capacities to translate the inquiry process into**  
680 **innovative and consistent instruments ([P2])**

681

682 The definition of actions first collided against the weakness of the inquiry process. The absence  
683 of a collective re-problematization of the objective with the lock-in perspective led to proposals

684 that were relatively disconnected from the objective and from each other. This, in turn, led to a  
685 form of layering of ideas rather than a multi-level, multidimensional and consistent policy (fig. 3-  
686 A - L1-2):

- 687 • The instruments were not really defined according to the expected results. Similar  
688 instruments could have been proposed for a policy aiming at lower reduction levels or at a  
689 reduction over a longer period of time (see sections 4.3 and 4.6.);
- 690 • Some instruments had no direct link with the reduction of pesticides, such as actions  
691 aimed at protecting the health of users (see section 4.6.)
- 692 • The instruments did not make it possible to mobilize the various reduction levers at  
693 different levels of the sociotechnical system. The 1<sup>st</sup> plan was mainly focused on farmers and  
694 their advisers (Martin and Munier-Jolain, 2014; Guichard et al, 2017). The 2<sup>nd</sup> plan tried to open  
695 up the targets of public action but limited itself to integrating cooperatives and trading companies  
696 and not the other actors of the sociotechnical system (see sections 4.3. and 4.6. and table 1).
- 697 • The instruments were relatively independently imagined and managed (section 4.5 and  
698 4.7), especially during Ecophyto 2+. This led to instruments that lacked consistency and  
699 presented opposite logics, such as the advising/sales separations and the Pesticides Saving  
700 Certificates.

701  
702 What the narration shows is that beyond the weaknesses of the inquiry process itself, the  
703 policymakers did not have any competencies or resources to translate the understanding of the  
704 situation by the group into innovative, multi-level and consistent policy instruments. The  
705 instruments were defined through adaptation or recycling of already existing ones – such as the  
706 Plant Health Bulletin (see section 4.3.), working groups or reports made by external experts.  
707 The framework given for Ecophyto 1 by the Minister of Agriculture was explicitly based on old  
708 public action logic. There was no use of specific creativity tools that could help the collective to  
709 get out of pre-constructed ideas. Actors engaged in a purposive design process only for the  
710 DEPHY network and the Pesticide Saving Certificates, which only represents a small part of the  
711 policy.

### 712 713 **5.3. A need for capacities to design a suitable implementation structure ([P3])**

714  
715 Finally, policymakers were limited by their capacities to design adapted structures for the  
716 implementation phase, that would take the lock-in and actors' positions and visions into account.  
717 First of all, implementation was delegated, which left to certain actors in charge of delegations

718 the possibility to redirect or attenuate the content of certain instruments (see section 4.5. and  
719 the case of the Certiphyto). This is largely due to other organizational routines within the  
720 Ministries that lead policymakers to delegate implementation to dominant actors (see verbatim  
721 13; Aulagnier, 2020). In Ecophyto, using delegations as an enrollment tool constituted a  
722 significant risk because the delegates had divergent objectives (fig. 3-A L1-3) and the  
723 administration had few resources to follow them closely (Ansaloni, 2017). Even if the  
724 delegations created a link of accountability between the delegates and the ministries (through  
725 contractual obligations, decrees, etc.), the evaluation method was not anticipated or designed in  
726 a way that could allow the ministries to guide with finesse the action of the delegates towards a  
727 contribution to the 50% reduction goal.

728

729 In addition, the policymakers' routine led them to work in a fragmented manner (see verbatim 8-  
730 a and b), which in turn meant they designed a compartmentalized implementation structure that  
731 resulted in fragmentation of implementation (fig. 3-A L2-3). There were few links between the  
732 management groups of the different instruments, preventing any overall perspective (section  
733 4.5.). This limited the contribution of the implementation phase to the construction of compatible  
734 interpretations of the situation. Indeed, each stakeholder had a good understanding of only one  
735 part of the public policy and very few individuals had access to a global vision (fig. 3-A L3-1).

736

## 737 **6. Discussion**

738

739 The Policy Sciences literature has already described the difficulties encountered by policymakers  
740 to develop policy processes ensuring the design of effective instruments matching policy  
741 objectives (Cohen et al., 1972; Lascoumes et Le Galès, 2012; Jordan and Turnpenny, 2015;  
742 Lascoumes, 2018; Teisman, 2000), and identified several generic policy capacities needed to  
743 improve policy design (Wu et al., 2015; George and Reed, 2016; Bali and Ramesh, 2018).  
744 Nonetheless, there is still a need for deeper understanding of the specific case of collective  
745 sustainability transitions policymaking in the agri-food sector.

746

747 Within the Sustainability Transitions literature, several authors have provided a critical analysis of  
748 policy processes (Stegmaier et al., 2014 and 2021; Loorbach and Rotmans, 2010; Loorbach et  
749 al., 2015; Hoffmann et al., 2017; etc.), but very few focused on policy capacities (Förster et al.,  
750 2021; Borrás et al., 2023). In their literature review on the subject, Borrás et al. (2023) highlight

751 that most studies focus on system or organizational capacities, rather than on the individual  
752 capacities of civil servants. At the organizational level, few studies explore in-depth the capacities  
753 for policy formulation, rather, they study policy implementation (Takao 2012; Ryan 2015;  
754 Marquardt 2017; Kattel and Mazzucato 2018; Förster et al., 2021), public innovation (Gieske et  
755 al. 2016; Grotenbreg and van Buuren, 2018; Meijer 2018) or focus only on analytical or learning  
756 capacities (Fiorino, 2001; Oliphant and Howlett, 2010; Elgin and Weible, 2013).

757

758 Our analysis allows us to complement this literature by identifying specific capacities needed for  
759 managing policymaking processes to overcome a lock-in in the case of pesticide reduction. By  
760 studying the operational tools and approaches used by policy-makers, it enabled us to show that  
761 the plan's failure was already scripted in Ecophyto's elaboration process itself, and that this can  
762 be explained by the fact policymakers lacked various important capacities.

763

764 Based on our results, we defined three interconnected pillars for the management of collective  
765 policy processes and its adaptation to the characteristics of sustainability transitions in the  
766 presence of a lock-in, presented fig. 3-B. These pillars were built to allow for the correction of the  
767 shortcomings synthesized in fig. 3-A. Going from situation 3.A. to 3.B. would require several policy  
768 capacities that policymakers lacked in the Ecophyto processes. Achieving a situation close to  
769 fig.3. B., even with the right capacities, might be an impossible ideal. Building compatible  
770 interpretations can sometimes be impossible by lack of time, or because participants' views are  
771 too far apart. The literature on policy-making, namely on limited rationality (Muller, 2000;  
772 Lascoumes, 2018), has already expressed the probable impossibility to create perfectly optimized  
773 public policies. Fig.3.B was therefore built as an ideal goal, to direct progress in the right direction  
774 and give recommendations on the policy capacities that States need to develop. We describe  
775 here more in-depth what those capacities are and what they entail:

776

- 777 • **Capacities for managing an inquiry process allowing the construction of**  
778 **compatible interpretations of the goal of sustainability** (fig. 3-B – P1): By using the  
779 management situation concept, we show the importance of equipping the creation of compatible  
780 interpretations through the process of inquiry. This inquiry must explore the implications of the  
781 goal for *all actors* of the sociotechnical system, and their interactions. Many authors (Geels and  
782 Schot, 2007; Loorbach et al., 2015) also emphasizes the importance of creating compatible  
783 interpretations. The literature on capacities highlights the need for analytical skills, such as  
784 exploring or interpreting an issue (Wu et al., 2015; Pedde, Kok et al., 2019; Borrás et al., 2023).

785 Nonetheless, to our knowledge, none highlight the simple fact that doing so for public policies  
786 that require system-level changes is an extremely complex task, that requires specific  
787 capacities. By highlighting the fact that the ministries tried, in Ecophyto, to mobilize science and  
788 expertise to support collective sensemaking, our analysis shows that public actors did not fail  
789 because they did not try to create compatible interpretations of the goal of sustainability, but  
790 because they did not know how to concretely do so, especially considering the important  
791 subjective aspect of sensemaking. Beyond the issue of indicators that has already been  
792 discussed above, a rich literature exists and suggests tools that could be used as resources for  
793 helping policymakers in this area. Turnheim and Nykvist (2019) for instance suggest to re-think  
794 the type of knowledge used for modelling-based scenario tools by integrating often overlooked  
795 dimensions in the analysis, such as political feasibility or institutional inertia, which could help  
796 suggest new framing for expertise reports. Serious games are another well-developed type of  
797 tools that could be relevant. Using those tools would then require new competencies for  
798 policymakers.

799

800 • **Capacities for managing the process of collective design of interdependent, multi-**  
801 **level and multidimensional actions** (fig. 3-B – P2). The literature on policy capacities shows  
802 that co-designing instruments or identifying and selecting them is challenging and requires  
803 analytical, political and operational capacities – calling for both skills, knowledge and  
804 methodological resources (Mukherjee and Bali, 2018; Blomkamp, 2018). Despite the diversity of  
805 the actors mobilized in Ecophyto, their proposals did not make it possible to escape old action  
806 logics or to innovate, hereby highlighting an important need for improved co-design capacities.  
807 Because of the lock-in, these capacities need to allow policymakers not only to enhance the  
808 creativity of the group, but also to create interdependent, multi-level, multidimensional  
809 instruments – as part of a coherent, consistent, credible and comprehensive policy mix (Rogge  
810 and Reichardt; 2016). The challenge here lies in the need to go back and forth between sub-  
811 parts of the policy, while reaping the knowledge provided by the variety of stakeholders  
812 involved, as well as ensuring participants understanding and agreement. Moreover,  
813 policymakers need to be able to integrate the design of the implementation structure as an  
814 integral element of the policy instrument design process (L2-3) (Bali and Ramesh, 2018). In  
815 order to enhance innovation and creativity, some scholars, such as Loorbach (2010) for  
816 Transition Management, suggest selecting participants for a policymaking process based on  
817 their ability to translate a transition vision into concrete actions. Nonetheless, institutionalized  
818 policy processes can rarely select participants based on their personal abilities, which calls for a

819 more fundamental work on providing support to participants through the creation of adequate  
820 resources (e.g.: trainings, methods, analytical support...). To help such an ambitious endeavor,  
821 several authors developed interesting tools and methods to collectively generate action ideas  
822 for sustainability transitions (Matti and de Vincente, 2016; Pluchinotta et al., 2019; Van  
823 Rijnsoever and Leendertse, 2020...), which could be usefully adapted to the issues highlighted  
824 here.

825

826 • **Capacities for co-designing a process of implementation adapted to the**  
827 **interdependency of the actions** (fig. 3-B - P 3): Our pragmatist perspective allowed us to  
828 consider the implementation phase as a constitutive part of the policy process, which echoes  
829 the results of the political sociology approach to public policy instruments (Lascoumes and Le  
830 Galès, 2012; Lascoumes, 2018) as well as the literature on policy mixes (e.g.: Rogge and  
831 Reichardt, 2016). We showed that the implementation systems used by the French  
832 administration was itself victim of the lock-in: they considered it necessary to delegate  
833 instruments to the actors of the dominant regime (agricultural organizations) to ensure greater  
834 efficiency. Nevertheless, they did not design the delegations in a way that could limit the ability  
835 of those actors to transform the instruments. This could be done by having a more in-depth  
836 analysis of which actor would be the most relevant to implement the instrument, or by  
837 structuring the accountability system in a way that prevents delegates from transforming the  
838 instruments (with, for instance, precise indicators and resources to ensure the successful  
839 monitoring of the delegations). In addition, they did not develop an implementation design that  
840 ensured interconnections between interdependent actions to facilitate co-evolution and learning.  
841 Those elements require both analytical capacities to understanding how the structuration of the  
842 socio-technical system can influence instruments' implementation, as well as co-design  
843 capacities to define the implementation structure and ensure its adaptability. On this matter,  
844 inspiration can be found in the work of Baiz (2018), who developed a method to evaluate *ex-*  
845 *ante* the potential issues that could limit the implementation of an instrument.

846

847 • **Capacities for ensuring learning between the three pillars of the policy design**  
848 **process:** These three pillars are strongly interlinked: the inquiry process must orient actions  
849 definition (L1-2) and implementation (L1-3), and those must feed the collective learning process  
850 and improve collective sensemaking (L2-1; L3-2; L3-1). Exploring actions definition and  
851 implementation possibilities could lead the collective to realize that the original objective is too  
852 ambitious or poorly framed, which would lead to its redefinition. It is therefore crucial to develop

853 the different capacities identified in a coordinated way.

854

855 The generic policy capacities that we identified were already mentioned in the literature  
856 (sensemaking, co-designing, stakeholder management, etc.) (Wu et al., 2015; Bali and  
857 Ramesh, 2018; Mukherjee et Bali, 2018; Borrás, 2023...). Our results specify how those need to  
858 be adapted to the characteristics of sustainability transitions in the agri-food sector and the  
859 presence of a lock-in, and show the important complementarity amongst all capacities. This  
860 highlights the need to enhance research to better understand the operational needs of  
861 policymakers to manage transition policy processes. It also suggests avenues for future  
862 research-action at the interface between public management, systemic agronomy, sustainability  
863 and design sciences, to provide tools, resources and training programs to support policymakers  
864 in a concrete manner.

865

866 More broadly, our results strongly suggest a wider problem of dynamic capabilities, within the  
867 ministries, to adapt to sustainability transitions. Dynamic capabilities have been conceptualized  
868 as “the firm’s ability to integrate, build, and reconfigure internal and external competencies to  
869 address rapidly changing environments” (Teece, Pisano and Shuen, 1997). It has then been  
870 used in the case of public organizations (Borrás et al., 2023). In the case of Ecophyto, we can  
871 see that the lack of capacities remained the same through time, even though the public policy  
872 was being increasingly criticized. The dynamic capabilities concept suggests on the contrary  
873 that, to be efficient, an organization should be able to reinvent itself after a problem has been  
874 identified. One hypothesis explaining this lack of dynamic capabilities could be the absence of  
875 processes to reflect on the policymaking difficulties and question the ministries’ policy  
876 capacities. All evaluations were made on the policy instruments themselves. When the  
877 philosophy of the policy process was changed to take a “top-down approach”, it was rather  
878 made by going back to old organizational routines than following an in-depth reflection and  
879 renewal of the ministries’ capacities. This is consistent with the literature on dynamic capabilities  
880 in the public sector, which explains that structuring a routine of internal evaluation and learning  
881 is a necessary building block of dynamic capabilities (Fiorino, 2001; Rogge, 2018; Kattel, 2022).  
882 This opens the way for further research on how to enhance the States’ dynamic capabilities,  
883 especially considering that the research on this topic remains small (Loureiro et al., 2021; Kattel,  
884 2022).

885

886 Finally, our result highlight other contributions, which are of a methodological nature. The

887 combination of the management situation concept with the perspective of sociotechnical system  
888 transitions has proved to be particularly fruitful. It has enabled us to identify key pillars needed  
889 to manage collective action for transitions policy processes. In addition, while the concept of  
890 management situation has been used to study relatively circumscribed environmental issues  
891 (Barbier et al., 2020), to our knowledge this is the first article using this concept to study state-  
892 level policy processes.

893  
894 Despite these contributions, our research has some limitations. First, we did not analyze  
895 potential local successes hidden by the national statistics or evaluate the contribution of  
896 Ecophyto to a long-term transition in the agricultural sector. Nonetheless, since 2017, the use of  
897 pesticides has decreased (fig. 2), which might indicate an actual change. Analyst will need to  
898 reflect on this when they have more perspective on the stability of this trend. In addition, our  
899 analysis is based on a single case study. Its generality will have to be verified by analyzing other  
900 policies to validate, amend or enrich the conclusions. It will also be necessary to test the  
901 usefulness of our recommendations to the development of agri-food systems transition policies.

902

## 903 **7. Conclusion**

904

905 Enhancing policymaking processes to improve the design of transition public policies is a  
906 subject of growing interest. This article has sought to contribute to this field of research, starting  
907 from the analysis of French pesticide public policies. We analyzed what policymakers would  
908 need to improve the management of Ecophyto formulation processes and create suitable plans  
909 to overcome the lock-in. The “management situation” concept enabled us to closely analyze the  
910 micro-level, operational actions that policymakers take to manage the policymaking process.  
911 Through our narrative approach, we were able to follow several attempts at renewing the policy  
912 process over time. This allowed us to find an important need for policy capacities adapted to the  
913 characteristics of sustainability transitions in the agri-food sector.

914

915 More specifically, our results make it possible to identify several sets of interconnected  
916 capacities that policymakers lacked in the making of the Ecophyto plans. We highlight the need  
917 for capacities to manage three interconnected processes: the process of inquiry, to create  
918 compatible interpretations of the goal of sustainability; the processes of collective definition of  
919 interdependent, multi-level and multidimensional actions; and their processes of  
920 implementation. In our case-study, processes to create compatible interpretations were not

921 absent, but were ill-adapted to the diversity of actors and their issues. They did not allow the  
922 actors to grasp the importance of taking the lock-in into account. Without compatible  
923 interpretations of the objective and an understanding of the interdependence of the different  
924 parts of the sociotechnical system, actions were defined by layering various proposals, without  
925 making any real link with the objectives to be achieved. The absence of a creative process  
926 forced the collective to repeat old public action logic. The implementation processes, based on  
927 delegations, largely collided with the diversity of actors' visions. The interconnections between  
928 the instruments were too weak to allow mutual readjustments and collective learning. Finally,  
929 the State's attempt to turn to a "top-down" management resulted in a blockage of the  
930 management situation. These results enabled us to highlight that policymakers lacked important  
931 policy capacities, specifically suited to the characteristics of sustainability transitions

932  
933 Our research points to promising research-action perspectives, which would focus on the  
934 development and experimentation of new concrete methods, tools or resources for supporting  
935 policymakers in the co-design of public policies to overcome a lock-in. By basing such research-  
936 action on the four dimensions that we identified, researchers would have an opportunity to  
937 increase their impact on sustainability transitions by creating deeper links between the fields of  
938 sustainability transitions, systemic agronomy, public management, and design and creativity.  
939 We also believe our results open the way for important research on dynamic capabilities  
940 (Teece, Pisano and Shuen, 1997) for sustainability transitions, to help strengthen the long-term  
941 ability of States to react and adapt to challenges that will only become more and more complex.

942

## 943 **Acknowledgements**

944

945 This work was supported by the "Growing and Protecting Crops Differently" French Priority  
946 Research Program, part of the national investment plan operated by the French National  
947 Research Agency (ANR) [grand number: ANR-20-PCPA-0001]; and the French Ministry of  
948 Agriculture. The authors would like to thank Alan Burlot, Samuel Bladwell, Leonard Frank and  
949 Fiona Kinniburgh for their help for the framing as well as the proof reading of the article.

950

## 951 **References**

952

953 Ansaloni, M., 2017. Le marché comme instrument politique: Le désengagement de l'État dans

954 l'usage des pesticides en France. *Sociétés contemporaines* 105, 79.  
955 <https://doi.org/10.3917/soco.105.0079>  
956  
957 Aubertot, J.-N., Barbier, J.M., Carpentier, A., Gril, J.J., Guichard, L., Lucas, P., Savary, S.,  
958 Savini, I., Voltz, M., 2005. Pesticides, agriculture et environnement. Réduire l'utilisation des  
959 pesticides et en limiter les impacts environnementaux.  
960 <https://doi.org/10.3917/quae.exper.2011.01>  
961  
962 Aulagnier, A., 2020. Le gouvernement des pratiques agricoles à l'épreuve des pesticides.  
963 Sciences Po - Institut d'études politiques de Paris, Paris.  
964  
965 Bali, A.S., Ramesh, M., 2018. Policy capacity : A Design Perspective, in: Routledge Handbook of  
966 Policy Design. Taylor & Francis, New York.  
967  
968 Baiz, A., 2018. De l'innovation des instruments de politique publique: développement d'une  
969 méthode de conception combinatoire autour d'un langage algorithmique et application au  
970 dispositif des certificats d'économie d'énergie. Paris Sciences et Lettres.  
971  
972 Barbier, M., 2017. The institutionalisation of pesticide reduction in France. The sub-politics of  
973 building futures based on a critique of neo-corporatism. Presented at the Annual Conference  
974 SASE 2017, Soc. for the Advancement of Socio-Economics (SASE)., Lyon, France, p. 18.  
975  
976 Barbier, R., Daniel, F.-J., Fernandez, S., Raulet-Croset, N., Leroy, M., Guérin-Schneider, L.,  
977 2020. L'environnement en mal de gestion - Les apports d'une perspective situationnelle,  
978 Presses Universitaire du Septentrion. ed, Environnement et société.  
979  
980 Belmin, R., Meynard, J.-M., Julhia, L., Casabianca, F., 2018. Sociotechnical controversies as  
981 warning signs for niche governance. *Agron. Sustain. Dev.* 38, 44.  
982 <https://doi.org/10.1007/s13593-018-0521-7>  
983  
984 Blomkamp, E., 2018. The Promise of Co-Design for Public Policy: The Promise of Co-Design for  
985 Public Policy. *Australian Journal of Public Administration* 77, 729–743.  
986 <https://doi.org/10.1111/1467-8500.12310>  
987

988 Borrás, S., Haakonsson, S., Poulsen, R.T., Pallesen, T., Hendriksen, C., Somavilla, L.,  
989 Kugelberg, S., Larsen, H., 2023. The Transformative Capacity of Public Sector Organizations in  
990 Sustainability Transitions: A Conceptualization. Papers in Innovation Studies.  
991  
992 Boy, D., Brugidou, M., Denord, F., Evrard, A., Gaultier-Voituriez, O., Halpern, C., Lascoumes,  
993 P., Pollard, J., Sénit, C.-A., 2012. Le grenelle de l'environnement : acteurs, discours, effets.  
994 SciencesPo, CEVIPOF/CNRS.  
995  
996 Butault, J.-P., Dedryver, C.-A., Gary, C., Guichard, L., Jacquet, F., Meynard, J.-M., Nicot, P.,  
997 Pitrat, M., Reau, R., Sauphanor, B., Savini, I., Volay, T., 2010. Ecophyto R&D - Quelles voies  
998 pour réduire l'usage des pesticides ? - Synthèse de 8 pages.  
999  
1000 Butori, R., Parguel, B., 2010. Les biais de réponse - Impact du mode de collecte des données et  
1001 de l'attractivité de l'enquêteur. Presented at the AFM, France.  
1002  
1003 Charrier, F., Hannachi, M., Barbier, M., 2020. Rendre l'ingérable gérable par la transformation  
1004 collective de la situation de gestion : étude du cas de la gestion d'une maladie animale en  
1005 Corse. Annales des Mines - Gérer et comprendre N°139, 33.  
1006 <https://doi.org/10.3917/geco1.139.0033>  
1007  
1008 Cohen, M.D., March, J.G., Olsen, J.P., 1972. A Garbage Can Model of Organizational Choice.  
1009 Administrative Science Quarterly 17, 1. <https://doi.org/10.2307/2392088>  
1010  
1011 Conseil d'Etat, 2019. Réglementation de l'usage des pesticides [WWW Document].  
1012  
1013 Conseil d'État. URL [https://www.conseil-etat.fr/actualites/reglementation-de-l-usage-des-](https://www.conseil-etat.fr/actualites/reglementation-de-l-usage-des-pesticides)  
1014 [pesticides](https://www.conseil-etat.fr/actualites/reglementation-de-l-usage-des-pesticides) (accessed 6.24.22).  
1015  
1016 Corbin, J., Strauss, A., 2014. Basics of Qualitative Research: Techniques and Procedures for  
1017 Developing Grounded Theory. SAGE Publications.  
1018  
1019 Cours des comptes, 2019. Référé S2019-2659 - Le bilan des plans Ecophyto.  
1020  
1021 Dufour, A., Ronceray, C., Gravier-Bardet, M., Hubert, L., Deprost, P., 2021. Évaluation des

1022 actions financières du programme Écophyto (No. CGEDD n°013476-01, CGAAER n°20070,  
1023 IGF n°2020-M-040-03). CGEDD, CGAAER, IGF.  
1024  
1025 Dumez, H., Jeunemaître, A., 2005. La démarche narrative en économie. *Revue économique* 56,  
1026 983. <https://doi.org/10.3917/reco.564.0983>  
1027  
1028 Dumez, H., 2016. *Comprehensive Research. A methodological and epistemological introduction*  
1029 *to qualitative research.*, Copenhagen: Copenhagen Business School Press.  
1030  
1031 Elgin, D.J., Weible, C.M., 2013. A Stakeholder Analysis of Colorado Climate and Energy Issues  
1032 Using Policy Analytical Capacity and the Advocacy Coalition Framework: Stakeholder Analysis  
1033 of Colorado Climate and Energy Issues. *Review of Policy Research* 30, 114–133.  
1034 <https://doi.org/10.1111/ropr.12005>  
1035  
1036 Fiorino, D.J., 2001. Environmental Policy As Learning: A New View of an Old Landscape. *Public*  
1037 *Administration Review* 61, 322–334. <https://doi.org/10.1111/0033-3352.00033>  
1038  
1039 Flick, U., Kardoff, E. von, Steinke, I., 2004. *A Companion to Qualitative Research.* SAGE.  
1040  
1041 Förster, J.J., Downsborough, L., Biber-Freudenberger, L., Kelboro Mensuro, G., Börner, J.,  
1042 2021. Exploring criteria for transformative policy capacity in the context of South Africa's  
1043 biodiversity economy. *Policy Sci* 54, 209–237. <https://doi.org/10.1007/s11077-020-09385-0>  
1044  
1045 Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-  
1046 level perspective and a case-study. *Res. Policy*, 1257–1274. [https://doi.org/10.1016/S0048-](https://doi.org/10.1016/S0048-7333(02)00062-8)  
1047 [7333\(02\)00062-8](https://doi.org/10.1016/S0048-7333(02)00062-8)  
1048  
1049 Geels, F.W., 2004. From sectoral systems of innovation to sociotechnical systems. *Res. Policy*  
1050 33, 897–920. <https://doi.org/10.1016/j.respol.2004.01.015>  
1051  
1052 Geels, F.W., Schot, J., 2007. Typology of sociotechnical transition pathways. *Res. Policy* 36,  
1053 399–417. <https://doi.org/10.1016/j.respol.2007.01.003>  
1054  
1055 Gieske, H., van Buuren, A., Bekkers, V., 2016. Conceptualizing public innovative capacity: A

1056 framework for assessment 21.  
1057  
1058 George, C., Reed, M.G., 2016. Building institutional capacity for environmental governance  
1059 through social entrepreneurship: lessons from Canadian biosphere reserves. E&S 21, art18.  
1060 <https://doi.org/10.5751/ES-08229-210118>  
1061  
1062 Girin, J., 2011. Empirical Analysis of Management Situations: Elements of Theory and Method.  
1063 Eur. Management Rev. 8, 197–212. <https://doi.org/10.1111/j.1740-4762.2011.01022.x>  
1064  
1065 Girin, J., Chanlat, J.-F., Dumez, H., Breton, M., 2016. Langage, Organisations, Situations et  
1066 Agencements. Hermann.  
1067  
1068 Gouvernement de la République Française, 2018. Plan d’actions sur les produits  
1069 phytopharmaceutiques et une agriculture moins dépendante aux pesticides.  
1070  
1071 Gouvernement de la République Française, 2019. Plan Ecophyto 2+.  
1072  
1073 Gouvernement de la République Française, 2020. Ecophyto - Note de suivi 2018-2019.  
1074  
1075 Grotenbreg, S., Van Buuren, A., 2018. Realizing innovative public waterworks: Aligning  
1076 administrative capacities in collaborative innovation processes. Journal of Cleaner Production  
1077 171, S45–S55. <https://doi.org/10.1016/j.jclepro.2016.08.128>  
1078  
1079 Guichard, L., Dedieu, F., Jeuffroy, M.-H., Meynard, J.-M., Reau, R., Savini, I., 2017. Le plan  
1080 Ecophyto de réduction d’usage des pesticides en France : décryptage d’un échec et raisons  
1081 d’espérer. Cah. Agric. 26, 14002. <https://doi.org/10.1051/cagri/2017004>  
1082  
1083 Guillou, M., Guyomard, H., Huyghe, C., Peyraud, J.-L., Vert, J., Claquin, P., 2013. Vers des  
1084 agricultures doublement performantes pour concilier compétitivité et respect de  
1085 l’environnement. INRA, Agreenium.  
1086  
1087 Hoffmann, S., Weyer, J., Longen, J., 2017. Discontinuation of the automobility regime? An  
1088 integrated approach to multi-level governance. Transportation Research Part A: Policy and  
1089 Practice 103, 391–408. <https://doi.org/10.1016/j.tra.2017.06.016>

1090  
1091 Howlett, M., Mukherjee, I., 2018. Routledge Handbook of Policy Design, Taylor&Francis. ed,  
1092 Routledge Handbooks. New York.  
1093  
1094 Howlett, M., M, R., Perl, A., 2009. Studying Public Policy - Policy Cycles & Policy Subsystems,  
1095 Third Edition. ed. Oxford University Press.  
1096  
1097 Howlett, M., 2022. The Routledge Handbook of Policy Tools, Routledge International  
1098 Handbooks. ed. Routledge.  
1099  
1100 Jordan, A., Turnpenny, J., 2015. The Tools of Policy Formulation. Edward Elgar Publishing.  
1101 <https://doi.org/10.4337/9781783477043>  
1102  
1103 Journé, B., Raulet-Croset, N., 2008. Le concept de situation : contribution à l'analyse de  
1104 l'activité managériale en contextes d'ambiguïté et d'incertitude. M@n@gement Vol. 11, 27–55.  
1105  
1106 Kattel, R., Mazzucato, M., 2018. Mission-oriented innovation policy and dynamic capabilities in  
1107 the public sector. Industrial and Corporate Change 27, 787–801.  
1108 <https://doi.org/10.1093/icc/dty032>  
1109  
1110 Kattel, R., 2022. Dynamic capabilities of the public sector: Towards a new synthesis. Working  
1111 Paper - UCL Institute for Innovation and Public Purpose.  
1112  
1113 Kinniburgh, F., 2023. The politics of expertise in assessing alternatives to glyphosate in France.  
1114 Environmental Science & Policy 145, 60–72. <https://doi.org/10.1016/j.envsci.2023.01.017>  
1115  
1116 Kivimaa, P., Kern, F., 2016. Creative destruction or mere niche support? Innovation policy  
1117 mixes for sustainability transitions. Res. Policy 45, 205–217.  
1118 <https://doi.org/10.1016/j.respol.2015.09.008>  
1119  
1120 Köhler, J., Geels, F.W., Kern, F., Markard, J., Onsongo, E., Wieczorek, A., Alkemade, F.,  
1121 Avelino, F., Bergek, A., Boons, F., Fünfschilling, L., Hess, D., Holtz, G., Hyysalo, S., Jenkins, K.,  
1122 Kivimaa, P., Martiskainen, M., McMeekin, A., Mühlemeier, M.S., Nykvist, B., Pel, B., Raven, R.,  
1123 Rohracher, H., Sandén, B., Schot, J., Sovacool, B., Turnheim, B., Welch, D., Wells, P., 2019.

1124 An agenda for sustainability transitions research: State of the art and future directions. Environ.  
1125 Innov. Soc. Transit. 31, 1–32. <https://doi.org/10.1016/j.eist.2019.01.004>  
1126

1127 Kuokkanen, A., Mikkilä, M., Kuisma, M., Kahiluoto, H., Linnanen, L., 2017. The need for policy  
1128 to address the food system lock-in: A case study of the Finnish context. J. Clean. Prod. 140,  
1129 933–944. <https://doi.org/10.1016/j.jclepro.2016.06.171>  
1130

1131 Lamine, C., Barbier, M., Blanc, J., Buurma, J., Scherer-Haynes, I., Lehota, J., Maraccini, E.,  
1132 Egon, N., Paratte, R., Szabo, Z., Wierzbicka, A., 2010. Reducing the dependence on pesticides:  
1133 a matter of transitions within the whole agri-food system. Presented at the European IFSA  
1134 Symposium, Vienne, Austria, p. 13.  
1135

1136 Lascoumes, P., Le Galès, P., 2012. Sociologie de l'action publique (2e édition), Armand Collin.  
1137

1138 Lascoumes, P., 2018. Action publique et environnement, Que sais-je ? Presses Universitaires  
1139 de France, Paris.  
1140

1141 Loorbach, D., Rotmans, J., 2010. The practice of transition management: Examples and  
1142 lessons from four distinct cases. Futures 42, 237–246.  
1143 <https://doi.org/10.1016/j.futures.2009.11.009>  
1144

1145 Loorbach, D., Frantzeskaki, N., Lijnis Huffenreuter, R., 2015. Transition Management: Taking  
1146 Stock from Governance Experimentation. J. Corp. Citizsh. 2015, 48–66.  
1147 <https://doi.org/10.9774/GLEAF.4700.2015.ju.00008>  
1148

1149 Loureiro, R., Ferreira, J.J.M., Simões, J., 2021. Approaches to measuring dynamic capabilities:  
1150 Theoretical insights and the research agenda. Journal of Engineering and Technology  
1151 Management 62, 101657. <https://doi.org/10.1016/j.jengtecman.2021.101657>  
1152

1153 Macron, E. [@emmanuelmacron], 2017. J'ai demandé au gouvernement de prendre les  
1154 dispositions nécessaires pour que l'utilisation du glyphosate soit interdite en France dès que  
1155 des alternatives auront été trouvées, et au plus tard dans 3 ans. #MakeOurPlanetGreatAgain.  
1156 Twitter.  
1157

1158 Magrini, M.-B., Anton, M., Chardigny, J.-M., Duc, G., Duru, M., Jeuffroy, M.-H., Meynard, J.-M.,  
1159 Micard, V., Walrand, S., 2018. Pulses for Sustainability: Breaking Agriculture and Food Sectors  
1160 Out of Lock-In. *Frontiers in Sustain. Food Syst.* 2, 64. <https://doi.org/10.3389/fsufs.2018.00064>  
1161  
1162 Marquardt, J., 2017. Central-local Relations and Renewable Energy Policy Implementation in a  
1163 Developing Country. *Environmental Policy and Governance* 27, 229–243.  
1164 <https://doi.org/10.1002/eet.1756>  
1165  
1166 Martin, E., Munier-Jolain, N., 2014. Le dispositif Ecophyto est-il suffisant pour réduire l'usage  
1167 des pesticides ? *Agron., Environ. Soc.* 4, 11.  
1168  
1169 Matti, C., de Vicente, J., 2016. Visual toolbox for system innovation. *EIT Climate-KIC*.  
1170  
1171 Meijer, A., 2019. Public Innovation Capacity: Developing and Testing a Self-Assessment Survey  
1172 Instrument. *International Journal of Public Administration* 42, 617–627.  
1173 <https://doi.org/10.1080/01900692.2018.1498102>  
1174  
1175 Meynard, J.-M., Jeuffroy, M.-H., Le Bail, M., Lefèvre, A., Magrini, M.-B., Michon, C., 2017.  
1176 Designing coupled innovations for the sustainability transition of agri-food systems. *Agric. Syst.*  
1177 157, 330–339. <https://doi.org/10.1016/j.agsy.2016.08.002>  
1178  
1179 Ministère de l'agriculture et de la pêche, 2008. Plan Ecophyto 2018 de réduction des usages  
1180 des pesticides.  
1181  
1182 Ministère de l'agriculture et de la pêche, 2009. Plan Ecophyto 2018 - Fiches actions.  
1183  
1184 Ministère de l'agriculture, de l'agroalimentaire et de la forêt, 2012. Communiqué de presse –  
1185 Réduction de l'utilisation des produits phytosanitaires : Stéphane Le Foll ouvre une nouvelle  
1186 étape.  
1187  
1188 Ministère de l'agriculture et de la pêche, Ministère de l'écologie, du développement durable et  
1189 de l'énergie, 2015. Plan Ecophyto 2.  
1190  
1191 Ministère de l'agriculture et de la souveraineté alimentaire, 2022. Indicateurs des ventes de

1192 produits phytopharmaceutiques en France - 2021 [WWW Document]. Ministère de l'Agriculture  
1193 et de la Souveraineté alimentaire. URL <https://agriculture.gouv.fr/indicateurs-des-ventes-de->  
1194 [produits-phytopharmaceutiques](https://agriculture.gouv.fr/indicateurs-des-ventes-de-produits-phytopharmaceutiques) (accessed 1.4.23).  
1195  
1196 Möhring, N., Ingold, K., Kudsk, P., Martin-Laurent, F., Niggli, U., Siegrist, M., Studer, B., Walter,  
1197 A., Finger, R., 2020. Pathways for advancing pesticide policies. *Nat Food* 1, 535–540.  
1198 <https://doi.org/10.1038/s43016-020-00141-4>  
1199  
1200 Mukherjee, I., Bali, A.S., 2018. Capacities and Customization in Policy Design, in: *Routledge*  
1201 *Handbook of Policy Design*, Routledge Handbooks. Taylor & Francis, New York.  
1202  
1203 Muller, P., 2000. L'analyse cognitive des politiques publiques : vers une sociologie politique de  
1204 l'action publique. *Revue française de science politique* 50, 189–207.  
1205  
1206 Oliphant, S., Howlett, M., 2010. Assessing Policy Analytical Capacity: Comparative Insights  
1207 from a Study of the Canadian Environmental Policy Advice System. *Journal of Comparative*  
1208 *Policy Analysis*.  
1209  
1210 Oliver, T.H., Boyd, E., Balcombe, K., Benton, T.G., Bullock, J.M., Donovan, D., Feola, G.,  
1211 Heard, M., Mace, G.M., Mortimer, S.R., Nunes, R.J., Pywell, R.F., Zaum, D., 2018. Overcoming  
1212 undesirable resilience in the global food system. *Glob. Sustain.*  
1213 <https://doi.org/10.1017/sus.2018.9>  
1214  
1215 Paillotin, G., 2008. Rapport final du Président du Comité opérationnel "Ecophyto 2018."  
1216  
1217 Parlement européen, Conseil européen, 2009. Directive 2009/128/CE du Parlement Européen  
1218 et du Conseil du 21 octobre 2009 instaurant un cadre d'action communautaire pour parvenir à  
1219 une utilisation des pesticides compatibles avec le développement durable.  
1220  
1221 Pedde, S., Kok, K., Hölscher, K., Frantzeskaki, N., Holman, I., Dunford, R., Smith, A., Jäger, J.,  
1222 2019. Advancing the use of scenarios to understand society's capacity to achieve the 1.5  
1223 degree target. *Global Environmental Change* 56, 75–85.  
1224 <https://doi.org/10.1016/j.gloenvcha.2019.03.010>  
1225

1226 Pellissier, F., 2021. Tuer les pestes pour proteger les cultures. Université Gustave Eiffel.  
1227  
1228 Philippe, E., 2020. Réponse du Premier Ministre au référé de la Cour des Comptes sur les  
1229 plans Ecophyto.  
1230  
1231 Pluchinotta, I., Kazakçi, A.O., Giordano, R., Tsoukiàs, A., 2019. Design Theory for Generating  
1232 Alternatives in Public Decision Making Processes. *Group Decis Negot* 28, 341–375.  
1233 <https://doi.org/10.1007/s10726-018-09610-5>  
1234  
1235 Potier, D., 2014. Pesticides et agro-écologie: Les champs du possible.  
1236  
1237 Premier ministre de la République Française, 2016, Décret n° 2016-1842 du 26 décembre 2016  
1238 relatif à l'Agence française pour la biodiversité - Légifrance [WWW Document]. URL  
1239 <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000033691496> (accessed 6.24.22).  
1240  
1241 République Française, 2006. Plan interministériel de réduction des risques liés aux pesticides  
1242 2006-2009.  
1243  
1244 Rip, A., Kemp, R., 1998. Technological change, in: *Human Choice and Climate Change: Vol. II,*  
1245 *Resources and Technology*, Battelle Press. pp. 327–399.  
1246  
1247 Rogge, K.S., Reichardt, K., 2016. Policy mixes for sustainability transitions: An extended  
1248 concept and framework for analysis. *Res. Policy* 45, 1620–1635.  
1249 <https://doi.org/10.1016/j.respol.2016.04.004>  
1250  
1251 Ryan, D., 2015. From commitment to action: a literature review on climate policy implementation  
1252 at city level. *Climatic Change* 131. <https://doi.org/10.1007/s10584-015-1402-6>  
1253  
1254 Stegmaier, P., Kuhlmann, S., Visser, V.R., 2014. The Discontinuation of Socio-Technical  
1255 Systems as a Governance Problem, in: *The Governance of Socio-Technical Systems:*  
1256 *Explaining Change*. Edward Elgar Publishing Ltd., pp. 111–131.  
1257  
1258 Stegmaier, P., Visser, V.R., Kuhlmann, S., 2021. The incandescent light bulb phase-out:  
1259 exploring patterns of framing the governance of discontinuing a socio-technical regime. *Energy*,

1260 Sustainability and Society 11, 14. <https://doi.org/10.1186/s13705-021-00287-4>  
1261  
1262 Takao, Y., 2012. Making climate change policy work at the local level: capacity-building for  
1263 decentralized policy making in Japan. *Pacific Affairs* 85, 767–788.  
1264  
1265 Teece, D.J., Pisano, G., Shuen, A., 1997. Dynamic capabilities and strategic management.  
1266 *Strat. Mgmt. J.* 18, 509–533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7<509::AID-  
1267 SMJ882>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z)  
1268  
1269 Teisman, G.R., 2000. Models For Research into Decision-Making Processes: On Phases,  
1270 Streams and Decision-Making Rounds. *Public Administration* 78, 937–956.  
1271 <https://doi.org/10.1111/1467-9299.00238>  
1272  
1273 Turnheim, B., Nykvist, B., 2019. Opening up the feasibility of sustainability transitions pathways  
1274 (STPs): Representations, potentials, and conditions. *Res. Policy* 48, 775–788.  
1275 <https://doi.org/10.1016/j.respol.2018.12.002>  
1276  
1277 Van Rijnsoever, F.J., Leendertse, J., 2020. A practical tool for analyzing socio-technical  
1278 transitions. *Environmental Innovation and Societal Transitions* 37, 225–237.  
1279 <https://doi.org/10.1016/j.eist.2020.08.004>  
1280  
1281 Vanloqueren, G., Baret, P.V., 2009. How agricultural research systems shape a technological  
1282 regime that develops genetic engineering but locks out agroecological innovations. *Res. Policy*  
1283 38, 971–983. <https://doi.org/10.1016/j.respol.2009.02.008>  
1284  
1285 Vinnari, M., Vinnari, E., 2014. A Framework for Sustainability Transition: The Case of Plant-  
1286 Based Diets. *J Agric Environ Ethics* 27, 369–396. <https://doi.org/10.1007/s10806-013-9468-5>  
1287  
1288 Voss, J.-P., Bornemann, B., 2011. The Politics of Reflexive Governance: Challenges for  
1289 Designing Adaptive Management and Transition Management. *Ecol. Soc.* 16.  
1290 Weick, K., Sutcliffe, K., Obstfeld, D., 2005. Organizing and the Process of Sensemaking.  
1291 *Organization Science* 16, 409–421. <https://doi.org/10.4337/9781849807630.00024>  
1292  
1293 Weick, K., Sutcliffe, K., Obstfeld, D., 2005. Organizing and the Process of Sensemaking.

1294 Organization Science 16, 409–421. <https://doi.org/10.4337/9781849807630.00024>

1295

1296 Wilson, C., Tisdell, C., 2001. Why farmers continue to use pesticides despite environmental,

1297 health and sustainability costs. *Ecological Economics* 39, 449–462.

1298 [https://doi.org/10.1016/S0921-8009\(01\)00238-5](https://doi.org/10.1016/S0921-8009(01)00238-5)

1299

1300 Wu, X., Ramesh, M., Howlett, M., 2015. Policy capacity: A conceptual framework for

1301 understanding policy competences and capabilities. *Policy and Society* 34, 165–171.

1302 <https://doi.org/10.1016/j.polsoc.2015.09.001>

1303

1304 **Appendix A**

1305

Reference	Document type
French Republic, 2006. Interministerial Plan for the Reduction of Risks Related to Pesticides 2006-2009.	French government action plan on pesticides preceding the Ecophyto plans
Aubertot, J.-N., Barbier, J.M., Carpentier, A., Gril, J.J., Guichard, L., Lucas, P., Savary, S., Savini, I., Voltz, M., 2005. Pesticides, agriculture and environment. Reducing pesticide use and limiting environmental impacts.	Expert report from the National Institute for Agronomic Research on pesticides
Paillotin, G., 2008. Final report of the Chairman of the “Ecophyto 2018” Operational Committee.	Provisional report of the 1st Ecophyto plan produced by the Paillotin Operational Committee bringing together the various stakeholders
Ministry of Agriculture and Fisheries, 2008. Ecophyto 2018 plan to reduce pesticide use.	1st Ecophyto plan (2008-2018)
Ministry of Agriculture and Fisheries, 2009. Ecophyto Plan 2018 - Action sheets.	Sheets detailing the actions of the 1st Ecophyto plan, produced by the Agriculture Ministry’s administration

Butault, J.-P., Dedryver, C.-A., Gary, C., Guichard, L., Jacquet, F., Meynard, J.-M., Nicot, P., Pitrat, M., Reau, R., Sauphanor, B., 2010. Summary of the Ecophyto R&D study report.	“Ecophyto R&D” report by the National Institute for Agronomic Research on pesticides to shed light on the feasibility of achieving the objective set by the 1st plan
Ministry of Agriculture and Fisheries, Ministry of Ecology, Sustainable Development and Energy, 2015. Ecophyto 2 Plan.	Ecophyto 2 Plan (2015-2025)
Potier, D., 2014. Pesticides and agro-ecology, the fields of possibilities.	“Potier” report: evaluation report of the 1st Ecophyto plan
Government of the French Republic, 2018. Action plan on phytopharmaceutical products and agriculture less dependent on pesticides.	Pesticide use reduction plan drafted in 2018 following a multi-stakeholder conference organized by the State – subsequently integrated into the Ecophyto 2+ plan
Government of the French Republic, 2019. Ecophyto 2+ Plan.	Ecophyto 2+ Plan (2019-2025)
Court of Auditors, 2019. Summary procedure S2019-2659 - The results of the Ecophyto plans.	Summary evaluation of Ecophyto plans by the French Court of Auditors
Philippe, E., 2020. Response of the Prime Minister to the summary procedure of the Court of Auditors on the Ecophyto plans.	Response of the Prime Minister to the summary procedure of the French Court of Auditors on the Ecophyto plans.

1306

1307

1308

1309

Appendix A : List of archives on Ecophyto plans analyzed