



UNIVERSITE DE LIEGE
FACULTE DE MEDECINE VETERINAIRE
DEPARTEMENT DE GESTION VETERINAIRE DES RESSOURCES ANIMALES
SERVICE D'ECONOMIE DE LA SANTE ET DES PRODUCTIONS ANIMALES

**Evaluation intégrée des programmes de santé des animaux d'élevage :
une contribution s'appuyant sur le cas des partenariats public-privé**

**Integrated evaluation of livestock health programs:
a contribution based on the case of public-private partnerships**

Poupaud Mariline

**THESE PRESENTEE EN VUE DE L'OBTENTION DU GRADE DE
Docteur en Sciences Vétérinaires**

ANNEE ACADEMIQUE 2021-2022



Composition du jury

Jean-Luc Hornick	Université de Liège, Faculté de médecine vétérinaire	Belgique	Président du jury
Cécile Aenishaenslin	Université de Montréal, Faculté de médecine vétérinaire	Canada	Membre du jury
René Pocard Chapuis	Cirad, UMR Selmet	France	Membre du jury
Catherine Fallon	Université de Liège, Faculté de Droit, de Science politique et de Criminologie	Belgique	Membre du jury
Sibylle Mertens	Université de Liège, Ecole de Gestion	Belgique	Membre du jury
Frieda Vandeninden	Université de Liège, Faculté des sciences sociales	Belgique	Membre du jury
Etienne Thiry	Université de Liège, Faculté de médecine vétérinaire	Belgique	Membre du jury
Johann Detilleux	Université de Liège, Faculté de médecine vétérinaire	Belgique	Membre du comité
Philippe Lebailly	Université de Liège, Gembloux Agro-Bio Tech	Belgique	Membre du comité
Marisa Peyre	Cirad, UMR Astre	France	Co-promotrice
Nicolas Antoine-Moussiaux	Université de Liège, Faculté de médecine vétérinaire	Belgique	Promoteur

Remerciements

J'adresse mes sincères remerciements à mes encadrant·es de thèse. À Nicolas Antoine-Moussiaux, qui bien au-delà de son accompagnement dans cette thèse, grâce au temps et à l'attention qu'il a su m'accorder, m'a permis de découvrir les exigences, les questionnements et les riches expériences de terrain qu'entraîne une recherche interdisciplinaire. Je te remercie sincèrement pour la générosité de la transmission de tes connaissances et expériences, qui se lit dans la hauteur de tes attentes. Je suis heureuse d'avoir franchi la porte de ton bureau en dernière année de mon cursus vétérinaire, indécise dans mes choix d'avenir professionnel, et d'avoir suivi tes conseils jusqu'alors. À Marisa Peyre qui, dès le début de cette thèse, m'a accordé toute sa confiance et sa bienveillance. Merci pour ton soutien et pour le partage de tes savoirs et expertises.

Je souhaite également remercier Isabelle Dieuzy-Labaye, qui a tout fait pour faciliter mon intégration au projet de l'OIE. J'ai pu bénéficier pleinement des échanges, des groupes de travail et des ateliers d'expert·es qui m'ont permis d'avancer dans ces travaux. Ton dynamisme et tes encouragements ont rendu nos échanges toujours très agréables.

Merci au Cirad et à l'OIE pour le financement de cette thèse.

Mes remerciements vont également aux membres du comité de suivi : Aurélie Binot, Guillaume Duteurtre, Johann Detilleux et Philippe Lebailly, pour leur suivi régulier et bienveillant et pour leurs conseils éclairés et complémentaires qui ont grandement influencé ces travaux.

Aux membres du jury, Cécile Aenishaenslin, René Pocard Chapuis, Catherine Fallon, Sibylle Mertens, Frieda Vandeninden et Etienne Thiry qui ont accepté d'évaluer ce travail et qui, grâce à leurs investissements et nombreux conseils et apports, nous ont permis de grandement améliorer ce manuscrit. Merci à Jean-Luc Hornick d'avoir accepté de présider ce jury.

Merci à Flavie Goutard et Mathilde Paul pour leur encadrement lors de mon stage de master de spécialisation, pour leur confiance et bienveillance. À toutes les personnes de l'UMR ASTRE pour leur accueil chaleureux au sein de l'unité. À Anissa, que j'ai eu la chance d'accompagner dans son stage et qui a fait avancer ces travaux.

Au Cirad et à l'Université de Liège, pour les nombreuses formations et ressources auxquelles j'ai eu accès. Merci aussi aux documentalistes pour leurs nombreux conseils. Merci à Alexandra Elbakyan et à son site Web SciHub à qui, comme des milliers d'autres étudiant·es et chercheur·es, je dois l'accès à de nombreuses productions scientifiques.

Ces travaux n'auraient pu être menés sans la collaboration des partenaires de terrain que je tiens à remercier chaleureusement. Merci aux services vétérinaires et aux délégués de l'OIE du Paraguay, de l'Éthiopie et la Tunisie et du Laos. Merci à EthioChicken, à FUNDASSA (fundacion servicios por la salud animal), aux vétérinaires mandatées en Tunisie, et à l'université national du Laos et aux vétérinaires et fermiers laotiens rencontrés. Merci à Ruth et Raquel qui m'ont aidé dans les transcriptions des entretiens au Paraguay. Aux personnes du Paraguay et du Laos qui m'ont rendu les séjours bien heureux.

Aux personnes du projet DiFUSE qui m'ont permis de me sentir moins seule face à mes préoccupations environnementales. J'ai beaucoup appris en travaillant à vos côtés. Merci à Abdoulaye que j'ai eu le plaisir de co-encadrer.

Je remercie toutes les personnes, nombreuses, qui ont participé à me faire apprécier les chemins de la recherche interdisciplinaire, menant vers toujours plus d'incertitudes et de remises en question. Merci aux personnes qui m'ont accordé du temps pour m'éclairer

Je m'estime chanceuse d'avoir pu étudier si longtemps, et j'espère trouver une voie qui me permette de rendre à la société les privilèges qu'elle m'a octroyés.

Enfin, quelle énergie aurai-je eu à investir dans ces travaux si l'amour et l'amitié n'égayaient pas ma vie et n'alimentaient pas ma curiosité ? À Jb, qui chaque jour m'élève en m'invitant à contempler, à rire et à danser (sur la tête !). À Manuche, qui m'a toujours accompagnée, même dans la relecture de ce manuscrit. Aux femmes de ma vie et à cette amitié enracinée et transcendante. Aux joyeux·ses luron·nes de Montpellier, aux évasions, aux fêtes et aux rires, aux feux de bois, au Mas Aubert, aux questionnements, sidérations et engagements, aux découvertes de plantes sauvages et d'un monde sonore parallèle. À ma famille et au repère qu'elle représente. Un repère parfois proche, parfois plus éloigné, mais un repère toujours lumineux et réconfortant. A ma sœur qui, accompagnée de sa petite Aria, a finalisé la mise en page de ce manuscrit en un tour de main.

Abréviations

Cirad	Centre de coopération internationale en recherche agronomique pour le développement
FAO	Organisation des Nations unies pour l'alimentation et l'agriculture
FMD	Foot and mouth disease / fièvre aphteuse
ODD	Objectifs de développement durable
OIE	Organisation mondiale de la santé animale
ONG	Organisation non gouvernementale
PPP	Public-private partnership / Partenariat public-privé
PVS	Performance of veterinary services / Performances des services vétérinaires
SENACSA	Servicio Nacional de Calidad y Salud Animal / Services vétérinaires publics du Paraguay

Table des matières

RESUME	1
SUMMARY	3
PREAMBULE	5
INTRODUCTION GENERALE.....	7
1. La gestion des programmes de santé animale	8
1.1 Les services vétérinaires publics nationaux.....	8
1.2 Le rôle des secteurs public et privé pour la gestion de la santé animale.....	9
2. Les partenariats public-privé	10
2.1 Les partenariats public-privé en santé publique.....	11
2.2 Les partenariats public-privé dans le domaine vétérinaire.....	13
3. Importance de l'évaluation dans les programmes de santé	16
3.1 Les évaluations des programmes : définition, buts et méthodes.....	16
3.2 Les évaluations de programmes en santé animale.....	20
4. Approches intégrées	22
4.1 Durabilité.....	22
4.2 Programmes de santé animale et durabilité.....	25
OBJECTIFS ET CADRAGE	28
1. Les approches d'évaluation sur lesquelles reposent cette thèse et définition de l'évaluation intégrée	29
2. Les PPP en santé animale considérés dans ces travaux	31
3. La problématique	31
4. Le modèle d'analyse	34
METHODOLOGIE GENERALE.....	36
1. La démarche	37
2. Sélection des études de cas	37
3. Récolte de données	39
4. Sélection des participant-es	43
5. Echelle d'analyse	44
6. Analyses des données	44
7. Structuration du manuscrit	45
SECTION ETUDES	46
Chapitre 1. Evaluation des PPP : les méthodes existantes	47
Préambule chapitre 1.....	48
Abstract.....	49
1. Introduction.....	50
2. Material and methods.....	52
3. Results.....	56
4. Discussion.....	68
Chapitre 2. Analyse du contexte	74
Préambule chapitre 2.....	75
Chapitre 2. 1^{re} partie : perspective historique d'un PPP	77
Abstract.....	77
1. Introduction.....	78
2. Methodology.....	79
3. Results.....	81
4. Discussion and conclusion.....	94
Chapitre 2. 2^e partie : résumé d'une étude de cartographie de parties prenantes	97
Chapitre 3. Analyse du processus des partenariats public-privé	100
Préambule du chapitre 3.....	101
Chapitre 3. 1^{re} partie : présentation d'un outil d'évaluation du processus	103
Abstract.....	104
1. Introduction.....	105
2. Material and methods.....	107
3. Results.....	112
4. Discussion.....	122

Chapitre 3. 2e partie : utilisation de l'outil pour évaluer un PPP en Tunisie	128
Résumé	128
Chapitre 4. Evaluation des résultats et des impacts des PPP	131
Préambule chapitre 4	132
Abstract.....	134
1. Introduction.....	135
2. Material and methods.....	138
3. Results.....	145
4. Discussion	163
DISCUSSION GENERALE - PERSPECTIVES	169
1. Vue d'ensemble sur la démarche	170
1.1 Développement d'un cadre théorique d'évaluation opérationnalisable	170
1.2 Les difficultés et limites de la démarche : partage d'expérience	173
2. Le concept de partenariats public-privé en santé animale	174
2.1 La diversité des initiatives comprises sous le concept de PPP.....	175
2.2 Les risques des PPP	176
2.3 Préventions des risques.....	179
3 L'évaluation des PPP dans le domaine vétérinaire	181
3.1 Spécificité des évaluations des PPP.....	181
3.2 Opérationnalisation du cadre d'évaluation intégrée	181
4 Application des travaux de thèse	186
5 Perspectives	188
5.1 Perspective opérationnelle : l'évaluation comme outil d'accompagnement.....	188
5.2 Perspective de recherche : amélioration du cadre d'évaluation intégrée des PPP	189
ACTIVITES PARALLELES ET DIFFUSION DES TRAVAUX	194
<i>Activités parallèles</i>	195
<i>Publications</i>	198
<i>Communications orales</i>	200
<i>Partages d'expériences et encadrement</i>	201
BIBLIOGRAPHIE	202
<i>Références citées dans les sections introduction et objectifs</i>	203
<i>Références citées dans le chapitre 1</i>	211
<i>Références citées dans le chapitre 2</i>	216
<i>Références citées dans le chapitre 3</i>	219
<i>Références citées dans le chapitre 4</i>	222
<i>Références citées dans la discussion (dont annexes) et dans la partie « activités parallèles »</i>	227
ANNEXES	231
<i>Annexes du chapitre 1</i>	232
<i>Annexes du chapitre 2</i>	251
<i>Annexes du chapitre 3</i>	281
<i>Annexes du chapitre 4</i>	294
<i>Annexes de la discussion</i>	305

Résumé

Si les partenariats public-privé (PPP) en santé publique sont étudiés depuis les années 1980, dans le domaine vétérinaire peu d'entre eux ont été évalués. Pourtant, de nombreux PPP dans ce domaine sont mis en œuvre à travers le monde. Ces PPP représentent des approches conjointes dans lesquelles les services vétérinaires publics et des parties prenantes privées tels que des vétérinaires privé-es, des associations de producteur-rices ou des entreprises privées, travaillent ensemble pour relever des défis complexes en matière de santé animale. Dans cette thèse, il est question de PPP pour la surveillance, la prévention et le contrôle de maladies animales infectieuses. Si des avantages de ces formes de collaborations existent, elles présentent aussi des risques. L'objectif de cette thèse était de développer un cadre d'évaluation intégrée en s'intéressant aux attributs et aux propriétés de ces PPP. Ces derniers informeraient l'évaluation du processus et de la portée de ces PPP pour en limiter les risques et favoriser des effets positifs.

Ce travail de thèse s'appuie à la fois sur des cadres pré-existants (de l'approche réaliste en santé publique et de la durabilité), sur une revue de la littérature, et sur les thèmes émergents de l'analyse de 4 cas d'étude, qui ont été mis en dialogue pour aboutir à un cadre d'évaluation. Des approches participatives ont été mobilisées dans les cas d'études, permettant de considérer la pluralité des points de vue des parties prenantes impliquées ou impactées par ces PPP. Des opinions, perceptions, et interprétations nuancées et diverses ont ainsi été recueillies. Ces approches ont ainsi permis d'appréhender l'organisation des PPP et leurs effets tels que perçus par ces acteur-rices, favorisant une vision systémique du PPP.

Dans un premier temps, une revue de la littérature sur les évaluations des PPP dans le domaine vétérinaire et de la santé publique a permis d'identifier les différentes méthodologies et critères d'évaluation existants. Cette revue nous a permis de proposer une première ébauche de cadre d'évaluation des PPP centré sur le concept de la durabilité. Le cadre d'évaluation proposé peut se découper en analyse du contexte, analyse du processus et analyse des résultats des PPP. Dans une deuxième partie de la thèse, pour être en mesure d'opérationnaliser l'analyse de contexte, deux méthodologies sont proposées. Une perspective historique d'un PPP au Paraguay permet de retracer l'émergence de la collaboration entre le secteur public et le secteur privé pour le contrôle de la fièvre aphteuse, et d'identifier les différents facteurs qui ont influencé la structuration de ce PPP. Une cartographie de parties prenantes au Laos, dans une perspective ex ante d'un éventuel PPP pour la gestion de l'antibiorésistance, permet d'identifier les connexions entre les parties prenantes, de comprendre comment elles s'influencent mutuellement, et d'explorer leurs intérêts et contraintes.

Dans une troisième partie de cette thèse, pour être en mesure d'analyser le processus de fonctionnement d'un PPP, un outil d'évaluation de la qualité du processus des PPP a été développé. Ce développement a été permis grâce aux critères identifiés dans la revue de littérature, une élicitation d'opinions d'expert·es (du secteur public et du secteur privé) et deux cas d'études. Cet outil s'intéresse particulièrement au fonctionnement de coordination, de collaboration et de gouvernance des PPP. Cet outil a ensuite été appliqué sur un PPP en Tunisie correspondant au mandat sanitaire vétérinaire. Finalement, dans une quatrième partie de la thèse, une application participative du chemin d'impact sur un PPP en Ethiopie dans le secteur de la volaille a permis de s'intéresser aux résultats et impacts permis par le PPP, ainsi que la contribution du PPP pour atteindre ces impacts. Les parties prenantes ont identifié une diversité d'impacts qui ont été caractérisés par des indicateurs.

Le cadre d'évaluation intégrée développé dans cette thèse vise à identifier des points d'amélioration des processus et des résultats des PPP en matière de santé des humains, des animaux et des écosystèmes, dans une perspective de durabilité. Ces objectifs s'intègrent donc explicitement dans une approche One Health, comprise comme appartenant aux sciences de la durabilité. Plusieurs difficultés liées à l'opérationnalisation de l'évaluation ont été identifiées, notamment la considération de la dimension environnementale et la participation des parties prenantes impactées négativement par les PPP. Ces difficultés limiteront la mise en place de changements des PPP évalués et donc les chances de favoriser une trajectoire plus durable. Pour dépasser ces difficultés opérationnelles, ce cadre d'évaluation peut être utilisé dans une perspective d'accompagnement sur le long terme par une équipe interdisciplinaire d'évaluateur·rices. Ces travaux méritent d'être continués et ce cadre d'évoluer. Par exemple, il serait intéressant de considérer d'autres échelles d'évaluation comme l'échelle individuelle ou l'échelle des réseaux d'acteur·rices. Il serait aussi intéressant de proposer des analyses de risques, d'approfondir l'analyse des jeux de pouvoir, et de réfléchir à une réelle considération de la dimension environnementale dans l'évaluation des PPP en santé animale.

Summary

Although public-private partnerships (PPPs) in public health have been studied since the 1980s, few have been evaluated in the veterinary domain. However, many PPPs in this field are being implemented around the world. These PPPs represent joint approaches in which public veterinary services and private actors, such as private veterinarians, producer associations or private companies, work together to address complex animal health challenges. This thesis focuses on PPPs for the surveillance, prevention and control of infectious animal diseases. While there are advantages to these forms of collaboration, there are also risks. The objective of this thesis was to develop an integrated evaluation framework by focusing on the attributes and properties of these PPPs. These would inform the evaluation of the process and outcomes of these PPPs to limit the risks and favor positive effects.

This thesis work is based on pre-existing frameworks (realistic approach in public health and sustainability), on a literature review, and on the themes emerging from the analysis of four case studies, which were put into dialogue to arrive at an evaluation framework. Participatory approaches were mobilized in the case studies, allowing for the consideration of the plurality of viewpoints of stakeholders involved or impacted by these PPPs. Nuanced and diverse opinions, perceptions, and interpretations were thus collected. These approaches have made it possible to understand the organization of PPPs and their effects as perceived by these stakeholders, allowing a systemic vision of the PPP.

First, a review of the literature on the evaluation of PPPs in the veterinary domain and public health allowed us to identify the different methodologies and evaluation criteria that exist. This review allowed us to propose a first draft of an evaluation framework for PPPs centered on the concept of sustainability. The proposed evaluation framework can be divided into context analysis, process analysis and outcome analysis of PPPs. In a second part of the thesis, in order to be able to operationalize the context analysis, two methodologies are proposed. A historical perspective of a PPP in Paraguay traces the emergence of the collaboration between the public and private sectors for the control of foot and mouth disease, and identifies the different factors that influenced the structuring of this PPP. A mapping of stakeholders in Laos, from an ex-ante perspective of a potential PPP for the management of antimicrobial resistance, allows us to identify the connections between stakeholders, to understand how they influence each other, and to explore their interests and constraints.

In a third part of this thesis, in order to be able to analyze the operating process of a PPP, a tool for assessing the quality of the PPP process was developed. This development was made possible thanks to the criteria identified in the literature review, an elicitation of expert opinions (from the public and private sectors) and two case studies. This tool focuses on the coordination, collaboration and governance functioning of PPPs. This tool was then applied to a PPP in Tunisia corresponding to the veterinary health mandate. Finally, in the fourth part of this thesis, a participatory application of the impact pathway on a PPP in Ethiopia in the poultry sector focused on the outcomes and impacts enabled by the PPP, as well as the contribution of the PPP to achieving these impacts. Stakeholders identified a variety of impacts that were characterized by indicators.

The integrated evaluation framework developed in this thesis aims to identify points of improvement in the processes and outcomes of PPPs in terms of human, animal and ecosystem health, from a territorial sustainability. These objectives are therefore explicitly integrated into a One Health approach, understood as belonging to the sciences of sustainability. Several difficulties related to the operationalization of the evaluation have been identified, including consideration of the environmental dimension and the participation of stakeholders negatively impacted by PPPs. These difficulties may limit the implementation of changes in the PPPs evaluated and therefore the chances of promoting a trajectory towards a more sustainable territory. To overcome these operational difficulties, this evaluation framework can be used in a long-term support perspective by an interdisciplinary team of evaluators. This work deserves to be continued, and this framework to evolve. For example, it would be interesting to consider other scales of evaluation such as the individual scale or the scale of stakeholder networks. It would also be interesting to propose risk analyses, to deepen the analysis of power games, and to reflect on a real consideration of the environmental dimension in the evaluation of PPPs in animal health.

Préambule

Ces travaux de thèse ont débuté en septembre 2018 et s'insèrent dans le projet « Progrès Public-Privé » mené par l'Organisation Mondiale de la Santé Animale (OIE) en collaboration avec le Cirad (Centre de coopération internationale en recherche agronomique pour le développement). Cette thèse a été financée pendant 3 ans et 4 mois par le Cirad et par l'OIE dans le cadre du projet. Le projet est financé par la Fondation Bill & Melinda Gates. Une des composantes de ce projet s'intéresse à l'évaluation des partenariats public-privé (PPP) dans le domaine vétérinaire et c'est dans cette partie qu'intervient ce travail de thèse. Pour réaliser ces travaux, j'ai été accueillie dans l'unité ASTRE du Cirad, et j'ai bénéficié de plusieurs séjours à l'Université de Liège et à l'OIE.

Cette thèse est réalisée dans le cadre du Collège doctoral en Sciences Vétérinaires de la Faculté de Médecine Vétérinaire de l'Université de Liège. De formation vétérinaire, avec un master de spécialité dans les approches intégrées des risques en santé, j'ai cependant bénéficié d'un encadrement interdisciplinaire lors de cette thèse (épidémiologie, socio-économie et anthropologie). En effet, l'objet principal de cette thèse est la santé animale, et particulièrement la gestion des programmes de contrôle de maladies animales infectieuses, mais les approches évaluatives m'ont amené à mobiliser des cadres théoriques de différentes disciplines.

Ces travaux de thèse s'appuient sur différentes sources de données dont quatre cas d'étude. Une enquête en ligne avait été menée avant le début de cette thèse dans le cadre du projet, permettant d'identifier 97 expériences de PPP impliquant des services vétérinaires publics nationaux ou locaux et différents acteurs privés. J'ai participé au processus de publication de cette enquête, notamment par un travail de contextualisation bibliographique, et les résultats principaux de cette étude sont présentés dans l'introduction (partie 2.2 de l'introduction). Les quatre cas d'études concernent l'Ethiopie, la Tunisie, le Paraguay et le Laos. Dans le cadre du projet, une évaluation participative mobilisant le chemin d'impact d'un PPP en Ethiopie avait été initiée. Les données de terrains avaient été récoltées par un étudiant de master de spécialisation de mars à juin 2018. Pour ma part, j'ai organisé et analysé ces données et je les ai complétées par des données quantifiables grâce à l'analyse des rapports internes de l'entreprise. Cet étudiant et moi, ainsi qu'avec l'équipe de recherche associée, avons collaboré pour écrire l'article correspondant (chapitre 4). Une étudiante de master de spécialisation a réalisé son stage dans le cadre du même projet, de janvier à juin 2021, où je l'ai co-encadrée. Son stage a porté sur une évaluation d'un PPP en Tunisie en mobilisant un outil d'évaluation développé dans ces travaux de thèse. Je présente un résumé de cette étude dans ce manuscrit (chapitre 3).

J'ai eu la chance de pouvoir me rendre au Paraguay le premier quadrimestre de 2020 pour tester et améliorer le cadre d'évaluation préalablement développé (chapitre 2 et discussion). Une deuxième mission de terrain de trois mois au Paraguay était initialement prévue à l'été 2020 mais n'a pas pu être réalisée en raison de la pandémie de covid-19. Finalement, un résumé d'une étude réalisée au Laos lors de mon stage de master de spécialisation de six mois est également présenté (chapitre 2). Ce stage était encadré par le Cirad et l'Organisation des Nations unies pour l'alimentation et l'agriculture (FAO) en collaboration avec l'Université nationale du Laos. J'ai finalisé l'analyse de ces données et mener le processus de publication pendant cette thèse.

Introduction générale

Préambule de l'introduction

Dans cette introduction, les concepts autour desquels cette thèse est articulée sont présentés, à savoir : les partenariats public-privé (partie 2 de l'introduction), l'évaluation (partie 3 de l'introduction), et les approches intégrées (partie 4 de l'introduction). Dans un premier temps, les programmes de santé animale et leur gestion par les services vétérinaires et le secteur privé seront abordés (partie 1 de l'introduction). Ainsi, cette introduction nous permettra de définir les objectifs et le cadre de cette thèse.

1. La gestion des programmes de santé animale

1.1 Les services vétérinaires publics nationaux

Assurer une bonne santé des animaux d'élevage nécessite de mettre en place des programmes de surveillance, de prévention et de contrôle des maladies animales contagieuses parfois zoonotiques. La mission des services vétérinaires nationaux est notamment de mettre en place et de coordonner ces programmes afin de garantir la détection précoce des foyers de maladies animales, de fournir une réponse rapide et, si possible, de contrôler ces foyers dans leur pays. En effet, tous les gouvernements ont un mandat clair pour investir dans des services vétérinaires afin de surveiller et gérer la propagation des maladies animales au niveau national et international (World Organisation for Animal Health, 2020a).

L'OIE, organisation intergouvernementale anciennement appelée l'Office international des épizooties, a été créée en 1924 suite à un accord international signé par 28 États reconnaissant la nécessité de lutter contre les maladies animales dans le monde entier, et notamment la peste bovine qui sévissait à l'époque. L'OIE a participé à l'émergence des services vétérinaires nationaux au niveau mondial. En effet, dès 1928, l'OIE stipulait que seuls les documents sanitaires « *émanant de nations dotées de services vétérinaires régulièrement organisés* » peuvent donner des garanties suffisantes aux importateurs. De plus, depuis 1998, les normes établies par l'OIE sont reconnues comme références mondiales par l'Organisation Mondiale du Commerce (Organisation Mondiale de la Santé Animale, 2020). Si certains services vétérinaires émergent dès les années 1900, comme en France (Portail National des Archives, 1984), d'autres émergent plus tardivement, comme au Paraguay en 1967 (Servicio Nacional de Calidad y Salud Animal, 2020a). Une des missions principales de l'OIE est d'accompagner les services vétérinaires nationaux dans le renforcement de leurs capacités à prévenir et maîtriser les maladies animales (World Organisation for Animal Health (OIE), 2019).

Depuis 2007, à travers des évaluations formelles de la performance des services vétérinaires (PVS), l'OIE aide à fixer des priorités et à préparer des plans d'action que devraient implémenter les services vétérinaires des pays membres de l'OIE (World Organisation for Animal Health, 2019a). Aujourd'hui les 182 États membres de l'OIE ont tous des services vétérinaires.

Assurer une bonne santé animale, nécessite des fonds et des ressources humaines importants (Knight-Jones and Rushton, 2013). Selon l'Organisation des Nations unies pour l'alimentation et l'agriculture (FAO), les services vétérinaires publics, financés par des fonds publics, doivent être en mesure de supporter le maintien de la santé du cheptel national (Food and Agriculture Organization of the United Nations, 1997). Cependant, un financement public adéquat des services vétérinaires, pour leur permettre d'assurer les missions et attentes de leurs gouvernements, et d'être conformes aux normes de l'OIE, représente un défi pour tous les pays du monde. Un manque d'investissements publics et internationaux pour l'élevage et des services vétérinaires est à souligner, et ce malgré une contribution importante de l'élevage à l'économie de nombreux pays (World Organisation for Animal Health (OIE), 2019). L'importance d'un bon fonctionnement des services vétérinaires s'est accrue ces dernières années pour la mise en place de programmes permettant d'élaborer des réponses efficaces et coordonnées à l'émergence de maladies contagieuses à fortes retombées sanitaires et économiques (encéphalopathie spongiforme bovine, nouvelles formes de grippe aviaires, fièvre aphteuse) (Stemshorn and Zussman, 2012).

1.2 Le rôle des secteurs public et privé pour la gestion de la santé animale

Des collaborations entre secteurs public et privé dans plusieurs fonctions, telles que la surveillance, la prévention, ou le contrôle des maladies contagieuses, sont souvent nécessaires. Par exemple, l'intermédiaire d'organisations de la société civile, de paraprofessionnelles et de systèmes communautaires est souvent nécessaire pour assurer des services vétérinaires dans les zones reculées (Ahuja, 2004a). La participation du secteur privé pour le bon fonctionnement des services vétérinaires est reconnue de longue date par l'OIE.

Les services vétérinaires sont ainsi définis par l'OIE comme « les organisations gouvernementales et non gouvernementales qui mettent en œuvre sur le territoire les mesures relatives à la santé et au bien-être des animaux [...]. Les organisations du secteur privé, les vétérinaires, les para-professionnels vétérinaires ou les professionnels de la santé des animaux aquatiques sont normalement accrédités ou agréés par l'Autorité vétérinaire pour exercer les fonctions déléguées ». De plus, le guide d'évaluation formelle de la performance des services vétérinaires (PVS) de l'OIE est constitué de 4 parties, dont une dédiée aux interactions entretenues avec les parties prenantes non gouvernementales (World Organisation for Animal Health, 2019a).

D'un point de vue financier, la participation du secteur privé aux services vétérinaires publics peut être vue comme une façon d'améliorer l'efficacité et de réduire les coûts pour le gouvernement, à travers des mandats sanitaires et d'autres formes de collaborations (Stemshorn and Zussman, 2012). Ces interactions peuvent également permettre aux services vétérinaires publics de s'appuyer sur l'expertise non gouvernementale, et de soutenir la protection de la santé animale et des marchés dans le pays en fonction des besoins des parties prenantes (World Organisation for Animal Health, 2019a).

Bien qu'il soit admis que les secteurs public et privé ont un rôle à jouer dans la provision de services vétérinaires, l'équilibre entre leurs rôles est débattu depuis les années 1980. En général, la contribution des services vétérinaires publics pour soutenir la santé et la production animale est requise pour réguler les activités où le marché ne permet pas d'atteindre une situation optimale dans l'allocation des ressources et pour assurer un traitement juste et égal à tous les groupes d'une société, en particulier les pauvres et les défavorisés (van Veen and de Haan, 1995). Si la mise en place de services vétérinaires est une responsabilité essentielle de l'État qui ne peut être déléguée, cette mise en place peut s'appuyer sur des stratégies visant à assurer la complémentarité entre les secteurs public et privé (Dehove et al., 2012). Dans son septième plan stratégique pour la période 2021-2025, l'OIE reconnaît que la réponse aux défis sanitaires et de production animale de demain nécessitera la participation de multiples parties prenantes, y compris de partenariats public-privé (World Organisation for Animal Health, 2020b). Cependant, ces collaborations entre secteurs public et privé rencontrent des difficultés dans la mise en œuvre sur le terrain et sont peu étudiées, montrant la nécessité de poursuivre les efforts de conceptualisation autour de cette collaboration dans le domaine vétérinaire (Ahuja, 2004a).

2. Les partenariats public-privé

Dans le domaine vétérinaire, les partenariats public-privé (PPP) sont officiellement définis par l'OIE seulement depuis 2019. Les PPP sont « une approche conjointe selon laquelle les secteurs public et privé conviennent de responsabilités et partagent ressources et risques pour atteindre des objectifs communs qui génèrent des bénéfices de manière durable » (World Organisation for Animal Health, 2019b).

Cette définition émerge d'un travail qui a recensé 97 PPP actuellement mis en œuvre dans le monde (Galière et al., 2019a). Avant ce travail, les PPP dans le domaine vétérinaire étaient peu étudiés.

En revanche, les PPP dans le domaine de la santé publique sont étudiés depuis les années 1980 (Roehrich et al., 2014). Un parallèle entre le domaine de la santé publique et celui du domaine vétérinaire peut être établi, car tous deux sont concernés par les mêmes missions que sont la surveillance, la prévention et le contrôle des maladies infectieuses, et la protection de la santé d'une population. Les enseignements tirés de l'étude des PPP dans le domaine de la santé publique pourraient servir de guide pour l'étude des PPP dans le domaine vétérinaire.

2.1 Les partenariats public-privé en santé publique

En santé publique, les interactions du secteur public avec le secteur privé ont toujours existé mais sont devenues de plus en plus dominantes dans le discours sur la réforme du secteur public depuis les années 1980 (Martin and Halachmi, 2012). Dans ces années, les tendances visant la privatisation de certaines fonctions du secteur public au nom d'une efficacité accrue et d'économies de coûts, notamment au niveau de la santé publique, prédominent (Johnston and Finegood, 2015). Les PPP sont alors acceptés comme un moyen de créer de nouvelles opportunités en tirant parti des ressources financières, humaines et technologiques qui ne seraient pas disponibles si le gouvernement agissait seul (Martin and Halachmi, 2012). Les gouvernements nationaux et les organisations économiques mondiales ont commencé à se tourner vers le secteur privé pour améliorer les systèmes de santé et les PPP en santé publique ont vu leur popularité augmenter (D. A. Barr, 2007). La restructuration du service national de santé britannique sous la direction de Margaret Thatcher en est un exemple (Al-Hanawi and Qattan, 2019; D. A. Barr, 2007). Au cours des 30 dernières années environ, les PPP en santé publique se sont considérablement accrus en nombre et en diversité, notamment promus par les Nations unies et l'Organisation Mondiale de la Santé (Nishtar, 2004 ; Guilbaud, 2015). Ainsi, la responsabilité du secteur public de maintenir des systèmes qui favorisent la santé et le bien-être tels qu'ils étaient initialement imaginés dans la Déclaration des droits de l'homme des Nations unies a été diluée (Johnston and Finegood, 2015).

En santé publique, les PPP incluent différents acteurs avec au moins une représentation (i) du secteur public : agences gouvernementales nationales ou locales ou des institutions au niveau international qui sont contrôlées par les gouvernements, comme l'OMS, et (ii) du secteur privé : secteur privé à but lucratif, société civile, organisations à but non lucratif telles que les ONG et les institutions philanthropiques (Widdus, 2005). Une diversité de PPP existe en santé publique. Certains PPP sont le résultat d'une politique publique visant à construire des infrastructures telles que des hôpitaux avec des sources de financement privées (Barlow et al., 2013). Certains PPP visent le développement de nouveaux médicaments ou vaccins. D'autres PPP ont pour objectif le contrôle de maladies non transmissibles ou infectieuses (Johnston and Finegood, 2015; Salve et al., 2018) ou l'amélioration à l'accès à des produits ou des services des populations cibles (Widdus, 2005). Il existe aussi des PPP hybrides recouvrant plusieurs objectifs.

Certains PPP impliquent des organisations internationales comme des multinationales ou l'Organisation Mondiale de la Santé (« PPP for global health » ou « global PPP »). Ces PPP globaux existent depuis les années 1990 (Buse and Waxman, 2001) et sont abondamment financés par des fondations privées (notamment la Fondation Bill et Melinda Gates) (Reich et al., 2003). Ces PPP ont modifié les politiques et les pratiques de l'Organisation mondiale de la santé (OMS), ce qui a suscité des débats sur la répartition des pouvoirs, les conflits d'intérêts ou encore l'agenda sanitaire mondial (Buse and Harmer, 2004; Buse and Waxman, 2001; Guilbaud, 2015b).

La littérature en santé publique attire l'attention sur des risques récurrents des PPP comme une distorsion des priorités et des politiques définies au niveau national ou des conflits d'intérêts (Buse and Harmer, 2004). En effet, les PPP qui impliquent un contrat unissant le secteur public et le secteur privé, comme toute relation contractuelle, peuvent être considérés comme une relation "principal-agent". Le principal est le partenaire public (les services vétérinaires publics) qui utilise le service d'un agent, le partenaire privé. Les différents partenaires impliqués dans le contrat, n'ont pas forcément une congruence parfaite des objectifs et peuvent essayer de tirer profit, au détriment de l'autre partenaire, dans des situations d'incertitude ou d'asymétrie d'information posant alors certains risques (Maatala et al., 2017a). Le risque d'affaiblissement du rôle du secteur public dans ses missions est souvent cité dans la littérature en santé publique. Par exemple, en Inde, l'augmentation de PPP dans les années 1990 a influencé la structuration des services de santé publique et a redéfini les rôles du secteur public et privé. Le secteur public a dû adhérer aux règlements définis par des accords formels du PPP, en tant que partenaire égal du secteur privé, ce qui a diminué son influence sur la conception des programmes (Baru and Nundy, 2008). De plus, à travers des PPP, des bailleurs de fonds extérieurs (comme la Banque mondiale) peuvent influencer les politiques nationales de santé publique en soutenant et finançant des PPP, dont les conceptions sont souvent fondées sur des notions d'efficacité économique du marché, et ainsi diminuer le rôle du secteur public (Baru and Nundy, 2008). Ainsi, la diminution de responsabilité du secteur public et de son influence dans la définition des politiques de santé publique peut éroder des valeurs publiques telles que la participation démocratique aux choix de politiques de santé, ou l'équité d'accès aux soins (Baru et Nundy, 2008 ; Vrangbæk, 2008). Finalement, les partenaires publics et privés courent le risque de conclure des contrats de PPP qui s'avèrent sous-optimaux ou problématiques à long terme, notamment à cause de l'assemblage complexe des PPP et d'un coût de transaction (comme le coût de la négociation du contrat et le coût de la surveillance et du suivi des activités du partenaire) (Vrangbæk, 2008).

De manière plus positive, les PPP sont aussi vus comme une voie pour susciter de meilleures pratiques au sein des bureaucraties publiques, pour ouvrir le processus décisionnel à des groupes auparavant marginalisés, tels que les organisations de la société civile, ou pour promouvoir une bonne gouvernance dans le domaine de la santé (Buse and Harmer, 2004). Certains PPP sont aussi reconnus pour leur importance dans l'augmentation significative d'accès à des services essentiels de santé publique dans certains pays (Salve et al. 2018), ou l'amélioration de l'expertise des différents partenaires par la complémentarité des compétences (Albis et al., 2019).

La diversité des PPP, en termes d'objectif, de conception et de composition, est si large qu'il est difficile d'évaluer de manière globale leur mérite et leur efficacité dans l'amélioration des résultats en matière de santé (Hernandez-Aguado and Zaragoza, 2016).

2.2 Les partenariats public-privé dans le domaine vétérinaire

En santé animale, peu d'études ont analysé les PPP mis en œuvre empêchant une analyse des expériences réussies et moins bien réussies, des bénéfiques et des risques. Une enquête auprès de membres du secteur privé et du secteur public dans les 181 pays membres de l'OIE, concernant leurs expériences de PPP, a été réalisée grâce à un questionnaire en ligne, dans le cadre du projet de l'OIE « progrès public-privé ». Cette enquête a permis d'identifier 97 expériences de PPP dans 76 pays impliquant des services vétérinaires publics nationaux ou locaux et différents acteurs privés. Au vu de la faible quantité d'information disponible sur les PPP en santé animale, les données de cette enquête ont largement structuré les travaux de cette thèse (**Annexe 1**, (Galière et al., 2019a)).

Un questionnaire a été envoyé aux délégués de l'OIE (qui sont le plus souvent les directeur·rices des services vétérinaires) des 181 pays membres et à 47 contacts privés identifiés par les délégués de l'OIE. Les différentes questions ont permis de recueillir 36 variables caractérisant les PPP : l'objectif du PPP, les partenaires impliqués, la période de mise en œuvre, le type d'interaction entre les partenaires, le mécanisme de financement, le mécanisme de gouvernance, les activités mises en œuvre, des données d'évaluation (si disponibles) et, les forces et faiblesses du PPP.

Les données de cette enquête ont permis d'aboutir à la définition des PPP dans le domaine vétérinaire mentionnée en début de partie 2 de cette introduction qui provient donc de l'analyse d'initiatives de terrain existantes. La plupart de ces 97 PPP avaient pour objectif(s) la prévention le contrôle de maladies animales infectieuses et/ou l'extension des zones couvertes par les services vétérinaires. Ces PPP ont été mis en place, car ces objectifs avaient été identifiés comme non-atteignables sans la participation des secteurs public et privé. Les PPP ont été initiés soit par les deux secteurs en même temps dans 55% des cas, soit par le secteur public dans 25% des cas, soit par le secteur privé dans 15% des cas. Les PPP recensés sont mis en œuvre en Afrique (22 pays), en Europe (22 pays), en Amérique du Nord et du Sud (17 pays), en Asie et Océanie (9 pays), et au Moyen-Orient (6 pays).

Les parties prenantes publiques étaient des services vétérinaires nationaux (96%) ou provinciaux (4%). Les parties prenantes privées étaient majoritairement à but lucratif (91%) et une minorité à but non-lucratif (9%). Les parties prenantes privées à but lucratif étaient des vétérinaires privé·es indépendant·es (le plus souvent représenté·es par des associations de vétérinaires) (29%), des organisations ou coopératives de producteur·rices (23%), des entreprises privées (15%) ou des consortiums représentant plusieurs types de ces partenaires privés à but lucratif (24%). Les parties prenantes à but non-lucratif étaient des ONG, des fondations privées, ou des agences para-publiques (9%).

Les PPP impliquant des vétérinaires privé·es (indépendant·es ou représenté·es par des associations) ont surtout été décrits en Europe et en Afrique, presque toujours en lien avec le mandat sanitaire. Les PPP impliquant des entreprises privées étaient plus fréquemment décrits en Afrique, souvent motivés par des objectifs de développement, et dans une moindre mesure en Europe. Les PPP impliquant des organisations de producteur·rices ont quant à eux surtout été décrits dans les Amériques, en particulier en Amérique centrale et latine.

L'alignement des objectifs et la mobilisation des partenaires ont été les facteurs clés de succès les plus cités. Les autres facteurs clés de succès étaient la communication et la confiance entre les partenaires, la transparence des prises de décisions et des activités, la définition d'objectifs communs et les avantages mutuels, ainsi que le niveau d'implication des partenaires. Le manque de ressources, en particulier la disponibilité et la durabilité du financement, les capacités et la disponibilité limitée des ressources humaines, ainsi que le manque de soutien législatif pour les PPP et la complexité administrative ont été le plus souvent signalées comme des obstacles. Dans cette enquête, aucune donnée sur les risques potentiels ou existants des PPP mis en œuvre n'a été récoltée. Cependant, on peut faire l'hypothèse que les risques sont les mêmes que ceux identifiés en santé publique.

L'analyse de cette enquête, suite à des analyses multifactorielles, a abouti à une typologie différenciant 3 types de PPP dans le domaine vétérinaire selon, notamment, les partenaires privés, les actions entreprises et les types de gouvernance (**Tableau 1**).

Le type 1 représente les « *PPP transactionnels* ». Ce type correspond à des PPP motivés par le besoin de développer des prestations vétérinaires au niveau local et sont initiés et financés par le secteur public. Les acteur·rices privé·es comprennent des vétérinaires ou des paraprofessionnel·les vétérinaires, des entreprises vétérinaires ou des associations. Le prestataire privé est engagé par contrat ou se voit confier un mandat sanitaire. Il y a éventuellement un paiement de la part de l'éleveur·se qui bénéficie du service. Le type 2 représente les « *PPP collaboratifs* ». Ce type correspond à des PPP motivés par les exportations et/ou les intérêts commerciaux, initiés à la fois par les services vétérinaires publics et le secteur privé. Les acteur·rices privé·es sont le plus souvent des associations d'éleveur·ses. Ces PPP se basent sur un engagement conjoint, pour mettre en œuvre des politiques et des résultats convenus mutuellement. La gouvernance va de réglementations encadrées par des lois aux accords non officiels. La prise de décision est partagée entre les deux secteurs. Le type 3 représente les « *PPP transformatifs* ». Ce type correspond aux PPP axés sur des objectifs de développement commerciaux, initiés et financés par le secteur privé (entreprises nationales ou multinationales) mais contrôlés et sanctionnés par les services vétérinaires publics et en collaboration avec eux. Ces programmes majeurs seraient autrement irréalisables. Ces PPP peuvent initialement bénéficier de l'aide internationale ou du secteur philanthropique/caritatif afin d'obtenir un rendement commercial à long terme. La gouvernance est conjointe, et peut passer par exemple par un protocole d'accord.

Tableau 1. Les trois types de PPP dans le domaine vétérinaire identifiés suite à l'analyse de la description de 97 PPP de 76 pays. Ce tableau a été adapté de Galière et collaborateur·rices

	Type 1, PPP « transactionnels »	Type 2, PPP « collaboratifs »	Type 3, PPP « transformatifs »
Partenaires privés à but lucratif	Vétérinaires privé·es indépendant·es et associations de vétérinaires	- Organisations ou coopératives de producteur·rices - Consortium d'acteurs privés	Entreprises privées
Type d'interaction	Accréditation	- Accréditation - Participation à des programmes conjoints - Consultation	Participation à des programmes conjoints
Gouvernance	Mandat sanitaire	- Législation - Accord/convention	Accord/convention (souvent de type Memorandum d'entente)
Région principale	Europe ou Afrique	- Amériques - Asie/Pacifique	Afrique
Mise à disposition de ressources financière	Secteur public	Secteurs public et privé	Secteur privé
Initiation de la collaboration	Partenaire public	Partenaires publics et privés	Partenaire privé
Objectif	Multiplés : maladies infectieuses, sécurité alimentaire, bien-être animal, etc.	Maladies infectieuses : prévention, contrôle, éradication	Maladies infectieuses : contrôle et prévention Antibiorésistance But commercial
Partenaires additionnels	Aucun	Aucun	Partenaires internationaux du secteur public ou fondations/ONG

L'éventail des partenaires privés décrits dans l'enquête élargit la compréhension traditionnelle des PPP impliquant les services vétérinaires, qui tendait à restreindre les PPP aux mandats sanitaires. Cette étude confirme que de nombreux PPP dans le domaine vétérinaire sont mis en œuvre et qu'ils correspondent à une grande diversité d'acteur·rices, d'initiatives et d'objectifs.

3. Importance de l'évaluation dans les programmes de santé

3.1 Les évaluations des programmes : définition, buts et méthodes

De nombreuses disciplines se sont intéressées à l'évaluation (comme la gestion, l'analyse politique, l'éducation, la sociologie, l'anthropologie sociale ou la santé) aboutissant à différents cadres théoriques et définitions (Peyre et al., 2021a). Par exemple, l'évaluation dans le domaine de la santé publique résulte d'une union de l'évaluation économique, l'évaluation fondée sur l'épidémiologie et la pratique clinique, et, de plus en plus, de l'évaluation issue des sciences sociales (Champagne et al., 2011a). Nous nous appuyerons sur une définition de l'évaluation issue de la santé publique : « Évaluer consiste à porter un jugement de valeur sur une intervention en mettant en œuvre un dispositif capable de fournir des informations scientifiquement valides et socialement légitimes sur cette intervention ou sur n'importe laquelle de ses composantes » (Champagne et al., 2011a). On peut proposer de différencier l'évaluation de l'appréciation (« assessment ») et du suivi des performances (« performance monitoring »). L'appréciation est la collecte et l'analyse des données d'un indicateur défini. Il s'agit d'une étape technique du processus d'évaluation. Le suivi des performances est un suivi effectué de manière continue et dont les résultats sont utilisés en interne par les acteurs du système. Le suivi des performances se fait à l'aide d'indicateurs de performance (Peyre et al., 2021a).

3.1.1 Les buts de l'évaluation

Selon Champagne et al. (2011a), l'évaluation peut se faire pour : (i) aider à la planification et à l'élaboration d'un programme, ayant alors un but *stratégique* ; (ii) fournir de l'information pour l'amélioration d'un programme, et contribuer à une prise de décision informée et à un changement plus éclairé, ciblant ainsi un but *formatif* ; (iii) déterminer les effets d'un programme pour décider de son maintien, transformation ou abandon visant un but *sommatif* ; (iv) contribuer à l'avancement des connaissances et à l'élaboration théorique, dans un but *fondamental* ; (v) ou utiliser les résultats de l'évaluation comme plaidoyer, dans un but *tactique* ou un but politique. L'évaluation peut aussi représenter un moyen de renforcer les partenariats et le processus de collaboration en assurant le dialogue, la transparence et la confiance entre les partenaires (Allen, 2019).

Les finalités ne sont pas toujours explicites et transparentes du côté de l'évaluateur·trice ou du côté des acteur·rices qui demande l'évaluation, et il est donc essentiel de prendre conscience des buts implicites et des stratégies des différents acteur·rices (Champagne et al., 2011a).

L'évaluation peut être réalisée ex ante, in itinere ou ex post. L'évaluation ex ante, c'est-à-dire avant la mise en œuvre du programme, est stratégique et fournit des éléments essentiels pour améliorer la valeur du programme prévu, sa conception et sa planification. L'évaluation in itinere, c'est-à-dire pendant que le programme est en place et fonctionne, a pour but d'être formative, c'est-à-dire d'ajuster le programme, ou sommative dans le but d'éclairer les décideur·ses. Le moment de l'évaluation dépendra de l'objectif de l'évaluation, défini en fonction de l'objectif du programme et d'éléments externes tels que l'évolution de la situation de la maladie. Elle peut être faite pour évaluer les performances et la valeur ajoutée du programme. L'évaluation ex post, c'est-à-dire après la fin du programme, est faite pour tirer des leçons de l'intervention ou du projet achevé, elle peut être mise en œuvre pour identifier les leçons à tirer de sa mise en place et du déroulement du programme (Peyre et al., 2021a).

3.1.2 Les principes de l'évaluation

L'évaluation doit être transparente, objective et fondée sur des preuves afin de garantir la confiance dans ses résultats et de promouvoir la mise en œuvre des recommandations par les parties prenantes concernées par l'évaluation et ainsi générer des changements. Les recommandations ne pourront être acceptées que si elles sont perçues comme réellement utiles à l'amélioration du programme et ne profitent pas injustement à certaines parties prenantes. Le processus d'évaluation doit donc être clair, et transparent pour toutes les parties prenantes, ainsi que les résultats et les recommandations, en particulier la manière dont ils ont été conçus (Peyre et al., 2021a). L'association américaine d'évaluation préconise cinq principes éthiques que les évaluateur·ices devraient suivre. Ces principes, sont interdépendants, et portent sur l'enquête systématique, la compétence, l'intégrité, le respect des personnes, le bien commun et l'équité (American Evaluation Association, 2011). D'autres principes éthiques sont également mentionnés dans la littérature comme la réflexivité, l'humilité et l'honnêteté (Apgar and Allen, 2021).

3.1.3 L'importance de la participation dans le processus de l'évaluation

Certain·es auteur·es soulignent l'importance de la participation dans l'évaluation. L'évaluation participative est une approche qui implique les parties prenantes d'un programme ou d'une politique dans le processus d'évaluation. Cette participation peut intervenir à n'importe quel stade du processus d'évaluation, depuis la conception de l'évaluation jusqu'à la collecte et l'analyse des données et la rédaction du rapport d'évaluation. Le niveau de participation dans l'évaluation peut varier en fonction de la place qu'est donnée aux parties prenantes dans les différentes étapes de l'évaluation et de mise en œuvre des recommandations, allant de la consultation à la délégation de pouvoir (Arnstein, 1969; Cornwall, 2008). L'évaluation participative peut inclure des entretiens individuels, des cartographies participatives, des explicitations de lien de causalité entre les composantes d'un programme, des notations ou des ateliers de réflexions sur les forces et les faiblesses d'un programme (BetterEvaluation, 2012a).

L'objectif des approches participatives, dont l'essor date des années 1990, est de permettre aux communautés et aux acteur·rices de trouver leurs propres solutions adaptées à leurs enjeux (Aluma et al. 2009). Ces approches favorisent les méthodes ascendantes (*bottom-up*) par rapport aux méthodes descendantes (*top-down*) dans des processus décisionnels, visant à améliorer l'appropriation des stratégies et activités à implémenter par les populations (Debevec et al., 2019). L'intérêt des approches participatives dans l'évaluation des programmes de santé a, par exemple, été montré pour le programme national de lutte contre l'échinococcose kystique au Maroc (Saadi et al., 2021).

L'évaluation participative peut favoriser la formulation de questions d'évaluation localement pertinentes, permet de formuler des recommandations adaptées au contexte, ainsi que de soutenir l'apprentissage collectif (Bryson et al., 2011; Taut and Brauns, 2003). De plus, les évaluateur·rices de programmes peuvent se heurter à la résistance des acteur·rices affecté·es par l'évaluation, percevant cette dernière comme un exercice de pouvoir externe. Afin d'améliorer la mise en œuvre d'une évaluation et de diminuer la réticence des acteur·rices, l'implication effective et active des acteurs dans l'ensemble du processus d'évaluation, et l'adaptation aux structures organisationnelles existantes sont des éléments importants pour établir une confiance entre l'évaluateur ou évaluatrice et les acteur·rices (Taut and Brauns, 2003). En effet, le contrôle sur le processus et les résultats de l'évaluation des acteur·rices améliore leur acceptation. Prendre en compte la diversité des perceptions individuelles et essayer de les comprendre peut favoriser des prises de décisions utiles pour le groupe. Cependant, si le contrôle des résultats d'évaluation par les parties prenantes, et particulièrement par un groupe dominant, est trop grand, cela peut créer un conflit d'intérêt, ces acteur·rices étant à la fois juge et partie (BetterEvaluation, 2012a; Taut and Brauns, 2003).

3.1.1 Les approches de l'évaluation

Dans tout programme, on retrouve cinq composantes : des ressources (ressources humaines, ressources financières, structure organisationnelle), des acteur·rices et leurs pratiques, des processus de fonctionnement du programme, un ou plusieurs objectifs et enfin, un contexte (Figure 1). Les acteur·rices et groupes d'acteur·rices du programme et leurs pratiques sont au centre de tout programme. En fonction de leurs caractéristiques, de leurs intentions, de leurs intérêts et de leurs convictions, il-elles modèlent le programme (Champagne et al., 2011a).

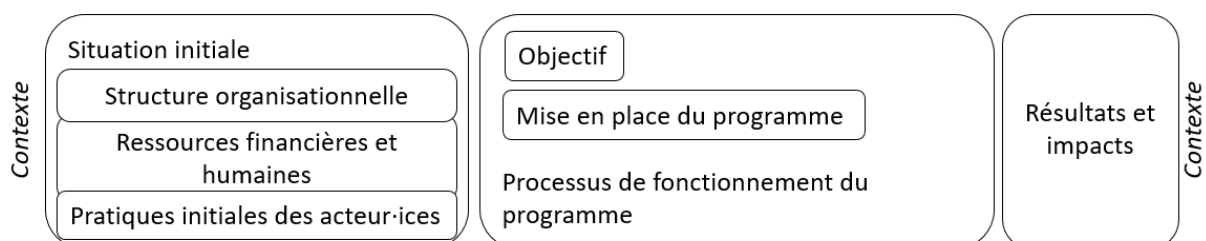


Figure 1 : les composantes d'un programme. Adapté de Champagne et collaborateur·rices (2011).

Nous proposons de distinguer deux approches d'évaluation : l'évaluation normative ou les approches réalistes de l'évaluation (Champagne et al., 2011a; Robert and Ridde, 2013). L'*évaluation normative* cherche à apprécier chacune des composantes de l'intervention en fonction de critères et de normes. Elle s'inscrit dans un procédé de vérification de la conformité des composantes du programme par rapport à des références préalablement établies (Champagne et al., 2011a). L'approche réaliste en évaluation s'attache à comprendre les relations de causalité entre les différentes composantes d'un programme. Les évaluations s'appuyant sur l'approche réaliste s'attachent à mettre en lumière et à comprendre la complexité qui caractérise les programmes et de ces différentes composantes : le contexte, les acteurs et leurs décisions et volontés, le processus de mise en œuvre d'un programme (modalités de financement, l'administratif, les mesures de suivi et d'évaluations etc.), le temps (l'histoire du programme en influence le processus), l'influence d'autres programmes mis en œuvre parallèlement sur les résultats, les résultats du programme et les émergences du programme liées aux interactions des acteurs qui modifient leur comportements et transforment ainsi le programme. C'est une approche d'évaluation fondée sur les hypothèses théoriques quant aux mécanismes à l'œuvre (« theory based evaluation ») (Robert and Ridde, 2013). Elle permet de répondre non seulement à la question classique « est-ce qu'un programme fonctionne ou non pour entraîner tel résultat ? », mais surtout à des questions comme « pourquoi un programme fonctionne ou non ? Comment il fonctionne ? Pour qui il fonctionne et dans quel contexte ? » (Brousselle and Buregeya, 2018).

3.1.2 Les processus d'évaluation

Il existe des centaines de méthodes et de processus d'évaluation différents. Des combinaisons de méthodes et de processus peuvent être utilisées en fonction de la question d'évaluation et de ce qui doit être évalué. Les données récoltées peuvent être quantitatives et/ou qualitatives (BetterEvaluation, 2010).

Un point important à mentionner est que dans les évaluations, les résultats du programme ne doivent pas comparés à la situation avant que le programme n'ait commencé. Il est donc important de faire la distinction entre la situation *avec* programme, *sans* programme et *avant* programme. En effet, même sans programme, une situation évolue avec le temps. L'analyse des résultats doit être effectuée sur base de la situation additionnelle qui correspond à la différence entre la situation *sans* programme (et non pas *avant*) et la situation *avec* programme (**Figure 3**). Cette différence correspond à l'apport réel du programme (European Union Capacity4dev, 2018). Comme les PPP représentent un moyen d'atteindre des objectifs, les PPP doivent présenter des avantages en termes de collaboration, c'est-à-dire qu'ils doivent représenter une valeur ajoutée pour atteindre des résultats et impacts par rapport à un programme qui n'implique pas de PPP (Bryson et al., 2015).

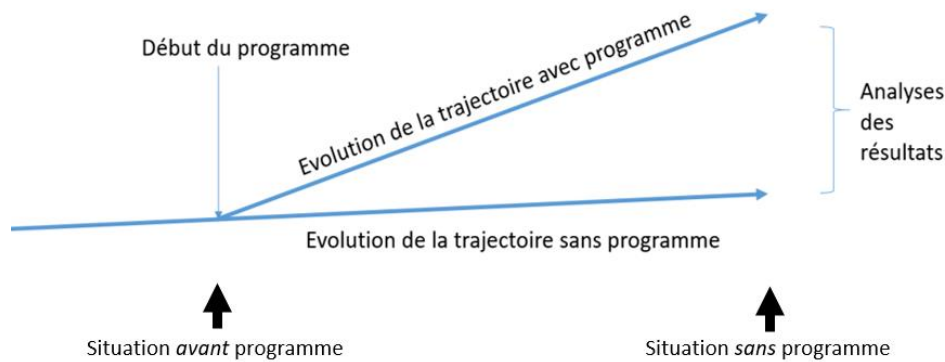


Figure 3 : Analyse des résultats dans l'évaluation de programme.

L'analyse des résultats est usuellement effectuée sur base de la situation additionnelle qui correspond à la différence entre la situation sans programme (qui peut être analysée en définissant un contrefactuel) et la situation avec programme.

Cependant, il n'est pas facile de mesurer la valeur ajoutée de la collaboration. Une des manières de le faire serait de comparer les résultats d'un PPP avec un « contrefactuel » existant ou modélisé d'une situation *sans* PPP. Par exemple en le comparant à un territoire sans PPP ou à une alternative purement publique ou purement privée qui aurait évolué dans les mêmes contextes.

3.2 Les évaluations de programmes en santé animale

Globalement, les évaluations de programme de santé animale sont encore trop peu utilisées dans le processus de prise de décision des parties prenantes des programmes et des décideur·ses (Peyre et al., 2021a). Les évaluations de programmes dans le domaine vétérinaire sont principalement des évaluations techniques ou de l'efficacité. L'efficacité d'un programme est souvent caractérisée par des pertes évitées de production animale. Les évaluations en santé animale s'intéressent également à l'efficience en comparant les résultats ou avantages aux coûts d'un programme (Rushton, 2007). Ces analyses ne s'intéressent pas aux aspects socio-économiques et socio-écosystémiques qui permettraient une vision holistique des programmes évalués.

Par exemple, ces évaluations ne s'appuient que rarement sur des analyses institutionnelles des mécanismes de collaboration et de coordination entre les parties prenantes, qui dans le cadre des PPP occupent une place importante si les succès et échecs sont à analyser en regard du fonctionnement y ayant mené.

Cependant, au cours des 20 dernières années, des méthodologies ont été développées pour permettre une évaluation du processus des programmes en santé animale. L'évaluation du processus (ou du fonctionnement) consiste à évaluer les conditions dans lesquelles le système fonctionne, les éléments de l'organisation et la fonction du système qui affecteront ses performances. L'évaluation du processus du programme permet par exemple de mieux comprendre les raisons des performances limitées. Plusieurs méthodologies d'évaluation du processus des programmes en santé animale ont été établies, parmi lesquelles deux outils spécifiques à l'évaluation des systèmes de surveillance en santé animale : *OASIS* et la *matrice de surveillance One Health* (Bordier et al., 2019; Hendrikx et al., 2011). Des évaluations plus globales qui intègrent l'évaluation de l'efficacité, de la portée d'un programme, et d'éléments affectant les performances du programme, ont également été développées. Ces évaluations ont par exemple mis en évidence l'importance du secteur privé dans les programmes de surveillance de la santé animale (Delabougliose et al., 2015) ou l'importance de la confiance entre les acteurs impliqués et leur acceptabilité dans le système (Calba et al., 2015a; Pham et al., 2017). Des méthodologies d'évaluations s'intéressant particulièrement aux programmes impliquant des approches intégrées dans le cadre One Health ont aussi été développées. Ces évaluations s'intéressent, entre autres, au contexte du programme, aux objectifs, aux actions mises en œuvre (le processus du programmes), et aux résultats et impacts (NEOH, 2020). Ces évaluations considèrent les dimensions sociétales, environnementales et économiques, et utilisent des méthodes multiples comme la théorie du changement (Rüegg et al., 2017). Toutefois, aucune des évaluations mentionnées ne s'est intéressée explicitement aux PPP dans le domaine vétérinaire. De plus, la prise en compte du contexte, de la multiplicité des parties prenantes et de leurs logiques de décision, de la complexité des liens entre les parties prenantes ou des objectifs multiples pour une action représente encore des défis pour l'évaluation (Peyre et al., 2021a). Finalement, si les évaluations se sont de plus en plus tournées vers la prise en compte de facteurs socio-économiques, la dimension environnementale, pourtant un des piliers de la durabilité, est souvent délaissée. Il y a un enjeu de développement méthodologique autour de l'évaluation des PPP dans le domaine vétérinaire et, dans cette thèse, l'évaluation est posée comme un objet de recherche.

4. Approches intégrées

Les programmes de santé animale, et notamment les PPP, peuvent influencer l'ensemble du système d'élevage qui, lui-même, peut influencer la durabilité du territoire dans le quel l'élevage est mis en œuvre. Ainsi, il est intéressant de se pencher nous seulement sur les résultats d'un PPP en termes de santé animale mais aussi en termes de respect des limites planétaires et de contribution à un territoire plus durable. En effet, le dernier rapport du Groupe d'experts intergouvernemental sur l'évolution du climat nous confirme que dépasser le seuil de +1,5°C aura déjà des impacts irréversibles pour les systèmes humains et écologiques, et que si « la vie sur Terre peut se remettre d'un changement climatique majeur en évoluant vers de nouvelles espèces et en créant de nouveaux écosystèmes ; l'humanité ne le peut pas. » (Masson-Delmotte et al., 2021). Si « nous avons besoin d'une transformation profonde des processus et des comportements à tous les niveaux: individus, communautés, entreprises, institutions et gouvernements » (Masson-Delmotte et al., 2021), il semble que les limites planétaires et l'environnement devraient être pris en compte dans tous les domaines de recherche.

4.1 Durabilité

La durabilité est un processus caractérisé par un ensemble de comportements et de pratiques qui tend à préserver un bien commun dans le temps et dans l'espace. La durabilité signifie répondre aux besoins des générations actuelles, sans toutefois compromettre la capacité des générations futures (White, 2013).

Habituellement, trois dimensions de la durabilité sont prises en compte : le développement économique, le développement social et la protection de l'environnement (Adams, 2006). L'importance des approches multisectorielles et de l'engagement communautaire pour trouver des solutions à des problèmes complexes a été soulignée (Bloom, 2007), et la gouvernance est parfois considérée comme la quatrième dimension de la durabilité (James et al., 2015). La gouvernance est définie comme toutes les formes de coordination entre les acteur·rices, la diversité des règles et des cadres influençant le comportement des acteur·rices (James et al., 2015).

4.1.1 Les objectifs de développement durable et les limites planétaires

Dès 1972, le rapport « Meadows », sur la base d'un modèle de corrélations calculées à partir de données disparates (conséquences écologiques de la croissance économique, limitation des ressources et évolution démographique), émet l'hypothèse que la trajectoire mondiale de croissance démographique et industrielle n'est pas soutenable (Meadows et al., 1972). Depuis, les perspectives se sont aggravées, et à une échelle globale il n'y a plus de doute sur le fait que nous consommons davantage de ressources qu'il ne s'en régénère et que l'environnement se dégrade à toute vitesse.

Au niveau international, en septembre 2015, l'ensemble des pays membres des Nations Unies ont adopté les 17 objectifs de développement durable. Les objectifs de développement et d'environnement sont, en théorie, enfin fusionnés (The United Nations, 2015). Cependant, ce cadre peine à montrer des résultats opérationnels, et les changements profonds nécessaires pour respecter l'agenda de la durabilité ne sont pas observés. Par exemple, aucun pays industrialisé qui a signé l'accord de Paris ne parvient à atteindre les objectifs fixés par l'accord (United Nations Environment Programme, 2017).

Le Stockholm Resilience Center propose de considérer les économies et les sociétés comme des éléments intégrés de la biosphère, qui devient alors la base de tout (Stockholm Resilience Center, 2018). Il y a ainsi neuf limites planétaires quantitatives à l'intérieur desquelles l'humanité peut continuer à se développer et à prospérer pour les générations à venir (**Figure 4**). Le franchissement de ces limites augmente le risque de générer des changements environnementaux abrupts ou irréversibles à grande échelle. Quatre des neuf frontières planétaires ont été franchies en raison de l'activité humaine : changement climatique, perturbation des cycles biogéochimiques (phosphore et azote), changement d'occupation des sols, érosion de la biodiversité. Les 5 autres limites sont la pollution chimique, la destruction de l'ozone stratosphérique, les émissions d'aérosols dans l'atmosphère, l'acidification des océans et la consommation d'eau douce (Steffen et al., 2015; Stockholm Resilience Center, 2015).

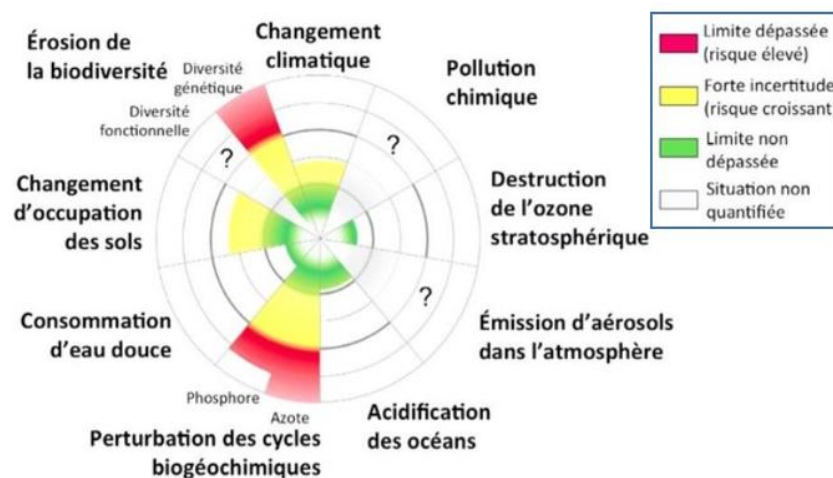


Figure 4 : les neuf limites planétaires à l'intérieur desquelles l'humanité peut continuer à prospérer pour les générations à venir.

Figure adaptée de Steffen et collaborateurs (2015).

Depuis cette perspective, de nombreux pays occidentaux dépassent les limites planétaires (O'Neill et al., 2018). Il est bien sûr essentiel de prendre en compte le fait qu'il existe beaucoup de pays et d'individus pour qui la notion de « développement » renvoie à bien d'autres considérations. Par exemple, actuellement, 690 millions de personnes souffrent sévèrement de la faim et sont en situation de sous-alimentation chronique, c'est-à-dire dans l'incapacité d'accéder de façon régulière à de la nourriture en quantité suffisante et couvrant leurs besoins essentiels (Food and Agriculture Organization of the United Nations, 2020).

4.1.2 Sciences de la durabilité et santé durable

La science de la durabilité est un domaine de recherche défini par les problèmes qu'il aborde plutôt que par les disciplines qu'il emploie. La recherche relative aux objectifs du développement durable a longtemps été menée à partir de disciplines séparées comme la géographie, l'écologie, l'économie, la physique ou les sciences politiques. La science de la durabilité cherche à dépasser les préoccupations spécifiques des disciplines. Elle se concentre sur la compréhension de la dynamique complexe qui résulte des interactions entre les systèmes humains et environnementaux pour participer aux efforts de résolution de problèmes ciblés sur des besoins. La science de la durabilité est principalement inspirée par des problèmes complexes et un engagement à transformer ces connaissances en actions sociétales (Kates, 2011).

Une dimension de la science de la durabilité s'intéresse à la santé durable (« sustainable health »). La santé durable souligne l'importance des approches multisectorielles et l'engagement communautaire pour apporter des solutions durables aux problèmes complexes de santé (Bloom, 2007). Si des avancées majeures en matière de santé publique ont été permises ces dernières décennies, l'impact de l'empreinte humaine sur l'environnement (qui est le principal déterminant de la santé humaine) a été négligé. Ainsi, certains chercheurs affirment que les enjeux environnementaux actuels nous obligent à repenser la conception de la santé publique et d'y apporter une approche écologique (Brousselle and Butzbach, 2018; Brousselle and Guerra, 2017).

Comme l'existence humaine ne peut être dissociée des dynamiques planétaires et biologiques, ces chercheurs invitent à accepter, comprendre et influencer les relations écologiques entre humains et environnement naturel, constitué d'entités vivantes, pour assurer une bonne santé publique pour toutes (Lang et Rayner, 2015). Elles invitent à considérer la durabilité comme le premier critère dans la définition des priorités, la conception et l'évaluation des programmes de santé publique (Brousselle and Butzbach, 2018; Brousselle and Guerra, 2017). L'action de santé publique se positionne alors à l'intersection de la santé des populations, des changements écologiques et des changements sociaux et économiques (**Figure 5**) (Canadian public health association, 2015). La nécessité de prendre en compte la durabilité dans l'évaluation des PPP pour la santé publique a également été évoquée, invitant ainsi à réfléchir à l'impact à long terme des PPP (Nishtar, 2004).

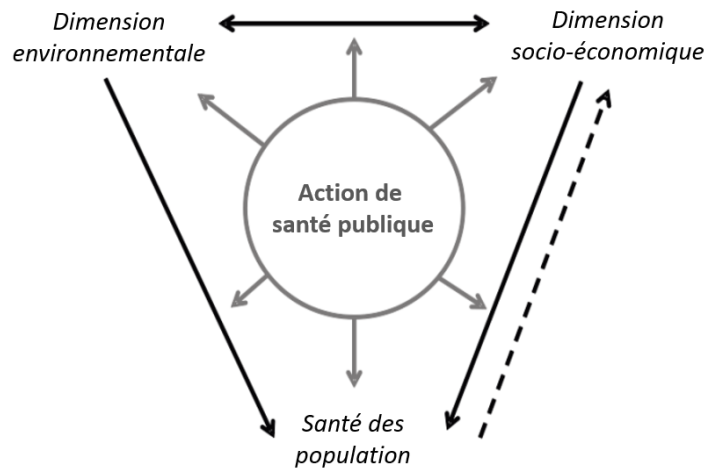


Figure 5 : Le cadre de la santé publique durable.
Adapté de Canadian public health association (2015)

Le terme de santé globale et les approches écosociales de la santé résonnent avec les concepts One Health ou EcoHealth déjà bien appropriés par les organismes internationaux. Les approches EcoHealth sont « des approches qui visent à mieux comprendre et à promouvoir la santé et le bien-être (des humains, des animaux et des écosystèmes) dans le contexte des interactions complexes entre la santé, les inégalités sociales et la viabilité des écosystèmes » (Communauté de pratique en approches écosystémiques de la santé (COPEH-Canada), 2013). Nous reconnaissons cette résonance entre ces différents concepts, cependant, pour une question d'homogénéisation du vocabulaire, je parlerai principalement de durabilité dans la suite du manuscrit.

4.2 Programmes de santé animale et durabilité

4.2.1 Les conséquences des programmes de santé animale sur la durabilité

Les résultats d'un programme de santé animale peuvent influencer l'ensemble du système d'élevage (par exemple en augmentant la productivité, ou en augmentant le cheptel national). Les changements du système d'élevage, s'insérant dans un territoire, influenceront la structure socio-économique, le mécanisme de gouvernance et les aspects environnementaux de ce territoire.

L'élevage et la santé animale représentent une opportunité et un défi pour la durabilité en termes de santé publique et de sécurité alimentaire, de stabilité socio-économique et d'interaction avec l'environnement. Environ 70 % des maladies humaines émergentes sont d'origine animale (Jones et al., 2008), tandis que des millions de personnes dans le monde dépendent des activités agricoles et d'élevage pour leur subsistance (HLPE, 2016). Les systèmes d'élevage contribuent à la réalisation des objectifs de développement durable (ODD), tels que l'éradication de la pauvreté (ODD 1), l'éradication de la faim (ODD 2), la garantie d'une vie saine et du bien-être (ODD 3), l'égalité des sexes (ODD 5), le travail décent (ODD 8), la lutte contre le changement climatique (ODD 13) et l'utilisation durable du système terrestre (ODD 15) (Müller, Jean-Pierre; et al., Under publication). Mais cet équilibre est fragile et l'élevage peut largement contribuer à des impacts négatifs sur ces ODD. De plus, les animaux d'élevage ont une série d'effets sur des processus qui peuvent conduire à dépasser les limites planétaires ou à les respecter (Debnath et al., 2021).

D'un point de vue économique, l'élevage procure des moyens de subsistance et des avantages économiques directs à au moins 1,3 milliard de producteur·rices et de détaillant·es. L'élevage assure la sécurité alimentaire de millions de familles et représente également une part importante du commerce international de certains pays (Bennett, 2012; Dury et al., 2019). D'un point de vue social, l'élevage joue un rôle culturel important et les produits animaux ont également une valeur culturelle élevée dans de nombreux pays (Bertrand Dumont et al., 2019; Dury et al., 2019). Les femmes et les personnes vulnérables (enfants, personnes âgées) jouent un rôle essentiel dans la gestion de nombreux systèmes d'élevage. Souvent, le bétail constitue une réserve de capital des ménages agricoles, servant de réserve stratégique qui réduit les risques et ajoute de la stabilité à l'ensemble du ménage (Steinfeld et al., 1997).

En ce qui concerne l'environnement, dans un contexte de raréfaction des ressources et face à la nécessité de réduire les émissions de gaz à effet de serre, de nombreuses études ont identifié l'élevage comme un domaine d'action essentiel (HLPE, 2016). Certains systèmes d'élevage basés sur le pâturage rendent des services écosystémiques tels que le piégeage du carbone à l'échelle mondiale (Soussana, et al., 2010). Le pâturage du bétail peut améliorer la richesse de la microflore et la faune du sol, l'infiltration de l'eau et la recharge des nappes phréatiques, ou la fertilité du sol (Steinfeld et al., 1997). Cependant, le bétail a également un impact négatif sur l'environnement. Le rapport de la FAO "Livestock's long shadow", publié en 2006, mettait en garde contre la menace que représente le développement de l'élevage pour l'avenir, en mettant en balance la demande croissante de protéines animales et les dommages climatiques et environnementaux liés à l'élevage (Steinfeld et al., 2006). L'élevage est l'activité humaine nécessitant la plus grande utilisation de terres (HLPE, 2016). L'élevage peut avoir une interaction négative avec la biodiversité naturelle et la fertilité du sol (Cavicchioli et al., 2019; Hoffmann, 2010) et contribue à environ 14,5 % des émissions anthropiques totales de gaz à effet de serre, responsables du réchauffement planétaire (HLPE, 2016).

Dans un même temps, certains systèmes d'élevage sont parmi les plus vulnérables au changement climatique (notamment ceux des zones sèches). Il est également important de souligner que, pour certains petits exploitants ayant une empreinte environnementale souvent très limitée, l'élevage est l'une des rares options permettant d'augmenter leurs revenus et de maintenir leurs moyens de subsistance (Herrero et al., 2009).

4.2.2 Le rôle des services vétérinaires pour la durabilité des territoires nationaux

À ce jour, il semblerait que les politiques publiques vétérinaires soient encore peu tournées vers l'interaction élevage-environnement et que peu d'études s'intéressent aux impacts environnementaux des programmes de santé animale. Pourtant, les programmes de santé animale mis en œuvre par les services vétérinaires, notamment via des PPP, peuvent diminuer ou, au contraire, augmenter la pression sur les limites planétaires. Par exemple, il a été souligné que des stratégies nationales des services vétérinaires qui se concentrent uniquement sur l'augmentation de la production pour les marchés peuvent avoir un impact négatif sur les limites planétaires (Debnath et al., 2021). Depuis 2011, l'OIE a défini l'impact des systèmes de production animale sur le changement climatique comme un de ces domaines d'action dans son 5^e Plan stratégique (Organisation Mondiale de la Santé Animale, 2020). De plus, une récente revue de l'OIE intitulée « Les services vétérinaires dans un monde en mutation : le changement climatique et autres facteurs externes » montre l'importance d'une approche intégrée pour penser les programmes de santé animale, et notamment les partenariats public-privé (Smith et al., 2021).

La promotion d'un élevage durable, de la santé et de la biodiversité des sols, par exemple par le biais de systèmes de production animale extensifs et semi-intensifs agro-écologiques, s'inscrit dans les cadres de One Health et EcoHealth, déjà familières à de nombreux services vétérinaires nationaux. Les systèmes vétérinaires pourraient s'engager dans une collaboration intersectorielle et interdisciplinaire, afin de surveiller, d'analyser et de promouvoir des systèmes d'élevage adaptés aux conditions locales favorisant la durabilité d'un territoire (Debnath et al., 2021). De plus, conformément aux ODD, les programmes de santé animale devraient idéalement permettre de prendre en compte les besoins et les intérêts des populations les plus vulnérables (qui comprennent généralement les femmes, les enfants, les migrants et les peuples autochtones) (The high level panel of experts on food security and nutrition, 2016). Les services vétérinaires, en s'engageant dans de réelles collaborations entre les sphères privées et civiles, permettant des formes participatives et inclusives de gouvernance, favoriseraient la bonne gestion des programmes de santé animale, permettant des processus de réflexion avec un éventail de voix et de connaissances différentes (Antoine-Moussiaux et al., 2017). Ainsi, les services vétérinaires pourraient avoir la responsabilité de prendre en compte la contribution de l'élevage à la durabilité des territoires, et de contribuer aux discussions nationales et mondiales sur la transformation des systèmes d'élevage.

Objectifs et cadrage

1. Les approches d'évaluation sur lesquelles reposent cette thèse et définition de l'évaluation intégrée

Les travaux de cette thèse reposent sur des approches réalistes de l'évaluation en cherchant à comprendre le comment et le pourquoi des résultats. Pour la suite de ces travaux, nous proposons une classification simplifiée des composantes des approches réalistes en évaluation (Champagne et al., 2011a; Robert and Ridde, 2013). **L'analyse du contexte** s'intéresse au contexte organisationnel des parties prenantes du programme (leurs pratiques et stratégies, leurs liens d'influence en dehors du programme), à la pertinence du programme en regard du contexte et de la situation problématique, et à l'influence du contexte sur le programme. L'histoire du programme est aussi incluse dans l'analyse du contexte. **L'analyse du processus** s'intéresse à la qualité du processus de fonctionnement du programme au moment où il est évalué. Elle s'intéresse aux liens entre les ressources utilisées et les résultats. **L'analyse des résultats et impacts** englobe l'analyse des résultats et l'analyse logique. L'analyse des résultats s'intéresse aux résultats voulus et non attendus. L'analyse logique examine le chemin causal entre objectifs, moyens et résultats (**Figure 1**).

En effet, les composantes d'un PPP, et donc ces différentes analyses, sont importantes à considérer selon la méthodologie de la théorie du changement. Cette méthodologie s'attache à comprendre la manière dont les activités entreprises dans le cadre d'un programme donnent lieu à une chaîne de résultats dans un contexte donné. Il faut ainsi être en mesure de vérifier si les résultats observés ont bien été causés par les activités mises en œuvre par le programme. Les résultats d'une analyse de processus permettent une compréhension approfondie du fonctionnement du programme, et ces informations peuvent alors aider à améliorer les activités futures du programme et donc ses résultats (Breuer et al., 2016).

Dans cette thèse, les approches d'évaluations s'appuieront sur des approches intégrées. Dans la lignée de chercheur·es en santé publique, nous essaierons de poser la durabilité comme un critère qui soutient l'évaluation des PPP en santé animale (Brousselle and Butzbach, 2018). L'évaluation des PPP en santé animale devrait être en mesure de considérer la contribution de ces PPP à la durabilité d'un territoire (**Figure 1**).

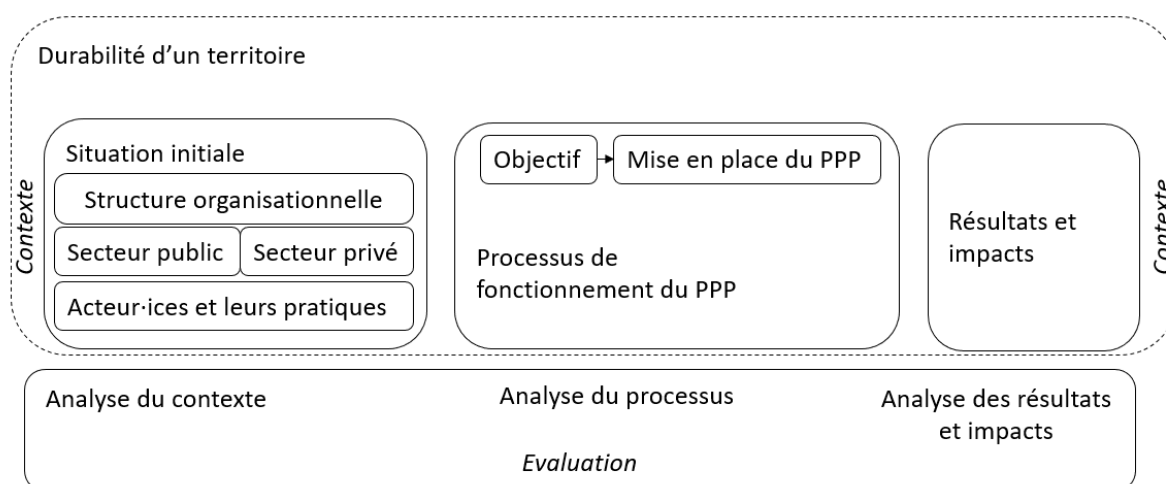


Figure 1 : Les composantes des PPP qui seront considérées dans cette thèse et les types d'évaluation des programmes sur lesquels s'appuie cette thèse

Dans cette thèse, l'évaluation est pensée comme un moyen d'améliorer le processus et les résultats des PPP dans le but de contribuer à la durabilité des territoires. Les solutions recherchées seront contextualisées et diversifiées et ne reposeront pas sur la mise en place d'un modèle universel. L'évaluation est pensée comme un outil qui aide à travailler avec la complexité et non pas qui essaye de la réduire (Mahoney et al., 2009). Pour y arriver, tout comme dans les approches de santé publique durables, nous reconnaissons l'importance des approches multisectorielles et l'engagement de différentes parties prenantes dans l'évaluation des PPP (Bloom, 2007). Ainsi, les pratiques de recherche participative dans l'évaluation des PPP seront mobilisées pour nous guider dans l'intégration des disciplines et des différentes perspectives.

Nous proposons ici une définition des évaluations intégrées. Les évaluations intégrées sont des évaluations s'intéressant aux différentes composantes d'un programme et aux liens de causalité entre celles-ci. Elles prennent en compte l'évaluation des résultats du programme, mais aussi du processus mis en œuvre pour sa réalisation et le contexte dans lequel s'insère le programme, deux aspects clé qui influencent les résultats du programme. Elles s'appuient sur des connaissances issues de différentes disciplines, et sur la pluralité des points de vue des acteur-ices impliqués ou impactés par le programme évalué. Ces évaluations s'intéressent à l'influence du programme sur les quatre dimensions de la durabilité que sont la société, l'économie, la gouvernance et l'environnement.

2. Les PPP en santé animale considérés dans ces travaux

Cette thèse a pour sujet les PPP nationaux dans le domaine vétérinaire qui ont pour objectifs la surveillance, le contrôle et la gestion des maladies animales ou zoonotiques infectieuses, et l'accès aux produits ou services vétérinaires. Les partenaires publics sont les services vétérinaires publics nationaux ou locaux. Les partenaires privé-es peuvent être par exemple des vétérinaires privé-es mandaté-es (PPP de type 1, dit « transactionnel »), des associations d'éleveur-ses (PPP du type 2, dit « collaboratif »), ou des entreprises nationales (PPP de type 3, dit « transformatif »).

De nombreux PPP ne seront pas considérés dans cette thèse :

- (i) Les PPP pour la construction et le maintien d'infrastructures, car ils impliquent des exigences d'évaluation spécifiques : le contrat signé pour plusieurs décennies inclut souvent des termes et conditions très techniques pour la construction, l'entretien et le paiement du loyer de l'infrastructure entre les différents partenaires ;
- (ii) Les PPP internationaux, impliquant des organisations internationales, car ils nécessitent une étude particulière des réglementations internationales et de la gouvernance intergouvernementale ;
- (iii) Les PPP ne correspondant pas au cadre du projet, comme les PPP pour le développement de nouveaux produits, les PPP dans le domaine vétérinaire n'incluant pas les services vétérinaires, les PPP pour les animaux de compagnie ou les chevaux (répondants à des logiques économiques très différentes que celles pour le contrôle de maladies infectieuses d'animaux d'élevage), des PPP pour l'enseignement vétérinaire ou des PPP pour le développement de produits.

Nous nous inspirerons des méthodologies d'évaluation développées pour les PPP en santé publique. En effet, il nous apparaissait plus pertinent d'investiguer ce domaine au vu des similarités des missions (préventions et contrôles de maladies infectieuses et accès aux services de santé publique) comparé, par exemple, au domaine de l'agriculture. En agriculture, un grand nombre de PPP concerne en effet la construction et le maintien de grandes infrastructures (Maatala et al., 2017b)

3. La problématique

L'objectif général de cette thèse est de contribuer au développement d'un cadrage et de méthodologies d'évaluation intégrée des PPP en santé animale. Pour cela, nous chercherons à identifier les attributs et propriétés des PPP en santé animale qui informeraient l'évaluation du processus et de la portée de ces PPP. Plusieurs difficultés empêchant une évaluation intégrée des PPP dans le domaine vétérinaire ont été soulevées dans l'introduction (**Figure 2**).

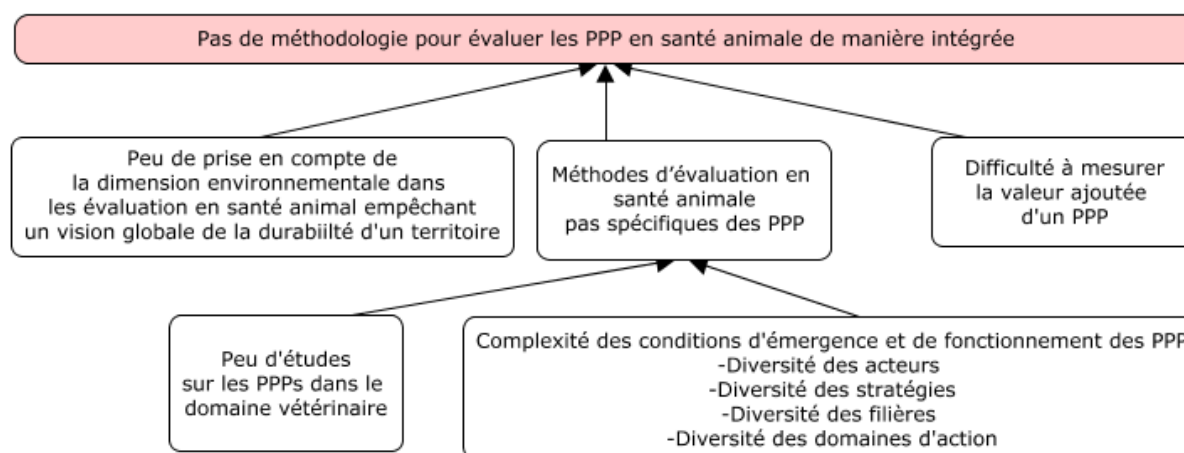


Figure 2 : arbre à problème de l'évaluation des PPP en santé animale

La question générale de recherche de cette thèse peut se formuler ainsi : « **quels attributs et propriétés des PPP en santé animale devraient être pris en compte pour une évaluation intégrée de ces PPP ?** ». Cette question peut se découper en quatre sous-questions qui sont associées chacune à une hypothèse (**Figure 3**) :

1) *Quels éléments du contexte sont à considérer dans l'évaluation des PPP en santé animale ?*

Le contexte sanitaire, social, politique, économique et environnemental influence les stratégies des acteur·rices, et donc l'organisation du PPP. Une compréhension du contexte est primordiale pour être en mesure de fournir des recommandations pertinentes à l'issue du processus d'évaluation.

2) *Quels attributs et propriétés du processus de fonctionnement dans un PPP en santé animale sont à considérer dans l'évaluation ?*

Pour comprendre les succès et les échecs de ces PPP, le processus de fonctionnement du PPP ayant menés aux résultats (succès ou échecs), est important à prendre en compte dans l'évaluation pour pouvoir dégager des pistes d'amélioration du fonctionnement du PPP et donc de ses résultats.

3) *Quels sont les résultats (bénéfices et risques) et impacts permis par des PPP, et est-il possible d'évaluer la contribution du PPP pour y parvenir ?*

Les impacts sont les effets positifs et négatifs, directs ou indirects, intentionnels ou non, induits par un programme. L'élevage représentant un enjeu en termes de santé publique, d'environnement et de stabilité socio-économique, une intervention en santé animale par le biais de PPP peut donc avoir des effets diffus et variés. Au vu de la complexité des facteurs influençant des résultats et l'importance du contexte dans lequel est implémenté un PPP, modéliser ou trouver un contrefactuel existant est presque impossible. Un moyen de dépasser cette difficulté serait de s'attacher à décrire les liens de causalités entre les moyens et les résultats pour comprendre la contribution du PPP à ces résultats.

4) *Quelle influence des PPP sur les systèmes d'élevage et la durabilité d'un territoire national ?*

Cette question est transversale aux autres questions. Une évaluation intégrée doit permettre une vision holistique des PPP implémentés. Dès lors, il faut penser à l'influence de l'élevage dans son territoire. L'objectif à long terme d'un PPP de santé des animaux d'élevage devrait être de participer à une meilleure durabilité du territoire en influençant les systèmes d'élevages, c'est-à-dire participer à la bonne santé animale et santé publique, à la situation économique, et sociale et à la bonne gouvernance de l'élevage ; tout en respectant les limites planétaires et en permettant une bonne santé de l'environnement. Cependant, nous précisons dès à présent que cette question ne sera que partiellement traitée dans les différentes études. Nous reviendrons sur cette question dans la discussion générale et dans les perspectives.

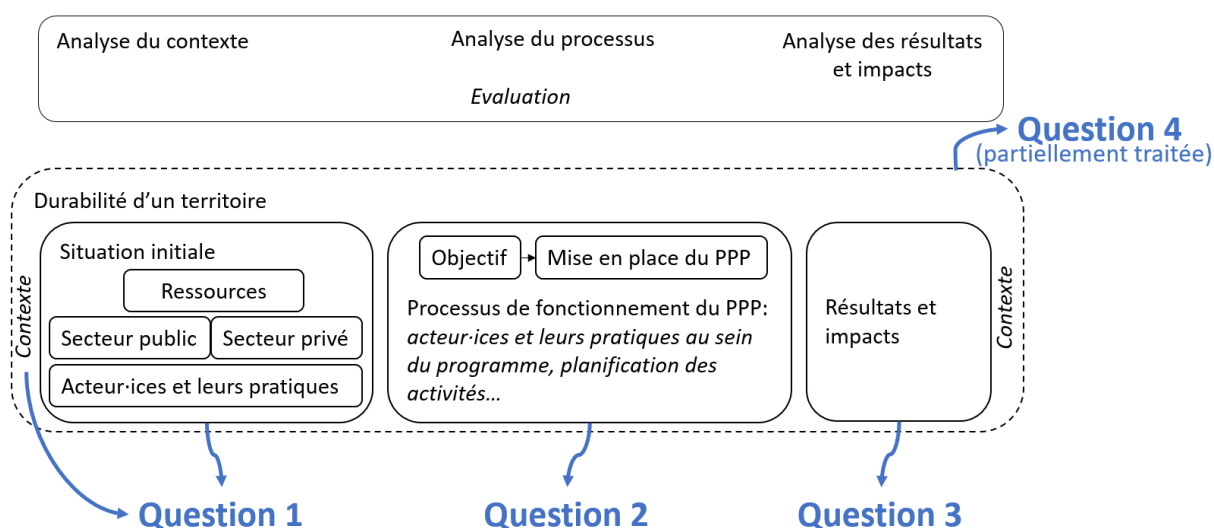


Figure 3 : les questions de recherche portent sur les différentes composantes d'un PPP pris en compte dans un approche réaliste de l'évaluation.

4. Le modèle d'analyse

Pour répondre à ces questions, nous proposons de nous appuyer sur le modèle d'analyse présenté dans la **Figure 4**. Ce modèle s'intéresse à l'analyse du contexte (*écriture italique*), à l'analyse du processus de fonctionnement du PPP (rectangles gris) et aux évaluations de résultats du PPP (rectangles blancs encadrés d'une ligne en pointillés).

Dans l'analyse du contexte, nous essaierons de comprendre quels éléments ont influencé l'émergence, la mise en place et la structuration du PPP évalué. Les éléments pourront être des éléments sociétaux tels que les pratiques des acteur·rices (rectangle bleu), économiques tels que les ressources financières disponibles (rectangle orange), des éléments environnementaux tels que la disponibilité des terres (rectangle vert) ou des éléments de gouvernance tels que la structure organisationnelle des acteur·rices et leurs liens d'influence (rectangle jaune). L'histoire du programme est aussi comprise dans l'analyse de contexte.

Dans l'évaluation du processus de PPP, le modèle d'analyse s'intéresse aux éléments du PPP qui influencent son organisation et son fonctionnement.

Enfin, dans l'évaluation des résultats, le modèle s'intéresse aux résultats de santé animale directement permis par le PPP. Comme les résultats en matière de santé animale pourront influencer l'ensemble du système d'élevage, le modèle considère aussi les résultats indirects du PPP sur la structure socio-économique (rectangles bleu et orange), les aspects environnementaux (rectangle vert) et les mécanismes de gouvernance (rectangle jaune) du territoire national.

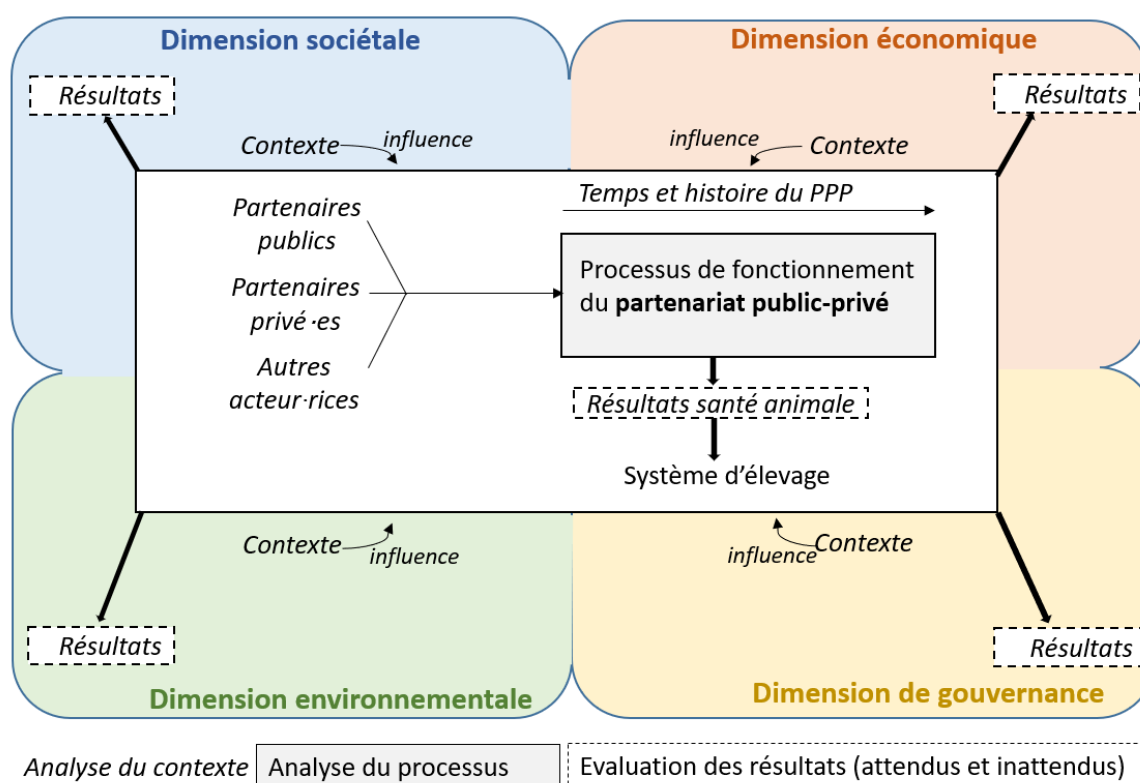


Figure 4 : le modèle d'analyse sur lequel repose cette thèse

Nous signalons dès à présent que, malheureusement, la dimension environnementale a peu été explorée dans les différentes études qui composent ce manuscrit. Cela peut s'expliquer en partie par le fait que la deuxième période de terrain au Paraguay qui était prévue, lors de laquelle cette dimension devait explicitement être abordée, n'a pas pu se réaliser en raison de la pandémie de Covid 19. Dans la discussion, nous présenterons d'autres difficultés liées à l'opérationnalisation de la prise en compte de la dimension environnementale dans l'évaluation de PPP, et plus largement des programmes en santé animale, et dans les perspectives nous proposerons des pistes pour dépasser ces difficultés.

Méthodologie générale

1. La démarche

Cette thèse s'insérant dans un projet de l'OIE, les travaux avaient pour double mission de répondre à des demandes de l'OIE et de poser une approche de recherche.

Ce travail de thèse s'appuie à la fois sur des cadres préexistants (de l'approche réaliste en santé publique et de la durabilité présentés en introduction), sur une revue de la littérature, et sur quatre cas d'étude qui ont fait émerger des thèmes d'évaluation.

Une revue de la littérature sur les évaluations des PPP pour la santé animale et la santé publique, suivant les lignes directrices de la méthodologie Prisma, étendue aux études exploratoires (scoping review) (Tricco et al., 2018), a permis d'identifier les différentes méthodologies et critères d'évaluation existants. Quatre cas d'étude ont été sélectionnés pour explorer les possibilités d'opérationnalisation des différents types d'évaluations (de contexte, du processus et des résultats) : au Paraguay, au Laos, en Tunisie, en Ethiopie. Les études de cas, c'est-à-dire l'étude d'une unité particulière – dans notre cas un PPP, permettent d'étudier cette unité de manière approfondie et détaillée en situation réelle et ainsi d'étendre les connaissances sur ces unités. S'appuyer sur des études de cas, peut être particulièrement utile pour comprendre comment différents éléments du PPP étudié s'imbriquent et comment différents éléments (mise en œuvre, contexte et autres facteurs) ont produit des résultats (Balbach, 1999; Flyvbjerg, 2006; Morra and Friedlander, 1998). Pour chaque étude de cas, nous nous sommes penchés sur un type d'analyse ou d'évaluation. Pour un des cas d'étude (Paraguay), une évaluation intégrée regroupant les différents types d'évaluations était planifiée. Cependant, la deuxième phase de terrain au Paraguay n'a pas pu se dérouler en raison de la pandémie de Covid 19, empêchant la réalisation de cette ambition. Finalement, pour finaliser le développement d'un outil d'évaluation du processus d'un PPP, une élicitation d'opinion d'expertes a été menée.

2. Sélection des études de cas

Comme mentionné, ces travaux de thèse s'appuient sur quatre études de cas, situées au Paraguay, au Laos, en Tunisie et en Ethiopie (**Figure 1**). Deux des études de cas, les PPP en Éthiopie et au Paraguay, ont explicitement été sélectionnées par l'OIE, car vues comme des PPP réussis pouvant servir d'exemple. Dans le projet, il a été décidé de commencer les études de cas par des PPP mis en œuvre depuis longtemps et réussis. L'hypothèse était que l'analyse de PPP réussis pouvait nous renseigner des critères importants à considérer dans l'évaluation. En effet, en évaluation, l'analyse de cas de réussite (comme des PPP) peut être une approche utile pour développer une compréhension des facteurs qui favorisent ou entravent les résultats ou impacts (BetterEvaluation, 2019). Ces deux cas ont été identifiés suite à l'enquête en ligne répertoriant les 97 PPP dans le monde et à des contacts internes de l'OIE.

Une évaluation a été réalisée pour le PPP en Ethiopie, mais pas pour le PPP au Paraguay. En effet, la deuxième phase de terrain au Paraguay n'ayant pas pu se réaliser, nous ne parlerons pas d'évaluation pour ce cas d'étude. A noter que pour ces deux études de cas, les parties prenantes du PPP n'étaient pas demandeuses d'évaluation. En revanche, elles se sont montrées intéressées par la démarche et ont accepté de nous accueillir et de mettre en place des démarches participatives pour l'analyse de leur PPP. Le cas d'étude en Tunisie a quant à lui été inclus car les parties prenantes de ce PPP ont formulé une demande d'évaluation à l'OIE et au Cirad. Une évaluation du processus de ce PPP a été réalisée. Quant au cas d'étude au Laos, il a été inclus car les données récoltées lors de mon stage de master représentaient une opportunité d'explorer la méthodologie des cartographies de parties prenantes pour l'analyse de contexte. L'objectif de développement d'un cadre d'évaluation intégrée des PPP qui puisse correspondre à une diversité de PPP sous-tend notre choix de s'appuyer sur quatre différents cas d'étude. Le cas d'étude au **Paraguay** correspond à un PPP entre les services vétérinaires publics et une association d'éleveurs pour le contrôle de la fièvre aphteuse chez les bovins. Ce PPP appartient au **type 2 « collaboratif »**. L'étude de cas du **Laos** correspond à la mise en place de nouvelles réglementations sur l'utilisation des antibiotiques vétérinaires dans une perspective **ex ante** d'un éventuel PPP entre les services vétérinaires publics et les vendeurs et utilisateurs d'antibiotiques. L'étude de cas en **Tunisie** correspond au mandat sanitaire, par lequel les services vétérinaires publics délèguent des fonctions aux vétérinaires privés agréés pour le contrôle des maladies animales prioritaires. Ce PPP appartient au **type 1 « transactionnel »**. L'étude de cas en Ethiopie correspond à une collaboration entre les services vétérinaires publics et une entreprise du secteur de la volaille. Ce PPP appartient au **type 3 « transformatif »**.

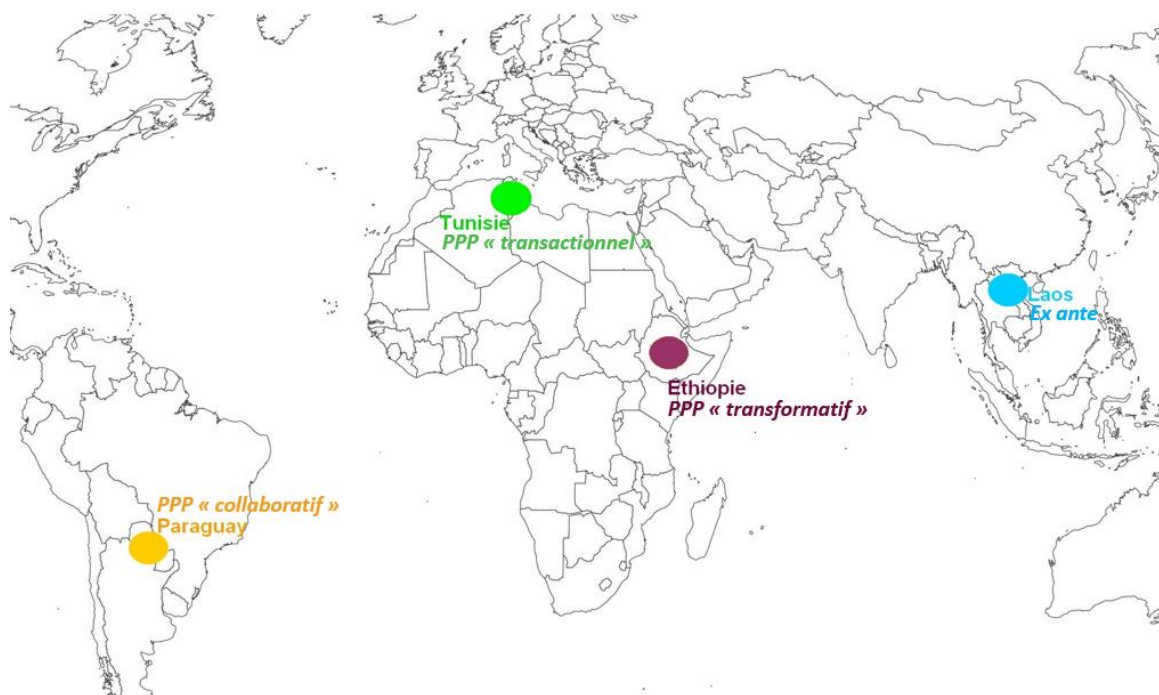


Figure 1 : Les quatre cas d'étude soutenant ces travaux de thèse.

3. Récolte de données

3.1 Méthodes communes aux différentes études de cas

Nous avons donc réalisé deux évaluations (du PPP en Ethiopie et du PPP en Tunisie) et deux autres analyses (au Paraguay et au Laos). Lors des études de cas, nous nous sommes intéressés aux points de vue des parties prenantes (Olivier de Sardan, 2012a) impliquées ou impactées par ces PPP. Pour appréhender l'organisation des PPP et leurs effets tels que perçus par ces acteur·rices, et ainsi favoriser une vision systémique du PPP concerné, nous nous sommes intéressés à leurs opinions, perceptions, et interprétations du PPP. Nous avons principalement utilisé des méthodes qualitatives, et dans une moindre mesure quantitatives (Robert and Ridde, 2013).

Les méthodes quantitatives ont concerné des questionnaires en ligne (pour l'élicitation d'opinions d'expert·es). Les méthodes qualitatives ont principalement concerné l'observation, les entretiens semi-structurés, les entretiens de groupes, les ateliers, et les sources écrites (Olivier de Sardan, 2012b). L'observation directe a, par exemple, porté sur le fonctionnement de réunions des conseils exécutifs du PPP ou le fonctionnement de la mise en place de la vaccination au Paraguay (**Figure 2**). Les entretiens individuels semi-directifs, dans le sens où ils n'étaient ni entièrement ouverts, ni canalisés par un grand nombre de questions précises, mais cadrés par des guides d'entretiens préalablement établis, ont été menés pour saisir des points de vue individuels (Mariner and Paskin, 2000). Des entretiens semi-structurés ont aussi été menés en groupe, principalement pour des raisons de contraintes de temps. Ces entretiens de groupes peuvent masquer les opinions individuelles (Mariner and Paskin, 2000), mais afin de favoriser une information validée de manière consensuelle, les groupes étaient constitués d'acteur·rices homogènes (Campenhout et al., 2017a). Les entretiens ont été menés de manière respectueuse, les chercheur·es essayant d'établir une bonne atmosphère et veillant à être le plus neutre possible.



Figure 2 : Observation de la campagne de vaccination contre la fièvre aphteuse au Paraguay.

Pour les deux évaluations réalisées (Tunisie, Ethiopie), nous parlerons d'évaluation participative dans le sens où les questions d'évaluation ont été définies avec les acteur·rices du PPP et que les sorties d'évaluations ont été co-construites avec les acteur·rices (BetterEvaluation, 2012a). Pour le cas d'étude au Laos, nous parlerons de cartographie d'acteur·rices participative, car la cartographie a été co-construite avec les acteur·rices concerné·es. Des ateliers participatifs ont été menés en Ethiopie et au Laos dans un but de co-construction, comme par exemple dans l'élaboration des recommandations pour améliorer le PPP en Ethiopie. Le cas d'étude en Tunisie a été mené lors de la pandémie de Covid 19 et des ateliers n'ont pas pu être organisés. Au Paraguay, nous nous sommes appuyés sur des approches qualitatives, mais ne parlerons pas d'approches participatives car la contrainte du temps ne nous a pas permis de co-construire des résultats avec les acteur·rices.

Finalement, les données ont été complétées par le recueil et l'analyse de sources écrites telles que des revues scientifiques, des documents législatifs, des archives ou des sources liées au PPP en question (ce que l'on nomme des données secondaires, car elles ont été récoltées par des personnes autres que les chercheur·es, en fonction d'un autre objectif que celui lié à l'objectif de recherche): contrats entre les deux parties, analyses internes des résultats techniques du PPP, rapports des organisations.

3.2 L'analyse de contexte

Pour opérationnaliser l'analyse du contexte, dans une première étude, nous nous sommes intéressés à une perspective historique du PPP au Paraguay. Nous ne sommes pas partis d'une méthodologie préexistante. Les données ont consisté en des entretiens semi-structurés et des analyses de rapports et d'archives (**Figure 3**). Nous nous sommes également intéressés au contexte sanitaire, de gouvernance et socio-économique, qui a pu influencer l'histoire du PPP. Le contexte environnemental et son influence sur le PPP n'ont pas été explicitement explorés.



Figure 3 : récolte de données au Paraguay pour permettre une perspective historique

Dans une deuxième étude au Laos, nous nous sommes appuyés sur la méthodologie de l'analyse des parties prenantes (Schmeer, 1999) pour s'intéresser aux pratiques des acteur·rices et leurs liens d'influence existants avant PPP et s'interroger sur la façon dont ceux-ci peuvent influencer l'émergence et la structuration d'un éventuel PPP. L'analyse des parties prenantes est un processus de collecte et d'analyse d'informations qualitatives visant à déterminer quels intérêts doivent être pris en compte lors de l'élaboration et/ou de la mise en œuvre d'un programme (Schmeer, 1999). Cependant, il est à noter que dans ces analyses, l'analyse des ressources des parties prenantes (Brugha, 2000) et des enjeux de pouvoir entre elles est centrale mais n'a été que brièvement abordée dans cette étude, et c'est pour cela que nous parlons de cartographie d'acteur·ices et non pas d'analyses de parties prenantes (**Figure 4**).



Figure 4 : élaboration d'une cartographie de parties prenantes lors d'un atelier participatif au Laos.

Nous sommes conscient·es que dans l'analyse du contexte d'autres éléments aurait pu être explorés tels que l'influence des accords commerciaux internationaux, ou l'influence de la dimension environnementale d'un territoire. Ces deux études sont des propositions d'opérationnalisation d'analyse du contexte, parmi d'autres possibles.

3.3 Développement d'un outil pour l'évaluation du processus

Pour opérationnaliser l'analyse du processus nous avons développé un outil spécifique aux PPP en s'appuyant sur des outils préexistants (Bordier et al., 2019; Hendrikx et al., 2011), sur les cas d'étude au Paraguay et en Ethiopie et sur une élicitation d'opinions d'expert·es (Bojke et al., 2021).

3.4 L'évaluation des résultats et des impacts

Pour l'évaluation d'impact en Ethiopie, nous nous sommes appuyés sur la méthodologie du chemin d'impact (Douthwaite et al., 2003). Cette étude aborde donc aussi l'analyse de contexte et l'analyse du processus, en plus de l'évaluation des résultats, car elle cherchait à expliciter les liens entre les différentes composantes de ce PPP. L'identification des impacts a été réalisée par les acteur·rices impliquées dans et impactées par le PPP, sans à priori. Ainsi, le cadre de la durabilité n'a pas explicitement été amené.

3.5 Les approches d'évaluation non explorées dans cette thèse

Si les potentiels risques des PPP pour la santé des animaux d'élevage ont été identifiés lors de la revue de la littérature, l'entrée de ces études de cas ne s'est pas faite par des analyses de risques qui auraient permis l'identification de différents types de risques liés au PPP étudié et ainsi d'y être attentifs. Nous reconnaissons que des analyses de risques auraient permis d'avoir une compréhension plus approfondie des PPP étudiés et nous y reviendrons en discussion.

L'impact d'un PPP sur la dimension environnementale aurait pu être exploré grâce à des analyses de cycle de vie, mais lié à la pandémie de Covid 19, ces analyses n'ont pas pu être réalisées. Nous reviendrons sur ce point dans la discussion, et un protocole pour mettre en œuvre ces analyses au Paraguay est proposé en annexe de la discussion.

Il est aussi à noter que nous ne nous intéresserons pas de manière approfondie à l'évaluation des coûts des PPP, même si nous aborderons les mécanismes de financements du PPP lors de l'analyse du processus. Nous aborderons l'évaluation des coûts dans les perspectives de la discussion générale. Nous ne proposons pas non plus d'analyse des contrats des PPP. En effet, au sein de l'OIE, un service est spécialisé dans le soutien législatif vétérinaire et dans l'élaboration de contrats des services vétérinaires nationaux (World Organisation for Animal Health, 2020a).

Finalement, nous n'avons pas comparé les résultats des PPP étudiés à des contrefactuels, même si nous reconnaissons l'importance de ces contrefactuels. En effet, au vu de la complexité des facteurs influençant des résultats et de l'importance du contexte dans lequel un PPP est mis en œuvre, modéliser un contrefactuel aurait nécessité de consacrer une grande partie du temps de thèse à ce développement, et le choix de ne pas se pencher sur cette problématique a été fait. Ainsi, dans les cas d'étude, nous ne pouvons être sûrs de ce qui se serait passé si les PPP n'avaient pas été mis en œuvre. Cependant, dans le chapitre « analyse des résultats et impacts » nous avons mobilisé la méthodologie du chemin d'impact, qui en cherchant à expliciter les liens entre les différentes composantes du programme, permet de s'intéresser à l'attribution causale entre le programme et la production d'impact. Ainsi, cette méthodologie, qui ne s'appuie pas sur des contrefactuels, permet tout de même d'identifier les impacts d'un programme. Nous reviendrons sur ce point dans les perspectives présentées dans la discussion générale.

4. Sélection des participant·es

Dans les études de cas, nous avons essayé de capturer la diversité des points de vue des acteurs impliqués dans les PPP, mais aussi acteurs impactés par les PPP pour favoriser une vision systémique du PPP concerné et de ses effets. Cependant, il est à noter que la porte d'entrée dans les cas d'étude était par des acteur·rices des services vétérinaires centraux et/ou des partenaires privé·es clé des services vétérinaires (lié au fait que cette thèse s'insère dans un projet de l'OIE). Les portes d'entrée dans les cas d'étude influencent le choix des personnes à inclure dans l'étude et nous y reviendrons dans la discussion. La méthodologie d'échantillonnage est précisée pour chaque étude dans les chapitres correspondants. Au Paraguay et en Tunisie, principalement due à une contrainte de temps, seules les parties prenantes impliquées dans les PPP ont été incluses, des secteurs public et privé, et du niveau central et régional. En Ethiopie, des acteur·rices impactées par les PPP, y compris des opposant·es au PPP ont été incluses, permettant de favoriser une vision systémique du PPP.

Les expert·es qui ont participé à l'élucation d'opinion d'expert·es pour le développement d'un outil d'évaluation du processus du PPP sont de diverses origines, impliqué·es directement ou indirectement dans des PPP de longue durée. L'invitation à participer à cette étude a été envoyée au groupe des 42 expert·es que l'OIE avait constitué pour élaborer un guide de bonnes pratiques (World Organisation for Animal Health, 2019b), identifiés grâce à l'enquête en ligne recensant 97 PPP dans le monde. Parmi les 42 expert·es invité·es, 27 ont accepté de participer au premier tour de l'enquête, et 25 de ces 27 expert·es ont également accepté de participer au deuxième tour. Parmi ces 27 expert·es, 8 étaient des partenaires privé·es (par exemple, des entreprises privées, des vétérinaires privés ou des associations vétérinaires, des organisations de producteurs), 3 des partenaires publics des services vétérinaires officiels et la plupart (n = 16) des partenaires indirects de PPP venant d'organisations internationales telles que l'OIE, l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO) et le Fonds international de développement agricole (FIDA). Parmi ces 27 expert·es, 8 sont liés à un PPP de type 1 dit « transactionnel », 5 à un PPP de type 2 dit « collaboratif », et 5 à un PPP de type 3 dit « transformatif », et 9 sont reliés à plusieurs PPP. Parmi ces 27 expert·es, 10 sont lié·es à des PPP mis en œuvre en Afrique, 7 en Asie et Pacifique, 4 en Europe, 2 dans les Amériques (seulement Amérique du Sud), et 5 expert·es sont lié·es à plusieurs PPP de différentes régions. Il est important de noter que ces expert·es sont des parties prenantes des PPP à un niveau central, et non pas des parties prenantes à un niveau régional, ni impactées positivement ou négativement par des PPP.

5. Echelle d'analyse

Dans ce manuscrit, l'échelle considérée sera celle du territoire national. En effet, ces travaux de thèse s'inscrivent dans un projet de l'OIE qui a pour mission le renforcement des services vétérinaires nationaux. Ce territoire national sera considéré comme un niveau d'organisation dans lequel se situent les PPP pour la santé des animaux d'élevage à évaluer (Vigne et al., 2017). On s'intéressera alors aux PPP et aux systèmes d'élevage sans prise en compte exhaustive des autres acteur·rices du territoire national. En d'autres mots, le territoire national n'est pas lui-même objet d'étude. Le territoire national est ici vu comme lieu de coordination entre acteur·rices multiples du PPP, en situation d'asymétrie de pouvoir, aux intérêts divergents, un lieu de négociation entre acteur·rices visant à mettre en cohérence des objectifs de ces PPP et des politiques publiques associées (Caron, 2017). Ainsi, dans les cas d'études, plusieurs régions ont été incluses (4 régions au Paraguay, 5 régions au Laos, 2 régions en Tunisie et 4 régions en Éthiopie) mais les spécificités régionales n'ont pas été explorées et les résultats ont été lissés à un niveau national.

Cependant, il aurait été intéressant d'explorer d'autres échelles d'analyses et nous aborderons ce point dans la discussion générale.

6. Analyses des données

Tous les entretiens et ateliers ayant été enregistrés, ont été transcrits mot à mot. Cette étape est particulièrement chronophage, mais très importante pour permettre une classification et une analyse rigoureuse de ses données. Les analyses des études de cas ont principalement été menées sur base d'analyses de contenu s'intéressant aux thèmes abordés, à la façon dont l'interviewé les développe, et/ou à leur récurrence. Les analyses de contenus permettent de traiter de manière méthodique des informations et des témoignages des entretiens et des ateliers. Dans certains cas, ces analyses de contenu servaient à la découverte de nouvelles idées. Dans d'autres cas, nous avons utilisé l'analyse de contenu thématique pour regrouper les informations par thèmes pertinents selon nos hypothèses de travail et les organiser selon une structure qui leur donne sens (comme par exemple la structure du chemin d'impact pour le cas d'étude en Éthiopie) (Campenhoudt et al., 2017a).

7. Structuration du manuscrit

Le manuscrit est organisé en quatre chapitres (**Figure 5**). Le **chapitre 1** présente une revue exploratoire de la littérature sur les cadrages et les méthodologies des évaluations de PPP dans le domaine vétérinaire et de la santé publique. Le **chapitre 2** propose deux analyses de contextes : une perspective historique d'un PPP au Paraguay et un résumé d'une cartographie de parties prenantes au Laos dans une perspective *ex ante* d'un potentiel PPP. Le **chapitre 3** développe un outil d'évaluation de la qualité du processus des PPP. Cet outil a ensuite été appliqué à un PPP en Tunisie. Le **chapitre 4** décrit l'application d'une démarche participative d'analyse du chemin d'impact pour identifier les résultats et impacts d'un PPP en Ethiopie.

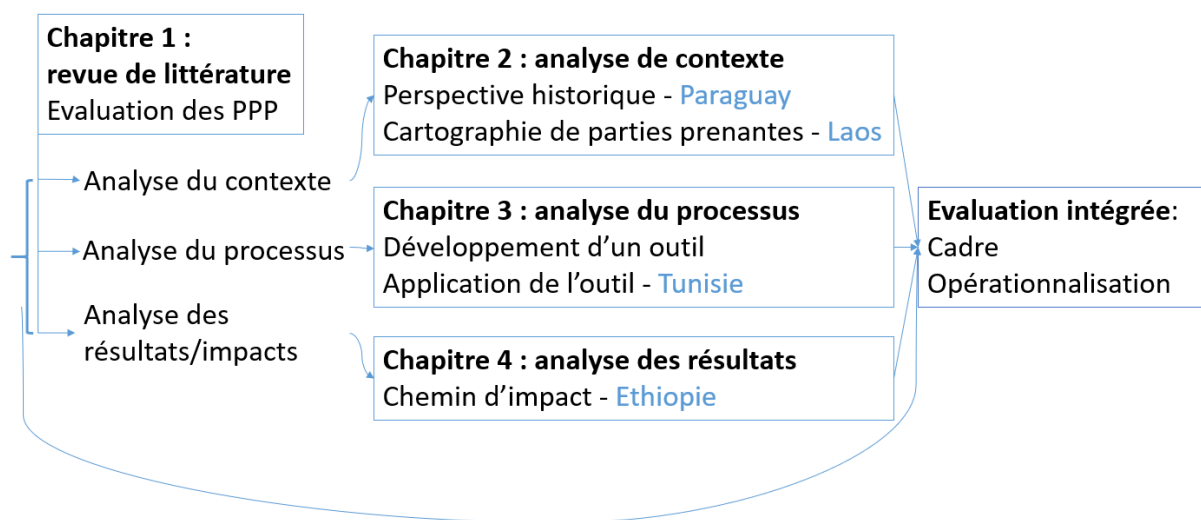


Figure 5 : structuration du manuscrit de thèse découpé en quatre chapitres.

Section études

Chapitre 1

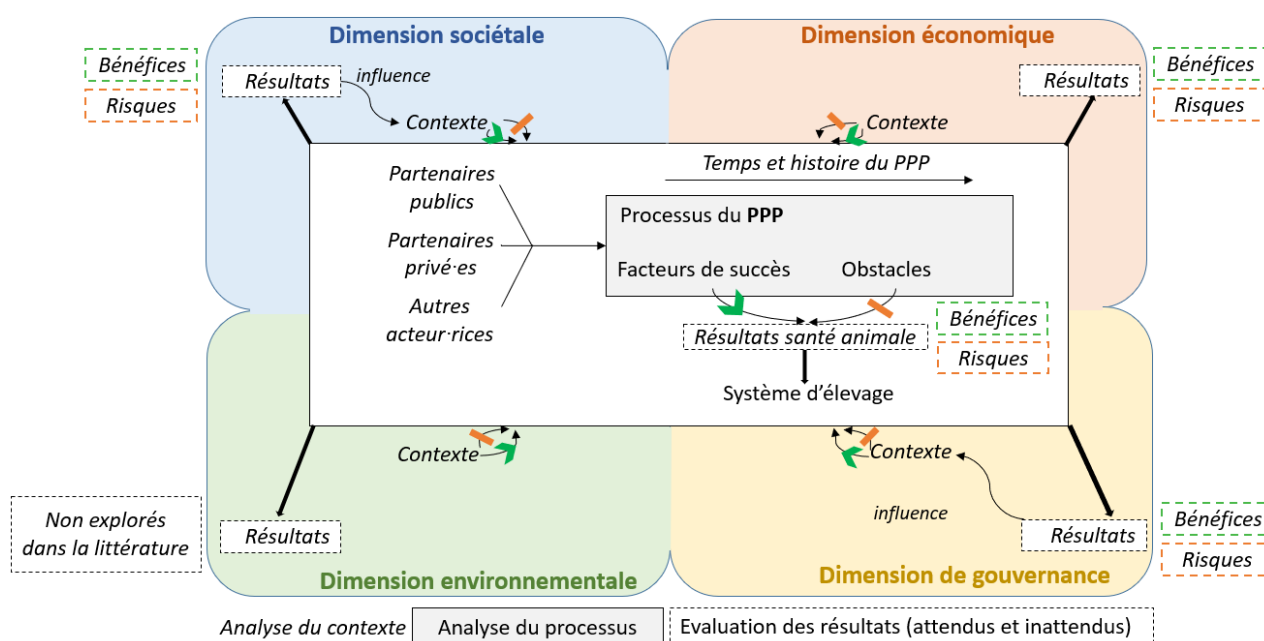
Chapitre 1. Evaluation des PPP : les méthodes existantes

Cette étude a été soumise dans un journal a comité de lecture

Préambule chapitre 1

L'objectif final de cette thèse étant de développer un cadre d'évaluation intégrée pour les PPP dans le domaine vétérinaire, il était important de se pencher sur la littérature à ce sujet. Une revue exploratoire de la littérature, suivant les lignes directrices de la méthodologie Prisma pour les scoping review, a été réalisée. Une première recherche a montré que peu d'articles s'étaient intéressés aux PPP pour la santé des animaux d'élevage. Les critères de recherche ont donc été étendus au domaine de la santé publique, en supposant qu'au vu de la similarité des missions de ces deux domaines, les leçons tirées de l'évaluation des PPP dans le domaine de la santé publique pourraient être transposables au domaine de la santé des animaux d'élevage. Les modèles théoriques, les méthodes et critères d'évaluation utilisés pour l'analyse du contexte, l'analyse du processus ou l'analyse de résultats en santé publique et dans le domaine vétérinaire ont été identifiés.

La revue de littérature a permis d'identifier des facteurs clés de succès (flèches vertes) qui vont favoriser la mise en place du PPP et son bon déroulement pour l'atteinte de résultats positifs et des obstacles (barre orange) qui, au contraire, vont les entraver (**Figure 1**). Les facteurs de succès et les obstacles peuvent être liés au contexte ou au processus de fonctionnement du PPP. Des résultats en termes de santé, de société, d'économie et de gouvernance ont été identifiés. Ces résultats peuvent être positifs (bénéfices) mais aussi négatifs (risques) (**Figure 1**). Certains résultats sociétaux (par exemple la création de confiance entre les partenaires) ou de gouvernance (par exemple l'évolution de l'environnement législatif) peuvent avoir des influences sur le contexte et favoriser ou entraver la mise en place d'autres PPP (**Figure 1**). La dimension environnementale n'a pas été explorée dans les documents analysés dans cette revue.



Title: Evaluation of public-private partnerships for livestock health: a scoping review

Mariline Poupaud^{1,2*}, Margot Galière^{3,4}, Isabelle Dieuzy-Labaye⁵, Nicolas Antoine-Moussiaux², Marisa Peyre¹

¹ UMR ASTRE, Univ Montpellier, Cirad, INRA, Montpellier, France.

² Fundamental and Applied Research for Animals and Health (FARAH), University of Liège, Liège, Belgium.

³ France Vétérinaire International (FVI), Paris, France

⁴ Association vétérinaires éleveurs du millavois (AVEM), Millau, France

⁵ World Organisation for Animal Health (OIE), Paris, France.

Abstract

Livestock represents an opportunity and a challenge for sustainability of a territory in terms of public health and food security, socio-economic stability, and interaction with the environment. Public and private actors work together to improve livestock health management. These collaborations can lead to public-private partnerships (PPPs). PPPs for livestock health are being implemented worldwide but few have been evaluated. The main objective of this work was to identify evaluation criteria of PPP for livestock health, considering the influence of these PPP on the contribution of the livestock system to the sustainability of a country or territory. A scoping review was conducted using three databases (Medline, CAB abstracts, Embase). Out of 881 documents screened, 37 were selected. The present study, through a rigorous scoping review, represents solid data summarizing methods and outcomes of evaluation of PPPs for livestock health. This work mapped not only livestock health outcomes but also social, economic, governance outcomes as well as evaluation criteria for context analysis and the quality of the PPP process. The environmental dimension of sustainability was not considered in the evaluation criteria of the documents analysed. Based on this scoping review, we discuss the need and the challenge to develop an evaluation framework that could be used by decision-makers and partners to assess the needs, added value and ways to improve PPPs and minimize their risk, and guide public policies to favour the contribution of PPPs to the sustainability of a territory.

Keywords: Evaluation, Animal Health Programs, Sustainability, Public-Private Partnership, veterinary domain

1. Introduction

Livestock and animal health represent both opportunities and challenges for the sustainability of many territories worldwide. 70% of emergent human diseases are of animal origin (Jones et al., 2008) while millions of people around the world depend on agricultural and livestock activities for their livelihoods (HLPE, 2016). With regards to environment, livestock can provide ecosystem services (such as fertility of soil and carbon sequestration), but this balance is fragile and global livestock production contributes also to negative impacts such as global warming (B. Dumont et al., 2019; Steinfeld et al., 2006).

To ensure good livestock health through surveillance, prevention, and control of zoonotic or contagious animal diseases, public and private actors may collaborate within livestock health programmes. These collaborations can lead to public-private partnerships (PPPs) for livestock health programme, defined as “a joint approach in which the public and private sectors agree responsibilities and share resources and risks to achieve common objectives that deliver benefits in a sustainable manner” (World Organisation for Animal Health, 2020c). Galière et al. provided in 2019 the first census of PPPs for livestock health, analysing 97 examples of PPPs implemented worldwide. This work highlighted the various type of private actors- such as private veterinarians, producer associations or private companies producing or distributing veterinary products- and the various type of governance (e.g. formal contract or informal collaboration) of PPPs (Galière et al., 2019a). This work also highlighted the fact that PPPs for livestock health are diverse and go beyond the classic veterinary sanitary mandate whereby the public sector contracts the private sector to implement a sanitary action (e.g. vaccination campaign) (Galière et al., 2019a).

Evaluation is an important step in any programme cycle, including health programs, in order to plan, redefine strategies, initiate appropriate corrective actions, optimize resources and help to ensure the effectiveness of actions. Evaluation can focus on different aspects of the programmes such as the context, the process and/or the outcomes of the programme (Brousselle and Champagne, 2011). Evaluations of livestock health programme have mainly focused on efficiency by comparing the benefits (e.g. avoidance of productivity losses) with the costs of a programme (Rushton, 2007). These evaluations did not include any analysis of the collaboration and coordination mechanisms between the actors involved, which seem to be particularly decisive elements for the success of a PPP. Over the past 20 years, methodologies have been developed to allow other type of evaluations of livestock health programmes. Such evaluations highlighted the importance of the private sector in animal health surveillance programmes (Delabouglise et al., 2015) as well as the importance of trust between the actors involved and their acceptability in the system (Calba et al., 2015a; Pham et al., 2017). However, none of these evaluations focused explicitly on the PPPs for livestock health.

PPPs in public health have been studied since the 1980s (Roehrich et al., 2014). A parallel between programmes in public health field and livestock health programmes can be established, as both are concerned with surveillance, prevention and control of infectious diseases, and protection of the health of a population. Knowledge about evaluation of PPPs developed in the public health could provide guidance for developing an evaluation framework for PPPs for livestock health programmes. Literature reviews on PPPs in public health have been performed, but they did not focus on the evaluation itself (Johnston and Finegood, 2015; Roehrich et al., 2014).

In public health, the need to consider sustainability in evaluation has been mentioned, with an underlying assumption that PPP may contribute to increasing health inequalities, thus inviting reflection on the long term impact of the PPP (Nishtar, 2004). The concept of sustainability is indeed important to mobilize in the evaluation of PPPs to be able to take into account the long-term socioeconomic or environmental implications of the public-private interactions (Mahoney et al., 2009). Usually, three dimensions of sustainability are considered: economic development (e.g. creating value), social development (e.g. promoting equity), and environmental protection (e.g. limiting greenhouse gases and protecting biodiversity) (Adams, 2006). The importance of multi-sectoral approaches and community engagement in providing solutions to complex public health problems was highlighted (Bloom, 2007), underlying the importance to consider governance as a pillar of sustainability (Food and Agriculture Organization, 2013; James et al., 2015). Governance can be defined as all forms of coordination between actors, the diversity of explicit and implicit rules influencing the behaviour of actors. In this paper, we will consider governance as the fourth dimension of sustainability (James et al., 2015).

The main objective of this work was to identify evaluation criteria of PPP for livestock health programme, considering the influence of these PPP on the contribution of the livestock system to the sustainability of a country or territory. This paper focuses on PPPs for livestock health such as infectious disease prevention and control and access to services, that involve national or local veterinary services. Indeed, this study is part of a project from the World Organisation for Animal Health (OIE) that aims to understand the interaction between public veterinary services and the private sector. Therefore, we reviewed the existing literature about evaluations of PPPs for livestock health. Because little information was available, we also reviewed the existing literature for PPPs in public health with similar missions (i.e the prevention and control of infectious diseases and access to services). In this study, we have reviewed the existing PPP evaluations frameworks and methodology and identified the evaluation criteria to evaluate the context, process and outcomes of PPPs for livestock health and public health. This study allowed us to provide initial elements on how to carry out an evaluation of PPPs for livestock health and to identify avenues of research to be invested in to enable an evaluation framework of those PPPs.

2. Material and methods

2.1 Protocol

We followed the scoping review methodology to be able to summarize findings from a body of knowledge that is heterogeneous in methods or discipline and identify gaps in the literature to aid the planning and commissioning of future research (Tricco et al., 2018). Supplementary information on the protocol is available in **Appendix 1**. No protocol has been pre-published elsewhere. The article was written according to the PRISMA-ScR guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) (Tricco et al., 2018).

2.2 Identifying the research questions and relevant documents

Inclusion criteria. The literature search included documents published up to April 2021 in the English language. We considered PPPs for livestock health and PPPs in public health with objective(s) related to surveillance, prevention or control of human, zoonotic or animal contagious diseases; and/or for better delivery of veterinary/health products or animal/human health services. In this paper, PPP for livestock health programme was considered to indicate intersectoral relationships between the public veterinary services and private actors (private individuals such as veterinarians, farmers or private organizations such as producers, private companies, NGOs).

Documents were included in the scoping review if: (i) they described an evaluation of PPPs, (ii) they proposed a framework/methodology of evaluation of PPPs, (iii) they mentioned criteria for the evaluation. For the third inclusion criterion in public health, given the large number of documents, only documents offering theoretical perspectives (e.g overview article) or synthesis (e.g literature review) were included (descriptions of specific PPPs in public health were excluded). Evaluation framework is defined as general framework for evaluations of different PPPs by providing principles to guide the planning, management, and conduct of evaluations, and may include guidance on data sources and data management processes (BetterEvaluation, 2012b).

Data source. Three online scientific databases (Medline via Pubmed, CAB abstracts via Ebsco, and Embase) were used in this study to identify documents. A grey literature document was also included : a database, describing 97 PPPs for livestock health, retrieved in the context of the work undertaken between OIE and Cirad on PPP in the veterinary domain between 2017 and 2019 (World Organisation for Animal Health, 2020c) (**Figure 1**). The methodology for collecting information in this OIE database is described elsewhere (Galière et al., 2019a). For each PPP, the database contains information on the objectives of the PPP, the private partner, the public partner, the country, the source of funding, the key success factors, the obstacles, the evaluation performed, the outcomes (benefits and risks) of the PPP.

Some criteria (the key success factors and obstacles of PPPs) of this database were analyzed in the article by Galière et al. (2019) and are also included in this scoping review, while other criteria (methodologies of evaluation, benefits and risks of PPPs) were specifically analyzed for this study.

Literature Search. Three concepts were included in the search: ‘public-private partnership’, ‘veterinary domain’, and ‘public health’. In this article, veterinary domain was restricted to programmes for livestock health such as delivery of services or products for surveillance, prevention, or control of zoonotic or animal contagious diseases (according to the topic of interest of the OIE project in which this study takes place). Therefore, public health was restricted to delivery of services or products for surveillance, prevention, or control of zoonotic or human contagious diseases. The concept ‘evaluation’ was not written in the search, as it would have excluded articles not dealing with evaluation but mentioning important elements to be taken into account in an evaluation process. The full search equation is available in **Appendix 1**. All documents retrieved from the scientific databases were imported into Zotero® version 5.0 and duplicate documents were removed (**Figure 1**).

2.3 Document selection

The documents were selected through two screening phases: i) a first screening using titles and abstracts; ii) a second screening based on full text analysis (**Figure 1**). For both screening phases, the following four exclusion criteria were applied to stay within the scope of the OIE project:

- 1) documents not corresponding to the inclusion criteria (e.g: PPPs in the veterinary domain not including veterinary services, PPPs for the construction and maintenance of health facilities or infrastructure such as hospital, PPPs for food safety, PPPs for pets, PPPs for veterinary or public health education, PPPs for product development).
- 2) documents not addressing PPPs as their main study object and only briefly mentioning PPPs in the conclusion or as a recommendation.
- 3) global or international PPPs involving international organization, or multinational companies, because they require a particular study of international regulations. and intergovernmental operations.
- 4) PPPs to build infrastructure such as hospitals; because they imply specific evaluation requirements: the contract signed for several decades often includes very specific terms and conditions for the construction, maintenance, and rent payment of the infrastructure between the different partners.
- 5) opinion paper, commentary, letter to the editor and conference abstract.

A flow chart diagram of the selection process for this study was developed based on the PRISMA approach (**Figure 1**). One author (MPo) screened all titles and abstracts of retrieved documents. For the second screening phase, two authors (MPo and MG) screened 50% of the selected document using full text. Since the selection of document was similar between the two authors, MPo continued the screening of the other 50% of the documents using full text.

2.4 Data charting process

Two authors independently allocated 30% of the selected documents between the two databases and categorized their content. The distribution between the two databases and the categorization were similar between the two authors. Then, one author continued the allocation and categorization for the other documents.

The analysis of the documents was based on content analysis. Two different database templates, developed in Microsoft Excel® version 2007, were used to classify: i) the data from the documents describing a type of evaluation, ii) the important criteria to take into account in the evaluation process from all the documents (**Appendix 1**). The definitions of the concepts used in this study are given in **Appendix 1**.

2.5 Data items

Two different database templates, developed in Microsoft Excel® version 2007, were used to classify: i) the data from the documents describing an evaluation case study, ii) the criteria to take into account in the evaluation process from all the documents (**Appendix 1**). The analysis of the documents was based on content analysis. The categories used in each database were pre-determined.

Documents were classified as evaluation case-studies if they were presenting methodologies for setting and designing the evaluation, analyzing the data, and/or presenting the results of the evaluation (Brousselle and Champagne, 2011).

For the first database (evaluation case-studies) the categories were: goal of evaluation, methodology for data collection, type of data analysis, type of evaluation, challenges and recommendations of evaluation and evaluation criteria used (Brousselle and Champagne, 2011).

We defined the types of evaluation as context analysis, process evaluation, outcomes evaluation and/or cost analysis. Indeed, in a given context (which may influence the emergence and outcomes of the PPP), a PPP is implemented through an organizational process (which also influences the outcomes of the PPP). This PPP can lead to expected and unexpected outcomes, which can be positive (benefits) or negative (risks). The implementation of this PPP has a certain financial cost, and the benefits or risks of this PPP can also be financial.

Context analysis involves considering different elements of the context in which the PPP operates. As we considered the sustainability of the territory/country where the PPP is implemented, the subcategories were defined as societal context, economic context, governance context and environmental context.

Process evaluation is about assessing the conditions under which the PPP is performing, the elements of the organization and function of the PPP that will affect its performances (Peyre et al., 2022, p. 2). Process evaluation subcategories emerged from the reading and analysis of the documents. These subcategories were analysis of the objective(s) of the PPP, analysis of the governance mechanism of the PPP, analysis of the planning of activities implemented in the PPP, and analysis of the collaboration mechanism between the PPP partners. The analysis of the objective(s) of the PPP focused on the definition and understanding of the objective by the partners. The analysis of the governance mechanism focused on the contract and decision-making process. The analysis of the planning of activities implemented in the PPP focused on the roles and responsibilities in various activities as well as the finances. The analysis of the collaboration mechanism analyzed the interaction between the PPP partners (power, equity, satisfaction).

Outcomes evaluation is the measurement of the results of the PPP. Outcomes evaluation attempts to answer the question of whether and to what extent the objectives of a PPP are/were achieved, but also looks at the unintended outcomes of PPPs (Peyre et al., 2022).

Cost analysis focuses on the financial aspect of the PPP such as the total cost of the PPP, the cost per unit of benefit, and/or the distribution of cost-burden among partners, funders and beneficiaries (Schröter, 2012).

For the second database, the pre-defined categories were: obstacles, key success factors, positive outcomes (benefits), negative outcomes (risks). Key success factors are defined as criteria of the context or the process that favour the achievement of PPP objectives. Obstacles are defined as criteria of the context or the process that limit the implementation and success of the PPP. Outcomes are the results of an intervention (BetterEvaluation, 2015). As we considered the sustainability of the territory/country where the PPP is implemented, the sub categories of outcomes were health, societal, economic, governance, and environmental outcomes.

2.6 Synthesis of the results

Selected documents were used to describe the existing case studies PPP evaluations, and to identify and classify the evaluation criteria of PPPs. To summarize the results we have divided the evaluation into four parts: context analysis, process evaluation, outcomes evaluation and cost analysis.

3. Results

3.1 Data selection

This study retrieved 1066 documents from the databases including 185 duplicates removed (**Figure 1**). In total, 881 documents and 1 OIE database (which described 97 case studies of PPPs in livestock health) were screened. Among the 37 documents selected for this scoping review, 18 documents described PPP evaluation case-studies and 20 documents mentioned evaluation criteria (the PPP case-studies from the OIE database described both evaluation and criteria). The documents were published between 2000 and 2021. The list of references of the 37 documents selected for this study and presented in the results is provided in **Appendix 2**.

A total of 23 documents focused on PPP in public health: 14 describing PPP evaluation case-studies, including 3 presenting an evaluation framework, and 9 mentioning evaluation criteria. A total of 14 documents focused on PPPs for livestock health: 3 documents describing an evaluation case-study, 1 OIE database, 10 documents presenting evaluation criteria. The 14 documents focusing on livestock health described 109 different PPPs around the world.

The main objectives of the PPPs described in the documents analyzed are presented in **Appendix 3**.

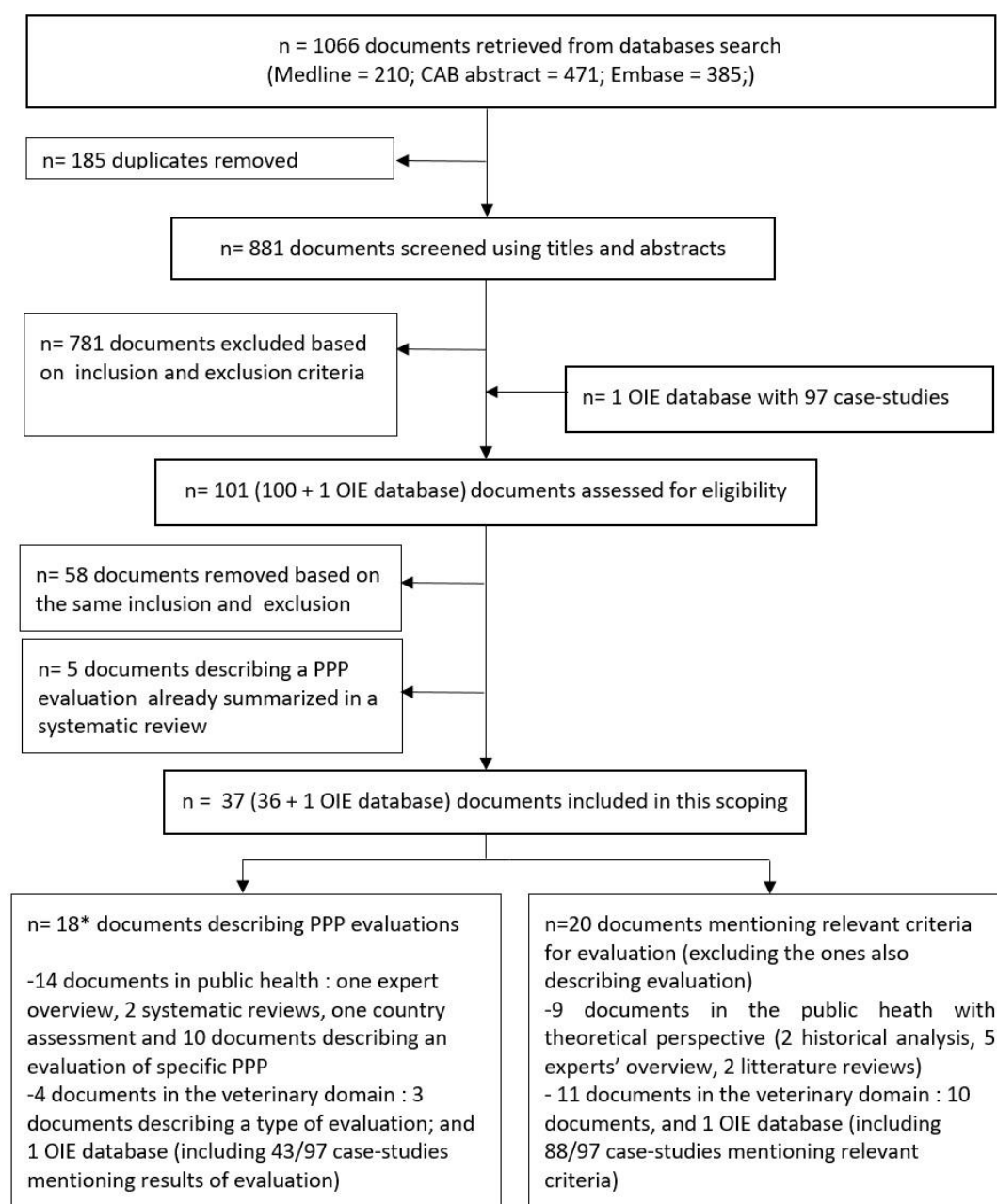


Figure 1. PRISMA flow chart diagram of documents selection process to include in the scoping review. OIE: World Health Organisation for Animal Health. *the OIE database describes PPP case study evaluations and evaluation criteria.

3.2 Summary of the results of the scoping review: elements to consider for PPP evaluation

The results of this scoping review underlined the importance of analysing the context, the process, and several outcomes of the PPP. Indeed, among the 18 documents describing PPP evaluation case-studies, some focused on the context of implementation (n=11/18), on the process (n=11/18), on the outcomes of the PPPs (n=17/18) and on the cost of the PPP (n=6/18) (**Table 1**).

The PPP evaluation goals, the way to collect data (e.g. documents reviews, interviews) and the type of analysis (e.g. descriptive, measurement of indicators) used during the evaluation process of those PPP evaluation case-studies are described in the (**Appendix 4**). A document noted that there is a burden of evaluation due to complex PPP arrangements (Barr, 2007) leading to limited conceptualization and empirical evidence on the effectiveness of PPP (Vrangbæk, 2008; Roehrich et al., 2014). The existing PPP evaluation case-studies lack of detailed information on how to implement the evaluation in practice. Some studies highlighted that PPP evaluation could include a comparison with a control (e.g. full public initiative, PPP in another area) but also pointed out the difficulties of setting the control (Lei et al., 2015; Vrangbæk, 2008). In general, PPP evaluation case-studies have been conducted to inform PPP policies at the macro level (such as risk management, access to resources, appropriateness of PPPs), to propose strategies for improving of PPP practices at the meso and micro levels, and to assess the progress of PPPs in achieving their objectives and assess outcomes (Roehrich et al., 2014). One document warned of a potential positive bias due to the fact that successful PPPs are more often mentioned in the literature (Barr, 2007). To avoid this bias, it has been proposed to consider the causes of failures of different PPPs as well as their risks in the evaluation and not to only focus on the successful PPPs (Vrangbæk, 2008; Roehrich et al., 2014).

Some evaluation criteria of the economic, societal, and governance contexts were identified (see **Table 2**). From the results of this scoping review, the environmental dimension was not considered for the context analysis, and environmental context criteria still needs to be defined. Elements of the context were identified as either obstacles or as key success factors regarding the implementation of the PPP and its outcomes.

The PPP process evaluation focused on the mechanism of the PPP itself. The importance of asking “how” PPP works (PPP process) in a given context rather than "do things work" (outcomes), in order to provide useful recommendations for partners and policymakers was emphasized (Prashanth, 2011). The PPP process evaluation considered the analysis of the objective(s) of the PPP, analysis of the governance mechanism of the PPP, analysis of the planning of activities implemented in the PPP, and/or analysis of the collaboration mechanism among the PPP partners (**Figure 2**). Elements of the PPP process were identified as either obstacles or key success factors (see **Table 2**). The evaluation of the PPP process also focused on the type of partners involved and their power relationship, as well as the decision and adhesion mechanism of partners and end-beneficiaries (**Figure 2**).

Finally, the outcomes evaluation considered direct or indirect outcomes and positive and negative outcomes of the PPP and did not focus solely on health outcomes. Evaluation criteria of the economic, societal, and governance outcomes were also identified (**Figure 2**, and see **Table 3**). In the OIE database, 92 case studies out of the 97, mentioned one or several outcomes of their PPP on health (71/97), economy (56/97), governance (56/97) and society (14/97) (see **Table 3** and **Appendix 6**). Environmental outcomes have not been not considered in any of the documents and have yet to be defined. Vrangbaek (2008) advised to map all the negative outcomes (risks) for both private and public partners during the evaluation.

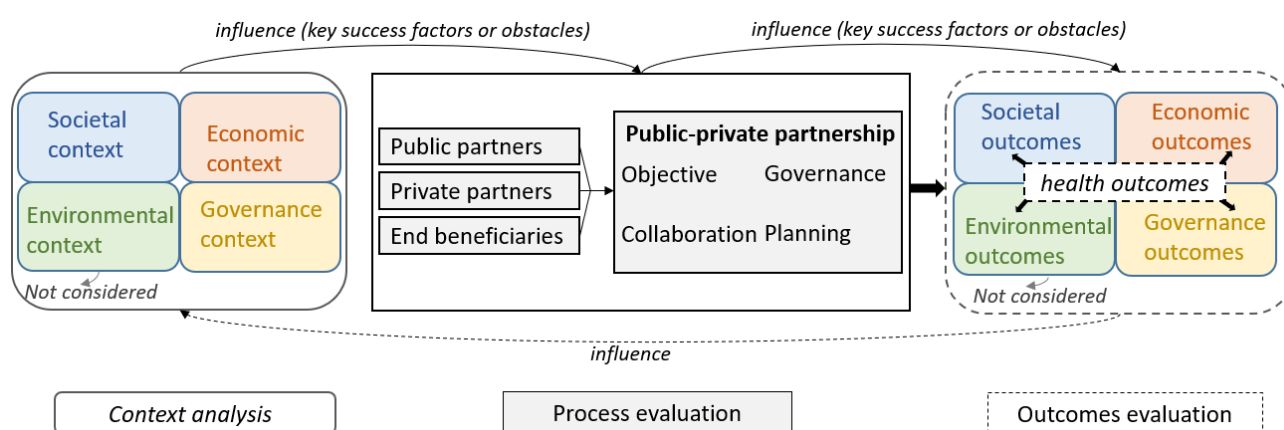


Figure 2: Summary of the results of the scoping review elements to consider for PPP evaluation.

The documents consider analysis of the context in which the PPP is implemented (italic writing) and the process evaluation (grey rectangle). In addition to health outcomes, some documents also consider indirect outcomes related to societal (blue), economic (orange), environmental (green), and governance (yellow) outcomes. Environmental context and environmental outcomes are not considered in any of the documents.

Table 1. Evaluation case-studies presented in documents analysed in the scoping review (n=18), of PPPs in public health (n=18) and PPPs for livestock health (n=4). In this study, PPP is restricted to services or product delivery for surveillance, prevention, or control of human, zoonotic, or animal contagious diseases. The list of references of the 37 documents selected for this study is provided in **Appendix 2.**

Domain and reference of the articles	Context	Process				Outcomes					Cost
		objective	governance	planning	collaboration	health	economy	society	governance	environment	
Public Health											
Albis et al., (2019)	✓					✓	✓				
Alonazi, (2017)	✓	✓		✓		✓					
Baig et al. (2014)				✓		✓		✓			
Bakibinga et al., (2014)	✓					✓					✓
Barr (2007)	✓	✓	✓	✓	✓	✓		✓			
Biermann et al. (2016)	✓			✓	✓	✓					
Gharaee et al (2019)	✓		✓	✓	✓	✓	✓	✓	✓		
Kempe et al., (2014)					✓	✓	✓		✓		✓
Lei et al., (2015)						✓		✓			✓
Laktabai et al., (2017)	✓					✓					✓
Roehrich et al. (2014)	✓	✓	✓	✓	✓	✓	✓		✓		✓
Salve et al. (2018)	✓		✓	✓	✓						
Sutton, (2010)						✓		✓			✓
Vrangbæk (2008)	✓		✓	✓		✓	✓	✓			✓
Livestock Health											
Dione et al. (2019)	✓	✓	-	✓	✓	✓		✓			
Hamill et al. (2017)						✓					
Maiti et al. (2011)						✓					
OIE PPP database (43/97case-Studies)					✓	✓	✓	✓			
Total by sub-categories		4	5	8	8	17	5	7	3	0	
Total by categories	11	11				17					6

3.3 Context analysis: what elements of the PPP context are considered, and how are they evaluated?

The analysis of the societal context mainly looked at the social acceptability of the PPP by the civil society.

The economic context was mainly about the infrastructure and the organisation of the market system in the territory/country where the PPP operates. The lack of these elements was identified as an obstacle and their availability as a key success factor. Some analysis of the economic context also looked at the justification for the PPP through complementarity of the partners or by analysing if a purely public or purely private initiative was considered but seemed limiting (**Table 2, Appendix 5**).

The governance context was mainly about the legislative and political environment of the territory/country where the PPP operates. The most mentioned obstacles related to governance context and were the lack of policy to guide PPPs, lack of transparency of the governance of one sector, or administrative barriers. One framework mentioned that an analysis of the governance context such as the regulatory environment could explain the limited use of PPP in a country (Vrangbæk, 2008). For PPPs for livestock health, a lack of effectiveness of the public veterinary services or a weakness of the Veterinary Authority have also been identified as external obstacles (Galière et al., 2019). Favourable political environment with policy and legislative frameworks shaping PPPs within countries was identified as key success factors.

3.4 Process evaluation: what elements of PPP process are considered, and how are they evaluated?

Regarding the definition of the objective(s) of the PPP, it was advised assessing whether the objective(s) of the PPP is clearly defined and corresponds to a common goal of the partners and whether each partner had identified the expected benefits (Donald A. Barr, 2007).

Regarding the governance mechanism of the PPP, the key success factors were: clearly defined nature of the agreement between partners (memorandum of understanding, letter of association, terms of references, contracts, etc.), participatory decision-making and shared decision-making with equality of power between partners, a plan to allocate resources and availability of human and financial resources from both sides, a transparent governance system, and adaptability and flexibility of the PPP structure. Lack of those elements were identified as obstacles (**Table 2**).

Regarding the planning of activities implemented in the PPP, two evaluation frameworks specific to PPP mentioned that evaluation should focus on the regular identification of the risks and challenges faced by the partners, the steps taken to mitigate these challenges and on identifying which partner is most susceptible to risks (Barr, 2007; Vrangbæk, 2008). PPP evaluations recommended analysing the roles and responsibilities of the different partners (Barr, 2007; Salve et al., 2018). Different key success factors related to the planning of activities implemented in the PPP such as identification and discussion about the potential risks and conflicts of interest before the implementation, or an open and frequent channel for communication between partners and transparency of action of each partners. The lack of these elements and the administrative complexity of the initiatives has been identified as obstacles (**Table 2**).

Regarding the collaboration mechanism among the PPP partners, the analysis of the strategies of the actors involved in the creation of PPPs and the relationships between partners, including their power relationships, was encouraged (Barr, 2007; Roehrich et al., 2014; Salve et al., 2018). A systematic review underlined that an intermediary role between the private and public sector with sufficient power (played by NGO for example) can be essential to improve the governance of the PPP and avoid asymmetry of power (Lei et al., 2015). A PPP evaluation advised analysing the inclusiveness of the various partners in the different phases of the partnership (definition of objective, decision-making process, protocol writing, etc.). The success of PPPs would depend on an inclusive network to build social capital, on the recognition of the importance of all stakeholders and on understanding the culture of the partner (Salve et al., 2018). Growing mistrust between partners was proposed as unseen obstacles to PPP while satisfaction of the PPP experience, and trust between partners would be a key success factor for good functioning of the PPP process (Lei et al., 2015). Obstacles related to the collaboration process were: partner's relationship such as power relationships between the partners, cultural barriers such as difficulties in taking local communities into consideration, a lack of involvement of the partners. In some conditions, the interactions between partners were also represented as key success factors: where partners have a mutual understanding of their respective culture, previous experience in partnership or a good level of engagement (**Table 2**).

Table 2. Criteria to evaluate the context and the process of public-private partnerships (PPP) mentioned in all documents analysed during the scoping review. The documents describe PPPs in public health (n= 23) and PPPs for livestock health (n=14). All associated references are presented in the **Appendix 5**.

Categories		Key success factors				Obstacles			
		Public (n=23)	Health	Livestock (n=14)	Health	Public (n=23)	Health	Livestock (n=14)	Health
Context analysis	Societal context: PPP socially acceptable	2		0		0		0	
	Economic context: PPP justification (added value), infrastructure, market system	2		1		2		2	
	Governance context: Legislative and political framework	10		3		7		1	
	Environmental context	0		0		0		0	
	Total (context)	11¹		3¹		8¹		2¹	
Process evaluation	Objective	Common goal	1		1		1		0
		Mutual benefits	2		1		1		0
		Alignment with national priorities	1		0		0		0
		Total (process, objective)	3¹		1¹		1¹		0
	Governance	Nature of agreement, negotiation contract	6		0		5		0
		Inclusiveness in decision-making process	6		0		4		1
		Funding and human resources availability and repartition	5		1		5		2
		Transparency of decision and activities implemented	1		2		1		0
		Adaptability of the PPP	1		0		1		0
		Total (process, governance)	13¹		2¹		9¹		2¹
	Planning of the	Regular risk identification and analysis	3		0		2		0
		Communication between partners	5		2		0		2
		Dissemination of knowledge, information sharing with external actors	4		1		1		0
		Role and responsibility of partners	5		2		6		1
		Planning of activities	1		0		2		0

		Distribution and efficiency of administrative tasks	0	1	2	1
		Distribution of ownership of PPP outputs	0	1	0	0
		Capacity building, training of actors involved in the PPP	3	1	2	1
		Evaluation of the PPP	2	1	0	1
		Total (process, planning)	11¹	3¹	9¹	2¹
	Collaboration	Power relationship between partners	3	0	3	0
		Inclusiveness	2	0	1	0
		Understanding of partner culture	2	0	2	0
		PPP structure	1	0	1	0
		Partners' satisfaction/ trust between partners	0	0	1	0
		Partner's involvement	1	1	1	1
		Total (process, collaboration)	6¹	1	7¹	1

¹Some documents mentioned several key success factors or obstacles categories.

3.5 Outcomes evaluation: what positive (benefits) and negative (risks) outcomes of PPPs are considered, and how are they evaluated?

Difficulties in monitoring the added value of PPP and in identifying the outcomes that are actually the result of PPP activities have been identified (Donald A. Barr, 2007; Vrangbæk, 2008). It was pointed out that ideally, an evaluation of PPP in public health should include a counterfactual (such as comparisons with a purely public alternative) but also mentioned the difficulty in modelling potential alternative paths (Vrangbæk, 2008). The evaluations of outcomes were based on longitudinal study design (Bakibinga et al., 2014; Lei et al., 2015), or cross-sectional study (pre and post comparison of the PPP intervention) (Kempe et al., 2014; Lei et al., 2015; Laktabai et al., 2017; Albis et al., 2019). In order to set a counterfactual, studies compared a PPP with a non-PPP (Baig et al., 2014; Kempe et al., 2014; Laktabai et al., 2017), studies compared different PPPs (in different areas or for different interventions) (Lei et al., 2015), and studies compared an area with a PPP and an area without a PPP (Albis et al., 2019). Some studies compared the public with the private sector performance in the PPP. Most of these studies were based on secondary data provided by the PPP (Bakibinga et al., 2014; Kempe et al., 2014), and a minority on data from field survey (Lei et al., 2015).

Health outcomes

The health outcomes were the most mentioned (**Table 3, Appendix 6**). They were, for example, service coverage (such as the rate of vaccine coverage), or the quality of actions such as decreasing the incidence or prevalence of a disease. The positive health outcomes of PPPs were also linked to the improvement of expertise of different partners through complementary skill. Regarding livestock health, three case studies of the OIE database mentioned benefits in food security through the improvement of livestock health (**Table 3, Appendix 6**). The negative health outcomes were the long-term erosion of health competencies of the public partners by delegating activities to the private sector and the risks of service failure (**Table 3, Appendix 6**).

Societal outcomes

Regarding societal outcomes, a PPP evaluation framework encouraged assessing the outcomes for vulnerable groups and assessing the equity of outcomes for each partner (Donald A. Barr, 2007). Another evaluation framework mentioned to focus on the creation of public value by the PPP, as PPP may erode public values because public sector organizations consider a broader set of demands and values (democratic participation, social responsibility, openness, equity) compared to private organizations (Vrangbæk, 2008). For PPPs for livestock health, case studies from the OIE database mentioned that one of the benefits was women's empowerment (through their important role in poultry farming) and the improvement of the livelihood of communities (through the increase of household profits or the availability of animal products for example). The capacity of defining new regulations,

which can improve the animal health services, has been mentioned as a benefit. The loss of public sector responsibility and the decrease of public sector influence in defining standards and norms, policies and priorities as been reported as a risk (**Table 3, Appendix 6**).

Economic outcomes

Regarding economic outcomes, an evaluation framework mentioned economic risks faced only by the private or public partners: private partners may face changes in contextual factors and political strategies or changes in regulatory framework and policies, which may decrease the economic outcomes; public partners may face economic risk in case of insolvency of the private partner (Vrangbæk, 2008). Both public and private partners run the risk of entering contracts that prove sub-optimal or problematic in the long term (**Table 3, Appendix 6**).

Additional resources, better allocation and stability of resources, reduction in financial cost of the process have been identified as benefits improving operationality of the PPP. Reduction of risk and risk allocation between partners and timely execution of activities are other benefits identified. For livestock health management, economic benefits were improved market access thanks to eradication or control of a disease, and increasing employment. Risks pointed out in the documents was the cost and inefficiency due to complex PPP assembly, the transaction cost (negotiating the contract and monitoring the partner), and the risk of monopolies or oligopolies by strengthening one specific private enterprise (**Table 3, Appendix 6**).

Outcomes on the governance of the PPP.

Governance was also considered a potential outcome of the PPP if the PPP process influence the governance mechanism of the PPP it self or of a broader governance structure (such as public policy).

PPP evaluation case-studies mentioned that PPP can lead to trust between partners, resulting to better response to challenges faced during the PPP implementation, and better stability of the PPP (Voss et al., 2012). For livestock health, the improved trust between partners was mentioned as a benefit in 52/97 case studies of the OIE database (**Table 3, Appendix 6**). The quality of the process of the activities implemented and accountability (improved legitimacy and fairness of decision making, transparency, and administration) were identified as potential positive outcomes of the PPP.

Negative governance outcomes were also identified, the complex PPP procedure leading to a lack of transparency, unclear accountability structures or the exclusion of some actors from decision making. A risk of erosion of trust between partners in the event of repeated failure, misconduct or use of regulatory interventions by the public partners, conflicts of interests and increasing corruption risk were the risks most often mentioned. An evaluation framework raised concerns about potentially restricting the flexibility to make decisions about the delivery of PPP services in a democratic manner, given that the PPP creates a long-term contractual obligation. (Vrangbæk, 2008) (**Table 3, Appendix 6**).

Table 3. Potential positive outcomes (benefits) and negative outcomes (risks) of public-private partnerships mentioned in documents analysed during the scoping review. The documents describe PPPs in public health (n= 23) and PPPs for livestock health (n=14). All associated references are presented in **Appendix 6**.

Outcomes categories		Benefits / positive outcomes		Risks / negative outcomes	
		Public health	Livestock Health	Public health	Livestock Health
Health	Service coverage	8	3	0	0
	Quality of actions: case detection and management / treatment outcomes	4	5	1	0
	Expertise, skills of the partners	4	2	1	0
	Food security	0	1	0	0
	Total (health)	10¹	6¹	1¹	0
Society	Considering vulnerable groups, and creation of public value	2	2	1	0
	Definition of regulations related to (livestock) health	0	1	0	0
	Public sector responsibilities	0	0	2	0
	Equity of outcomes	5	0	1	0
	Total (society)	6¹	2¹	4¹	0
Economy	Resources and cost of the PPP (including transaction cost)	3	1	1	0
	Reduction of risks	0	1	0	0
	Timely execution of activities	3	1	2	0
	Market access	0	2	0	0
	Employment	3	1	0	0
	Oligo/monopolies	0	0	1	0
	Total (economy)	7¹	3¹	2¹	0
Governance	Quality of the process and trust between partners	3	2	1	1
	Accountability and corruption	1	0	2	1
	Merging of interest or conflict of interest	0	1	2	1
	Total (governance)	4	2¹	4¹	3
Env	Total (environment)	0	0	0	0

3.6 How is evaluated the cost of a PPP?

Two documents mentioned that costs can be underestimated in PPP projects because of transaction costs for both the public and the private partner in entering a tendering procedure (Vrangbæk, 2008; Roehrich et al., 2014). Vrangbaek et al. (2008) recommended distinguishing two phases: (i) the initial phase, where transaction and investment costs may be high for PPPs; (ii) and a lifetime perspective, where the benefits of mutual learning may result in better and more cost-effective practices (Vrangbæk, 2008).

Some studies analysed cost by focusing on the patient and considered cost spent on treatment, fees per patients, and lost income due to work delay. Some studies focused on the annual operational costs of the PPP. A cost-effectiveness studies focused on the cost per patient tested positive and successfully treated. In some studies, the cost was compared to similar programmes without PPP or to the situation before the implementation of the PPP (Lei et al., 2015).

Overall, the lack of data on the estimated costs and cost-effectiveness of PPP intervention was highlighted (Konduri et al., 2017).

4. Discussion

The present study, through a rigorous scoping review, represents solid data summarizing the evaluation criteria used to evaluate PPPs for infectious disease prevention and control, and for access to services in public health and livestock health. While the health outcomes of the PPP were the most mentioned, this study showed the importance of considering the context analysis, process evaluation, and societal, economic and governance outcomes. Many PPPs for livestock health were identified but few of them have been evaluated and no evaluation framework or methodology has been developed for these specific programmes. None of the documents reviewed consider the environmental dimension of sustainability in their evaluation criteria, either for context analysis or for outcome evaluation. The concept of sustainability is not yet used in the evaluation of PPPs for livestock health, and we argue that future research should address this issue.

4.1 The need for an integrated evaluation framework for PPP for livestock health

This scoping review highlighted different examples of PPPs for livestock health programmes, illustrating the large number of such initiatives around the world. However, only in a limited instance, good practices of PPPs for livestock health have been analysed (Ahuja, 2004b; Bennett, 2012; Lubroth et al., 2007). Only three documents have presented practical examples of evaluations of PPPs for livestock health, most of them focusing on livestock health outcomes (Dione et al., 2019; Hamill et al., 2017; Maiti et al., 2011). Only Dione and al (2019) also focused on context analysis, engagement and interaction between partners.

The lack of evaluation of PPPs for livestock health emphasizes the need to develop an evaluation framework to ensure good PPP practices and minimize potential risks. This study also shows us that the evaluation framework for PPPs for livestock health should not only focus on their key success factors and positive outcomes, but also on their potential obstacles and risks (Donald A. Barr, 2007; Martin and Halachmi, 2012). Researchers working on PPP evaluation for livestock health can build on the identified evaluation criteria and evaluation methodologies to develop this evaluation framework. This evaluation framework should address the context analysis, the quality of the PPP process, and the multiple outcomes of PPPs. The development of such a framework would then allow for the development of tools for the practical implementation of the evaluation, such as defining indicators to measure the different evaluation criteria.

4.2 Specificity of public-private partnership evaluation

The different evaluation criteria of the context, the process and the outcomes identified in this scoping review, could be applied for the evaluation of livestock health programmes other than PPPs. However, we believe that the specificity of a PPP evaluation is not especially based on specific criteria or outcomes to be evaluated but more on their prioritization and relative importance. For example, the analysis of the governance context was found to be particularly important for the context analysis of PPPs. Evaluation criteria related to the PPP process, such as the power relationship or the governance system, were identified as essential to consider.

This scoping review underlined the importance and the challenges in assessing the added value of the PPP. Identifying the causal relationship between the PPP process and the outcomes is necessary for the evaluation but was identified as a challenge. In some documents this has been done through a counterfactual (such as a purely public or purely private alternative, a territory without PPPs, or another PPP). But in other cases, it may be difficult to find an existing counterfactual. In such cases, the focus may be on identifying PPP-related elements in the context and process that may explain the outcomes. This can be done by linking the inputs of the PPP, the PPP process and outcomes in the logic model

based on the theory of change, as proposed by an evaluation framework for partnership for research (Breuer et al., 2016; Rieker, 2011). A another way to demonstrate the added value of a PPP, could be to engage in dialogue and deliberation with the different partners to assess the added value of the collaboration, as has been highlighted in Public Affairs domain (Bryson et al., 2015). In the same vein, evaluating partners' perceptions of the added value of PPPs has been proposed to overcome the difficulty to assess the added-value of global PPP in public health (Kamya et al., 2016). These elements emphasize the value of participatory evaluations. For example, a participatory impact pathway methodology would allow public partners, private partners and actors impacted by the PPP to identify the cause-and-effect relationships between inputs of PPPs, PPP process, and outcomes (Blundo-Canto et al., 2020).

4.3 Limits of this study

Most of the documents about livestock health included were describing specific examples of PPP, whereas most of the studies included in the public health were articles with theoretical perspectives (overview article) or summarizing the evidence (review of literature). The inclusion of different types of studies may lead to heterogeneity of synthesis results. However, the objective was not to provide new knowledge in the field of public health, but rather to compare the criteria that emerged from public health knowledge with criteria from evaluation case studies of PPPs for livestock health management.

The concept of PPP was included as a key word in the literature search process. As this concept is not yet well developed nor used for livestock health programmes some articles describing a PPP without naming it a PPP might have been missed. However, our study included the OIE database which describes 97 examples of PPP for livestock health management worldwide, representing an important source of data.

PPPs related to livestock health were not included in this study if they do not work through veterinary services, in order to remain within the scope of the OIE project. However, we recognize that other PPPs, including for example agricultural organizations, are important in the livestock health sector. Another study could focus on these other types of PPPs related to livestock health and their evaluations. The evaluation of other PPPs, for example those specialized in agricultural infrastructures, construction, management and administration were not included in this review. However, we believe that the choice to focus on the field of public health, in particular PPPs seeking to prevent and control infectious diseases, was interesting given the similarity of missions with PPPs for livestock health. Investigating how PPPs in different domains are evaluated could be an interesting way to complement further this work in the future.

As with all evaluation research studies, an important limitation is the lack of publications or access to completed evaluations. Indeed, this scoping was mainly based on scientific databases. The grey literature was limited, and for example we did not have access to evaluations that could have been done in the context of public policy by the countries themselves. It would be interesting to think about how to integrate these evaluations from the grey literature into another study. However, we believe that with the inclusion of the OIE database describing 97 PPPs around the world, we have had access to a large number of case studies and that our results remain robust.

4.4 Challenges identified for PPP evaluation in livestock health to be addressed in future research

This scoping review underlined the importance of evaluating the PPP process, i.e. the quality of the mechanism and functioning of PPP, and the identification of those criteria were used to develop an evaluation tool of the quality of the PPP process (Poupaud et al., 2021). Some PPP evaluation underlined the importance of considering the nature of interaction and power relationship between partners (Donald A. Barr, 2007; Salve et al., 2018). Depending on the type of PPP for livestock health programmes, differences in terms of unequal power relationship can be expected. The power relationship can be expected to represent a disadvantage for the private sector in PPPs between the public veterinary services and private veterinarians or producers' associations. It could represent a disadvantage for the public sector in PPPs between the public veterinary services and a national private company. This indicates that the evaluation of PPPs needs to take into consideration the institutional capacity of the public and private partners, with regards to their own objectives and interests, which will influence the governance process. Particular attention needs to be paid to the contract between partners, when relevant and required, to ensure that the partners do not take advantage of contract incompleteness, as underlined in other domains. In regards to the institutional capacity of each partner, the contract should be "*clear, comprehensive*" and "*create certainty for the contracting parties*" (World Bank Institute, 2017).

Regarding outcome evaluation, we believe that outcomes of PPPs for livestock health could be similar to others programmes. This scoping review showed that the outcomes of PPPs for livestock health are various and go beyond livestock health outcomes. Indeed, livestock health outcomes of a PPP can influence the whole livestock system. The evolution of the livestock system, which is embedded in a country/territory, will then bring indirect outcomes. Economic and societal outcomes have been mentioned in PPPs for livestock health within this scoping review. Indeed, livestock can represent one of a limited number of options to increase incomes and sustain the livelihoods, especially for smallholders (Herrero et al., 2009) and plays an important cultural and heritage role (Dury et al., 2019). Although environmental outcomes were not mentioned in any of the documents, we believe that future evaluation should consider them, as the implementation of a livestock health programme may result in indirect environmental outcomes. For example, the control of foot and mouth disease in Brazil, allowing livestock export, is indirectly linked with an expansion of Amazonia deforestation (Nepstad et al., 2006).

Other indirect negative outcomes of PPPs that change the livestock system could be related to land resource use, loss of soil biodiversity and fertility, and the production of greenhouse gas emissions (Cavicchioli et al., 2019; HLPE, 2016; Soussana, et al., 2010). Outcomes could also be positives as some livestock systems can play ecosystemic services such as carbon sequestration (Soussana, et al., 2010), or soil fertility improvement through manure (Steinfeld et al., 2006). To our knowledge, few evaluation of livestock health programmes have considered the environmental outcomes of the programme- but now a number of initiative are calling for including environmental and biodiversity aspect within livestock health programme evaluation (Peyre et al., 2021b). As for food and agriculture programmes, we believe that future evaluation should consider the interaction of livestock health programmes and indirect societal, environmental, environmental and governance outcomes (Food and Agriculture Organization, 2013). Further work should focus on developing sustainable indicators to measure the various outcomes of a PPP for livestock health identified in this study and identifying additional outcomes (Bell and Morse, 2008).

Finally, regarding cost evaluation, few PPP evaluations focused on the cost of the initiative. This could be explained by the fact that PPPs for infrastructure construction, for which cost analyses are well documented, were excluded from this scoping review. To assess the relevance of a PPP compared to another option, it would be necessary to establish the costs of setting up and running the PPP (Hellowell, 2019). Future research should focus on cost-effectiveness or cost-benefit analysis of PPPs for livestock health, taking into account the transaction cost of implementing PPP. The evaluation of the cost of PPPs for livestock health management will face the same challenges as the assessment of the added value of the PPP: identifying the costs related to the PPP mechanism, and comparing such costs with an alternative (e.g. all the activities implemented by one sector only). Another important point of the evaluation will be to look at the distribution of the financial benefits created by the PPP between the public veterinary services, the private partners and the beneficiaries.

4.5 Conclusion

Livestock health represent both opportunities and challenges for sustainability of a country/territory. Public and private actors collaborate to implement programmes to improve livestock health, sometimes leading to PPPs. In order to promote good practices and positive impacts and minimize potential risks of such PPPs, integrated evaluations are needed. This scoping review identified the evaluation criteria used to evaluate PPPs for infectious disease prevention and control, and for access to services in public health and livestock health. This work mapped not only livestock health outcomes but also social, economic, governance outcomes as well as evaluation criteria for context analysis and the quality of the PPP process. This work represents a milestone upon which to build an evaluation framework for PPPs for livestock health. The evaluation frameworks, in addition to evaluation criteria identified would need to consider the environmental dimension in the context analysis and outcome evaluation. This framework would be useful for the development of indicators and tools for practical implementation of the evaluation. Evaluation of PPPs for livestock health would enable decision-makers and partners to assess the needs, added value and ways to improve PPPs and minimize their risk, and guide public policies to favour the contribution of PPPs to the sustainability of a territory.

Chapitre 2

Chapitre 2. Analyse du contexte

Préambule chapitre 2

Le chapitre 2 porte sur la partie « analyse de contexte » du modèle d'analyse (**Figure 1**). Il a été souligné dans la revue de littérature qu'une analyse de contexte était nécessaire pour favoriser la formulation de recommandations applicables et pertinentes suite à l'évaluation d'un PPP. Deux méthodologies sont proposées pour être en mesure d'opérationnaliser cette analyse de contexte : une perspective historique et une cartographie de parties prenantes. Cependant, de nombreuses méthodologies d'analyse de contexte existent, et ces deux méthodologies sont proposées à titre illustratif.

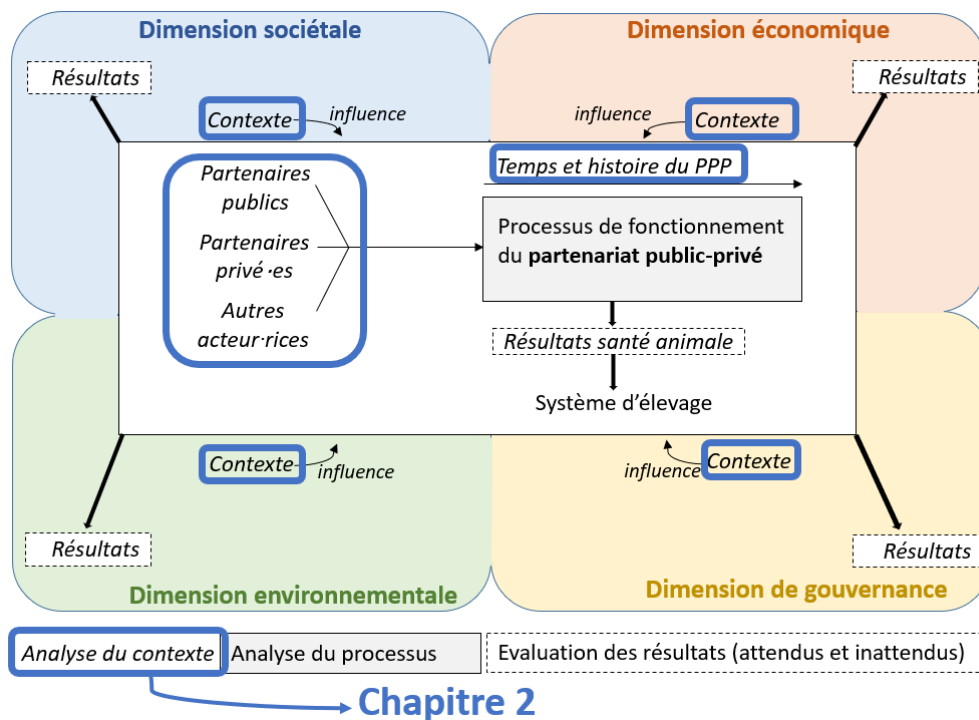


Figure 1 : Le chapitre 2 explore les pistes d'opérationnalisation de l'analyse de contexte (rectangles bleus), correspondant à une partie du modèle d'analyse.

Une perspective historique d'un PPP au Paraguay est proposée en première partie de ce chapitre. Pour rappel, ce cas d'étude n'a pas été « évalué » à proprement parler, étant donné que la deuxième phase de terrain n'a pas pu se réaliser à cause de la pandémie Covid 19. Cependant, au vu de l'existence de long terme de ce PPP, de l'évolution de sa structuration et de son organisation, il nous a semblé intéressant de se pencher sur les différents éléments qui ont influencé l'histoire de ce PPP. Cette perspective historique, réalisée à travers des entretiens semi-structurés et le recueil et l'analyse de documents (rapports, archives), permet de retracer l'émergence de la collaboration entre le secteur public et le secteur privé pour le contrôle de la fièvre aphteuse, et d'identifier les différents éléments du contexte qui ont influencé la structuration de ce PPP. Cette étude peut être source d'enseignement pour d'autres PPP qui évoluent dans des contextes similaires (et particulièrement en Amérique du Sud).

Il nous semble que la compréhension de l’historique du PPP, par exemple à travers la méthodologie présentée dans cette étude, est importante dans une analyse de contexte pour être en mesure de formuler des recommandations pertinentes suite à une évaluation.

Dans une deuxième partie de ce chapitre, une cartographie de parties prenantes au Laos, dans une perspective *ex ante* d’un éventuel PPP, est résumée. Cette étude nous permet de nous pencher sur l’intérêt de la méthodologie des analyses de parties prenantes pour l’analyse du contexte des PPP. La méthodologie de cartographie des parties prenantes apparaît également intéressante à mobiliser pour une analyse *in itinere* d’un PPP. Cette méthodologie permettrait d’identifier les connexions entre les parties prenantes, de comprendre comment elles s’influencent mutuellement, et d’explorer leurs intérêts et contraintes liés à l’objectif du PPP.

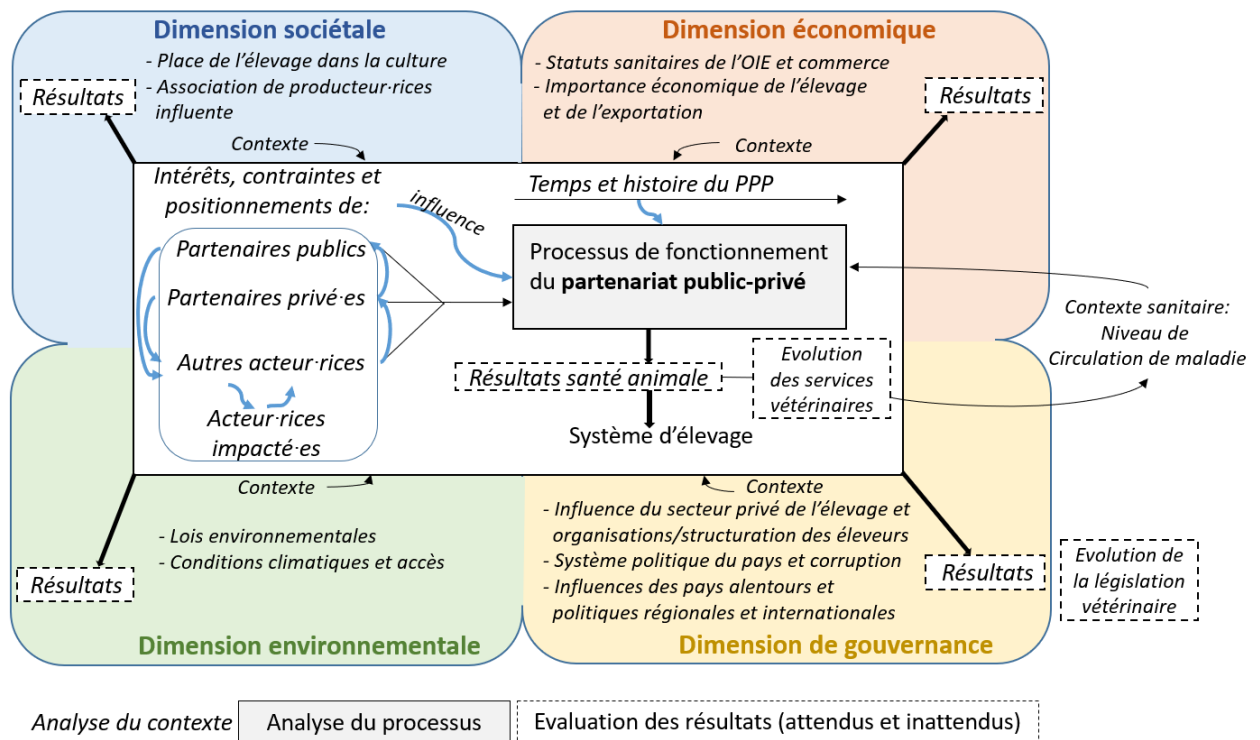


Figure 2 : Le chapitre 2 nous a permis de nous intéresser à deux méthodologies pour opérationnaliser l’analyse de contexte. La perspective historique a montré l’influence de l’histoire du PPP sur sa structuration et son processus actuels, et a montré l’influence de certains éléments du contexte sur le PPP. La cartographie des parties prenantes permet d’explorer les intérêts, contraintes, positionnements et connexions d’acteur-ices qui peuvent influencer le processus du PPP.

Chapitre 2. 1^{re} partie : perspective historique d'un PPP

Cette étude a été envoyée sous la forme d'un rapport aux partenaires du Paraguay.

Abstract

Foot and mouth disease control in Paraguay requires a massive vaccination campaign of the national cattle herd. To implement it, the Public veterinary services of Paraguay are collaborating with an association of private producers in a public-private partnership. In order to provide relevant recommendations in the evaluation of this PPP, this study focuses on the analysis of its context of the implementation. The history of the FMD control program in Paraguay is analyzed through the lens of the collaboration between the public veterinary services and the private sector. Semi-structured interviews were conducted with the main actors of the FMD control program (n=10), both from the public and private sectors. Records, laws and regulations of the Statistics Department of the veterinary services, the Central Bank of Paraguay, the National Institute of Statistics, and the Pan-American Foot and Mouth Disease Center were analyzed. Cattle ranching began in 1545 in Paraguay, and some of the ranchers joined to form the Asociación Rural del Paraguay (ARP) in 1885. The North American impulse for FMD control in the continent, after the outbreaks in Mexico, Venezuela and Colombia around 1950, through the creation of the Pan-American Foot and Mouth Disease Center. USA financial loans allowed the emergence of Public veterinary services and the beginning of the control program in Paraguay in 1967. The establishment of an official status related to FMD by the World Organization for Animal Health in 1994 gave an impetus to the FMD control program and the evolution of Paraguayan regulations. Although the collaborative structure and governance system between the public and private sectors, through the producers' association of Paraguay, has evolved, the control program has always involved both sectors. Today, 100% of the cattle population is vaccinated, and the vaccination operation is entrusted to the private sector, through a foundation recognized as a legal entity, and is supervised and evaluated by the Public veterinary services. The FMD program has enabled the expansion of veterinary coverage throughout the country and the emergence of a traceability system. The FMD-free status since the last outbreak in 2012 has allowed an increase in the volume of beef product exports.

1. Introduction

Ensuring good animal health requires animal disease surveillance, prevention and control programmes. It also requires funding and human resources, for example to ensure massive vaccination campaign (Knight-Jones and Rushton, 2013). Actors from both the private sector (producers, veterinarians, companies) and the public sector (such as veterinary Services) need to collaborate in the implementation and maintenance of these animal disease management programmes. These collaborations can lead to public-private partnerships (PPPs) (World Organisation for Animal Health, 2020c).

For example, in order for Paraguay, the sixth largest exporter of beef in the world, to obtain the status of foot and mouth disease (FMD) “free country with vaccination” from the World Organization for Animal Health (OIE), all 14 million head of cattle in the country must be vaccinated. To implement this massive vaccination campaign, the public veterinary services of Paraguay collaborate with a private producer association. The private sector is responsible for the practical implementation of vaccination campagne and the public sector assesses and ensures that it is carried out to the required standards. This PPP corresponds to the “collabortive” category of PPP in the veterinary domain (Galière et al., 2019a). This category corresponds to PPPs driven by exports and/or commercial interests, initiated by both the public veterinary services and the private sector. FMD is a contagious viral disease of cattle, swine, sheep, goats and other cloven-hoofed ruminants (World Organisation for Animal Health (OIE), 2021). This disease affects the production of livestock and has an economic impact through direct losses (reduced livestock production) and indirect losses (costs of FMD control, poor access to markets) (Knight-Jones and Rushton, 2013). Effective control of FMD with vaccination requires high levels of vaccine coverage to develop herd immunity (Le Gall and Leboucq, 2004). It was the first disease for which the World Organisation for Animal Health (OIE) established official status recognition in 1994 (World Organisation for Animal Health (OIE), 2021). All countries that have eradicated FMD exclude beef imports from exporting countries whose herds show evidence of FMD. The control of FMD has therefore a strong commercial stake for meat exporting countries (Knight-Jones and Rushton, 2013).

Paraguay is a landlocked country in South America with a population of 7.13 million people. Income inequality has declined since 2003, but it is still high and 23.5% of the population living below the national poverty line. In 2020, the agriculture, forestry, and fishing, represented 11% of the national gross domestic product (Word Bank, 2020). Informal economy, including rural activities related to livestock, could account up to 40% of GDP (World Bank Group, 2018). More than 14 million cattle are raised in the country and 70% of the meat produced is exported (Servicio Nacional de Calidad y Salud Animal, 2020b). The national cattle herd increased by 40.6% between 2006 and 2020.

There are approximately 140,000 livestock owners, and many formal and informal workers directly or indirectly employed by the livestock production system (241,000 people directly and 450,000 indirectly) (World Wildlife Fund Paraguay and Germany, 2016). The social status of the livestock owner is highly variable, going from the subsistence farmer to the livestock owner-investor with up to 500,000 cattle. Among the livestock owners, the 15% with the largest herds own the equivalent of 85% of the cattle in the country. The livestock system is almost always extensive, pasture-based, and feedlot fattening is almost never used.

Evaluation is important for any programs, including PPPs in the veterinary domain, to plan, redefine strategies, initiate appropriate corrective actions, optimize resources and help to ensure the effectiveness of actions (Brousselle and Champagne, 2011). Evaluation can focus on the analysis of the context, of the process of the PPP (such as governance or collaboration), and of the results and impacts. A review of literature about evaluation of PPPs, underlined the importance to analyse the context of implementation to provide relevant recommendations (Poupaud et al., Under publication).

In this study, we propose to conduct a historical review as a way to operationalize the context analysis, focusing on the emergence of PPP in Paraguay for the control of FMD. The purpose of this study is to try to understand what elements of the context influenced the emergence and implementation of the PPP, but also to try to understand the influence of the history of the PPP on its operating process.

2. Methodology

The researcher (MP) was introduced to public and private actors at national level by the OIE delegate present in Paraguay. The fieldwork took place from January to March 2021. At the beginning of the study, a meeting introducing the researcher, the project and the evaluation framework was held with the researcher and key actors of the PPP from the public and private sector.

The study was conducted in the capital of Paraguay, Asuncion, and in four regions of Paraguay, corresponding to animal health commissions: Neembucu sur, Paraguari, Amanbay and Consanzo 17 (**Figure 1**). These regions were chosen because they correspond to different geographical situations. Three of the regions (Neembucu sur, Paraguari, Amanbay) are located in the eastern zone of Paraguay (located east of the Paraguay River), where 97% of the total population lives. Consanzo 17 is located in the western zone of Paraguay (located west of the Paraguay River), where 3% of the population lives, characterized by low rainfall and extreme temperatures, but which contains 50% of the cattle population. The Neembucu region shares a border with Argentina, Amanbay with Brazil, and Consanzo 17 with Bolivia, while Paraguari is a central region.



Figure 1: The four regions of Paraguay included in this study. Paraguay shares borders with Bolivia, Brazil and Argentina.

Ten semi-structured interviews using an interview guide were conducted with key actors of the FMD control program from Public veterinary services (n=4) and from the private sector (n=6) (foundation for animal health) at national level and regional level following an interview guide (**Appendix 1**). The key actors were the OIE delegate, the manager of the FMD program from the public veterinary services at central and regional levels (in four regions), the national directors (technical and executive directors) of the private foundation, and the regional directors of the private foundation in four regions. The researcher had been previously trained in qualitative approaches. All semi-structured interviews were conducted in Spanish. Interviews took place in the office of public or private partners. The interviews lasted from 40 to 90 minutes. The discussions were recorded and transcribed in Spanish.

A unique number was given to each of the transcripts to ensure the anonymity of the interviewees. The transcripts were read, and were analyzed through content analysis. We coded the information in this way: the history of the collaboration (events classified by date if the date was mentioned), history of the legal framework, elements of the context influencing the history of the PPP. The interviews allowed us to have a first outline of the history of the PPP and to highlight important dates.

Next, a search of the grey literature allowed us to triangulate the data provided by the interviews, but also to detail them and to obtain various types of numerical monitoring. These figures relate to the size of the herd, the number of producers, the number of vaccinated cattle, the level of beef exports (in volume and price), the coverage of veterinary services (number of veterinarians in the public veterinary services, number of offices in the regions and localities).

The annual report from 1967 to 2020 of the Pan American Health Organisation and Pan American Foot and Mouth Disease Center were consulted¹, as well as the different laws and regulation². The statistical data from the department of statistics of the Public veterinary services SENACSA, which contain data from 2007 to 2020 were analyzed³. With the help of this department, archive (Anuarios Estadísticos del Paraguay) from 1967 to 1997 of the national institute of Paraguay (Instituto Nacional de Estadísticas), established by the Finance Ministry (Dirección General de Estadística y Censo) were obtained and analyzed. Foreign trade bulletin published by the central bank of Paraguay, from 1961 to 2021, were also analyzed⁴. A detailed report was sent to key actors of the program in october 2021 to check the validity of the results.

3. Results

3.1 The history of the public-private partnership for FMD control in Paraguay (1545-2021)

3.1.1 The beginning of livestock raising and implementation of FMD control strategy in South America and in Paraguay and the creation of the private rural association (1545-1965)

Cattle were introduced in 1545 in Paraguay (Asociación Rural del Paraguay, 2011). FMD was first detected in 1870 in South America. By the end of the 19th century, FMD had spread to many countries including Paraguay (Correa Melo and Lopez, 2002; Rosenberg and Goic, 1973). In 1885, the rural association of Paraguay (ARP), a private non-profit organization, was founded in order to brings together agricultural producers from all over the country, and which seeks to make livestock production an instrument for Paraguay's development, (Asociación Rural del Paraguay, 2011).

¹ available on <https://iris.paho.org/>;

² available on <https://www.bacn.gov.py/leyes-paraguayas>

³ available on <https://www.senacsa.gov.py/index.php/informacion-publica/estadistica-pecuaria>

⁴ available on <https://www.bcp.gov.py/boletin-de-comercio-exterior-trimestral-i400>

In 1917, Paraguay began exporting meat in the form of corned beef, for example through the Liebig company (Asociación Rural del Paraguay, 2011). In 1917, a livestock Service was established in Paraguay, under the Ministry of Agriculture and Livestock, in order to guarantee the quality and health of meat, and the first Animal Health Law, Law 269, was drawn up. The first Animal Health Unit was created in the same year (Facultad de Ciencias Veterinarias, 2021). In 1950, the four first health regions (zona sanitaria) were created as well as the first rural medicine centre in the country (zonal unit) with a veterinarian. In 1954, the Faculty of Agronomy and Veterinary Medicine was created under the Ministry of Agriculture and Livestock. The Faculty of Agronomy and Veterinary Science became part of the National University of Asunción on 1956 (Facultad de Ciencias Veterinarias, 2021).

In 1938, the first effective FMD vaccine was developed in Germany. The vaccine was produced in South America in 1940 (Argentina, Brazil, Chile, Peru, Uruguay) (Rosenberg and Goic, 1973). The introduction of FMD into Mexico in 1946, and then into Venezuela and Colombia in 1950, marked the beginning of the development of the control of the disease throughout the Americas. In 1951, the United States, through the Organization of American States, initiated the establishment of the Pan-American FMD Centre (PANAFTOSA = “Centro Panamericano de Fiebre Aftosa”). The Pan-American FMD Centre was created through an agreement between the Organisation of American States, the Pan American Sanitary Bureau of the WHO and the Government of Brazil (Correa Melo and Lopez, 2002).

3.1.2 Creation of veterinary Services (1965-1994)

In 1965, the Inter-American Development Bank offered financial loans for the development of FMD control plans in South American countries (PANAFTOSA, 2018). With this loan, the veterinary Services of Paraguay were created in 1967 (Law 1267/1967) and followed guidelines of the Pan-American FMD Centre PANAFTOSA for their FMD control programs (Rosenberg and Goic, 1973; Servicio Nacional de Calidad y Salud Animal, 2020a). The main objective of the Public veterinary services was FMD control and they were initially called “SENALFA” for National FMD Control Services (“Servicio Nacional de Lucha contra la Fiebre Aftosa”) (Servicio Nacional de Calidad y Salud Animal, 2020a). Law 1267/1967 announced the start of the campaign to control FMD. This law created a tax imposed on farmers when selling their cattle to finance the national campaign against FMD (Gobierno Nacional de Paraguay, 1967).

In 1969, vaccination campaigns began in the eastern part of the country and in 1972 in the western part. From the beginning, the private sector has played a major role in the implementation of FMD vaccination. Indeed, at first, owners were responsible for vaccinating their cattle, and the Public veterinary services staff vaccinated a minority of the cattle. The rural association of Paraguay was in favor of this vaccination campaign since the beginning, and thanks to its presence in the whole country encouraged the breeders to vaccinate their livestock. In 1970, one third of the cattle were vaccinated (Organizacion panamerica de la salud, 1970).

Since 1970, Paraguay has been producing its vaccines in one public and one private laboratory (Organizacion panamerica de la salud, 1970). In 1972, the FMD programme had more than 60 veterinarians, most of them distributed in the countryside (Rosenberg and Goic, 1973). The programme had difficulties such as lack of resources and lack of personnel to cover producers, especially small producers who were less motivated to vaccinate their cattle (Organizacion panamerica de la salud, 1970).

In 1977, the public veterinary services' activities were extended to the control of rabies, brucellosis and bovine tuberculosis, and they were renamed SENACSA for "National Animal Health and Quality Service" ("Servicio Nacional de Calidad y Salud Animal") by Law 675/1977. This law defines the Public veterinary services SENACSA as an institution with technical and administrative autonomy and legal standing (Gobierno Nacional de Paraguay, 1977). Since 1981, the Public veterinary services SENACSA's budget is fully covered by the institution's own income and do not depend from financial loans from abroad such as of the Inter-American Development Bank.

Since its creation in 1951, the Pan-American FMD Centre PANAFTOSA has been influencing the different national FMD control programmes in South America, especially in Paraguay, by establishing guidelines that these programmes should follow. In 1972, the South American Commission for the control of FMD (COSALFA) was created, composed of the directors of animal health services and representatives of the production sector of the South American countries, a collaboration between the public and private sectors in South America. In 1988, the Hemispheric FMD Eradication Programme of the Pan-American FMD Centre PANAFTOSA and its first action plan (1988-2009), were created, establishing guidelines for national programmes for the eradication of the disease in the different countries (P. Centro Panamericano de Fiebre Aftosa, 2018).

In 1994, the OIE developed standards to allow a system of official recognition of FMD-free member countries with animal health status (World Organisation for Animal Health, 2020b).

3.1.3 The beginning of the official collaboration between the Public veterinary services and the private sector (1996-2001)

The FMD status creation from OIE gave a new boost to the program. In 1996, Law 808 declared the national FMD eradication programme mandatory throughout the country. This law officially initiated the collaboration of the veterinary Services with the private sector through the creation of inter-institutional commission (Articles 7 and 8). This commission, composed of representatives of the public sector and the private sector through the rural association of Paraguay, were intended to support the Public veterinary services SENACSA in the execution of vaccination. This law also established the resources of the inter-institutional commission by imposing on producers a percentage of the estimated value of each animal marketed (Gobierno Nacional de Paraguay, 1996). This tax now represents about 60% of the Public veterinary services SENACSA's funds.

“Some of this money was used by the programme workers, and some was kept in a savings bank so that in case of an emergency, the money was immediately available. And not to be dependent on the state.” [semi-structured interview, public actor at national level of the PPP]

In May 1997, Paraguay was certified as an FMD-free country with a vaccination regime by the OIE (Servicio Nacional de Calidad y Salud Animal, 2020b). In August 1999, vaccination against FMD was abolished, with the aim of achieving "FMD-free and vaccination-free status". Mass vaccination resumed in 2001 following reports of animals with lesions consistent with FMD (Organización Panamericana de la Salud, 1999).

3.1.4 Restructuration of the FMD programme and start of the official PPP (2002-2012)

In 2002, the OIE certification was suspended due to the reintroduction of the disease (Servicio Nacional de Calidad y Salud Animal, 2020b). This FMD outbreak highlighted the need to better organize the program.

“There was a lot of FMD and we wanted to export... but we had to stop lying and saying we didn't have the disease! We had no guarantee that the producer was doing his job properly, and that the cold chain was respected... “ [semi-structured interview, private actor at national level of the PPP]

The Public veterinary services SENACSA and rural association of Paraguay (ARP) looked for another organizational system to improve their program and were inspired by the Argentinian model.

“We saw experts from Argentina to help us. In Argentina, the Public veterinary services delegated the work to a private foundation for animal health.” [semi-structured interview, private actor at national level of the PPP]

In 2003, the rural association of Paraguay, which was already well structured throughout the country and had offices at the local level, decided to create non-profit animal health commissions in each of the 20 health regions of the country. The Public veterinary services SENACSA then relied on the organised rural association of Paraguay network and its animal health commissions for the implementation of the vaccination (Antonio Esteban Vasconsellos Portas, 2008).

"The Rural Association of Paraguay is the mother of all this programme... the animal health commissions were part of it". [semi-structured interview, private actor at national level of the PPP]

Law 2426/2004, which established the current Public veterinary services SENACSA, clearly defined the competent authority and chain of command, and gave them full powers to exercise control and enforcement mechanisms, including penalties and sanctions (Gobierno Nacional de Paraguay, 2004; World Organisation for Animal Health, 2014). This law made vaccination against FMD mandatory (Article 50). It formalised the relationship with the rural association of Paraguay (ARP) and its Animal Health Commissions by giving the possibility to carry out vaccination by third parties (Article 54) and to create Animal Health Commissions (Article 78).

"This law [2426] is the basis of the PPP." [semi-structured interview, public actor at national level of the PPP]

While the collaboration between the private sector and Public veterinary services SENACSA exists since the beginning, the PPP officially began in 2004. The animal health commissions, which replaced the interinstitutional commissions, are public-private, non-profit auxiliary bodies that collaborate on the FMD eradication programme and other programmes that the Public veterinary services SENACSA deem appropriate (Comisiones de Salud Animal, Mesa Coordinadora, 2012).

Since 2004, the animal health commissions were responsible for the planning and control of vaccination campaigns, by employing officials who received training and accreditation as a prerequisite for their accreditation.

In January 2005, Paraguay regains the OIE status of "Freedom of FMD with vaccination" (Servicio Nacional de Calidad y Salud Animal, 2020a). In 2006, in order to demonstrate the absence of virus circulation on its territory, the Public veterinary services SENACSA set up an epidemiological surveillance programme and initiated serological sampling for the evaluation of the level of immunity to FMD vaccination. Following the recommendations of an OIE audit, zones called "high surveillance zone" were defined, comprising a 15 km wide strip on either side of the border with neighbouring countries (Argentina, Brazil, Bolivia) (Organización Panamericana de la Salud, 2007). In 2010, the second action plan (2011-2020) of the Hemispheric FMD Eradication Programme of the Pan-American FMD Centre PANAFTOSA was approved (P. Centro Panamericano de Fiebre Aftosa, 2018).

In 2010, rural association of Paraguay created a new commission, the animal health commission coordination (ACONASA), to unify the 20 animal health commissions, to centralise resources and to unify decisions related to FMD control. The animal health commission coordination was a legally registered non-profit civil entity (Antonio Esteban Vasconsellos Portas, 2008). In 2011, the "high surveillance zone" was also recognized as free from FMD by OIE and record export levels were at their highest, with almost 70 markets open (Antonio Esteban Vasconsellos Portas, 2008).

3.1.5 The last FMD outbreak (2012-2017)

On September 2011 and January 2012, FMD outbreaks occurred, and the official status granted by the OIE was lost. The social and economic cost of these outbreaks were high, with thousands of direct jobs lost, exports down by 29% (in 2010 the volume of meat and by-products exported corresponded to 918 million dollars, and in 2011 to 750 million dollars), and the indirect impact still difficult to determine (Servicio Nacional de Calidad y Salud Animal, 2011; Food and Agriculture Organization of the United Nations, 2012).

After this outbreak, the resolution 2031/12 of the Public veterinary services SENACSA officially approved the organisation of the 20 animal health commissions and extended their functions. Since this resolution, the official role of these commissions was to be the operational managers of FMD vaccination throughout the country. The entire vaccination process, from planning, vaccination, issuing of documents such as work orders, recording of vaccination records, is controlled by the Public veterinary services SENACSA (Centro Panamericano de Fiebre Aftosa, 2012).

In 2014, the OIE Scientific Commission concluded that the two zones of Paraguay meet the requirements for the reinstatement of FMD free status with vaccination "Country with two FMD free zones where vaccination is practised" (Servicio Nacional de Calidad y Salud Animal, 2020).

3.1.6 Actual situation (2017-2021)

In 2017, the OIE has recertified the entire country with the sanitary status of "Country free of FMD with Vaccination", maintaining this status at present (Servicio Nacional de Calidad y Salud Animal, 2020a). The same year, the private foundation for animal health services (Fundación de servicios de salud animal =FUNDASSA) was created, replacing the private animal health commissions from rural association of Paraguay. The creation of the foundation was motivated to make the private animal health commissions less vulnerable to political changes.

"We [the animal health commissions] were handling a lot of money and the politicians wanted to get their hands on it... they wanted to do something political and not technical. We were very vulnerable." [semi-structured interview, private actor at national level of the PPP].

"ACONASA [the animal health commission coordination] was directly under the control of SENACSA [the Public veterinary services]. A president of SENACSA could decide from one day to the next day that the commission no longer exists. " [semi-structured interview, private actor at national level of the PPP]

The foundation for animal health services FUNDASSA was recognised as a legal entity by Executive Decree No. 7331/2017 (Gobierno Nacional de Paraguay, 2017). A cooperation agreement is signed between the Public veterinary services SENACSA and the foundation for animal health services FUNDASSA for a 10-year collaboration (SENACSA y FUNDASSA, 2017). All the obligations that the animal health commissions had assumed in support of the Public veterinary services SENACSA are maintained, including those related to vaccination against FMD. The foundation "may collaborate, coordinate, develop and carry out the activities necessary for the prevention, control and eradication of contagious animal diseases in the field of animal health, especially those carried out to comply with the country's FMD eradication programmes and others within the framework of the National Animal Health Plan" (SENACSA y FUNDASSA, 2017). In 2018, Paraguay started using a bivalent vaccine (A and O strains) instead of the trivalent vaccine (A, O, C strains) previously used, as the C strain is no longer circulating in the country (Centro Panamericano de Fiebre Aftosa, 2018).

The foundation for animal health services FUNDASSA structure is officially separate from the rural association of Paraguay, but often at the local level the chair of the animal health commission of the foundation is also the local chair of the rural association of Paraguay. The President of the rural association of Paraguay is also present at all weekly meetings at national level and participates fully in decision-making. Today, the Paraguayan private sector is actively involved in regional and global animal health issues both as rural association of Paraguay and the foundation for animal health services FUNDASSA, and international organisations recognise the participation of the private sector in animal health programmes. For example, the private sector is invited, together with the Public veterinary services, to the annual conference of OIE, to the annual meetings of the South American Commission for the control of FMD (COSALFA), or to support the implementation of the hemispheric FMD eradication plan of Panamericano FMD Centre PANAFTOSA (Antonio Esteban Vasconsellos Portas, 2008).

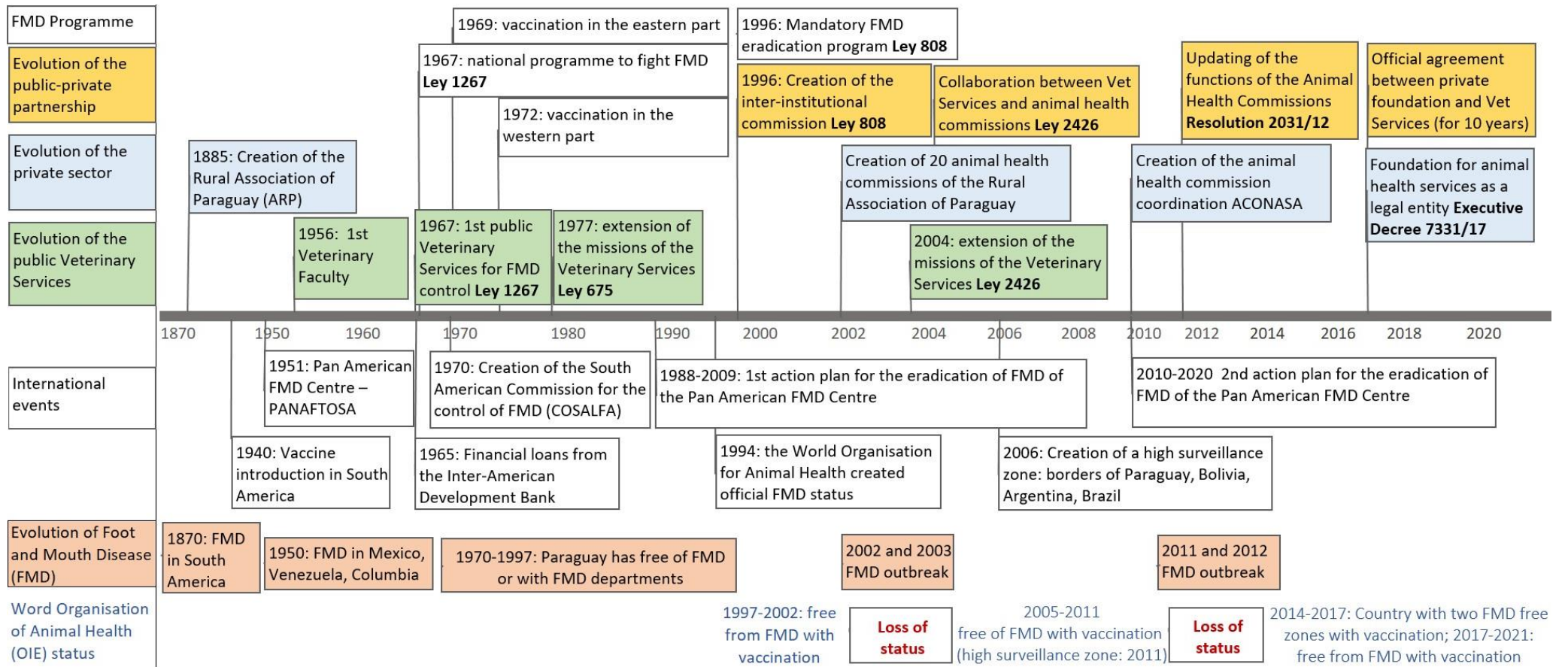


Figure 3: History of the foot-and-mouth disease (FMD) programme (top white squares) and of the public-private partnership (yellow square) in Paraguay from 1870 to 2020. The evolution of the private sector is described in the blue squares, and of the Public veterinary services in green squares. The international event which influenced the programs are described in down white squares. The evolution of the disease is described in red squares. The statuses of the FMD situation in Paraguay given by the World Organisation for Animal Health (OIE) are in blue and red text.

3.3 Evolution of the governance system of the PPP and consequence on the process of PPP

The forms of governance of collaboration between public and private systems for FMD control have evolved over time. The private sector, in particular through the rural association of Paraguay, which has been created since 1885, before the Public veterinary services existed, has been involved in the FMD programme from the very beginning, notably through participation in the meetings and programme of the Pan-American FMD Centre PANAFTOSA. Indeed, in South America, the private sector through producers' association became interested in FMD control, first for zootechnical reasons to improve the productivity of their livestock, and then for commercial reasons, especially since the creation of the OIE status in 1994. They realized that being part of a FMD disease-free circuit would improve their profit (Astudillo, 1997).

The vaccination against the FMD became compulsory by law in 1996, following the creation of the OIE status. The official governance of the collaboration between the rural association of Paraguay and the Public veterinary services, started in 1996 with the creation of a law (law 808), legitimising the inter-institutional commission and the support of the rural association of Paraguay for the implementation of vaccination. The inter-institutional commission ensured that money for the FMD program, mainly from a levy paid by farmers, and payment for vaccines, did not flow through the ministries. Stakeholders said this was an important step for the management of the program, denouncing the risks of government corruption.

In 2003, following an outbreak of FMD and the loss of OIE "free from FMD with vaccination" status, the implementation of the FMD control programme was accelerated thanks to the creation of the 20 animal health commissions of rural association of Paraguay (ARP), which were easily set up because the association was already well structured throughout the country. The collaboration with these animal health commissions of the rural association of Paraguay and the Public veterinary services was legitimised two years later by Law 2426 of 2004. The rural association of Paraguay network has enabled the Public veterinary services to ensure vaccination at the local level, and to develop their own network at the local level. The local units of the Public veterinary services have almost always developed alongside the offices of the animal health commissions of the rural association of Paraguay (which are now the commissions of the Animal Health Services Foundation FUNDASSA). In a need to homogenise the ways in which the different health commissions operated, and to homogenise the financial resources per commission, the animal health commissions coordination ACONASA was created in 2010. This coordination has enabled greater solidarity between the commissions, redistributing financial resources and supporting certain commissions that are in deficit (mainly because they are made up of small farmers which increases the number of farms to be vaccinated and makes logistics more difficult). Finally, the current structure, the Animal Health Services Foundation FUNDASSA, officially separated from the rural association of Paraguay, was only created in 2017.

Indeed, the actors of the health commissions felt vulnerable to a political change and being recognised as a legal person by a decree of the executive branch (decree 7331/2017) protects them for 10 years. Once again, the legislation followed the needs of actors on the ground. In 2018, an official agreement was then signed between the Public veterinary services SENACSA and the private foundation for 10 years. It is therefore not the legal environment that allowed the emergence of this PPP, but rather the networks of actors that influenced the legal evolution according to the needs identified to strengthen the program.

3.2 PPP's outcome on the animal health system: evolution of the veterinary services

Until 1939 there were only 5 veterinarians in the country. If there was a livestock service and an animal health unit since 1917, it was only to guarantee the quality of the meat and there was no support for animal health at field level in any part of the country (Facultad de Ciencias Veterinarias, 2021). Before 1968, there were about a dozen of veterinarians working in the interior of the country. The Public veterinary services of Paraguay really emerged in 1969 at the beginning of the control of FMD in South America, thanks to a loan from the Inter-American Development Bank. The Public veterinary services of Paraguay were created specifically for the control of FMD, and was called “National FMD control services”, and only 10 years after, in 1977, the missions of the veterinary Services were extended to other diseases. In 1969, Public veterinary services had 50 veterinarians in the FMD programme. In 2020, the Public veterinary services have 1620 employees including 400 veterinarians, 276 of which belong to the FMD programme. In 2021 the veterinary Services have competence in animal health and food safety, and are responsible for 9 sanitary programmes (FMD, bovine spongiform encephalopathy, avian influenza, classical swine fever, bovine brucellosis, bovine rabies, bovine tuberculosis, equine infectious anemia, newcastle disease) (Servicio Nacional de Calidad y Salud Animal, 2020c). The bovine brucellosis control programme officially started in 2016, and the strategy is to rely on the same system as the FMD control programme and to entrust the operation of vaccination to the private animal health foundation FUNDASSA.

3.2.1 PPP's indirect outcome on the animal health system: veterinary health coverage in the country

Local veterinary coverage of the Public veterinary services has expanded over the years, mainly in order to carry out the FMD control programme. The extension of this coverage was also made possible by the presence of the private sector, and in particular the rural association of Paraguay, which was already structured at the country level. Thus, the local offices of the public sector were built next to or in front of the association's offices. In 1950, the first five sanitary regional zone and the first local veterinary unit supervised by a private veterinarian were created (Facultad de Ciencias Veterinarias, 2021).

In 1989, there were 12 sanitary regional zones and 47 local veterinary units and 58 veterinarians from the Public veterinary services (SENACSA) in the field (Centro Panamericano de Fiebre Aftosa, 1989). In 2016 a new post of "head of zonal unit" of the Public veterinary services was created, and 50 professionals were recruited at field level (veterinarians, administrative staff). In 2020, there are 20 sanitary regional zones, 13 regional coordination units, 87 local veterinary units, and 159 veterinarians of the Public veterinary services SENACSA at local level (Servicio Nacional de Calidad y Salud Animal, 2020b) (**Figure 4**).

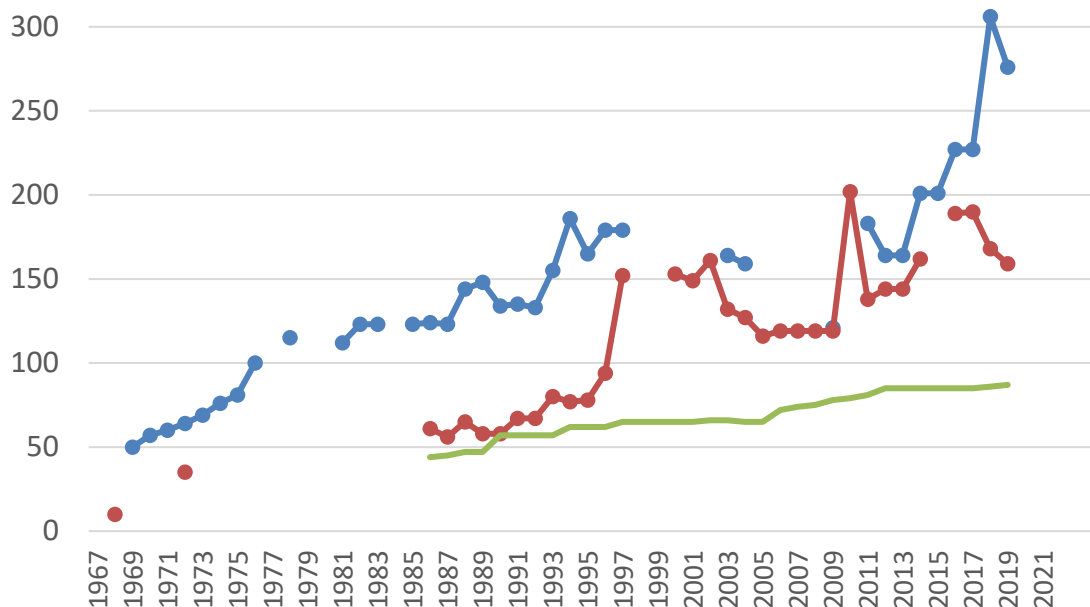


Figure 4: Evolution of the veterinary services coverage in Paraguay from 1968 to 2020.

Number of veterinarians of the public Veterinary Services for the foot-and-mouth disease program (blue line), number of veterinarians of the public Veterinary Services in the field (red line) and number of the local rural veterinary unit (green line). Broken lines mean that data for these years were not found.

3.2.2 PPP's outcome on the animal health system: evolution of the animal traceability system

To enable the FMD programme to function properly, the country's traceability system has been developed, also through a partnership with the rural association of Paraguay. There are two traceability systems in Paraguay: the systems SITRAP (Paraguay Traceability System – “*Sistema de Trazabilidad del Paraguay*”) and SIGOR (Computerised Management System for Regional Offices – “*Sistema Informático de Gestión de las Oficinas Regionales*”).

The Paraguay Traceability System, SITRAP, governed by decree 2504/2004 and resolution 1578/2008, is a traceability system which requires individual identifications with coded ear tags. This system is not compulsory by national legislation, but it is necessary for demanding markets (such as the European Union). This system brings together the most technically advanced and export-oriented farmers (Jori, 2012). The rural association of Paraguay is responsible for the implementation of Paraguay traceability system SITRAP under the authority of the Public veterinary services SENACSA, with coordination through a technical traceability commission. The rest of the animals in the country are not individually identified, except for the cattle holding fire brand which identifies them as property of a specific cattle holding.

The system Computerised Management System for Regional Offices, SIGOR, is a network where all owners must be registered to declare their livestock, the movements and the health information of their bovines, in particular regarding FMD. Before every vaccination campaign every livestock owner must update information on his cattle population. This system is key to the success of the FMD control programme because until the herd is vaccinated against FMD, the livestock holding is blocked in the system and then the owner is not able to perform any cattle transaction until the situation is clarified (Jori, 2012). This system, initially developed for the control of the FMD, in addition to allowing a census of the number of vaccinated bovines, it is also used to make a census of other species, number of owners and other livestock holding data (geographical location, epidemiological coordinates, infrastructure). The first version of this system was developed in 2000, corresponding to a single non-connected computer with a software, followed by the second version in 2003, connected to the network (in the form of distributed data) that was set up in different local units (Centro Panamericano de Fiebre Aftosa, 2003). In 2009, 99% of local units were equipped with this system. The third and actual version of this system, developed in 2010, connects all the computer of the local veterinary unit with the central networks of the Public veterinary services SENACSA (centralised database) (Jori, 2012). Since 2013 (resolution 2031), the entire vaccination process, from the planning to the recording of vaccination records, is carried out using Computerised Management System for Regional Offices SIGOR.

3.4 PPP's outcomes on the livestock system and on the economy: evolution of the cattle and of the meat exportation

Cattle breeding was introduced in Paraguay in 1545, and in 1800 there were 500,000 head of cattle. In 1969 there were 1.18 million head of cattle and this figure increased rapidly within a year to 4.34 million in 1970. The number of owners also increased rapidly, from 0.44 million in 1968 to 1.7 million in 1970. Thereafter, the increase remains more or less constant to reach 14.03 million cattle in 2020 and 137,409 owners. Between 2016 and 2020 the number of owners decreased from 150,689 owners to 137,409 owners, showing that some large owners have more and more cattle (Figure 5). For example, in 2020, the top 15% of owners own 85% of cattle.

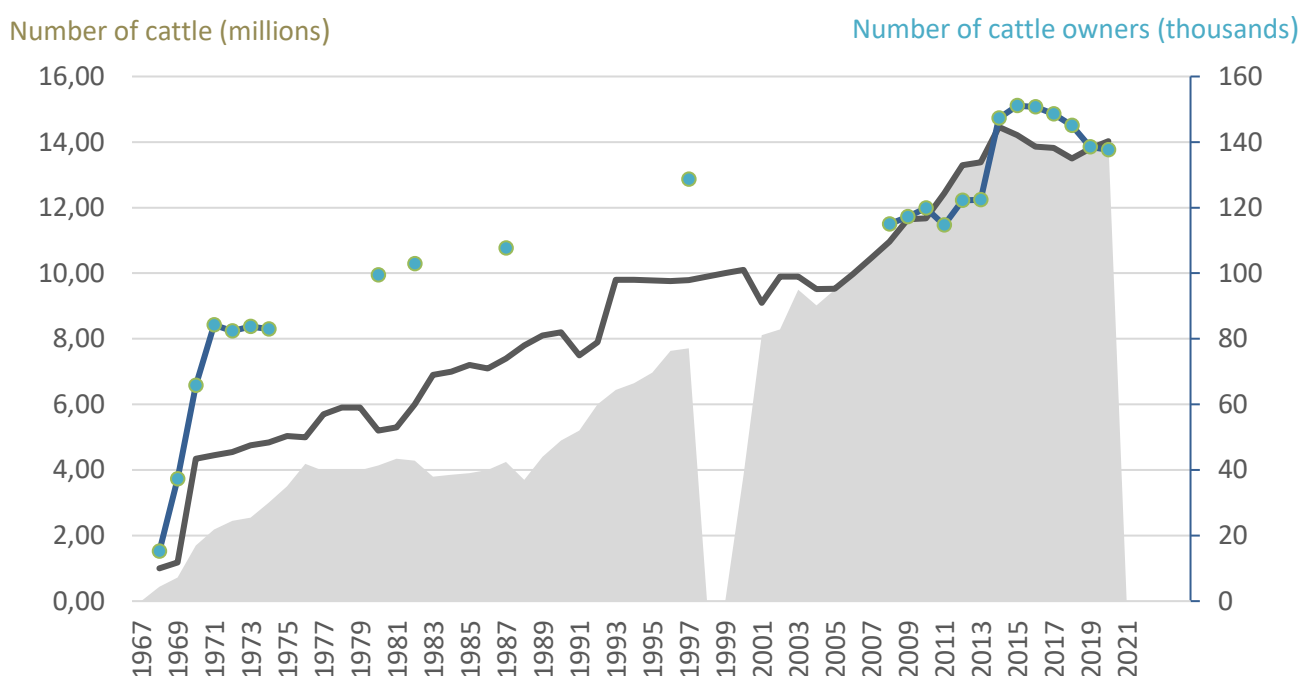


Figure 5: Evolution of the number of cattle and cattle owners in Paraguay from 1950 to 2020.

The black line corresponds to the number of cattle in millions and the top of the grey area to the numbers of vaccinated cattle (the corresponding figures are on the left). The blue line corresponds to the number of cattle owners in thousands (corresponding figures are on the right)

The volume of exports (which is represented in millions of kg of and in millions of dollars in the Figure 5) increases sharply from 2004, corresponding to the year of Paraguay's FMD-free status granted by the OIE. A decrease can be seen in 2011 after the outbreak of FMD. In 2020, the volume of exports reached 321,962 tons corresponding to USD 1,184 millions (Figure 6).

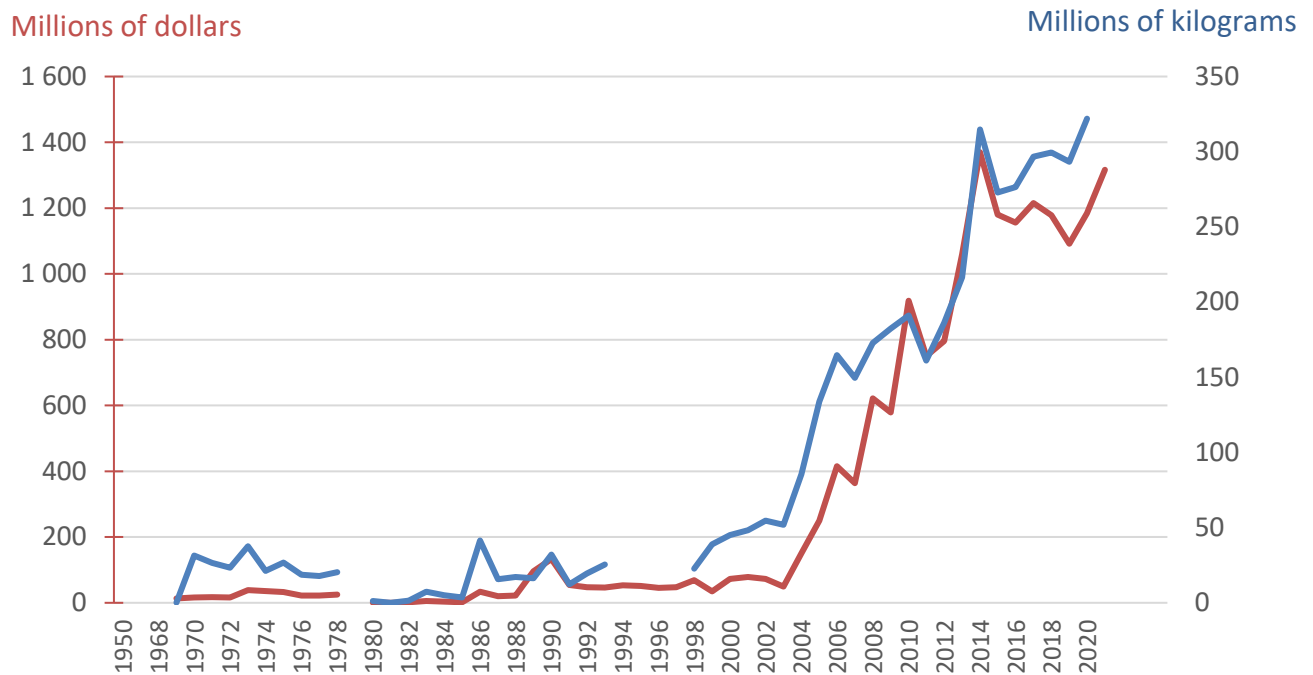


Figure 6: Evolution of the volume of meat offal, by-products and processed products exports and the corresponding financial value. The red line corresponds to the export value in millions of dollars. The blue line shows the export volume in millions of kilograms.

4. Discussion and conclusion

This historical perspective showed that the private sector always collaborated with the Public veterinary services in the FMD programme, but the collaboration evolved through time in terms of organization and governance because of various factors. It seems that the FMD program could not have been implemented without the collaboration of these two sectors. The rural association of Paraguay, the private producer association, was created in 1885, before to the public veterinary services. Since its creation, the veterinary services have been supported by the producers' association which had already existed for several decades and was already well structured throughout the country. From the beginning, the private sector has played a major role in the implementation of FMD vaccination, notably through its participation since the beginning in the meetings and programme of the Pan-American FMD Centre PANAFTOSA. The private sector, thanks to its structure, its human resources, and its influence and motivation to implement an efficient immunization program, has always been responsible for the operational implementation of vaccination, assessed by the public veterinary services. Today, 100% of the cattle population is vaccinated, and the vaccination operation is entrusted to the private sector, through a foundation recognized as a legal entity, and is supervised and evaluated by the Public veterinary services.

Elements of the governance context (regulations and policies) and the economic context (trade standards for the import of meat products), at an international level, have influenced the FMD control program in Paraguay and the PPP. The United States, fearing the introduction of FMD into their country, influenced FMD control in South America by creating PANAFTOSA. Through international loans from Inter-American Development Bank, Paraguay was enabled to create its Public veterinary services in 1967 (as many other countries in South America). The mission of Public veterinary services was only FMD control until 1977, then their missions were extended to other diseases. The creation of official OIE status led to the 1996 law that made the FMD control program mandatory. The influence of the international level, such as the influence of the policies carried out by the veterinary services in Argentina or Brazil (neighboring countries) or by the Pan-American Foot and Mouth Disease Center (PANAFTOSA), or the influence of the European Union and its sanitary requirements for the import of meat, or of the OIE and its performance evaluations and the issuance of statuses, could have been considered in more detail.

This study highlights several contextual elements that influenced the PPP. In terms of the sanitary context, which itself is influenced by the PPP and its results on animal health, we have seen that the various disease outbreaks have led to the restructuring of the PPP and to organizational changes. In terms of the social context, we can mention the important cultural place of livestock breeding in the country, and therefore the influence of the breeders' associations. In terms of the economic context, the importance of livestock in the country's economy has greatly influenced the implementation of the PPP. Indeed, the export of beef to certain countries is conditional on obtaining the health status issued by the OIE.

Several elements of the governance context influenced the PPP. We have already mentioned the influence of the policies of neighboring countries and interregional organizations such as PANAFTOSA, or the OIE health statutes. At the national level, governance among different actors has influenced the PPP. Indeed, the implementation of this PPP results from arbitrations and social choices involving various actors, public and private. The role that the producers' association has played in this PPP is very important. It should be noted that it was the more powerful livestock producers who had a commercial interest in the country's FMD-free status and who were able to influence the program. The non-export-oriented smallholders' farmers did not have any influence on the evolution of the program, but they are directly concerned, as they are now obliged to vaccinate their herds. In addition, it can be mentioned that the country's political system, which appears to be quite corrupt, was a source of motivation for the establishment of a PPP able to manage its own funds for the implementation of vaccination.

The environmental context was rarely mentioned in the interviews conducted during this study. It was mentioned particularly in the southern region of Neembucu, which is a wetland area, partly flooded. This region suffers from increasingly regular flooding, which makes it difficult to access the farms during vaccination campaigns and has an influence on the organization of the PPP (for example, actors are forced to travel on horseback rather than on foot or by car). Little information was available in the grey literature consulted that was related to livestock or PPP. However, given the interaction between livestock and land use, land availability, deforestation and environmental legislation, it would have been interesting to look at other sources of grey literature. We encourage people who want to analyze the influence of the context on the PPP to consider the environmental dimension.

We have also highlighted the influence of the history of the PPP on the results produced by the PPP, which leads to an evolution of the context. The networks of actors involved in the PPP have led to indirect governance outcomes: the evolution of legislative governance and regulations, resulting in the current system between FUNDASSA and SENACSA. In 2017, the animal health commissions of the producer's association created a foundation, recognized as legal entity, because they were afraid to disappear because of political changes, leading to the actual PPP for FMD control. The FMD program in Paraguay, based on collaboration between the public and private sectors, has result in outcomes on the animal health system. It has result in the emergence of a structured public veterinary service with a developed network at the local level. Today, the program provides 100% vaccination coverage of the herd. Paraguay has not experienced an outbreak of FMD since 2012. This review also showed that the FMD program allowed to develop the veterinary infrastructures such as offices at local level with computers and connected management system.

The review allowed for an understanding of the interactions between the public and private sectors, the evolution of forms of organization and collaboration, the evolution of the legislative system, and the systems of governance that we believe are necessary to formulate relevant recommendations in a PPP evaluation process. For these reasons, we think it is interesting to implement a historical perspective when evaluating PPPs. This will allow for a deeper understanding of the PPP process and the reasons for its current functioning, and thus be able to provide relevant recommendations. From a methodological point of view, the mix of semi-structured interviews with key informants who have been directly or indirectly involved in the PPP for a long time, seems interesting. However, we are aware that access to grey literature and archives is sometimes very limited in some countries. In Paraguay, and more broadly in South America, given the importance of the cattle sector in the national economy, data are numerous and accessible. In other contexts, it will be necessary to consider how to overcome this lack of access to data.

Chapitre 2. 2^e partie : résumé d'une étude de cartographie de parties prenantes

Cette étude a été publiée dans la revue Acta Tropica (Appendix 2)
<https://doi.org/10.1016/j.actatropica.2021.105943>

En réponse aux exigences internationales pour atténuer les risques liés à l'antibiorésistance, le gouvernement Laotien a élaboré de nouvelles réglementations sur l'accès et l'utilisation des antibiotiques vétérinaires en 2018. Cette étude cherchait à évaluer, dans une perspective *ex ante*, le potentiel de ces nouvelles réglementations de réduire effectivement les risques liés à la résistance aux antimicrobiens.

Une méthodologie basée sur la cartographie participative des parties prenantes a été utilisée. Les analyses ont été menées en trois étapes. L'étape 1 consistait en un atelier participatif de 10 participants, au cours duquel les différentes parties prenantes de la chaîne d'approvisionnement d'antibiotiques vétérinaires, leur rôle et leurs interactions ont été identifiées. L'étape 2 cherchait à déterminer le positionnement (légitimité, ressources, connections) des parties prenantes ainsi que leurs intérêts et contraintes concernant les nouvelles réglementations. Des entretiens semi-structurés (27 participant·es) ont été menés. Enfin, l'étape 3 cherchait à identifier les opinions et les pratiques concernant l'utilisation des antibiotiques vétérinaires sur la base de questionnaires (36 fournisseur·ses d'antibiotiques, 96 éleveur·ses de poulets, 96 éleveur·ses de porcs).

Les pratiques des 23 parties prenantes identifiées, du secteur public (services vétérinaires) et privé (multinationales, vendeur·ses et utilisateur·rices d'antibiotiques indépendant·es, et éleveur·ses non-laotien·nes) sont en mesure d'influencer le risque d'antibiorésistance. Les connections entre ces parties prenantes ont été explorées. Les parties prenantes liées aux multinationales (technicien·nes et éleveur·ses sous contrat) ne sont que peu connectées aux autres, tout comme les parties prenantes étrangères. Ces dernières utilisent leur stock d'antibiotiques directement importés de leurs pays (comme la Chine). Les services vétérinaires publics et les parties prenantes privées indépendantes, qui vendent ou utilisent des antibiotiques, sont liées par la vente d'antibiotiques ou la fourniture de conseils sur l'utilisation de ces antibiotiques (**Figure 1**). La plupart des antibiotiques trouvés dans les fermes d'éleveur·ses indépendant·es, provenant de sources différentes, étaient des antibiotiques d'importance critique utilisés en médecine humaine.

Les pratiques d'un groupe de parties prenantes influencent les pratiques des autres groupes. Par exemple, les propriétaires de pharmacies vétérinaires ont un rôle important de conseil d'utilisation d'antibiotiques auprès des éleveur·ses. Finalement, les intérêts et contraintes liés à de nouvelles réglementations, dont une restriction des usages antibiotiques vétérinaires, sont différents selon les parties prenantes. Les intérêts et contraintes des parties prenantes sont liés à son positionnement et à son niveau de ressources (ressources financières ou connaissances), de légitimité (selon si ses pratiques sont connues par le gouvernement et légales) ou de connections avec les autres parties prenantes. Ainsi, avoir une ordonnance d'un vétérinaire avant l'achat d'antibiotiques semblait impossible pour certain·es éleveur·ses vivant dans des endroits reculés sans accès à des services de santé animale.

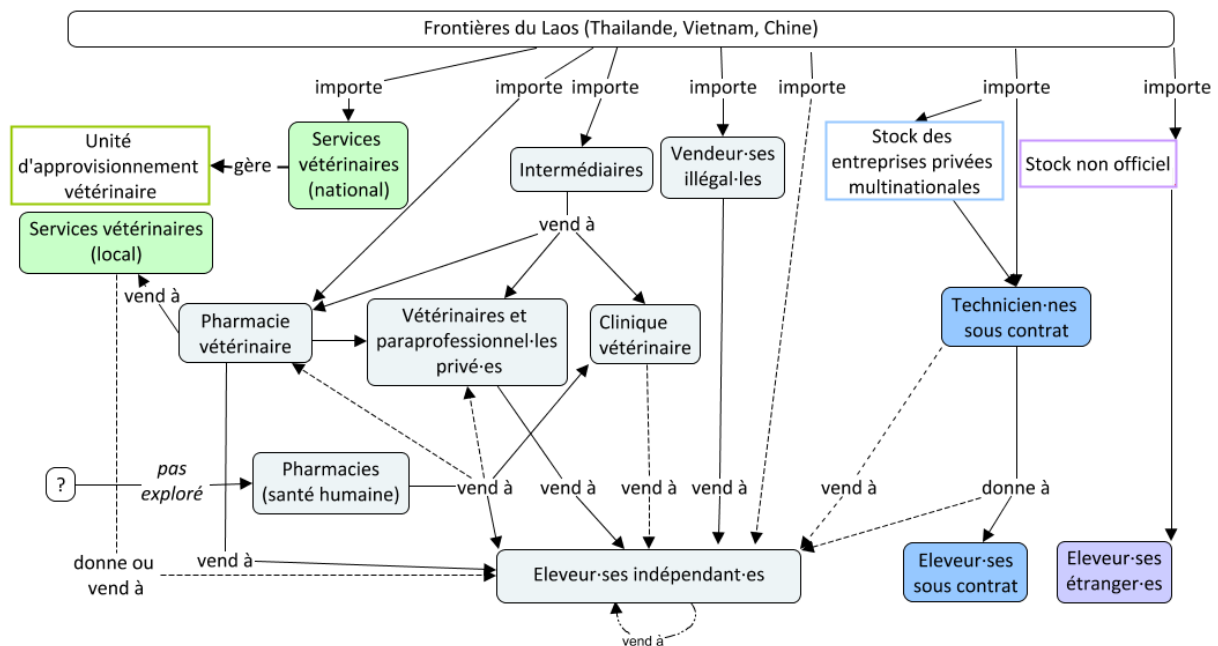


Figure 1 : Cartographie des acteur·rices et leurs liens d'influence de la chaîne d'approvisionnement en antibiotiques vétérinaires dans la capitale de Vientiane et la province de Vientiane, Laos, en 2018. Les parties prenantes sont du secteur public (rectangles verts) et du secteur privé (rectangles bleu foncé : multinationales privées, rectangles violets : éleveur·ses étranger·es, rectangles bleu clair : fournisseur·ses et utilisateur·rices d'antibiotiques indépendant·es).

Si les nouvelles réglementations sont promues par le gouvernement laotien et les services vétérinaires publics, les changements de pratiques des parties prenantes privées ne découleront pas forcément de la mise en œuvre de ces réglementations. Les contraintes amenées par ces réglementations pourraient pousser différentes parties prenantes à ne pas les respecter. Au vu du nombre de parties prenantes et de leurs liens, le gouvernement ne pourra que très difficilement contrôler l'ensemble de cette chaîne d'approvisionnement d'antibiotiques vétérinaires.

Ainsi, l'adhésion des parties prenantes privées pour un plan de gestion de l'antibiorésistance semble essentielle. Des mécanismes permettant le dialogue et l'engagement des parties prenantes identifiées devraient être encouragés, par exemple dans le cadre d'une collaboration public-privée. Ces mécanismes permettraient une compréhension commune du problème de l'antibiorésistance, des intérêts et contraintes des différentes parties prenantes et la coconstruction des objectifs à atteindre.

Cartographier les parties prenantes impliquées dans la vente ou l'utilisation d'antibiotiques vétérinaires s'est avérée utile pour identifier les obstacles que le gouvernement laotien pourrait rencontrer au moment de la mise en œuvre de nouvelles réglementations. Cela a aussi permis de proposer des leviers pour la mise en place d'un plan de gestion de l'antibiorésistance. Dans cette étude, l'analyse de positionnement et l'identification des contraintes et intérêts des parties prenantes n'ont été que brièvement abordés. Nous parlons donc de cartographie de parties prenantes (et non pas d'analyse de parties prenantes) car ces étapes sont centrales dans la méthodologie de l'analyse des parties prenantes. Ainsi, la méthodologie de la cartographie des parties prenantes (comme présentée dans cette étude), qui peut être poussée jusqu'à une analyse des parties prenantes (voir Schmeer (1999) et Varvasovszky et Brugha (2000)), nous semble intéressante à mobiliser dans l'analyse de contexte des PPP. L'analyse devra considérer les parties prenantes impliquées dans le PPP, mais aussi les personnes qui influencent le PPP et les personnes impactées par le PPP. Dans une perspective *ex ante*, c'est-à-dire avant la mise en place d'un éventuel PPP (comme dans cette étude), cette méthodologie peut permettre d'identifier et d'anticiper les intérêts et contraintes qu'ont des parties prenantes à s'impliquer dans un PPP. Une analyse des positionnements permettra donc d'être plus attentif·ves à certains risques associés à l'influence de certains acteur·rices dans le PPP ou à certains groupes d'acteur·rices qui seront impacté·es par ce PPP, et ainsi d'être en mesure de proposer des recommandations pour ajuster le futur PPP. Cette méthodologie nous semble aussi intéressante à mobiliser dans le cadre de l'analyse du contexte de PPP *in itinere* pour les mêmes raisons. De plus, cette analyse pourrait permettre, par exemple, d'identifier un·e acteur·rice manquant·e pour un bon fonctionnement du PPP ou pour favoriser certains résultats. Cette méthodologie, même si elle fait partie d'une analyse de contexte (dans le sens où les acteur·rices, liens et influences hors PPP sont aussi considérés), peut apporter une nouvelle lumière sur le fonctionnement du PPP et permettre de formuler des recommandations plus adaptées pour une amélioration du processus. La mise en place de cette méthodologie lors de l'évaluation, peut également permettre d'initier un dialogue entre les différents groupes de parties prenantes et de favoriser la transparence du processus de mise en œuvre du PPP.

Chapitre 3

Chapitre 3. Analyse du processus des partenariats public-privé

Préambule du chapitre 3

Le chapitre 3 porte sur l'évaluation du processus des PPP du modèle d'analyse (**Figure 1**).

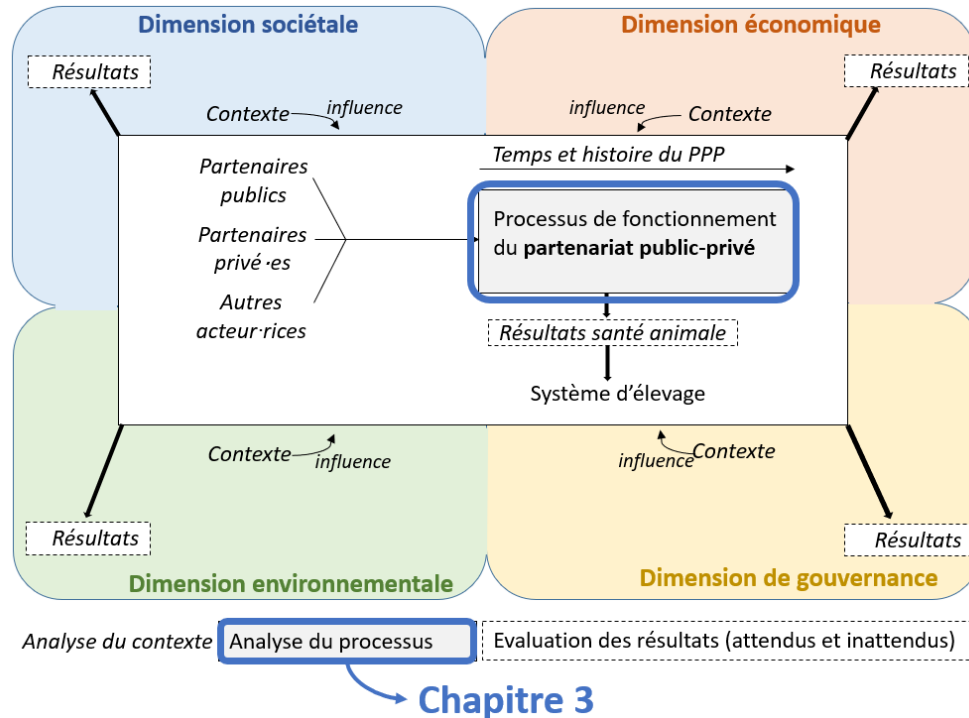


Figure 1 : Le chapitre 3 porte sur l'évaluation du processus du PPP (rectangles bleus), correspondant à une partie du modèle d'analyse

L'importance de s'intéresser au processus de fonctionnement (définition de l'objectif, mécanisme de gouvernance, planification des activités, collaboration) du PPP a été soulignée dans la revue de littérature. Pour être en mesure d'analyser le processus et d'identifier les forces et faiblesses de ce processus, un outil d'évaluation a été développé. Le développement de cet outil est présenté dans une première partie de ce chapitre. Ce développement s'est appuyé sur les critères d'évaluation du processus identifiés dans la revue de littérature, sur une élicitation d'opinions d'expert-es (du secteur public et du secteur privé) et sur deux cas d'étude. Les critères d'évaluation identifiés dans ce chapitre peuvent être regroupés en 10 sections principales : 1. définition d'objectif(s) commun(s) aux deux parties, 2. explicitation des intérêts et bénéfices spécifiques à chaque partie, 3. identification des risques et contraintes, 4. prise en compte des facteurs externes et élaboration de stratégies, 5. mécanisme de gouvernance, 6. Planification des activités du PPP, 7. renforcement des compétences et formations, 8. communication et transparence, 9. mécanisme de collaboration, 10. suivis et évaluations (**Figure 2**)

Cet outil a été élaboré dans le but de faciliter la mise en œuvre d'évaluations participatives. L'amélioration du fonctionnement du PPP permettrait de favoriser des résultats positifs et de limiter les risques et résultats négatifs du PPP. Dans une deuxième partie de ce chapitre, un résumé de l'utilisation de cet outil pour évaluer un PPP en Tunisie est présenté. L'outil développé est un outil « semi-quantitatif » et demande à ce que chaque critère d'évaluation soit noté de 0 à 3 par les parties prenantes impliquées dans l'évaluation. Cet outil permet des sorties graphiques facilement interprétables ce qui facilite la co-élaboration de recommandations pour améliorer le fonctionnement du PPP. Cependant, cet outil vient s'ajouter à et non pas remplacer d'autres approches, et notamment des approches qualitatives (comme des entretiens approfondis). La combinaison de ces approches permettrait alors une compréhension fine du processus de fonctionnement des PPP étudiés, expliquant ainsi « comment, pourquoi et dans quelles conditions est-ce qu'un PPP amène à de bons résultats ? ».

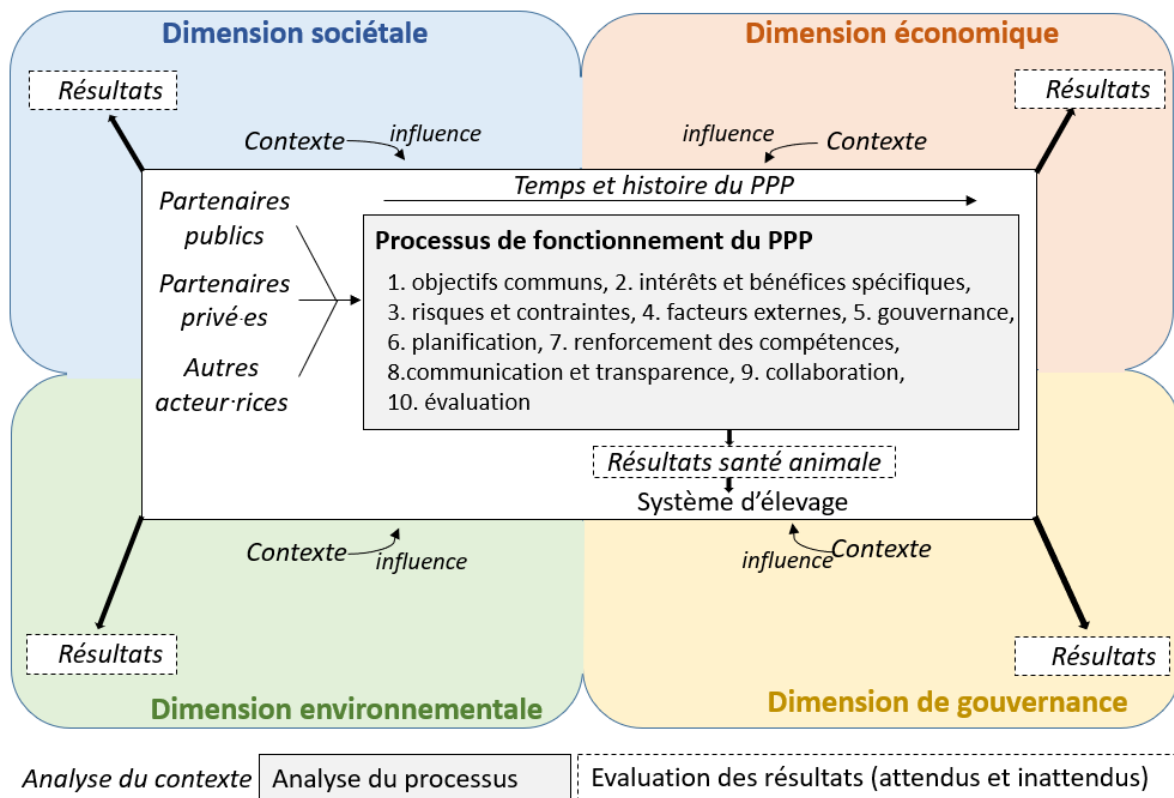


Figure 2 : Le chapitre 3 nous a permis d'identifier les éléments importants à considérer dans l'évaluation du processus du PPP

Chapitre 3. 1^{re} partie : presentation d'un outil d'évaluation du processus

*Cette étude a été publiée dans le journal Plos One en Mars 2021.
<https://dx.plos.org/10.1371/journal.pone.0252103>*

Title: An evaluation tool to strengthen the collaborative process of the public-private partnership in the veterinary domain

Mariline Poupaud^{1,2*}, Nicolas Antoine-Moussiaux², Isabelle Dieuzy-Labayé³, Marisa Peyre¹

¹ UMR ASTRE, Univ Montpellier, Cirad, INRAE, Montpellier, France.

² Fundamental and Applied Research for Animals and Health (FARAH), University of Liège, Liège, Belgium.

³ World Organisation for Animal Health (OIE), Paris, France.

Highlights

- A tool was developed to evaluate public-private partnership processes in the veterinary domain
- The viewpoints of public and private partners, catalyzers and actors impacted were captured
- This tool helps to promote good practices, strengthen the collaborative process and formulate recommendations for improvement of the public-private partnerships
- This tool helps to limit the potential risks and improve the outcomes and impacts of public-private partnerships

Abstract

Public-private partnerships (PPPs) in the veterinary domain are widely implemented worldwide and can help to strengthen the capacities of veterinary services. Few analyses have been made of these initiatives. This study is aimed at developing an evaluation tool based on participatory approaches and focusing on the quality of PPP processes in the veterinary domain.

The tool was divided into ten sections relevant to PPP process organisation and activities. The 44 evaluation criteria and six quality attributes (operationality, relevance, acceptability, inclusiveness, adaptability, and stability) were identified based on literature review and case-study application. The tool was adjusted during four regional PPP training workshops bringing together stakeholders from both public and private sectors. Finally, the tool was validated through an experts' elicitation process and applied in the field in Paraguay.

The tool was developed in a non-normative perspective to help the partners adapt the PPP to their specific context, to maximize the opportunities and minimize the risks of such collaborations, and to formulate adapted recommendations to strengthen and improve the PPP collaborative process and thus the outcomes. In an ex-ante perspective, this tool would also help public and private actors to engage and develop a PPP process following the best possible practices. The aim of this tool is to help decision making in terms of PPP development and implementation in the veterinary domain to ensure the added value and relevance of such a collaborative approach in different countries worldwide.

Key words: evaluation, participatory approaches, co-learning, public-private partnership, veterinary domain

1. Introduction

Public-Private Partnerships (PPPs) in the veterinary domain (as defined in the *Terrestrial Animal Health Code* (World Organisation for Animal Health, 2019c)) are "a joint approach in which the public and private sectors agree on responsibilities and share resources and risks to achieve common objectives that deliver benefits in a sustainable manner" (World Organisation for Animal Health, 2019b). The Performance of veterinary services (PVS) Pathway, a flagship program proposed by the World Organisation for Animal Health (OIE) for evaluating and advising on policies and strategies to strengthen national veterinary services (as defined in the *Terrestrial Animal Health Code* (World Organisation for Animal Health, 2019d)), recognises PPPs as a potential tool for such strengthening (World Organisation for Animal Health, 2019a).

From the analysis of 97 initiatives implemented across the world, Galière et al. (2019) highlighted that PPPs in the veterinary domain involve a diversity of actors, mechanisms and objectives and can be grouped into 3 main clusters (Galière et al., 2019a). Cluster 1, "transactional PPP" are often initiated and financed by the public sector and the services come from private veterinarians or paraprofessionals who are contracted or given a sanitary mandate. Cluster 2, "collaborative PPP", corresponds to PPPs usually motivated by trade, exports and/or commercial interests, initiated by both the private sector, often represented by producer associations, and the public sector. Finally, Cluster 3 "transformative PPP" corresponds to PPPs focused on establishing capability and development objectives, initiated and financed by the private sector (local or international companies). Ahuja (2004), analysing the economic rationale of sector roles in the provision of animal health services, stressed the importance of a division of labour between the public and private sectors. For example, with regard to animal health services in remote areas, it encourages working through civil society organisations, and using para-professionals and community-based animal health service delivery systems (Ahuja, 2004b).

Despite many examples of PPPs implemented in the field in the veterinary domain, few studies have evaluated the initiatives in place (Poupaud et al., Under publication). Evaluation is a means to reinforce partnerships and the process of collaboration. It helps in planning, redefining strategies, taking appropriate corrective actions, ensuring trust between partners, optimizing resources and finally ensuring the effectiveness of actions (Allen, 2019; Rieker, 2011).

However, no evaluation framework of PPPs in the veterinary domain has been formulated (Poupaud et al., Under publication). The evaluation frameworks in Public Health highlight the importance of evaluating the PPP process and not only its outcomes, by analysing the quality of the mechanism and functioning of PPP. Analysis of these evaluation frameworks has identified the important steps in evaluating the PPP process: analysing the PPP objective(s), the governance process, the planning process and the collaboration process between partners (Poupaud et al., Under publication).

For example, they emphasized the need for partners to understand their respective motivations and objectives (National Academies of Sciences, 2016). The quality of PPP outcomes will depend on the quality of its organization. Hence, the evaluation of the PPP process is crucial to providing recommendations on how to improve the PPP's outcomes. Evaluation of animal health programs does not usually include an analysis of the process. To our knowledge, the only two existing tools focusing on the process are specific to surveillance programs. The Oasis tool assesses the functional parts of a surveillance system (Hendrikx et al., 2011) and the One Health matrix assesses the multi-sectorial collaboration in One Health surveillance programs (Bordier et al., 2019). The Oasis tool model has been used to evaluate many surveillance systems and has demonstrated its ease of use.

The PPP process evaluation frameworks in Public Health provide a robust basis, but need to be adapted to the veterinary domain by including specific key success factors and obstacles identified in PPPs in this domain, and could be expanded towards a more integrated approach.

PPPs represent a means to achieve objectives and can be transitional; they need to be adapted to their own context and they cannot be reduced to “a formula” to be applied and followed (National Academies of Sciences, 2016). This is why we argue that PPP evaluation should mobilize an evaluative research approach that seeks to understand the how and why of the results, rather than a normative evaluation approach that seeks to compare the components of the intervention to standards (Champagne et al., 2011a). There is general agreement in the literature that PPPs need to present collaborative advantages; that is, they should represent an added value compared to a program that does not involve PPPs (Poupaud et al., Under publication). However, it is not easy to measure the benefits of collaboration. It is recognised that the best way to do so is to engage in deliberation among partners about this potential added value, using participatory approaches (Bryson et al., 2015). Furthermore, participatory approaches to evaluation have proven very useful in ensuring the adaptability and acceptability of the evaluation outputs, facilitating the implementation of corrective actions to improve process quality (Calba et al., 2016, 2015a). To the best of our knowledge, no tool has yet been developed to allow a participatory evaluation of the quality of the PPP process in the veterinary domain.

The aim of this study is to create a participatory tool that focuses on the PPP process in the veterinary domain. The intended tool would help in formulating recommendations to strengthen the collaborative process and thus improve the outcomes. In an ex-ante perspective, this tool would also help to anticipate a collaborative process.

2. Material and methods

2.1 Tool organisation and development

The tool was developed on the basis of existing tools – such as the Oasis tool which aims to evaluate the quality of the animal health surveillance system process (Hendrikx et al., 2011) and Survtool (Peyre et al., 2019) which assesses the strengths of collaborations within One Health surveillance systems. The tool is comprised of sections, representing PPP process organisation and activities. Each PPP process section is assessed using a set of evaluation criteria, each evaluation criterion being scored on a four grades scale from 0 to 3. The influence of the PPP process on its performance is assessed using quality attributes.

The PPP process sections, evaluation criteria to assess each PPP process section and the quality attributes which represent overall PPP performance were defined according to the literature review and PPP case-study analysis. The first version of the tool was tested during 4 regional PPP training workshops organised by the OIE in Africa and Asia, and the tool was amended based on user feedback. The revised version (version 2) of the tool was validated through an experts' elicitation process (**Figure 1**).

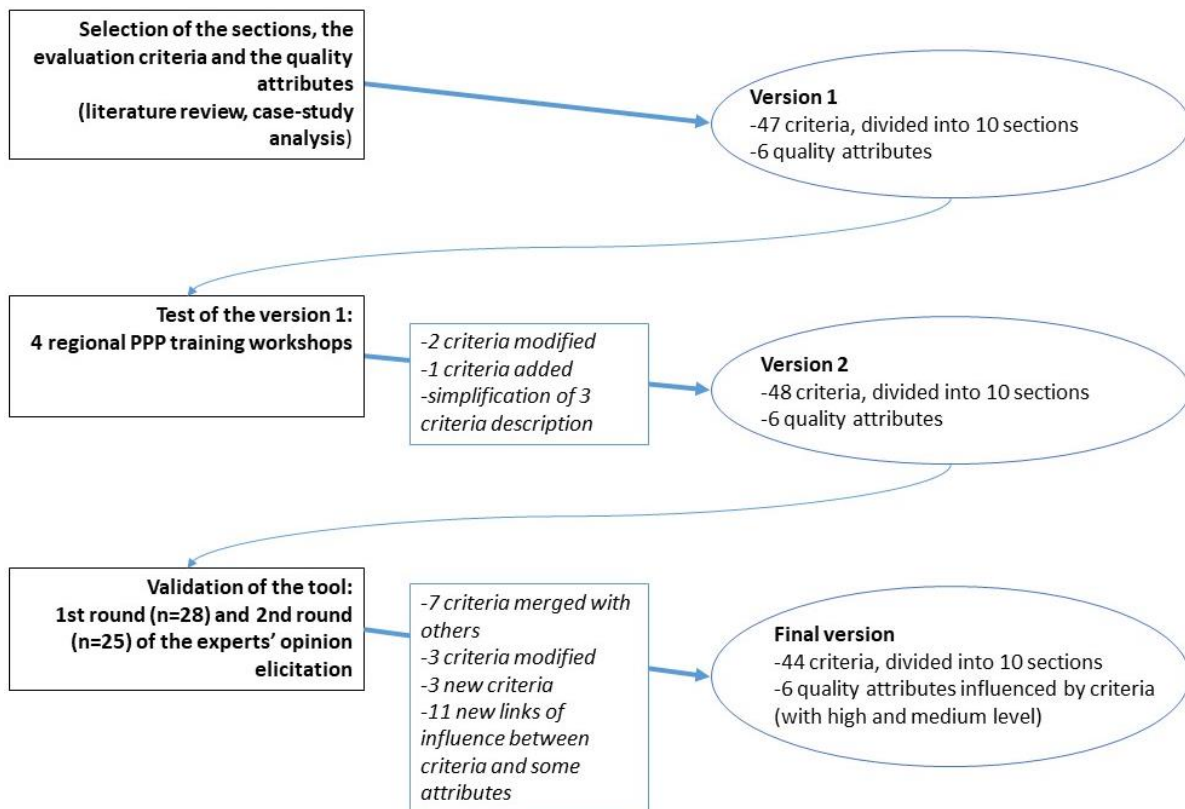


Figure 1. The process of the tool development. The different steps of this study captured the viewpoints of public and private partners, catalyzers and actors impacted by the public-private partnerships. *PPP*: *public-private partnership*.

In parallel, a checklist was created to support the collection of useful information to be used for the scoring of the evaluation criteria, together with a scoring guide to help the evaluators correctly understand the evaluation criteria and facilitate the scoring process. Finally, a spreadsheet was developed to integrate the evaluation criteria scores and automatically process calculation of the PPP process sections and quality attributes (Hendrikx et al., 2011).

2.2 Literature review and case study analysis to define the sections of the public-private partnership process, evaluation criteria and quality attributes

The sections of the PPP process and evaluation criteria, identified in a scoping review that analysed the existing evaluation frameworks of PPPs in the veterinary domain and public health, were used to construct the first version of the tool (Poupaud et al., Under publication). In addition, the OIE PPP Handbook of best practices, co-constructed with actors involved in PPPs or catalysers of PPPs (individuals or organisations whose activities support or enable the implementation of PPPs), was used to identify the PPP process sections of the tool (World Organisation for Animal Health, 2019b). Evaluation criteria used in the Oasis tool and One Health matrix to evaluate the process of surveillance programs were also analysed to identify additional evaluation criteria to include in the PPP tool (Bordier et al., 2019; Hendrikx et al., 2011). Indeed, as for PPP, surveillance systems are a collaboration of multiple actors from different sectors and with different perspectives.

Finally, in order to select the quality attributes of the PPP performance, the attributes from the One Health matrix were compared to the theoretical framework developed by Bryson and collaborators (2015) on cross-sectoral collaboration that includes public-private partnerships in the Public Affair domain .

The evaluation criteria were also defined using the results of a PPP evaluation case study performed within the framework of the OIE PPP initiative (World Organisation for Animal Health, 2016). This case study addressed a long-term public-private partnership in the veterinary domain, between a poultry producing company and the Ethiopian Ministry of Livestock and Fisheries, aiming at developing the poultry sector in Ethiopia (Poupaud et al., 2019). This evaluation case study was conducted with the participation of the different categories of actors involved, i.e. public and private actors from national and local levels. Semi-structured individual interviews (n=33) addressed the topics of the context of implementation, organisation and process of the PPP, the strengths and weaknesses of the system, the actors involved, the missing actors, and the prospects for improvement. In addition, two participatory workshops were held with the different stakeholders to validate the results obtained, compare the different viewpoints of stakeholders and co-develop improvement scenarii (n=26 and 53). Every discussion that took place during the workshops or individual semi-structured interviews was recorded and transcribed.

The transcripts were read, and categories emerged from the reading, corresponding to the functional process of the PPP (such as type of private partner, type of public partners, training organization etc). During a second reading of the transcripts, the qualitative data were classified into these categories in a spreadsheet file. Actors' narratives were used to identify which evaluation criteria selected from the literature were applicable to this case study and which evaluation criteria were missing.

2.3 Public-private partnership regional training workshops to test version 1 of the tool

Version 1 of the tool was tested and improved during four regional training workshops on PPPs organized by OIE. One workshop was held in Ethiopia for English-speaking African countries, another in Tunisia for French-speaking African countries, another in Nepal for South Asian countries and the last one in Thailand for South-East Asian countries. The four workshops involved around 200 public and private stakeholders who were engaged in PPPs or who were planning to set up a PPP initiative. Participants were from national veterinary services, producer associations, private veterinary workforce associations, private industry (meat, dairy or veterinary products) and non-governmental organizations. The tool was tested by groups of 5 to 10 people, mixed between public and private sectors, during a one-hour session. Participants were asked while implementing the tool to review the relevance of the evaluation criteria used, the clarity of evaluation criteria description, to identify any missing evaluation criteria, to comment on the usefulness of the tool, and how easy it was to use. Participants' feedback was collected and analysed to produce Version 2 of the tool and a revised list of evaluation criteria and associated definitions.

2.4 Experts' elicitation process to validate the tool (version 2)

The tool was validated by experts' elicitation in a two-round process, consisting of two online-questionnaires developed with the SurveyMonkey® tool that experts have to fill in. The aims of this experts' elicitation process were: 1) to validate the evaluation criteria (relevance, definition, exhaustiveness) used to assess the strengths and weaknesses of each section of the PPP process and 2) to validate the influence of each criterion on quality attributes of the PPP performance. The first questionnaire was sent on the 15th of September 2020 to 37 experts, and closed on the 1st of October; 27 experts responded to it with a mean time of 43 minutes (from 21 min to 2 hours and 25min). The 27 experts were private partners (e.g. private companies, private veterinarians or veterinary associations, producer organizations) (n=8), public partners from the official veterinary services (n=3) and catalysers from international organizations such as OIE, Food and Agriculture Organization of the United Nations (FAO), and the International Fund for Agricultural Development (IFAD) (n=16). The experts had been involved in PPPs or supporting PPPs for less than 2 years (n=6), from 2 to 5 years (n=7), from 5 to 10 years (n=9), or for more than 10 years (n=6).

The results were analysed and any discrepancies between experts were reviewed during a second round. The second questionnaire was sent to the same 27 experts on the 28th of October and closed on the 13th of November; 25 experts (two experts from the catalysers did not answer during the second round) responded with a mean time of 24 minutes.

The questionnaires from the two rounds included four main parts: (i) background information on the experts, (ii) review of the PPP process sections and evaluation criteria, (iii) review of the quality attributes, and (iv) review of the influence of the evaluation criteria on the quality attributes. The two questionnaires were tested through one pilot interview each. In parts 2 and 3, the experts were asked to review the relevance of the evaluation criteria (yes/no) and if they could identify missing ones. In part 4, the experts had to review the level of influence (no influence/ low level/ medium level/high level of influence) of the evaluation criteria on the quality attributes and to provide the level of confidence in their answers (0= not confident; 0.5 = quite confident; 1 = very confident). Experts' answers were then uploaded into a spreadsheet, a descriptive quantitative analysis was conducted for each answer, open comments and justifications about their selection of evaluation criteria and attributes were analysed.

The evaluation criteria and the quality attributes were validated if 85% or more of the experts considered them to be relevant. Experts' comments were used to improve or clarify the evaluation criteria definitions. The evaluation criteria not validated according to this threshold, were revised based on experts' comments and included in the second round. The percentage of experts who selected each levels of influence of the evaluation criteria on the quality attributes (high, medium, low, no influence) were weighted according to the level of confidence of the expert in their answers (**Table 1**).

Table 1. Calculation of the weighted percentage of experts used for the analysis of the experts' elicitation. The weights represent the level of confidence of the experts in their answers. This calculation was used to validate the level of influence of evaluation criteria on the six quality attributes.

Level of influence of an evaluation criterion on a quality attributes	Percentage of experts	Weight = level of confidence (from 0 to 1)	Weighted percentage of experts
High	a1	w1	$= a1*w1 / \sum ai*wi$
Medium	a2	w2	$= a2*w2 / \sum ai*wi$
Low	a3	w3	$= a3*w3 / \sum ai*wi$
No influence	a4	w4	$= a4*w4 / \sum ai*wi$

The level of influence was validated when the agreement between experts reached more than 50% of the weighted percentage. If not, they were included in the second round. If no agreement was reached after the second round, the intermediary level of influence was selected.

2.5 Field testing of the tool in Paraguay

The tool was implemented in a PPP in Paraguay for the control of foot-and-mouth disease (FMD). The tool was implemented through an external actor who is part of the research team, with groups of 3 to 7 people who were public and private partners. This was done at national level (n=3) with actors in charge of the national program and at local level, in two different localities (n=5 and n=7), with actors in charge of the program implementation in their localities. For each evaluation criterion, the actors had to agree on a grade. If they did not agree, they were asked to explain why they selected such a grade. They were then asked to find a consensus (e.g., a score of 1 if some had initially put 0 and the other 2). Each discussion lasted between 1 and 2 hours and was recorded and transcribed.

2.6 Ethics statement

This study does not concern human health and medical research or animal research, hence, no ethics committee was consulted for study approval.

For the case-study in Ethiopia, the approval to implement the participatory study was obtained from the managing director of the private poultry producing company and, the delegate of the OIE in Ethiopia, who is also the Chief Veterinary Officer at the Ministry of Agriculture. The semi-structured interviews and the workshops were carried out after presenting the study objectives and obtaining verbal informed consent from all volunteer participants. The results obtained from this evaluation case-study were presented and validated by the volunteer participants of the second workshop.

For the PPP regional training workshops, the workshops in the four regions were organised in collaboration with the respective regional representation of the OIE (of Africa for the workshops organized in Tunisia and Ethiopia, and of Asia and the Pacific for the workshops organized in Thailand and Nepal), and a permission was asked from each OIE Delegate, often also the Chief Veterinary Officer, of the involved country. In each workshop, when implementing the first version of the tool, explanation were given on the goal of this exercise to the volunteer participants.

For the experts elicitation, a first email was sent to 45 pre-selected experts (from the private sector, the public sector and catalyser groups), based on personal contacts of CIRAD and OIE, mentioning the goal of the study and asking if they were interested in participating. The first questionnaires was sent only to those who mentioned their interest (n=37), and the second questionnaire only to those who answered to the first questionnaire (n=27). Feedback from the analysis of the answers given to the two questionnaires was sent to all 27 experts.

For the field testing in Paraguay, the approval to implement the participatory evaluation of the PPP was obtained from the regional representative of the OIE of the Americas, the Delegate of the OIE of Paraguay, the Chief Officer of the veterinary services in Paraguay and the director of the private foundation of the bovine producers. The implementation of the evaluation tool was carried out after presenting the study objectives and obtaining verbal informed consent from all volunteer participants.

No personal information about volunteer participants was requested in any of the studies (Ethiopian case-study, PPP regional training workshops, experts' elicitation and the field testing in Paraguay), the privacy rights of participants were fully protected, and all data were anonymized. Any of the studies included minors.

3. Results

3.1 Public-private partnership process evaluation tool organisation

The final version of the tool is composed of 10 sections of the PPP process, representing the organisational process of a PPP and its activities, 44 evaluation criteria and 6 quality attributes, assessing the influence of the public-private partnership process on its performance (**Table 2 and 3**).

Table 2. Presentation of the tool validated by the experts' elicitation: 10 sections of the public-private partnership process, 44 evaluation criteria, and 6 quality attributes.

The sections represent the public-private partnership process organization and activities. Each section is composed of a set of evaluation criteria. The six quality attributes assess the influence of the public-private partnership process on its performance. The evaluation criteria and the quality attributes were validated if 85% or more of the experts considered them to be relevant.

PPP: public-private partnership

PPP process sections	Evaluation criteria	Influence on the quality attributes
Section 1: Objective(s) of the PPP	1.1 Common objective(s)	Operationality
	1.2 Formalization of the common objective	Stability
	1.3 Position of the partners regarding this common objective	Acceptability
	1.4 Added value of the PPP	Stability, Relevance
Section 2: Specific interest and benefits	2.1 The specific interest of the different partners	Relevance, Acceptability
	2.2 Allocation of benefits and other outputs (ownership)	Relevance, Acceptability, Inclusiveness
	2.3 Achievement of goal(s) of the veterinary services	Relevance
	2.4 Achievement of goal(s) of the private sector	Relevance
Section 3: Risks and constraints	3.1 Risks and constraints of getting involved in the PPP	Stability, Adaptability
	3.2 Allocation of the constraints	Acceptability, Inclusiveness
	3.3 Change of practices	Operationality, Adaptability
	3.4 Negative cost to the society	Stability, Relevance
	3.5 Conflicts of interest	Stability, Acceptability
Section 4: Analysis of the context and external factors	4.1 Relevance of common objective and of the strategy regarding the context	Relevance
	4.2 International, regional, national, and local laws	Operationality
	4.3 Potential threats of the PPP and mitigation	Stability, Operationality
	4.4 Organisation of private and public sectors	Stability, Operationality
	4.5 Analyses of pre-existing PPPs	Relevance

PPP process sections	Evaluation criteria	Influence on the quality attributes
Section 5: Governance of the PPP	5.1 Formalization of the PPP	Stability, Acceptability
	5.2 Knowledge of the terms of the partnership (contract) and endorsement by all the partners	Stability, Acceptability
	5.3 Shared decision making process	Acceptability, Adaptability, Inclusiveness
	5.4 Opportunities of private parties' involvement	Adaptability, Inclusiveness
	5.5 Funding and human resource availability	Stability, Operationality
	5.6 Funding and human resource allocation	Acceptability
	5.7 Adequacy with the veterinary services mandate	Relevance
Section 6: Planning and responsibilities of the PPP	6.1 Division of roles and responsibilities	Operationality, Acceptability
	6.2 Potential other partners	Stability, Adaptability, Inclusiveness
	6.3 Inclusion of vulnerable group	Adaptability, Inclusiveness
	6.4 Defined duration	Stability, Operationality
	6.5 Modalities of implementation of the PPP activities	Stability, Adaptability
	6.6 Joint work plan	Operationality, Adaptability
Section 7: Competencies and trainings	7.1 Confidence in other partners' competencies and satisfaction of partners about their own competencies	Acceptability, Inclusiveness
	7.2 Organisation of training and reinforcement of capacities	Operationality, Relevance, Adaptability
	7.3 Accessibility and frequencies of trainings	Operationality, Inclusiveness
Section 8: Communication and transparency of the PPP	8.1 Internal communication	Operationality, Acceptability, Adaptability, Inclusiveness
	8.2 Agreement in resolution modalities in case of conflict	Stability
	8.3 Communication with other parties, politics, and with end users	Acceptability, Adaptability, Inclusiveness
	8.4 Transparency	Stability, Inclusiveness
Section 9: Collaboration in the PPP	9.1 Willingness to collaborate and partners' acceptance of their own roles	Acceptability, Inclusiveness
	9.2 Level of involvement of partners/mobilisation	Acceptability
	9.3 Willingness for capacity building in PPPs (existence of a champion?)	Operationality, Adaptability
Section 10: Monitoring and evaluation of the PPP	10.1 Internal monitoring of the PPP	Operationality, Stability, Adaptability
	10.2 Agreed indicators for joint internal monitoring	Acceptability, Adaptability
	10.3 External evaluation	Operationality, Acceptability, Adaptability

Table 3. The six quality attributes of the public-private partnership process and their definition.

Those six quality attributes assess the influence of the public-private partnership process on its performance, and are influenced by different evaluation criteria. The high (score of 10) and medium (score of 5) level of influence of the evaluation criteria on the six attributes were validated during the experts' elicitation as the agreement between experts reached more than 50% of the weighted percentage of experts (see Table 1). The levels of influence that did not reach 50% of the weighted percentage of experts' consensus were between medium and high level and a score of 7,5 was given. *PPP: public-private partnership*

The six quality attributes and their definition	Evaluation criteria with a level of influence:		
	<i>high (10)</i>	<i>between medium and high (7,5)</i>	<i>medium (5)</i>
<p>Operationality (influenced by 16 evaluation criteria) The quality attribute of operationality includes the technical aspects of the program (governance, trainings, implementation of activities) and resource management. The governance of PPP is operational, and collaboration is effectively implemented to meet the main objective. Trainings are organised to be sure that stakeholders can fit their roles. The mechanisms for resource allocation are defined. The resources are appropriate and available for the effective implementation of activities.</p>	1.1, 4.2, 4.3, 4.4, 4.5, 5.5, 6.1, 6.6 7.3, 8.1, 9.3, 10.1, 10.3 (n=13)	6.4 (n=1)	3.3, 7.2 (n=2)
<p>Relevance (influenced by 9 evaluation criteria) PPP strategy, modalities and activities are relevant regarding the main objective. The main objective is relevant and useful regarding the context (epidemiological, institutional, environmental, societal). The PPP represents a clear added value to achieve the objective.</p>	1.4, 2.1, 2.2, 2.3, 2.4, 4.1, 5.7 (n=7)	3.4 (n=1)	7.2 (n=1)
<p>Acceptability (influenced by 17 evaluation criteria) All relevant stakeholders demonstrate trust in the system, mutual understanding and willingness to collaborate. The objectives and outputs of the PPP meet the stakeholder's expectations. Actors are satisfied with the distribution of resources. The PPPs have societal legitimacy.</p>	1.3, 2.1, 2.2, 3.2, 3.5, 5.1, 5.2, 5.3, 5.6, 7.1, 8.1, 8.3, 9.1, 9.2, 10.2, 10.3 (n=16)	(n=0)	6.1 (n=1)
<p>Inclusiveness (influenced by 13 evaluation criteria) Relevant actors participate in governance mechanisms. Roles in PPP are adequately allocated to actors with regard to their mandates and competencies. At the relevant level, corresponding actors and data sources are considered to meet the collaborative objective(s). PPP provide a trustworthy environment where stakeholders can freely express their views and be heard, creating mutual understanding. The vulnerable group are take into consideration.</p>	2.2, 3.2, 3.4, 5.3, 5.4, 6.3, 7.1, 7.3, 8.1, 8.3, 8.4, 9.1. (n=12)	(n=0)	6.2 (n=1)
<p>Adaptability (influenced by 15 evaluation criteria) PPP can adapt and evolve upon changes in governance modalities, knowledge and context in order to best suit the changing environment. PPP should be flexible to resist over time. PPP activities should be flexible to meet the partners' expectations. The</p>	5.3, 5.4, 6.5, 6.6, 7.2, 8.1, 8.3, 9.3, 10.1, 10.2, 10.3 (n=11)	3.1, 3.3, 6.3 (n=3)	6.2 (n=1)

decision-making process should allow for changes within the PPP to enable improvement of the process if deemed necessary.

Stability (influenced by 16 evaluation criteria)

PPP is stable in the time defined by the stakeholders. This means that the PPP is strong enough to withstand external threats, such as changing environment, and continue to operate during the defined duration. The formalisation and endorsement of the agreement satisfied all relevant stakeholders.

1.2, 1.4, 3.1, (n=0) 6.2, 6.4
 3.4, 3.5, 4.3, (n=2)
 4.4, 5.1, 5.2,
 5.5, 6.5, 8.2,
 8.4, 10.1
 (n=14)

The scoring guide is presented in **Appendix 1**. Four grades were defined for each evaluation criterion: grade 3 indicates that partners are fully satisfied with the criteria, while grade 0 indicates a total absence of satisfaction and ‘not applicable’ indicates that this criterion is not relevant to the PPP considered. Like the Oasis tool, the spreadsheet comprises three sheets. The grade of the 44 evaluation criteria, once selected, should be captured in the first spreadsheet. The second sheet displays the graphic output 1, a set of pie charts which represent the result of the scores obtained by all the evaluation criteria for each of the corresponding PPP process sections (**Figures 2 and 3**). Graphic output 1 is considered as a general view of the structure of the PPP process, helping to identify its strengths and weaknesses easily. The third sheet presents the graphic output 2, a spider chart which is the assessment of the six quality attributes. Graphic output 2 represents the influence of the process on the quality of the PPP performance. The result of each quality attribute is the result of the combination of the score of each corresponding evaluation criterion (**Figures 2 and 3**).

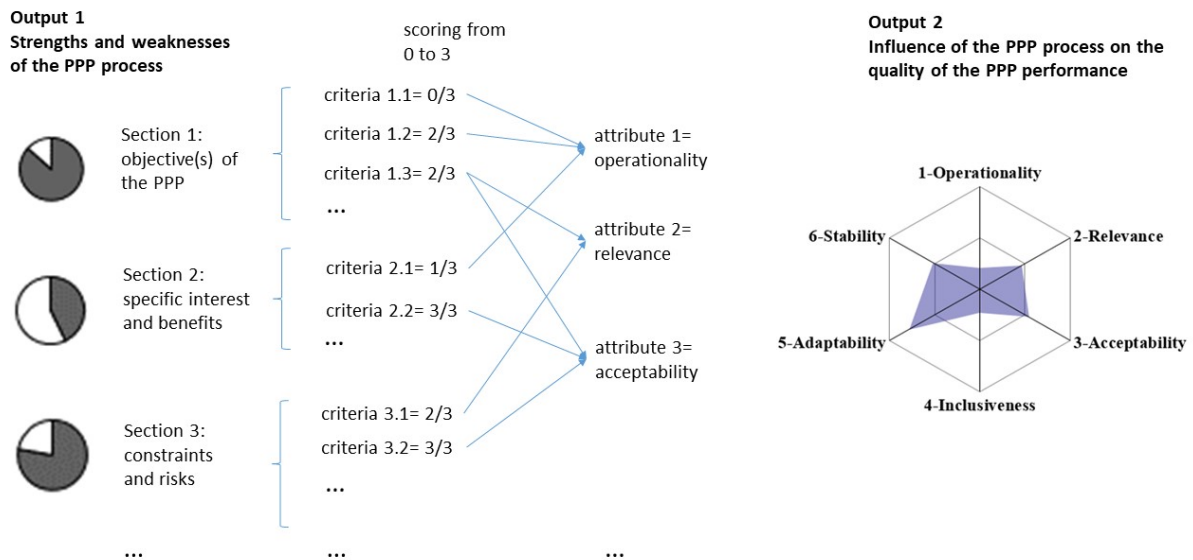


Figure 2. Principle of the scoring process used in the tool, allowing two graphic outputs. The graphic output 1 (the strengths and weaknesses of the structure of the process) represents the assessment of the ten sections using a set of evaluation criteria. The graphic output 2 (the influence of the process on the quality of the public-private partnership performance) represent the assessment of the six quality

attributes, influenced by evaluation criteria. The scores of the evaluation criteria have been randomly assigned. PPP : public-private partnership.

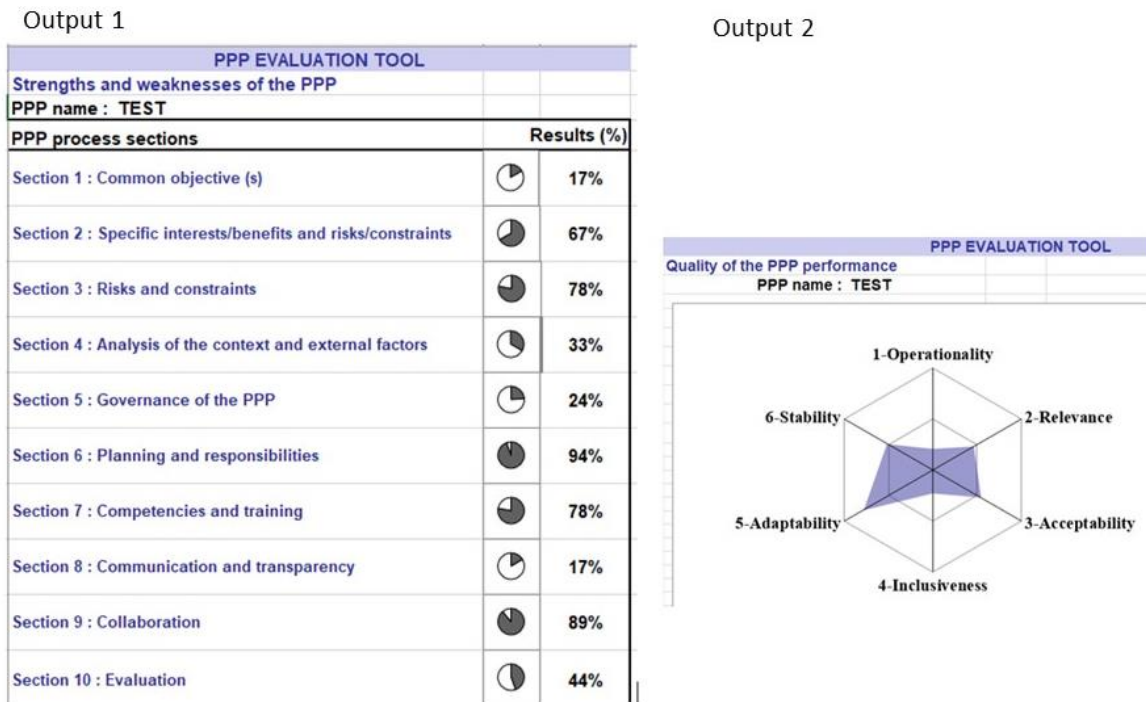


Figure 3. The two graphic outputs of the evaluation tool for the public-private partnership process. Graphic output 1 is a set of pie charts (the assessment of the sections), making it easy to identify the strengths and weaknesses of the process. Graphic output 2 is a spider chart (the assessment of the quality attributes), representing the influence of the process on the quality of the public-private partnership performance. The scores of the evaluation criteria have been randomly assigned.

3.2 Selection of public-private partnership process sections, evaluation criteria and quality attributes

Ten PPP process sections, and 47 evaluation criteria were retrieved from the literature analysis.

Two additional evaluation criteria were identified from the Ethiopian case study. The veterinary services in Ethiopia have limited numbers of veterinarians specialized in poultry production and many farmers reported having limited knowledge about poultry management.

- “We have general veterinarians; we don’t have poultry veterinarians who have good background in poultry. We have few but it’s not enough.” (interview, poultry production director of the public veterinary service)

This lack of capacity may limit the involvement of some actors in this PPP on poultry production, and an evaluation criterion “confidence in other partners’ competencies and satisfaction of partners about their own competencies” was added.

The smallholder farmers mentioned their fear of losing their local poultry breed, explaining why some of them are reluctant to get involved in this program involving an improved chicken breed.

- “There is no consideration in preserving the local genotypes” (interview, Ethiopian farmer)
- “[...] smallholders have preference for the local breeds based on their culture. They are used for adoration of ancestors, or for ceremony to solve disputes. [...]” (interview, social scientist in International Livestock Research Institute in Ethiopia)

Also, the private poultry producers not involved in the PPP were afraid of losing the production market. They do not allow the private actors of the PPP to access the poultry association.

An evaluation criterion “negative cost to the society” was added. This case study confirmed that it is important to consider all the potential results of the PPP, including the negative ones, which can weaken the initiative.

Six quality attributes (operationality, relevance, acceptability, inclusiveness, adaptability, and stability) were selected based on the functional attributes used in the One Health matrix (Bordier et al., 2019). Although those attributes are applied to a multi-sectoral surveillance system, they focus on a collaborative process and it appeared appropriate to employ the same vocabulary for the PPP process tool.

However, not all of them were appropriate; and to select the most relevant attributes for the PPP process, we compared them to the Bryson framework on cross-sector collaboration that includes public-private partnerships in the Public Affairs domain. This framework emphasizes that “collaborating parties should design processes, structures, and interactions in such a way that desired outcomes will be achieved”, which is implied by the **operationality** quality attribute. This framework emphasizes that partners must be sure that “there is a clear collaborative advantage to be gained by collaborating”, which is tackled in the quality attribute **relevance**. This framework recommends “use inclusive processes to develop inclusive structures”, which relates to the quality attribute **inclusiveness**. Finally, this framework stresses the need to “view collaborations as complex, dynamic, multilevel systems” and to “adopt flexible governance structures”, in line with the **adaptability** quality attribute. The need for adaptability is also acknowledged for PPPs in health system strengthening (National Academies of Sciences, 2016). Two other attributes presented in the One Health matrix were also selected. **Stability** represents the evaluation criteria necessary to ensure the partnership lasts the time defined by the partnerships. The final quality attribute was **acceptability**, which has been recognized as an essential attribute for collaboration, as for example in a surveillance system (Calba et al., 2015b).

Version 1 of the tool was improved thanks to the stakeholders' feedback from the PPP training workshops organized by OIE. Stakeholders pointed out that the evaluation criterion "achievement of goal(s) of the Veterinary Service" should be supplemented by another evaluation criterion on the goal(s) of the private service. They advised joint consideration of the funding and human resources, which constitute complementary inputs. Two evaluation criteria were then modified to "funding and human resource availability" and "funding and human resource allocation". They asked for clarification/simplification of some words, for example the term "externalities" which was revised to "cost to the society". They expressed the need for a self-assessment tool for implementation of the PPP field. The stakeholders perceived the tool as useful both to assess the quality of existing PPPs but also to assist them in planning new PPPs.

3.3 Validation of the tool through the experts' elicitation process

In the first round of experts' elicitation, 45 out of the initial 48 evaluation criteria were validated. It was underlined that, even if relevant, the evaluation criteria may not be appropriate for all PPPs:

- "an early collaborative PPP in a country with little PPP uptake may be enabled by the absence of a degree of formality that would put off potential partners" (comment from a public expert during the 1st round of the experts' elicitation)

Only 3 out of the 48 evaluation criteria were not considered as relevant by the experts: "shared decision making", "potential other partners" and "modalities of implementation of the PPP activities". Modifications and/or clarifications of those evaluation criteria were proposed based on the analysis of the experts' comments and included in the second round. Seven evaluation criteria were merged with other evaluation criteria based on the expert's comments. Two new evaluation criteria were proposed and included in the second round ("joint work plan", "conflict of interest").

The six quality attributes were validated. Some of the levels of influence of evaluation criteria (which can influence more than one quality attribute) on the six quality attributes were validated (12/15 for operationality attribute, 6/8 for relevance attribute, 15/17 for acceptability attribute, 11/12 for inclusiveness, 7/8 for adaptability attribute and 14/16 for stability attribute). The levels of influence not validated were included in the second round. The experts also suggested adding some influence links between evaluation criteria and certain quality attributes; these proposals were also included in the second round (11 new influence links).

All the modifications and clarifications of the evaluation criteria (3/3) were validated in the second round. Three experts still mentioned that the evaluation criterion "shared decision-making process" was not relevant:

- “how can we say that all decisions must be made in consultation with all PPP partners? Which level of decisions? Collaboration is time-consuming and costly and should be used when necessary, but not for all decisions” (comment from a catalyser expert during the 2nd round of the experts’ elicitation).

The two new evaluation criteria were validated. Commenting on the question on the evaluation criterion “conflict of interest”, one expert expressed concern that the tool may not pay sufficient attention to issues related to corruption, favoritism, unfair competition, consideration of the common good and the best interests of the population, as these risks could involve either private or public sector actors. A new evaluation criterion, “analysis of pre-existing PPP” was proposed during the second round and was included in the tool after validation by 4 members of the research team.

Almost all levels of influence of the evaluation criteria on the quality attributes were validated (15/19). The levels of influence that did not reach consensus were all between medium (score of 5) and high level (score of 10), therefore an arbitrary intermediate score was given to them (score of 7.5) (**Figure 4.**).

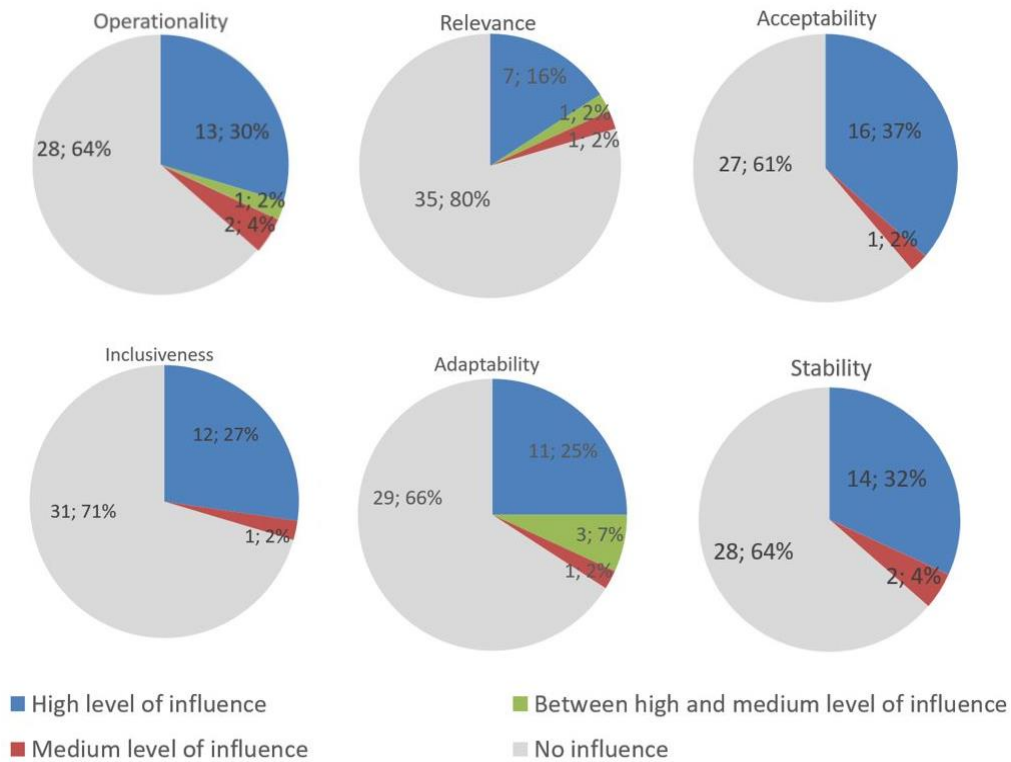


Figure 4. Each of the six quality attributes are influenced by some evaluation criteria. The level of influence of those evaluation criteria can be high (pie chart area in blue), between medium and high (pie chart area in green), medium (pie chart area in red). Some evaluation criteria do not influence the quality attribute (pie chart area in grey). The number and percentage of evaluation criteria per level of influence that influence each of the quality attributes are entered in the corresponding pie chart area.

Overall, 41 evaluation criteria were considered to highly influence at least one quality attribute; only 3 evaluation criteria influence the quality attributes with a medium or intermediary level only (3.3 “change of practices”, 6.2 “potential other partners”, 6.5 “modalities of implementation of the PPP activities”) and none were considered not to influence the quality of the PPP performance at all (Table 3). The high level of influence of the evaluation criteria “change of practices” on the attribute “operationality” was selected by only 25% of the catalyser experts and 33% of the public partners, whereas it was selected by 50% of the private partners, and a medium level of influence was attributed.

3.4 Application of the tool on a public-private partnership in Paraguay for the control of the foot-and-mouth disease.

This PPP has existed since 2003 between the public veterinary services and a private foundation created by bovine producers. The private sector is a foundation recognized by a decree of the executive power and is responsible for coordinating and vaccinating the 15 million head of cattle. All these activities are supervised by the veterinary services.

The PPP has evolved over the years, in terms of the partners involved and the type of governance. This PPP allowed Paraguay to obtain the status *FMD free with use of vaccination* from OIE. Paraguayan stakeholders, who have long experience of being involved in this PPP, found this tool comprehensive and the questions easy to understand. They acknowledged that, by implementing the tool, the group involved in the assessment process was able to address all the activities of the PPP.

It also raised important points, such as the future of this collaboration if vaccination stops (through the evaluation criteria 7.1 “Confidence in other partners’ competencies and satisfaction of partners about their own competencies”, 9.1 “Willingness to collaborate and partners’ acceptance of their own roles”, and 9.3 “Willingness for capacity building in PPPs”). Evaluation criterion 8.2 “agreement in resolution modalities in case of conflict between partners” had not been raised and the partners felt it was important to include it in their legal agreement. They revealed that the PPP represented a means to achieve their goal in a complex institutional environment (through evaluation criterion 4.2 “International, regional, national and local laws” and 4.3 “Potential threats of the PPP and mitigation”).

The public partners of the veterinary services were afraid of losing influence by letting a private foundation take care of the vaccination campaign (this was captured in evaluation criterion 3.1 “Risks and constraints of getting involved in the PPP” and 5.7 “Adequacy with the veterinary services mandate”). Meanwhile, the private foundation feared its status might be erased in case of a change of political regime (evaluation criterion 3.1 “Risks and constraints of getting involved in the PPP”). Therefore, they reconsidered the status of the foundation, clarifying its roles and its range of action at the legislative level (this was captured in evaluation criterion 5.1 “Formalization of the PPP”).

The PPP implemented for FDM vaccination enabled trainings for technicians at local level, resulting in an extension of the stakeholder network for the animal health value chain (captured in evaluation criterion 7.2 “Organisation of trainings and reinforcement of capacities” and 7.3 “Accessibility and frequency of trainings”). This network has, for example, led to reporting cases of bovine rabies in a village with rapid feedback of the information to veterinary services at the national level. The services provided by the PPP therefore exceed the initial objective of vaccination against FMD by reinforcing the veterinary services, and the tool was able to capture this element.

4. Discussion

This study presents the development of a tool to evaluate the PPP process through the participation of relevant actors directly or indirectly involved in PPPs in the veterinary domain worldwide. To our knowledge this work is original and provides an assessment of the quality of the PPP process in the veterinary domain, addressing the question: "how, why and under which conditions does the PPP work?". This tool can help to evaluate and improve an ongoing PPP initiative but also to plan a new PPP under development. The tool can be used in an *ex ante* evaluation- during the PPP design phase, to help raise collective awareness of the challenges of PPP collaborations and to promote a more coordinated approach to collective actions (Allen et al., 2014). The tool can also be used *in itinere*, when an initiative is already implemented, to promote partners' communication, good collaboration and to strengthen the PPP. The tool is freely accessible and placed under creative commons licence.

4.1 Enabling dialogue between public-private partnership partners

The tool was developed in the same format as the Oasis tool, which demonstrated its ease of use, an important aspect to ensure its implementation in the field (Peyre et al., 2011). This format can also be compared to the Rubric tool, an easy-to-use tool for collaborative performance assessment (Oakden, 2013). The Rubric tool is constructed with the same two key components: a list of evaluation criteria and gradations of the quality of those evaluation criteria by people involved in the collaboration (Oakden, 2013). It was initially employed in educational sciences but has also demonstrated its effectiveness in other fields such as pest management (Allen et al., 2014).

This specific tool format facilitates the sharing of diverse perspectives and is adaptable to varied programs (Allen et al., 2014). Like Rubric, the PPP evaluation tool developed here differs from a simple checklist, as each evaluation criterion requires gradations (from 0 to 3), involving discussion and precise justification of the expectations of the different stakeholders (Allen et al., 2018). Asking the partners from the Paraguayan PPP to justify their choice of a score for each evaluation criterion indeed implied

a process of dialogue between them, which facilitated reflection and analysis of the PPP. The use of the tool helped to clarify partner's expectations about various aspects of the PPP. This kind of tool allows stakeholders to make reliable judgements about their own work and identify room for improvement (Reddy and Andrade, 2010). The scores given to each evaluation criterion are not as important as the dialogue between stakeholders during the evaluation. This tool can be seen as a means of mediation, helping to identify points of disagreement between partners, but also to clarify stakeholders' expectations and ways of improving. These are essential aspects in PPP best practices to ensure performances and impact of collaboration (World Organisation for Animal Health, 2019b).

The tool can be used both for internal and external evaluation. A trained external evaluator expert can use this tool to evaluate any PPP process, but it is critical – as for any assessment - that the evaluation request arises from the stakeholders of the PPP themselves. The evaluator also needs to follow best evaluation practices, including objectivity and integration of multiple viewpoints (BetterEvaluation, 2012a) . This implies following a proper stakeholder mapping approach to ensure engagement with all the relevant stakeholders during the participatory interviews to capture diverse and representative viewpoints (Fusch and Ness, 2015; Saadi et al., 2021; Schmeer, 1999). Mapping may include stakeholders who will use the evaluation results directly, who will support or maintain partnerships or who will be affected by the partnership's activities or assessment results (Rieker, 2011). Stakeholder mapping is therefore a pre-requisite step before implementing the tool. To ensure objectivity in the evaluation, the external evaluator would need to ensure the involvement of the stakeholders during the scoring process, rather than simply reflecting the prevailing expert view (Oakden, 2013). This tool can also be used during an internal evaluation process by the partners involved in the PPP for self-assessment of the quality of their PPP, also ensuring the involvement of all the relevant stakeholders. This approach has the advantage of being inclusive; however, we argue that it would require either a previous training or a facilitation process for the partners by an evaluation expert to ensure proper use of the tool.

When using this tool, the evaluator should bear in mind that participatory approaches, including evaluation, cannot erase pre-existing social inequalities which may hamper the capacity of actors to express themselves freely. Genuine participation of all stakeholders may not be fully achieved, since power structures, inherent to social groups, will limit the free expression of marginalised people. Indeed these people may not be able to risk taking positions that run counter to those of power groups (Cooke, 2001). Trying to represent the diversity of viewpoints from stakeholders who influence, who are involved in or impacted by the PPP during the evaluation process is a real challenge. The use of this tool as well as participatory approaches can be a way to achieve this, but we argue that the limits of the evaluation process and results should be critically analyzed, emphasized, and expressed in a transparent manner by the evaluator. The risk of not doing so, would be to reinforce pre-existing power relations between stakeholders by only representing the dominant viewpoint (Mansuri, 2004).

4.2 A generic tool to evaluate the quality of the process across different public-private partnership clusters

As mentioned before, three main clusters of PPP (transactional, collaborative and transformative) have been identified in the veterinary domain, depending on the type of private partner involved and the governance process (Galière et al., 2019a). However, some PPPs are at the crossroad between clusters. The FMD control PPP in Paraguay, for example, is a mix between transactional PPP - private veterinarians and technicians are mandated and evaluated by the Veterinary Service to carry out the vaccination - and collaborative PPP – with the strong involvement of the producer association. Even though previous work has highlighted differences in obstacles depending on the PPP clusters, e.g. - the type of governance can represent an obstacle for collaborative and transformative PPPs, while the transactional PPP obstacles are mainly linked to lack of funding and human resources. Key success factors were not associated with any particular PPP type in the veterinary domain (Galière et al., 2019a). This indicates that the critical elements of the PPP process captured in this tool are similar across the clusters, which implies that PPP process evaluation could be generic across the different PPP types (Poupaud et al., Under publication).

4.3 The need for flexibility in public-private partnership evaluation

Each PPP in the veterinary domain, regardless of PPP cluster, needs to be adapted to the context; the evaluation process therefore needs to be flexible to ensure its relevance. This tool should not be used in a normative evaluation approach, and the evaluation criteria should not be seen as target objectives to be achieved.

For example, several evaluation criteria are linked to PPP formalization and naming the collaboration can increase the willing consent of partners (Koschmann et al., 2012) and support accountability (Babiak and Thibault, 2009). However, several experts mentioned that too much formalization may hamper the development of the collaboration. Depending on the PPP to be evaluated, these evaluation criteria may not be relevant. Regarding the evaluation criteria related to the planning of PPP (section 6), planning can be done as a “deliberate approach”, meaning that formal planning is carried out in advance, or as an “emergent approach”, whereby precise planning emerges over time (Bryson et al., 2015). One approach is no better than the other. Another example is the evaluation criterion linked to law and regulation (evaluation criterion 4.2): institutional and political environment as well as other external factors are important for the PPP process and can strongly influence the initiative (Bryson et al., 2015); however, in accordance with the testimonies of Paraguayan stakeholders, the external environment will not always determine collaborative action, and PPP may be a means to achieve objectives in a complex environment.

Finally, an evaluation criterion related to inclusion of vulnerable groups in the planning process (6.3), and an evaluation criterion targeting shared decision making (5.3) were included in the tool. The protocol for PPP evaluation in Public Health also has a section targeting vulnerable groups, as a crucial aspect of World Health Organization programs is to enhance equity in health and well-being (Donald A. Barr, 2007). However, one expert mentioned that inclusion is not always the most appropriate way to take decisions and that shared decision making should be used when necessary. These examples demonstrate that flexibility in the evaluation process in adapting to the specific PPP context is essential to providing useful recommendations.

The tool presents a predefined list of evaluation criteria, allowing the users to review and challenge some aspects/elements of their collaboration process that they might not have considered *a priori*. For example, after mentioning the evaluation criterion "mechanism in place in case of conflict", the Paraguayan partners discussed the possibility of creating such a mechanism. Indeed, the aim of the tool is to be as complete as possible to cover the multiple types of PPP process which exists worldwide (Galière et al., 2019a). However, some evaluation criteria may not always be relevant in all situations and the tool allows for the use of 'not applicable' to remove evaluation criteria from the scoring process. This option further enhances the flexibility of the tool and limits its normative aspect.

It is also interesting to note that in the experts' elicitation, a smaller proportion of catalyzer and public experts, compared to private experts, considered that the evaluation criterion highly influence quality attribute operationality. This may be due to the fact that private actors in the veterinary domain (such as private veterinarians, producers) are those who are impacted by the change in practices in the field, whereas the catalyzers are actors operating in international organizations, and public actors, from the veterinary services in our sample, often operate at a central level. However, this result should be interpreted with caution in the case of public actors, as only three of them participated in the experts' elicitation. For some actors not operating in the field, it may be difficult to anticipate the difficulties encountered by actors in the field in implementing the modalities decided at central level. This underlines the importance of considering multiple points of view in our methodology for the development of the tool.

4.4 The need to anticipate the risks of being involved in public-private partnerships

The OIE PPP handbook and the PPP reference guide from the World Bank both emphasize the need to compile a complete list of all risks associated with the project and to think about risk allocation (World Bank Institute, 2017; World Organisation for Animal Health, 2019b). The different steps of this study (literature review, PPP regional training workshop and experts' elicitation) confirmed that partners need to clearly identify those risks in order to be able to limit them.

The “negative cost to the society” (criterion 5.4) deals with the negative consequences of PPP, assuming that if the partners anticipate and undertake corrective action to prevent negative consequences of their partnership, the PPP will be more stable over time and its legitimacy in the eyes of society will be increased. Similarly, the Food and Agriculture Organisation guidelines to ensure good PPP practices within agricultural value chains proposes integrating the risks linked to the negative cost of a program (externalities) in the planning process to ensure sustainable value chains (Neven, 2014). The risks of potential conflicts of interest were recurrently highlighted during this study (literature review, experts’ elicitation). According to the World Bank, PPPs can represent a risk of corruption i.e. the misuse of public office for private gain (World Bank Institute, 2017). Corruption seems to be favoured when privatizing certain state-owned enterprises (Reinsberg et al., 2019). Moreover, PPPs, like any contractual relationship, can be seen as a “principal-agent” relationship in which the principal is the public partner (the public veterinary services) using the service of an agent, the private partner. This type of relationship involves differences of interest and asymmetrical information between the two contracting parties, with the practical impossibility for contracts to cover all possible cases and prevent all types of misconduct. Hence, partners having different interests are likely to develop opportunistic behaviour, taking advantage of asymmetries of information and loopholes in the contract (Maatala et al., 2017b). Therefore, for some PPPs, the contract between the two parties, the legislative environment and the governance structure will require particular attention to limit such risks. In addition, the evaluation of the PPP process needs to take into account the institutional capacity of both public and private partner. Indeed, depending on the type of PPP in the veterinary domain, unequal power relations can be expected (representing a disadvantage for the public or the private sector) that will influence the governance process. For example, it is most important that both partners are able to clearly defend their own interests without any opportunistic behaviour while having the necessary degree of information symmetry during the negotiation phase (Maatala et al., 2017b). When relevant and appropriate, PPPs should have a contract that is “clear, comprehensive” and that “creates certainty for the contracting parties” (World Bank Institute, 2017). Given the complexity and uncertainty of the environment, the contract will also require flexibility to enable changing circumstances to be dealt with (World Bank Institute, 2017) and to provide modalities for the renegotiation of contracts (Maatala et al., 2017b).

Such issues are taken into account by the evaluation tool proposed in this study and its implementation can help identify weaknesses in the PPP process that would need to be deeply analyzed. For example, experts in legal frameworks from the OIE Veterinary Legislation Support Program can deeply analyse the legal framework and the Performance of veterinary services evaluation can identify the potential weaknesses of the institution and help to prevent risks (World Organisation for Animal Health, 2020a, 2019a).

The tool helps to identify the strengths of the PPP process, as well as helping to promote partner engagement, transparency and trust, thereby limiting these risks. Regular PPP evaluations, e.g. using this tool, from the planning stage (*ex-ante* perspective), during the PPP (*in itinere*) until the end of the PPP (*ex post*), make it possible to promote good practices, improve the performance of PPPs and limit the potential risks associated.

4.5 Conclusions

The PPP process evaluation tool developed in this study represents a necessary milestone for a more comprehensive evaluation of PPPs. The tool does not replace other types of evaluation such as context analysis, economic, or impact assessment. It enables, with limited financial means, stakeholder engagement bringing out discussions that help to identify the strengths and weaknesses of the PPP process. It is also intended that this tool will serve as a basis for developing targeted support on PPP in the veterinary domain in the context of the OIE PVS Pathway. Recommendations following the implementation of this tool may include the need for further evaluation or analysis by implementing other methods, such as deeper investigation of the legal framework, or the analysis of institutional capacities. An evaluation of the impacts of the PPP may also be pertinent to define relevant indicators to monitor the progress of the initiative and motivate the partners involved, to advocate for additional resources from investors, or to ensure trust. This can be done for example with impact pathway methodology, using the theory of change (Barret et al., 2018; Douthwaite et al., 2003).

PPP in the veterinary domain are widely implemented worldwide and are often complex, dynamic, multilevel systems (Bryson et al., 2015). This PPP process evaluation tool represents a straightforward approach to provide direction or positive changes by strengthening the partnership

Chapitre 3. 2e partie : utilisation de l'outil pour évaluer un PPP en Tunisie.

Résumé

Un partenariat public-privé (PPP) pour le contrôle des maladies animales contagieuses prioritaires est établi depuis 2006 en Tunisie. Ce PPP consiste en un mandatement des vétérinaires praticiens privés par les services vétérinaires publics pour réaliser des campagnes de vaccination. Une demande d'évaluation de ce PPP a été adressée par la direction générale des services vétérinaires tunisiens à l'OIE et au Cirad, dans le but d'identifier des voies possibles de renforcement de son efficacité. Pour répondre à cette demande, une évaluation participative de ce PPP a été réalisée de janvier à juin 2021 dans le cadre d'un stage d'une étudiante en master de spécialisation.

L'évaluation a porté sur le processus du mandat sanitaire pour le contrôle de la fièvre aphteuse et de la clavelée. Cette évaluation a été faite en suivant le guide d'évaluation des processus de PPP dans le domaine vétérinaire. L'évaluation du processus s'est réalisée au niveau central et sur deux gouvernorats du Centre tunisien : Sfax et Sidi Bouzid. Le choix des régions sélectionnées pour cette étude s'est fait en se basant sur la taille des cheptels ovins et bovins, le nombre de vétérinaires mandatés, la présence de vétérinaires publics vaccinateurs, ainsi que sur la couverture vaccinale. Les parties prenantes impliquées dans cette évaluation étaient des vétérinaires du secteur public et privé. Au niveau national, les vétérinaires du secteur public étaient les responsables du mandat sanitaire dans les services vétérinaires, et les vétérinaires du secteur privé étaient des représentants de la chambre syndicale ou de l'ordre national des vétérinaires. Au niveau régional, les vétérinaires du secteur public étaient des vétérinaires inspecteurs, et les vétérinaires du secteur privé des vétérinaires mandatés.

Neuf entretiens semi-structurés individuels et 6 discussions de groupe (entre 4 et 8 personnes de la même catégorie de parties prenantes) ont été organisés et ont duré entre 1h30 et 2 heures. Les grilles de notation de l'outil d'évaluation du processus des PPP ont été remplies pour chaque catégorie de parties prenantes, et quatre grilles d'évaluation sont considérées dans les résultats (vétérinaires centraux publics, vétérinaires centraux privés, vétérinaires régionaux publics, vétérinaires régionaux privés). Dans un premier temps, il a été envisagé de garder des grilles de notations séparées pour la région de Sfax et Sidi Bouzid, mais au vu de la similarité des réponses des vétérinaires régionaux publics et privés de ces deux régions, leurs résultats ont été fusionnés. Une note de 0 à 3 a été attribuée pour chaque critère.

Cette évaluation a permis de mettre en évidence certains points forts et limites du processus de ce PPP. Le mandat sanitaire est considéré comme incontournable et indispensable à l'accomplissement des stratégies des services vétérinaires publics. Les objectifs de ce mandat sont bien définis et répondent aux stratégies des services vétérinaires publics nationaux. Il a été mentionné que les objectifs du PPP pouvaient être élargis au contrôle de nouvelles maladies (comme la tuberculose ou la peste des petits ruminants). L'évaluation a aussi pu montrer des points de consensus et des points de divergences sur la perception des forces et faiblesses du processus de ce PPP entre ces différentes parties prenantes (**Figure 1**). Par exemple, un manque de communication entre les différentes parties prenantes du mandat sanitaire a été unanimement mentionné, notamment entre les vétérinaires publics et les vétérinaires mandatés au niveau régional (section 8). La satisfaction quant au mécanisme de prise de décision dans le cadre de ce PPP diffère entre les parties prenantes régionales et nationales (section 5). La notation des critères des différentes parties organisationnelles du PPP a aussi influencé les résultats des attributs de qualité de la performance du PPP (**Figure 2**). La perception de ces attributs de performance est globalement similaire dans les différents groupes de parties prenantes. On peut noter que les vétérinaires publics ont une meilleure perception de l'inclusivité du processus du PPP que les vétérinaires privés.









































PPP process sections	Vétérinaires niveau central		Vétérinaires niveau régional	
	privé-es	publics	privé-es	publics
	Results (%)	Results (%)	Results (%)	Results (%)
Section 1 : Common objective (s)	 75%	 83%	 81%	 79%
Section 2 : Specific interests/benefits	 67%	 85%	 42%	 67%
Section 3 : Risks and constraints	 22%	 61%	 83%	 78%
Section 4 : Analysis of the context and external factors	 53%	 42%	 50%	 54%
Section 5 : Governance of the PPP	 90%	 81%	 79%	 89%
Section 6 : Planning and responsibilities	 83%	 89%	 83%	 83%
Section 7 : Competencies and training	 83%	 83%	 67%	 67%
Section 8 : Communication and transparency	 50%	 67%	 46%	 52%
Section 9 : Collaboration	 75%	 78%	 75%	 67%
Section 10 : Evaluation	 0%	 0%	 0%	 0%

Figure 1: Forces et faiblesses du processus du mandat sanitaire du point de vue des vétérinaires publics et privés aux niveaux central et régional.

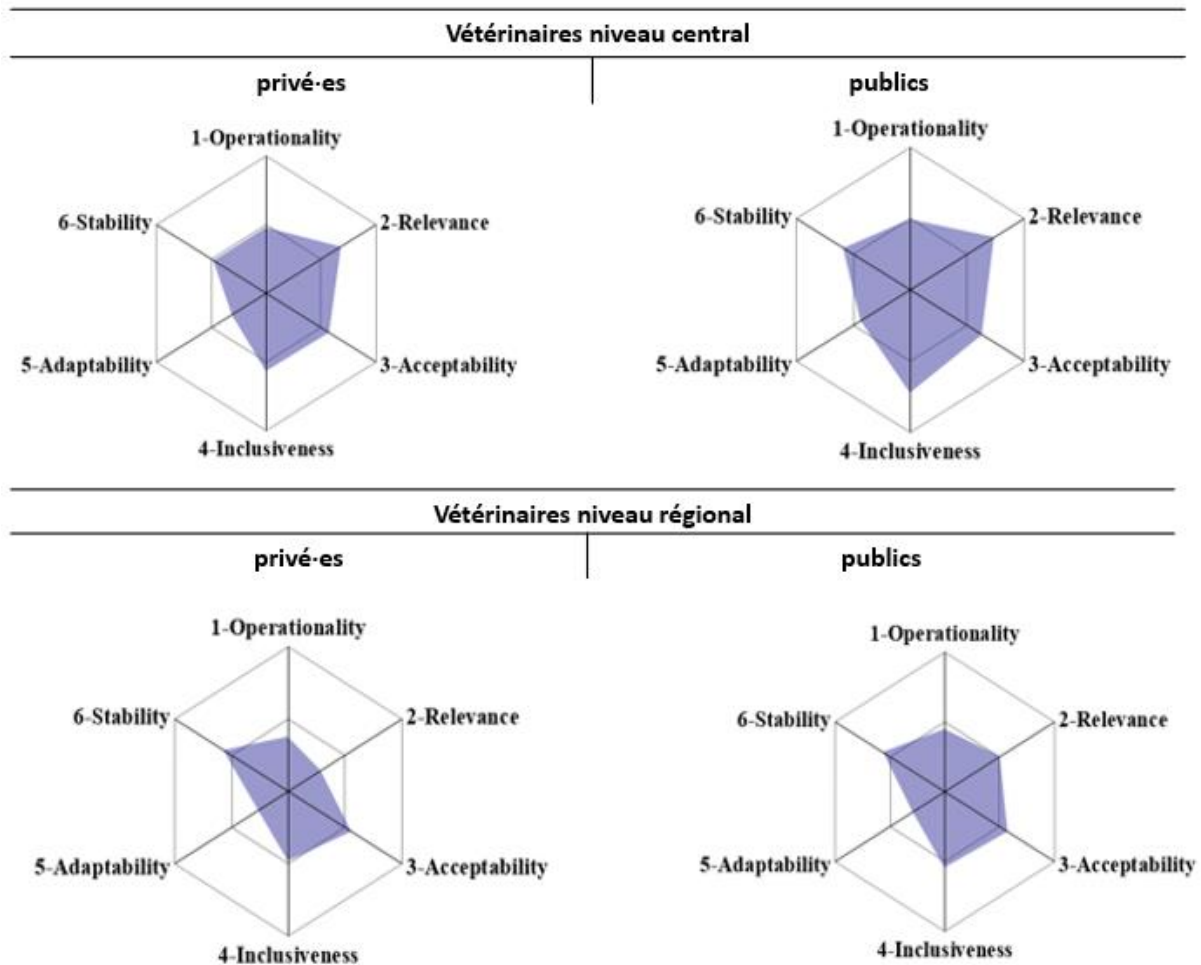


Figure 2: Attributs de qualité de la performance du PPP, influencés par le processus du PPP, du point de vue des vétérinaires publics et privé-es aux niveaux central et régional.

Un processus complet d'évaluation participative aurait dû aller jusqu'à la mise en débat de ces différences de points de vue pour co-élaborer des recommandations d'amélioration du processus. Les conditions ne l'ayant pas permis, en grande partie liées à l'épidémie de Covid-19, une restitution des résultats au niveau central, impliquant le délégué tunisien auprès de l'OIE, a néanmoins été faite. L'utilisation de l'outil a cependant permis d'aider à identifier des points d'amélioration et de formuler des recommandations, comme la création d'un fonds de santé animale pour financer sur le long terme le mandat sanitaire, la mise en place d'un plan de communication avec des réunions intersectorielles, ou l'augmentation de la durée de temps de formations des vétérinaires privé-es au niveau régional (les vétérinaires mandaté-es).

Chapitre 4

Chapitre 4. Evaluation des résultats et des impacts des PPP

*Cet article a été publié dans le journal *Frontiers in Veterinary Science*, section « *Veterinary Humanities and Social Sciences* » en Février 2022 <https://doi.org/10.3389/fvets.2022.735269>*

Préambule chapitre 4

Ce chapitre 4 porte sur l'évaluation des résultats (bénéfices, risques, impacts) des PPP (**Figure 1**). L'importance d'évaluer les résultats en matière de santé (bénéfices, risques ou impacts) mais aussi les résultats socio-économiques a été soulignée dans la revue de littérature. La difficulté de déterminer la contribution réelle de ce PPP à la production d'impacts a également été mentionnée. Pour surmonter cette difficulté, nous proposons d'utiliser la méthodologie du chemin d'impact pour évaluer de manière participative un PPP en Éthiopie. Cette méthodologie cherche à expliciter les liens entre le PPP et les résultats et impacts. Pour cela, nous avons aussi procédé à une brève analyse de contexte (historique du PPP et cartographie des acteurs) et une brève analyse de processus (en identifiant les intrants nécessaires au fonctionnement du PPP et en s'intéressant aux activités du PPP) (**Figure 1**). L'outil d'évaluation du processus présenté en chapitre 3 n'était pas encore développé au moment de la récolte de données de ce cas d'étude et n'a donc pas été appliqué.

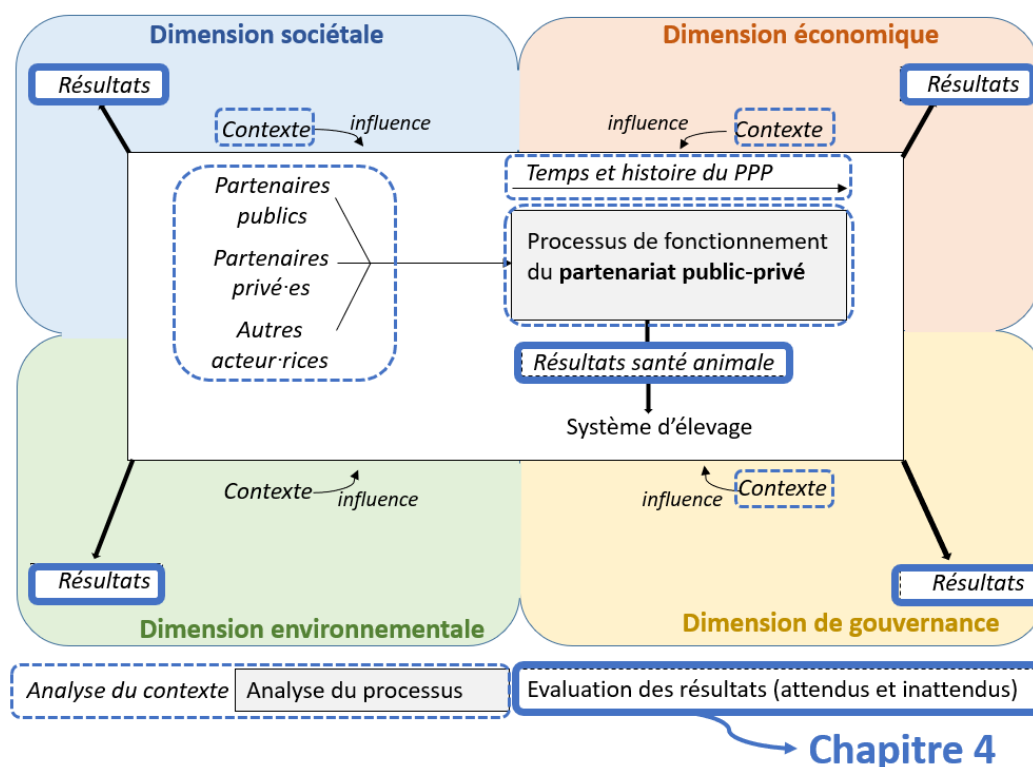


Figure 1 : Le chapitre 4 porte sur l'évaluation des résultats directs et indirects du PPP (rectangles bleus) du modèle d'analyse. Ce chapitre s'intéresse également, dans une moindre mesure, à l'analyse de contexte et à l'analyse de processus.

Divers résultats et impacts ont été identifiés par les acteur·rices (**Figure 2**), et les chemins causaux entre ses résultats et le PPP ont été explicités. Les résultats ont ensuite été caractérisés par la mesure d'indicateurs. Ces indicateurs sont à considérer à titre d'exemples, et pour chaque PPP évalué, les résultats et indicateurs devront être adaptés.

Les résultats environnementaux indirects n'ont pas été mentionnés par les acteur·rices dans ce cas d'étude (**Figure 2**). Le coût énergétique et le coût en eau du fonctionnement des grandes fermes où sont produits les poussins d'1 jour et les fermes où sont élevés les poulets d'1 à 45 jours auraient pu être explorés. Un résultat sur le système d'élevage qui a été mentionné est le risque de disparition des races locales de poules et le risque de dépendance à ces races génétiquement améliorées dont la génétique provient de grandes industries (**Figure 2**). Ce résultat a malheureusement peu été exploré dans cette étude, mais ce point est à garder en tête pour les futures évaluations et pourrait être systématiquement inclus dans des analyses de risques.

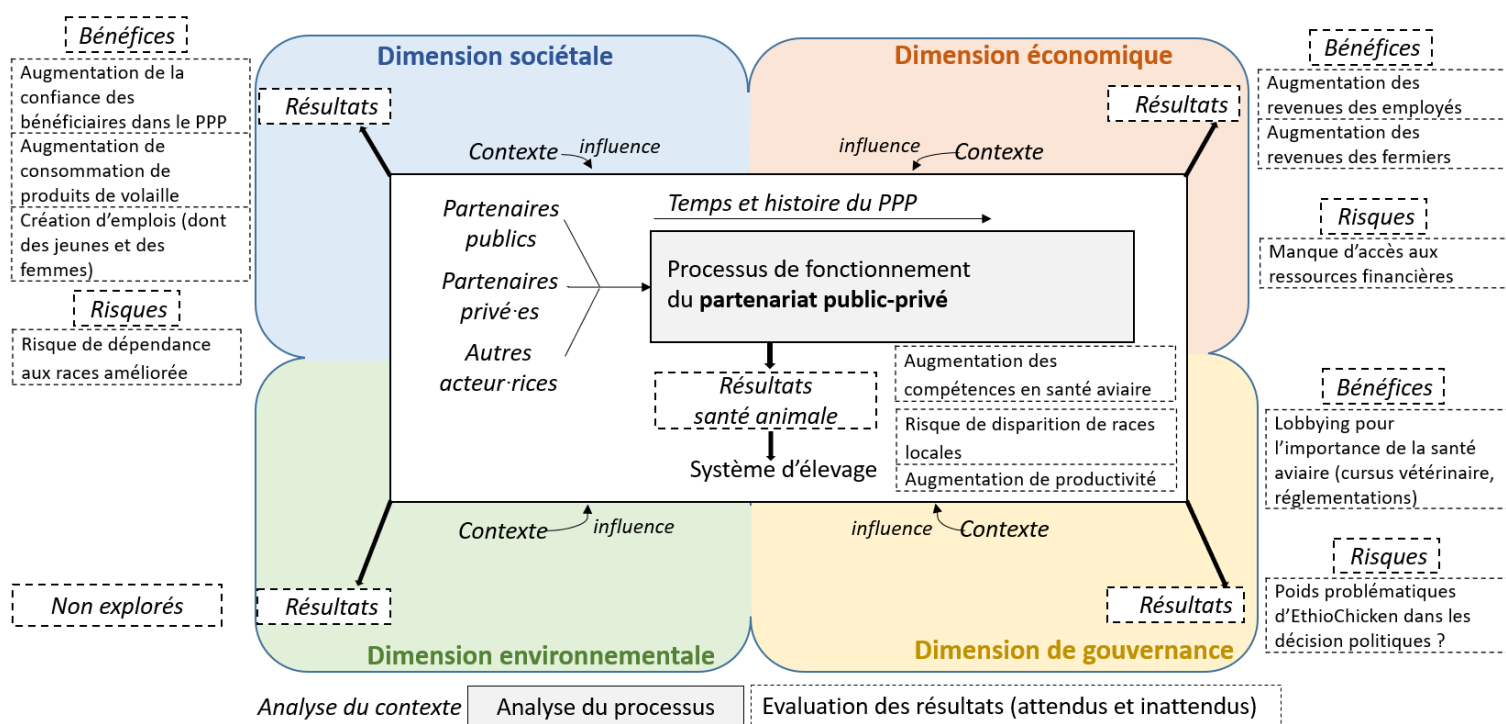


Figure 2 : Le chapitre 4 a permis d'identifier différents bénéfices et des risques qui ont été mesurés par des indicateurs pouvant servir d'exemples pour l'évaluation d'autres PPP.

Title: Evaluation of public-private partnership in the veterinary domain using impact pathway methodology: in-depth case study in the poultry sector in Ethiopia

N'gbocho Bernard N'Guessan^{1,2†}, Mariline Poupaud^{2,3†}, Isabelle Dieuzy-Labaye⁴, Yohannes T. Asfaw⁵, Barbara Wieland^{5,6}, Fseha Tesfu⁷, Ulric Daniel⁷, Phitsanu Tulayakul¹, Marisa Peyre²

¹ Faculty of Veterinary Medicine, Kasetsart University, Bangkok, Thailand

² UMR ASTRE, Univ Montpellier, Cirad, INRAE, Montpellier, France

³ Fundamental and Applied Research for Animals and Health (FARAH), University of Liège, Liège, Belgium

⁴ World Organisation for Animal Health (OIE), Paris, France

⁵ International Livestock Research Institute, Addis Ababa, Ethiopia

⁶ Institute of Virology and Immunology, Mittelhaeusern, Switzerland

⁷ EthioChicken, Ethiopia

†These authors have contributed equally to this work and share first authorship

Abstract

Public-private partnerships (PPPs) in the veterinary domain are joint approaches in which public veterinary services and private actors such as private veterinarians, producers' associations or private companies work together to address complex animal health challenges. They are implemented worldwide and can help to strengthen the capacities of veterinary services, but few have been evaluated. None of the evaluations developed in the veterinary domain explicitly addressed PPPs, their complex programme design, their evolving governance, and coordination system, and their impacts. This work represents the first application of the participatory impact pathway methodology for the evaluation of a PPP in the veterinary domain. The public-private partnership evaluated aimed at developing the poultry sector in Ethiopia and improving poultry health service coverage, particularly in remote areas. The combination of semi-structured interviews (n = 64) and collective reflection during three workshops (n participants = 26, 48, 18), captured the viewpoints of public and private partners, actors who influenced the partnership and actors impacted by it. The context of the public-private partnership was analysed and the causal relationships between the PPP and its impacts were investigated. This work showed that collaboration between the public and private sector occurred at several administrative levels. The actors considered a variety of impacts, on the economy, business, trust and health, which were then measured through different indicators. The actors also identified the added-value of the PPP to enrich those impacts. The participatory impact pathway methodology helped to strengthen the engagement of actors in the public-private partnership and to formulate recommendations at the policy level to favour positive results. This case study represents a milestone in building a participatory evaluation framework of public-private partnership in the veterinary domain.

1. Introduction

Public-Private Partnership (PPP) in the veterinary domain⁵ is defined by the World Organisation for Animal Health (OIE) as “a joint approach in which the public and private sectors agree responsibilities and share resources and risks to achieve common objectives that deliver benefits in a sustainable manner” (World Organisation for Animal Health, 2020c). Through PPPs, the public veterinary services and private actors, such as private veterinarians, producers’ associations or private companies, work together to address complex animal health challenges. PPPs may represent a means of strengthening the veterinary services⁶ and improving animal health programmes (World Organisation for Animal Health, 2019b). The establishment of effective PPPs can contribute to more efficient use of available resources or extension of veterinary health coverage, particularly in remote areas (Ahuja, 2004b; World Organisation for Animal Health, 2020c). Examples of risks of PPPs include conflict of interests, administrative burden, or lack of funding availability (Galière et al., 2019a). Galière et al. (Galière et al., 2019a), analysed 97 PPPs implemented across the world, described in detail through an online questionnaire. Three PPP clusters were identified. These clusters are largely conditioned by the type of private actor (Galière et al., 2019a). Cluster 1, ‘transactional PPPs’ are often initiated and financed by the public sector and the services come from private veterinarians or paraprofessionals who are contracted or given a sanitary mandate. Cluster 2, ‘collaborative PPPs’, corresponds to PPPs usually motivated by trade, exports and/or commercial interests. These PPP are initiated by both the private sector, often represented by producer associations, and the public sector. Finally, Cluster 3 ‘transformative PPPs’, corresponds to PPPs focused on establishing the capability to deliver otherwise unattainable major programmes. They are initiated and financed by the private sector (local or international companies) but sanctioned by, and working with, the national veterinary services (World Organisation for Animal Health, 2020c).

⁵ As defined in article 3.4.2 of the *Terrestrial Animal Health Code* of the OIE (https://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_vet_legislation.htm): “Veterinary domain means all the activities that are directly or indirectly related to animals, their products and by-products, which help to protect, maintain and improve the health and welfare of humans, including by means of the protection of animal health and animal welfare, and food safety.”

⁶ As defined in the glossary of *Terrestrial Animal Health Code* of the OIE “Veterinary Services means the governmental and non-governmental organisations that implement animal health and *welfare* measures and other standards and recommendations in the *Terrestrial Code* and the *OIE Aquatic Animal Health Code* in the territory.”

One of the PPPs described in the article by Galière et al. (Galière et al., 2019a), belonging to the "transformative" cluster, is implemented in Ethiopia since 2010, with the aim of developing the poultry sector. This PPP represents a collaboration between a company raising day old chicks and producing feed, EthioChicken, and the public veterinary services of Ethiopia. EthioChicken raises poultry parental stock and produces genetically improved day-old-chicks (hybrid breed for meat and egg production) in Ethiopia. The day-old-chicks are then raised to 45 days old by agents. The grower agents are trained by EthioChicken, and they provide the chicks with poultry health care, such as vaccination. These 45 days old chickens are delivered to smallholder farmers via a distribution network developed through PPPs between EthioChicken and the national and regional public veterinary services, under the supervision of the Ministry of Livestock and Fisheries⁷. The public veterinary services also provide poultry health services at the local level (Galière et al., 2019a).

In Ethiopia, more than 22 million people, representing 20% of the total population, live below the national poverty line (Trading Economics, 2019). The Ethiopian economy is primarily based on agriculture which provides 85% employment and contributes to around 45% of Gross Domestic Product and 62% of total exports (Trading Economics, 2019). In 2018, the total poultry population was estimated to be about 57 million (Central Statistical Agency Of Federal Democratic Republic Of Ethiopia, 2021). Rural poultry production is mainly based on the traditional family poultry system with indigenous breeds which represent 78.8% of the total poultry population (Central Statistical Agency Of Federal Democratic Republic Of Ethiopia, 2021). The average consumption of poultry meat is relatively low (600gr/person/annum) compared to other African countries (average of 2kg/person/annum), which is partly due to a low poultry production in the country. Since 2006, there has been a growing demand for chicken meat in urban areas in Ethiopia due to the increase of beef and sheep meat prices (USDA Foreign agricultural service, 2017). The Ethiopian government plays a role in the development of agriculture in order to reduce the poverty and malnutrition rate. Since 2015, the Ethiopian government, through the Ethiopian Livestock Master Plan 2015-2020, aims at increasing Ethiopians' production and consumption of poultry meat and eggs by developing improved family poultry production systems and specialized layer and broiler production systems (Ministry of Agriculture, Livestock Resources Development Sector, 2015). As an example, the exotic breed in Ethiopia produces 128 eggs of the eggs per hen and per period, while the hybrid breed produces 48 and the indigenous 13 (Central Statistical Agency Of Federal Democratic Republic Of Ethiopia, 2021). The government planned to meet these targets "by providing incentives to the private sector for poultry investment, strengthening research to select productive indigenous breeds, and by developing breeds suitable for improved family poultry production systems" (Ministry of Agriculture, Livestock Resources Development Sector, 2015).

⁷ The Ministry of Livestock and Fisheries has merged with the Ministry of Agriculture since April 2018

The PPP between EthioChicken and the public veterinary services aimed to help increase poultry production in Ethiopia by providing 45 days old chicken and poultry health support to smallholder farmers.

Despite many examples of PPPs implemented in the veterinary domain, few studies have evaluated the initiatives in place. Evaluation is an important step for any programmes: it helps in planning, redefining strategies, taking appropriate corrective actions, and optimizing resources (Allen, 2019). Evaluation is also a means of reinforcing partnerships and the process of collaboration and ensuring trust between partners (Rieker, 2011). Most evaluations mobilized in the veterinary domain are technical or efficiency evaluations, characterized for example by avoided losses in animal production (Rushton, 2007). Some evaluations, particularly those applied to surveillance programmes, have also focused on the process (or functioning) of the programmes by examining the conditions under which the programme operates and the organizational elements (Delabougliose et al., 2015; Hendrikx et al., 2011). However, none of the evaluation in the veterinary domain explicitly addressed PPPs and their impacts. In the case of PPPs, involving multi-actor collaboration, complex programme design, an evolving governance and coordination system, uncertain programme evolution, and a diversity of possible impacts, the evaluations mobilized to date in the veterinary domain do not appear to be fully adequate. Impact pathway methodology has been developed in agricultural development evaluation. The idea is to complement existing economic impact assessment methods and to gain insight into the non-linear mechanisms leading to impacts. This methodology analyses how programmes are built, and attempts to make explicit the complex causal relationship between the programmes and the impacts. The methodology also assesses and measures impacts, normally several years after the programme has finished, as the impacts are what remain after the programme's ending (Douthwaite et al., 2003). To our knowledge, this methodology had never been previously used to evaluate public-private partnerships in the veterinary domain, nor to evaluate other programmes in the veterinary domain.

The general objective of this study is to discuss the interest and challenges of the participatory impact pathway methodology for evaluating a PPP in the veterinary domain. To do so, we applied this methodology to evaluate the PPP between EthioChicken and the public veterinary services of Ethiopia. Seeking to understand the contribution of PPPs to impacts, the mapping of actors was described, the causal relationships between the inputs of the PPP and the impacts clarifying, and then the impacts measured.

2. Material and methods

2.1 The participatory impact pathway

In order to evaluate a PPP in the veterinary domain, we adapted the participatory impact pathway methodology “ImpresS”, developed to evaluate research projects by the French Agricultural Research Centre for International Development (Cirad) (Barret et al., 2018), itself inspired by pre-existing methodologies (de Janvry et al., 2010; Douthwaite et al., 2003; Springer-Heinze et al., 2003). As the PPP evaluated is still active, we used the guidelines for *in itinere* evaluation (ex post evaluation takes place when the programme is completed). ImpresS methodology is a participatory evaluation method (BetterEvaluation, 2012a). Participatory evaluation considers a plurality of viewpoints, thereby improving understanding a complex, multi-stakeholder program such as the PPP. The participatory evaluation also promotes the formulation of locally relevant evaluation questions, support for collective learning, and enhances the acceptability of evaluation recommendations by targeted stakeholders (Bryson et al., 2011; Calba et al., 2015a; Taut and Brauns, 2003).

The definition of impact pathway. The Impact Pathway is based on a programme theory, which is an explicit model of how a programme will, or has, brought about impacts. Impact Pathway makes it possible to determine the complex cause-and-effect relationships between a programme such as PPP and its impacts. The main objective of developing the impact pathway is to demonstrate the extent to which a programme contributes to impacts by looking at the change that it brings for actors and then the economic, social, environmental and other impacts that these changes produce. The Impact Pathway distinguishes between outputs (activity or products that result directly from the programme) and outcomes, which correspond to the appropriation and/or transformation of the outputs by the actors, these outcomes being translated into impacts (see box 1 for a more precise definition) (**Figure 1**).

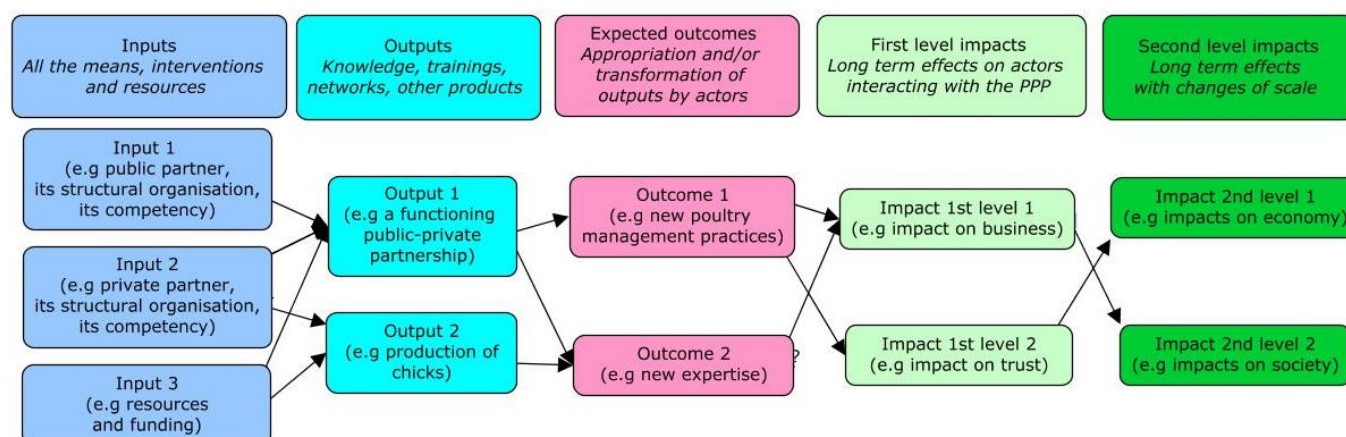


Figure 1. Simplified graph of an impact pathway. Some hypotheses were made on the potential inputs, outputs, outcomes and impacts of the PPP evaluated to illustrate the impact pathway.

Box 1. Definition of inputs, outputs, outcomes and impacts

Inputs encompasses all the means (interventions and resources) that make it possible to undertake a programme (human and material resources, budget, information, tacit or pre-existing knowledge, other activities, etc.) and thus generate results (outputs).

Outputs can take the form of knowledge, professional or academic training, expertise, technology, network or other forms of products.

Outcomes correspond to an appropriation and/or transformation of programme outputs by stakeholders leading to new practices (agricultural or managerial), new organizations, or new rules (Barret et al., 2018).

Impacts are the long-term effects induced by a programme. They are what remains after the programme is completed. The impacts could be of multiple natures (e.g. economic, social, sanitary, political), at various levels (e.g. individual, institutional, regional, national, global) and of different types (positive or negative; direct or indirect) (Barret et al., 2018). For PPPs in the veterinary domain, they can be of different types: economic, societal, related to business, health or trust and can be measured by indicators (World Organisation for Animal Health, 2019b).

The impacts can be characterized by intensity and magnitude through indicators. Intensity reflects the degree of change attributed to the programme and observed for a given impact, while magnitude reflects the extent or spread of the change (ex: number of producers affected by the change).

First level impacts are measured on actors interacting directly or indirectly with the programme and can be evaluated with these actors. Second level impacts result from changes of scale (e.g. from local to national) (Barret et al., 2018).

The participatory impact pathway methodology. The ImpresS methodology is divided into five phases: (i) preparation of the case study; (ii) dialogue with the actors to define hypotheses on the context of the programme and the nature of the impacts during a first participatory workshop; (iii) construction of the narrative of the context and history of the programme and of the impact pathway; (iv) characterization and measurement of the impacts and (v) validation with the actors during a second participatory workshop (Barret et al., 2018)

2.2 Study area

This study was conducted in the four regions of Ethiopia where EthioChicken operated in 2018: Tigray, Amhara, Oromia and the Southern Nations, Nationalities, and People's region (**Figure 2**). The four regions are among the most populated regions in Ethiopia, accounting for more than 80 percent of the Ethiopian population. Those four regions accounted for 95.3% of the total poultry population in 2018 (Central Statistical Agency Of Federal Democratic Republic Of Ethiopia, 2018) with 31.8% coming from EthioChicken. In 2018, the poultry production of EthioChicken was highest in the region Southern Nations, Nationalities, and People's (37%), followed by Oromia (31%) (**Appendix 1**).



Figure 2. Map of Ethiopia (bold line) and the four regions included in this study (in grey). The capital of Ethiopia, Addis Ababa (black circle), is surrounded by the Oromia region.

2.3 Methodology and research tools used for this case study

As the programme evaluated was a PPP in the veterinary domain (and not a research programme), and as the PPP evaluated was still active and we wanted to provide recommendations to improve the PPP, we adapted ImpresS methodology (remaining close to it). Our methodology was divided into 6 steps:

Step 1. Preparation of the case study with key PPP actors from public veterinary services and EthioChicken managers by identifying the actors to be involved;

Step 2. Dialogue with the actors to map the actors directly or indirectly involved or impacted by the PPP, to identify elements of the context and the history of the PPP, to identify the different inputs, outputs, outcomes or impacts of the PPP, and to identify the potential limits of the PPP;

Step 3. Co-construction of the mapping of the actors, the narrative of the context and history of the PPP, and the impact pathway. Discussion of the added value of the PPP to reach these impacts;

Step 4. Co-selection of the limits of the PPP that can be improved and co-construction of the improvement scenarii;

Step 5. Validation of the final results and co-construction of the final recommendations;

Step 6. Measurement of impacts identified based on grey literature, and internal data from EthioChicken.

This methodology used different participatory tools such as individual semi-structured interviews or grouped semi-structured interviews (=focus group), workshops, depending on the results the research team expected, the resources available and the availability of the actors (Alders et al., 2020).

For step 2 ‘dialogue with the actors’, semi-structured interviews, following a previously prepared checklist, were conducted in the four regions. These were mainly individual interviews to facilitate the capture of individual points of view (Mariner and Paskin, 2000). Due to the time constraint, two semi-structured interviews were conducted in groups (focus group discussions) in two regions. The focus groups may obscure individual opinions, but in order to favour consensually validated information, we homogenized the two groups of actors (one group of 4 growers of 45-day-old chickens, and one group of 8 smallholder farmers). Two different checklists were prepared: one for the actors at the conception of the PPP, one for the other actors. The themes covered by the checklist for the actors at the conception of the PPP were: (i) building of the PPP (inputs), (ii) functioning of the PPP (structure, governance, collaboration), (iii) outputs of the PPP. The themes covered by the other checklists were: (i) poultry production, (ii) involvement in the PPP and the EthioChicken model, (iii) interaction with other stakeholders, (iv) benefits of the PPP, and (v) limits of the PPP and scenario of improvement (**Appendix 2**). Furthermore, two proportional piling exercises were conducted with two groups of actors following the focus group discussions. The proportional piling is a semi-quantitative method that classifies elements by stacking small objects (such as seeds) on circles representing the different elements to classify (Mariner and Paskin, 2000). In this case, the elements to be classified were the benefits brought by getting involved in this model of poultry production.

For each of steps 3, 4 and 5, a workshop was organised (three workshops in total). The main goal of these three workshops was to construct the different elements of the evaluation and the recommendations in a collaborative manner. Unlike the focus groups, which were held with homogeneous groups of actors, the workshops should involve representatives of the different groups of actors directly or indirectly involved in the PPP as well as representatives of the actors impacted by the PPP: public and private, national and local actors.

For each workshop, a maximum of 50 persons was tolerated in order to conduct group work and allow participants to express themselves (according to the facilitation skills in the team, we were able to divide the participants into 3 working groups per workshop). The goal of the first workshop, conducted during step 3, was to present, improve and validate results obtained during step 2, based on the drafts prepared by the research team, regarding: (i) mapping of actors, (ii) elements of the context and the history of the PPP, and (iii) the impact pathway. The goal of the second workshop, conducted during step 4, was to explore the limits of the PPP between EthioChicken and the Ethiopian government, and to co-construct improvement scenarii. For the discussion of limits and improvement of the PPP evaluated, in this second workshop, a wide range of actors, including potential opponents was wanted. The goal of the third workshop, conducted during step 5, was to present and validate the final report with the actors directly involved in the PPP.

For step 6 ‘measurement of impacts’, results of the previous steps were used, as well as grey literature and internal data from EthioChicken such as company profile, and results of their client surveys.

2.4 Period, target population, and sampling strategy

Period. The first field investigation including individual and grouped interviews, proportional piling and the first two workshops was conducted between March and June 2018. The measurement of impacts was done from September to December 2018. The third workshop was conducted in August 2019.

Target population. Participants should represent a variety of stakeholders from national and local levels directly or indirectly involved in the PPPs between EthioChicken and the public veterinary services. Participants should correspond to public and private partners involved in the PPP, actors who influence the PPP, or actors impacted by the PPP. Defining the target population was an iterative process. As we moved forward with mapping of the actors, we identified new categories of actors to include in the participatory evaluation. We sought to include grower agents representative of this category, i.e. 30% women and with flocks of 1,300 chicks per cycle time on average (the numbers do not differ significantly between the four regions). We also sought to include smallholder farmers representative of this category, i.e. 90% of women raising 5 to 40 chicken on average (the numbers do not differ significantly between the four regions). Actors from almost every category of the target population were interviewed (see the results section 3.1 and **Appendix 4** presenting the participants of this study).

Sampling strategy. The main goal was to capture a diversity of points of view, representing the different categories of actors of in the target population. First, individual semi-structured interviews were conducted at the national level with actors at the conception of the PPP. Then, in the four regions, areas where grower agents operate and villages where smallholders’ farmers buy chickens from grower agents were selected. The first list of participants was composed of purposively selected actors, thanks to the help of the EthioChicken manager and village leaders.

Then, a non-probability snowballing sampling was used in the four regions, and the initial participants list was enlarged through the identification, by participants, of other actors that could be included in the study (Sadler et al., 2010). The number of interviews for each category of actors was determined by adapting the concept of saturation. Saturation in a category of actors was considered to be reached when additional interviews provided no new information compared to previous interviews (Fusch and Ness, 2015). The sample size was therefore not predefined. However, given the time and resource constraints, certain categories of actors were privileged to reach this level of saturation. These categories included actors at the conception of the PPP (actors from EthioChicken, actors from the public veterinary services, other actors from the Ministry of Livestock and Fisheries) and actors who adopted the PPP model (growers of 45-day-old chickens, also called grower agents, and smallholder farmers).

2.5 Data collection

Individual and grouped semi-structured interviews. The individual semi-structured interviews lasted from 20 to 30 minutes. The two focus group discussions lasted 45 minutes and 1 hour. Individual semi-structured interviews and focus group discussions were performed by teams of one Ivorian male researcher (**BN'g**), one Ethiopian male sales manager at EthioChicken (**FT**), three male staff of EthioChicken, and one Ethiopian male veterinarian. All had a veterinary medicine or epidemiology degree and were previously trained in participatory approaches. Only the regional sales members had a relationship with the interviewees as part of their activities. The interviews were conducted in English or local languages (Amharic, Oromifa, Tigrinya and Wolaytinya) depending on the interviewee. All the discussions were recorded, once the interviewee had agreed to participate in the study and be recorded.

Proportional piling. These exercises were done right after each of the two focus groups (**BN'g** and **FT**). Circles were drawn on a large white sheet of paper, representing the benefits mentioned during the two previous focus group discussions. For the group of growers of 45-day-old chickens, 3 circles were drawn as 3 benefits were mentioned ('better life', 'job opportunity', 'low investment in terms of land and capital'). For the group of 4 smallholder farmers, 4 circles were drawn as 4 benefits were mentioned ('women's empowerment', 'profit', 'easy to manage', 'low investment in terms of land and capital'). Then, 100 beans were given to each group and the actors were asked to stack the beans. The more the benefit was important to them, the more beans they had to put in. Once the distribution of beans among the different benefits was completed, the research team counted the beans, recorded the scores in percentage (e.g. if 29 beans were put on the circle 'profit' then it was noted "profit is 29% of total benefits perceived"), and took photos.

Workshops. Two researchers (**MPe**, a French female veterinarian and **BN'g**, an Ivorian male veterinarian) and four facilitators (**FT**, one Ethiopian male sales manager at EthioChicken, and **YT.A** and two other Ethiopian male researchers from the International Livestock Research Institute) conducted the three participatory workshops. The facilitators were trained to moderate, observe and take notes during the workshop. One observer took extensive notes (**IDL**). Two different groups were set up for each of the workshop: one for English speakers and the other for Ethiopian (Amharic) speakers. The discussions were conducted in English and Amharic, ensuring that all stakeholders took part in the discussions (Glenn, 2003). The three workshops lasted around 4 hours each and extensive notes were taken.

Measurement of impacts. Potential indicators of impacts were identified during the second workshop when constructing the impact pathway. Then, the results of the two proportional piling exercises conducted after the two focus groups with smallholder farmers and growers of 45 days old chickens, grey literature and internal data of EthioChicken were screened to quantify the impacts through indicators (**MPo**). The results from individual and grouped semi-structured interviews were also used to measure the impacts in a qualitative manner (**MPo**).

2.6 Data processing and analysis

The recorded discussions (i.e, the individual semi-structured interviews, the two focus group discussions), and the manual notes (taken during individual and grouped semi-structured interviews and during the three workshops), were transcribed into English. An unique number was given to each of the transcripts to ensure the anonymity of the interviewees. The transcripts were read, and themes (represented by codes and subcodes) emerged from the reading, corresponding to the functional process of the PPP (**Appendix 3**). A spreadsheet containing these codes and subcodes was prepared. During a second reading of the transcripts, the qualitative data was classified in the spreadsheet according to its corresponding themes (code/ sub-codes) (Campenhoudt et al., 2017b). A second spreadsheet database was prepared to draw the impact pathway, using different categories: inputs, outputs, outcomes and impacts. During another reading of the transcripts we classified the data in this second spreadsheet database. The results of the two proportional pilings were documented using photographs, and were reported in a word document.

Workshop results such as drawings and notes were documented using photographs. The notes from the three workshops were faithfully transcribed and classified in the same spreadsheet databases as for semi-structured interviews. The drawn impact pathway developed during the first workshop was reproduced on the CIRAD Impress tool (<https://impress-impact-recherche.cirad.fr/resources/impress-knowledge-management-system>).

All the data and recommendations were validated during the third workshop, except the measurement of impacts. The impact measurement results were sent to the actors of the conception of the PPP and discussed through email exchanges.

2.7 Ethics

The approval to implement this participatory evaluation was obtained from the managing director of the EthioChicken and the director of the poultry production department of the Ministry of Livestock and Fisheries. The semi-structured interviews and the workshops were carried out after presenting the study objectives and obtaining verbal consent from all volunteer participants. The interviewees could stop the interview whenever they wished. Names and contact details of interviewees were kept in a secured database only accessible to the research team, the privacy rights of participants were fully protected, and all data were anonymized.

3. Results

3.1 Mapping of the actors and participants involved in this study

Different actor categories were distinguished: actors of conception of the PPP, actors who adopted the PPP model, actors impacted by the PPP and also influencing the adoption, and actors who influence the development of the PPP. The actors can belong to several categories. Actors positively or negatively impacted by the PPP could either be the public and private partners and could also influence the adoption of the PPP model (**Figure 3**).

The actors who played a major role in conception of the PPP were the public veterinary services and other actors of the Ministry of Livestock and Fisheries and EthioChicken company (**Figure 3**).

The actors who adopted the model on the public side were the public veterinary services and other actors of the Ministry of Livestock and Fisheries (livestock officers and public development agents) at regional and national level. The public development agents were public actors who distributed the 45 days old chickens produced by the grower agents at local level to smallholder farmers. The actors who adopted the model on the private side were grower agents, smallholders' farmers, local communities and the village poultry development agents (**Figure 3**). The grower agents (independent private actors) raised day-old chicks supplied by EthioChicken until 45 days, provided poultry health care such as vaccination programme and were assisted by EthioChicken. The village poultry development agents (independent private actors) were actors elected by the local communities to deliver the 45 days old chickens from the grower agents to the smallholder farmers, operating in two regions due to the non-availability of public development agents.

The actors who influenced the adoption of the PPP model were the government of Ethiopia (public services structures and availability, laws and regulations), especially the Ministry of Livestock and Fisheries, international agencies and other poultry producers. The actors who influenced the development of the PPP model (intentionally or unintentionally) did not play a direct role in the conception. On the public side, they were actors of the public services, policy makers or actors of the Ethiopian Universities. On the private side, they were investors or technical international partners (Figure 3).

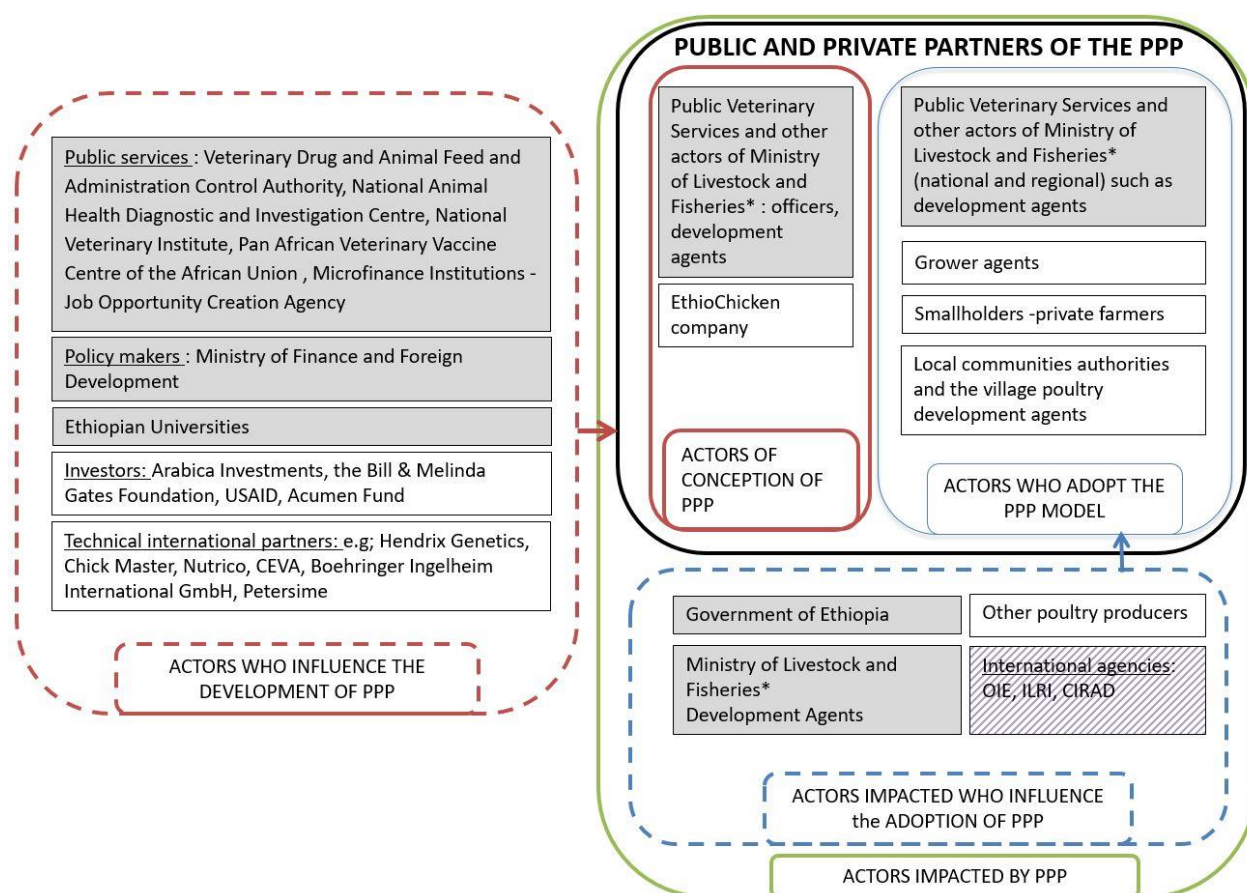


Figure 3. Mapping of categories of the actors involved directly or indirectly in the public-private partnership between EthioChicken and the public veterinary services. The dark grey rectangles indicate the public actors. The white rectangles indicate the private actors. The light grey rectangle indicates international agencies. *The Ministry of Livestock and Fisheries has merged with Ministry of Agriculture since April 2018. *CIRAD: French Agricultural Research Centre for International Development, OIE: World Organisation for Animal Health, PPP: Public-private partnership, USAID: United States Agency for International Development.*

A total of 64 semi-structured interviews were conducted. Almost all group of actors identified in the mapping of actors have been included, with the exception of some actors that influenced the development of PPP: investors and technical partners (due to their non-availability on the field, being international actors) and Ministry of Finance and Foreign Development (due to resource and time constraints) (**Appendix 4**). Participants were from different administrative levels: international (n=4), national (n=12), regional (n=7), district (n=13) and ward level (n= 28). All the interviews at international and national level were given in English, while interviews given at regional, district and ward level were given in local language. On the 48 interviews conducted at regional, district and ward level, more interviews were conducted in Oromia (n=19, 39%), Southern Nations, Nationalities, and People's (n=17, 35%) as the EthioChicken production was higher than in the two other regions (**Appendix 4**). The actors involved in the interviews represented public (n=20) and private actors (n=44). The individual semi-structured interviews involved 52 participants; while the two focus groups (followed by proportional piling) gathered 8 grower agents and 4 women smallholder farmers. The 8 grower agents involved in the focus group were women (25%, n=2) and men (75%, n=6) and possessing flocks of 605 chicks per cycle in average. The 23 smallholder farmers included in individual and groups interviews were women (74%, n=17) and men (26%, n=6), and they were raising an average of 27 chickens.

The first workshop had 26 participants, the second 48 participants representing a wide diversity of actors (Supplementary Table 2). The third workshop, gathered 18 participants, mainly actors directly involved in the PPP (actors from EthioChicken and actors from public veterinary services and other actors from the Ministry of Livestock and Fisheries) (**Appendix 4**).

3.2 The context of implementation of the public-private partnership between EthioChicken and the public veterinary services: history

The first phase of the development (2010 – 2014) of the PPP began in the Tigray region. In 2010, EthioChicken co-founders took charge of a government poultry farm, through an agreement with the Tigray regional government, which was underperforming at that time (*input 1 and first star*, **Figure 4**). Thanks to the PPP, EthioChicken had access to the extension services of public veterinary services of the Ministry of Livestock and Fisheries in Tigray region (first and second stars, **Figure 4**). Public development agents, public actor from the Ministry of Livestock and Fisheries, distributed chickens at local level to smallholder farmers who could raise them for meat and for eggs.

During a second phase of development (2014-2015), the success of the farm in Tigray led the government to recommend that they expand their model to three more regions, thereby expanding the PPP activities (*third star*, **Figure 4**). EthioChicken started to import dual-purpose improved genetic breed (*input 2*, **Figure 4**). Since then, the EthioChicken staff has been raising the parental stock (which was imported) and produce day old chicks in the three regional farms. Grower agents, who were private independent actors contracted by EthioChicken, were created in the four regions to raise the chickens from 1 to 45 days old and to ensure a vaccination program (*outcome 1 and economic impact*, **Figure 4**). The public development agents continued to deliver the chickens (45 days old) to smallholders' farmers. EthioChicken started to employ young graduate veterinarians from Ethiopian Universities (*output 2 and economic impact*, **Figure 4**).

During a third phase of development (2015-2019), the capacity of EthioChicken expanded into four regions of Ethiopia. Currently, EthioChicken manages five poultry farms (and four belonging to the government), two hatcheries and one feed mill production plant (*input 4*, **Figure 4**). In two regions, due to the low-availability of public development agents, EthioChicken, in agreement with the local communities, has developed village poultry development agents to deliver the 45 days old chickens from the grower agents to the farmers (*outcome 2*, **Figure 4**).

During the development of the model, EthioChicken received a crucial investment from different funds and foundations (*financial partners*, **Figure 4**)

At the time of the study, EthioChicken continued to produce improved breed day old chicks, that were distributed to smallholder farmers through the public veterinary services network. This model allowed smallholder farmers and their families to increase their consumption of meat (*societal and health impact*, **Figure 4**). Since 2010, the PPP has increased the number of days old chicks sold per year (*output 1, 3, 4 and 5*, **Figure 4**) which were distributed in 2018 to 3.2 million households of smallholder farmers (*outcome 3*, **Figure 4**). However, the PPP faced important issues linked to access to foreign exchange currency (*business impact*, **Figure 4**).

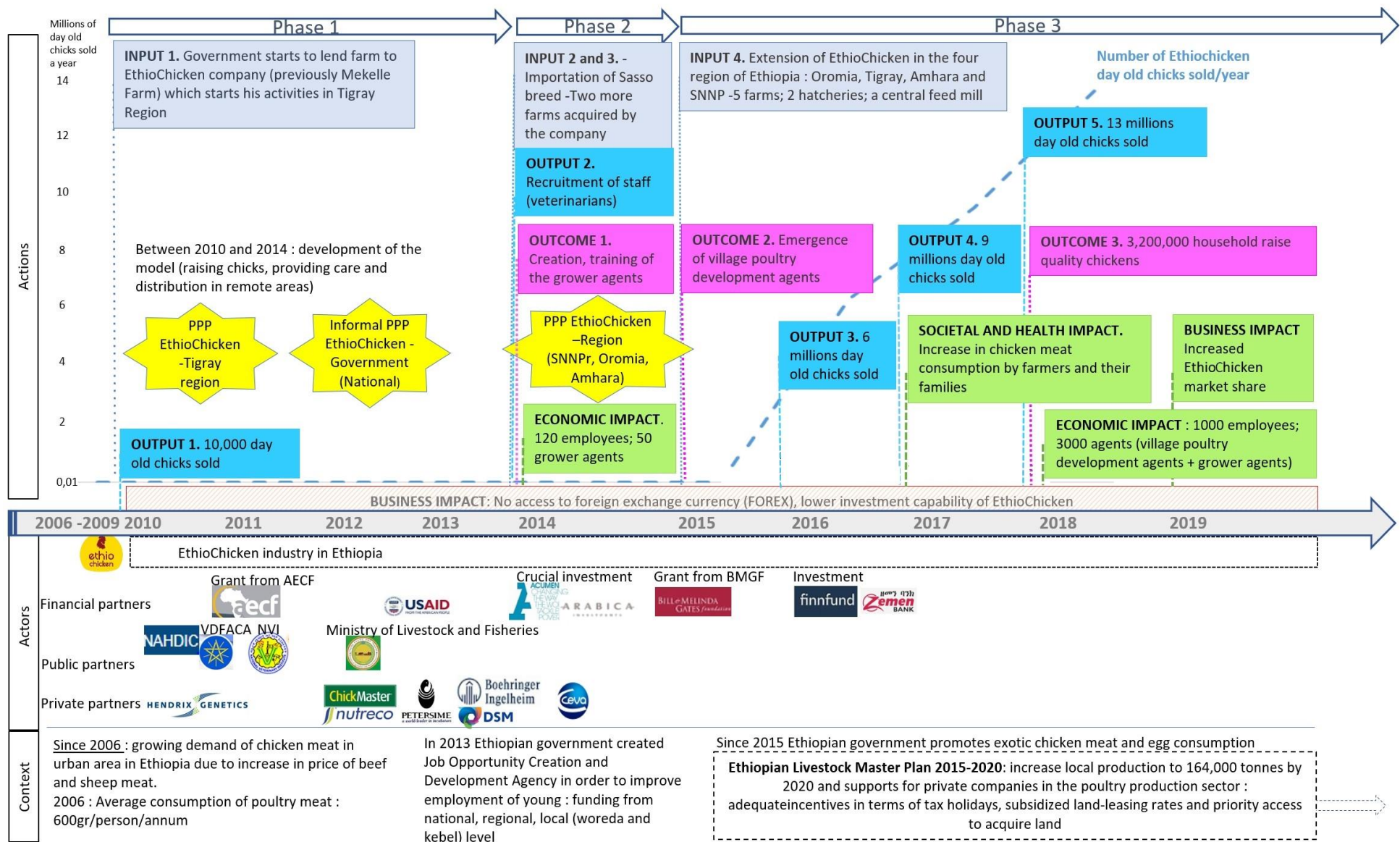


Figure 4. History of the public-private partnership development in three main phases (2010-2019) and impacts; capturing elements of context, actors and actions. The light blue rectangles indicate inputs, turquoise ones indicate outputs, pink ones indicate outcomes and green ones indicate positive impacts and red ones negative impacts. The stars indicate the building of public-private partnerships at national level (second star) and regional level (first and third stars). The actors represented are the financial partners, who have invested in the company EthioChicken, the public partners, and the other private partners. Elements of context are given at the bottom of the figure. The Ministry of Livestock and Fisheries was merged with Ministry of Agriculture since April 2018. AECF: Africa Enterprise Challenge Fund, BMGF: Bill and Melinda Gates Foundation, NAHDIC: National animal health diagnostic and investigation centre, Forex: foreign exchange currency, NVI: National Veterinary Institute, PPP: public-private partnership, SNNPr: Southern Nations, Nationalities and Peoples' region, VDFACA: Veterinary drug and animal feed and administration control Authority, USAID: United States Agency for International Development

3.3 Impact pathway

3.3.1 Inputs

The inputs included the political enabling environment: the Growth and Transformation Plan II, and the promotion of exotic chicken meat and egg consumption by the Ministry of Livestock and Fisheries. In 2013, the Ethiopian government created the Job Opportunity Creation and Development Agency Creation, which aims to improve the employment of young people through funding (they can access loans and start to manage a poultry farm) with the collaboration of the private Microfinance Institution (**Figure 5**).

The inputs also included (i) public services which provide the authorization of importation and control of the quality of poultry feed and vaccines from other countries, (ii) animal disease surveillance, (iii) investigation of animal diseases, (iv) production and control of national vaccines, and (v) extension service network down to ward (kebele) level with technical livestock offices, and regional governmental farms (**Figure 5**). Other inputs are represented by competencies of EthioChicken and their business partners and public partners in chicken production and health (**Figure 5**).

Finally, inputs included quality products made available in Ethiopia: improved chicken breeds imported by EthioChicken, quality national vaccines, quality feed produced by local crop producers, quality feed supplies from other countries, and health supplies from abroad. EthioChicken imported two different improved genetic breeds (Sasso and Bonvans breed) from two foreign companies to build up their parental stocks of chickens which they raise in Ethiopia and which produce day old chicks. EthioChicken imported feed from other countries only when the quantity of local feed was insufficient (this accounted for 6% of the total feed purchased by EthioChicken), as well as poultry health supplies (they imported poultry vaccines only when national production was not sufficient). Those inputs were bought in dollars sourced through various means by EthioChicken such as local importers who had access to USD, bank supply agreements and letters of credit from the banks or investor USD (**Figure 5**).

3.3.2 Outputs

National communication campaigns to promote poultry meat were organized by the Ethiopian government. A non-formalized PPP was initiated between EthioChicken and the Government of Ethiopia through the different public actors (**Figure 5**). Official PPPs, through a Memorandum of Understanding at regional level started between EthioChicken and regional and district livestock offices. These PPPs conditioned the outputs in terms of employment and training and the production of quality products (**Figure 5**).

3.3.3 Outcomes

The business outcomes included the increased sale of national veterinary institute vaccines and of products from local crops, since the demand for vaccines and feed by EthioChicken was high. Grower agent had access to new business with the increased numbers of smallholder farmers willing to buy the 45 days old chickens produced by EthioChicken genetics (**Figure 5**).

They were outcomes on employment and training. The creation of village poultry development agents in two regions (where the availability of public development agents was low), to deliver chickens to smallholder farmers, created employment opportunities. These actors were trained in poultry health and management by EthioChicken, and through them and the public development agents, smallholder farmers could receive advices and trainings related to chicken health and production. Actors from the public veterinary services (such as the Veterinary Drug and Animal Feed and Administration Control Authority) also received trainings from EthioChicken in poultry production and health practices (**Figure 5**).

Finally, there were outcomes on production and consumption of quality poultry products. Thanks to the PPP model, smallholder farmers raised healthy chickens (received at 45 days old) and produced quality eggs and meat and they and their families consumed more eggs and more chickens (**Figure 5**). These 45 days old chickens are produced by private grower agents who purchased day old chicks from EthioChicken, as well as vaccines. The grower agents managed the vaccination programme indicated by EthioChicken. They also received technical assistance from EthioChicken.

3.3.4 Impacts

This PPP has led to impacts related to public health, economy and business (at individual but also regional and national levels), as well as societal impacts such as improved education (farmers can send their children to school), women's empowerment and job employment opportunities (**Figure 5**).

3.3.4.1 Economic impact

There was a positive economic impact on the improvement of local and regional economies due to: (1) the rental of government farms to EthioChicken (20% of the profit from EthioChicken sales goes to the government in one region, and in two regions EthioChicken paid a monthly rent to use these government farms); (2) the increase of employment with the creation of grower agents who also employed paid staff in order to help them on their farm, the creation of village poultry development agents, and EthioChicken employed Ethiopian staff; (3) new incomes for many actors due to PPP.

There were also second level economic impacts: increased chicken production in Ethiopia, improved national economy thanks to improved local and regional economy, and new incomes for farmers outside EthioChicken as this PPP encouraged egg and meat consumption in Ethiopia (**Figure 5**). Regarding increase poultry production, in 2018, EthioChicken produced 13 million of day old chicks, representing 32.9% of the total chicks and layer hens production in Ethiopia (n=39.4 million).

3.3.4.2 Business impact

There was a positive business impact for EthioChicken with the new income generated from the sale of day old chicks to grower agents. There was also a negative business impact on EthioChicken due to the non-availability of foreign exchange currency which threatened EthioChicken activity: they had lower investment capability (**Table 1, Figure 5**).

There was a positive business impact for the National Veterinary Institute and national crops producers who sell their products to EthioChicken in large quantities (**Table 1, Figure 5**).

- *“We have a contract with EthioChicken, in their annual plan they give us a list of vaccines and their quantity, and on this basis, we deliver the number of doses. They are developing our business plan because their demand is very high; millions of vaccines are ordered.”* [Interview, head of department of the National Veterinary Institute]

There was a positive business impact for the smallholder farmers and grower agents who produce and sell quality chickens. The four smallholder farmers who participated in proportional piling about the benefits of participating in this PPP model, ranked the statement “profit” in 2nd place (representing 29% of the total benefit).

- *“I raise awareness in the communities that buy the chickens, so they are aware how to rear chicken, how to manage and how to benefit from chicken farming”.* [Interview, village poultry development agent]
- *“There is a high demand in credit by young people those days compared to years before, and a huge amount of microfinance institution money has been given to poultry producers [the grower agent] which are getting successful. They call their business “printing money” because they get profit in a short time”* [Interview, agent of Microfinance Institution]

Table 1. Indicators of business impacts related to different stakeholders generated by the public-private partnerships between the Ethiopian government and EthioChicken. Intensity reflects the degree of change attributed to the PPP and observed for a given impact, and magnitude reflects the extent or spread of the change.

1. Internal report made by Research Support Services (Collins O, O., Christopher, C.K., Meseret, M.B., Merihun, N.W.): “Verification study for Africa Enterprise Challenge Fund, Africa agribusiness project: AGFlow poultry’ Ethiopia, 2017.

2. Internal data from EthioChicken: “EthioChicken lean data” Ethiopia, 2016.

3. Internal data from EthioChicken: “EthioChicken internal statistics” Ethiopia, 2019.

*Among the farmers who adopted this PPP model, 79% of households live below 2.50 USD per person per day and 93% reported agriculture as their primary source of income

** In Ethiopia, the average salary per year in 2018 was about 3 652 USD and the minimum salary were about 495 USD (source: <http://www.salaryexplorer.com/salary-survey.php?loc=69&loctype=1>)

Indicator: New incomes			
Actors	Measure		Results
Farmers	Intensity 1.	Mean annual net benefit per household breeding Sasso chickens	~250 USD ^{1*}
	Intensity 2.	Net benefit (USD) for meat sold per year for flock of 100 heads: EthioChicken breed compared local breed revenue	Increase rate: 2.16 EthioChicken breed: 1017 USD ^(calculation from 1) Local breed: 470 USD ^(calculation from 1)
	Intensity 2.	Net benefit (Ethiopian Birr) for eggs sold per year for flock of 100 heads: EthioChicken breed compared local breed revenue	Increase rate: 3.8 EthioChicken breed: 20.5 USD ^(calculation from 1) Local breed: 5.4 USD ^(calculation from 1)
	Magnitude 3.	% of household which perceived increased income streams after they started rearing chickens from EthioChicken	74.7% ² (of 3,000,000 household ³)
Agent	Intensity	Mean annual net benefit per agent for rearing EthioChicken breed	~2,376.84 USD ^{1**}
	Magnitude 1.	% of agents who said that profitability is what made the poultry business through EthioChicken stand out from other options	64% ¹ (of 3,000,000 household ³)
	Magnitude 2.	% of agents who perceived that their income had increased since they start this business	81,4% ¹ (of 3,000,000 household ³)

3.3.4.3 Societal impact

The 8 grower agents who participated in the proportional piling about the benefits brought by this PPP ranked the statement “better life” in 1st place (representing 51% of the total benefit), and “job opportunity” in the 3rd place (representing 23% of the total benefit).

- “[the]Majority of our staff are Ethiopian, we only have two expatriate staff based in Ethiopia [...] we are the largest private employers of veterinarians in the country; we contact the Universities in order to interview and nominate students for our training program”. [Interview, manager of EthioChicken]
- “We do not have jobs so we want to work, and also chicken rearing can be an optional job”. [Interview, public development agent]

The four women smallholder farmers who participated in the proportional piling about the benefits brought by this PPP model, ranked the statement “women’s empowerment” in 1st place (representing 46% of the total benefit). Women, in most households, were the ones who take care of chicken rearing and in some households, they were the ones who decided what to do with the revenues from the sale of the eggs and the chickens. EthioChicken had a gender policy in their employment scheme (**Table 2, Figure 5**).

- “As women we have to take care of our children and stay at home for our household, and poultry farming doesn’t need any huge job so we can do it easily ... we can use the money that we earn for ourselves and the kids. Empower women equals empower the community because if the living level of women grows, the community will grow”. [Discussion during proportional piling, woman smallholder farmer who adopted PPP model]

Young people were able to create small micro enterprises and start their activities as grower agents.

There were also second level societal impacts: thanks to new incomes, smallholder livelihood was improved and the families were able to send their children to school (**Table 2, Figure 5**).

- “I am financially independent and I am fulfilling my house in term of furniture and materials. And I also support my young kid in terms of education tools and money for living expenses”. [Interview, village poultry development agent]
- “We want to change our life, from poultry production we profit in terms of money by selling, and we also enjoy meat and egg consumption. [...] With a small land and small capital, we can do chicken rearing so we like it”. [Interview, farmer]

However, there were also farmers who fear to lose their biodiversity of local breed.

- “There is no consideration in preserving the local genotypes” [Interview, farmer]
- “[...] smallholders have preference for the local breeds based on their culture. They are used for adoration of ancestors, or for ceremony to solve disputes. [...]”. [Interview, social scientist in International Livestock Research Institute Ethiopia]

Table 2. Indicators of societal impacts related to different stakeholders generated by the public-private partnerships between the Ethiopian government and EthioChicken. Intensity reflects the degree of change attributed to the PPP and observed for a given impact and magnitude reflects the extent or spread of the change.

1. Internal data from EthioChicken: “EthioChicken internal statistics” Ethiopia, 2019.
2. Internal report made by Research support services (Collins O, O., Christopher, C.K., Meseret, M.B., Merihun, N.W.): “Verification study for AFRICA ENTERPRISE CHALLENGE FUND Africa agribusiness project: AGFlow poultry’ Ethiopia, 2017.
3. Internal data from EthioChicken. “EthioChicken customer satisfaction survey” Ethiopia, 2017.

*NB: In Ethiopia, the average salary per year in 2018 was about 3 652 USD and the minimum salary was about 495 USD (source: <http://www.salaryexplorer.com/salary-survey.php?loc=69&loctype=1>)

Indicators	Actors	Measure	Results
Direct created job	EthioChicken employees	Magnitude	Number of employees at EthioChicken 1200 ¹
	Qualified EthioChicken employees	Magnitude	Number of veterinarians 100 ¹
	Agent	Intensity	Mean salary agents per year ~2,376.84 USD* ²
Indirect created job	Paid staff by the agents	Magnitude	Number of agents 5,000 ¹ (among them only 10% where farmer before ²)
		Magnitude	Number of paid staffs by the agents ~4,200 (estimation of 0.84 paid staff/agent ²)
	Feed crop business	Magnitude	Number of feed companies from which EthioChicken buys crops 82 ¹
Satisfaction of improved livelihood	Farmers	Magnitude	% of farmers saying that their life improved since raising EthioChicken chicken ~ 84% ³
Women’s employment opportunities	EthioChicken employees	Magnitude	Number of women employees at EC 400 ¹
Women’s role in chicken raising	Farmers	Magnitude	% of household with EthioChicken breed where women farmers take care of the chickens 57% ²
		Magnitude	% of household with EthioChicken breed where women make the main decision on the use of income from chicken products 28.6% ²

3.3.4.4 Poultry and public health impact

Poultry health was improved by reducing poultry disease circulation due to improved health supplies and health training delivered to grower agents, village poultry development agents, and farmers. Protein intake was improved for smallholder farmers within the PPP model and their families by increased consumption of better-quality chicken products (**Table 3, Figure 5**).

-“For us EthioChicken is one of the companies which are contributing to improvement of chicken productivity in Ethiopia”. [Interview, researcher at International Livestock Research Institute in Ethiopia]

Second level impacts on public health were linked to the strengthening of veterinary services and improved nutrition. veterinary services were strengthened by the positive impact on poultry health and the increased trust between farmers and veterinary agents (**Table 3, Figure 5**).

-“We get some trainings from EthioChicken about important poultry diseases”. [Interview, staff from the veterinary services, veterinary drug and animal feed and administration control authority]

Improved nutrition through better access to protein was another public health second level impact. This impact was due to the consumption of improved chicken quality and increased availability of chicken products. A governmental study (an internal communication) showed that the rate of stunting due to malnutrition in infants in the Tigray region decreased from 51% in 2015 to 38% in 2017. This study showed also that the increased of products from chickens raised in rural area and delivered by EthioChicken played an important role in the decrease of the infants’ stunting (**Table 3, Figure 5**).

Table 3. Indicators of public health impact related to different stakeholders generated by the public-private partnerships between the Ethiopian government and EthioChicken. Intensity reflects the degree of change attributed to the PPP and observed for a given impact and magnitude reflects the extent or spread of the change.

1. Internal data from EthioChicken. “EthioChicken customer satisfaction survey” Ethiopia, 2017.
2. Internal data from EthioChicken: “EthioChicken lean data” Ethiopia, 2016.
3. Internal data from EthioChicken: “EthioChicken internal statistics” Ethiopia, 2019.
4. USDA Foreign agricultural service. Ethiopia’s demand for chicken meat is expected to grow. 2017 (accessible here: <https://www.fas.usda.gov/data/ethiopia-ethiopias-demand-chicken-meat-expected-grow>)
5. Internal report made by Research support services: “Verification study for Africa Enterprise Challenge Fund Africa agribusiness project: AGFlow poultry’ Ethiopia, 2017.

Indicators	Actors	Measure	Results	
Improvement in poultry health management	Agents	Intensity	% of grower agents satisfied with EthioChicken sales manager’s advice	84 ¹
		Magnitude	% of grower agents who received a visit by the EC sales manager	83 ¹
	Farmers	Magnitude	% of farmers confirmed that they had participated in a training organized by EC	21.6 ²
Total meat production by EthioChicken	EthioChicken	Intensity	Increased production meat (tons of kg/year) from 2010 to 2018	From 67.5 to 110,700.0 tons kg/year ³
		Magnitude	Increased participation of EthioChicken meat out of total meat production in Ethiopia from 2010 to 2018*	From 0.15% to 6.9% ^{1,4}
Chicken product consumption	Farmer	Intensity 1.	Delta number of EthioChicken and local eggs eaten / week / household	9 ¹
		Intensity 2.	Delta number of EthioChicken and local chicks eaten / week / household	3 ¹
		Magnitude	Number of households	3,200,000 ³
Meat productivity	Farmers	Intensity	Increased production of meat (ton kg meat/year for flock of 100 heads): EthioChicken breed compared to local breed	47.06 (56,36 - 9,3) ^(calculation from 5)
Egg productivity	Farmers	Intensity 1.	Increased number of eggs/ years for flock of 100 heads: EthioChicken breed compared to local breed	130 (190-60) ^(calculation from 5)

3.3.4.5 Impact on trust

Farmers' and consumers' trust in the veterinary services increased thanks to the improved competencies of veterinary services in poultry health. Consumer trust increased with the quality of the chicken produced within the PPP model. The trust of farmers and other actors to start a low-risk business related to poultry production was increased thanks to the quality of the chicken produced within the PPP model (Table 4, Figure 5).

- “So when you walk around, it's common to see rural people rearing improved chickens from EthioChicken; they have 50, 100 or 200 chickens. That was not so easy previously”. [Interview, regional staff from Ministry of Livestock and Fisheries, Addis Ababa]

However, there was also a fear of disease outbreak due to a sense of the fragility of the improved breed compared to the local one.

- “Talking about disease surveillance, what type of disease can be transported to the farmers because of these improved chickens? I would like a project focus on this aspect. Right now we do not have big problems of disease but disease stays as a biggest challenge; parental stock comes from abroad, so how can we regulate this one more efficiently?”. [Interview, staff from Pan African veterinary vaccine centre of the African union]

Table 4. Indicators of impact on trust related to different stakeholders generated by the public-private partnerships between the Ethiopian government and EthioChicken. Intensity reflects the degree of change attributed to the PPP and observed for a given impact and magnitude reflects the extent or spread of the change.

1. Internal data from EthioChicken. “EthioChicken customer satisfaction survey” Ethiopia, 2017.
2. Internal data from EthioChicken: “EthioChicken internal statistics” Ethiopia, 2019.

Indicators	Actors	Measure	Results
Quality chicken	Farmers	Magnitude	% of farmers satisfied with the quality of chicken 91% ¹
Increase demand for the product (2014 to 2019)	Grower agents	Intensity	Increased number of day old chicks produced/ year by EthioChicken (2014 to 2019) 10 thousand to 16.4 million ²
		Magnitude 1	Increased number of grower agents (2014 to 2019) 100 to 5,000 ²

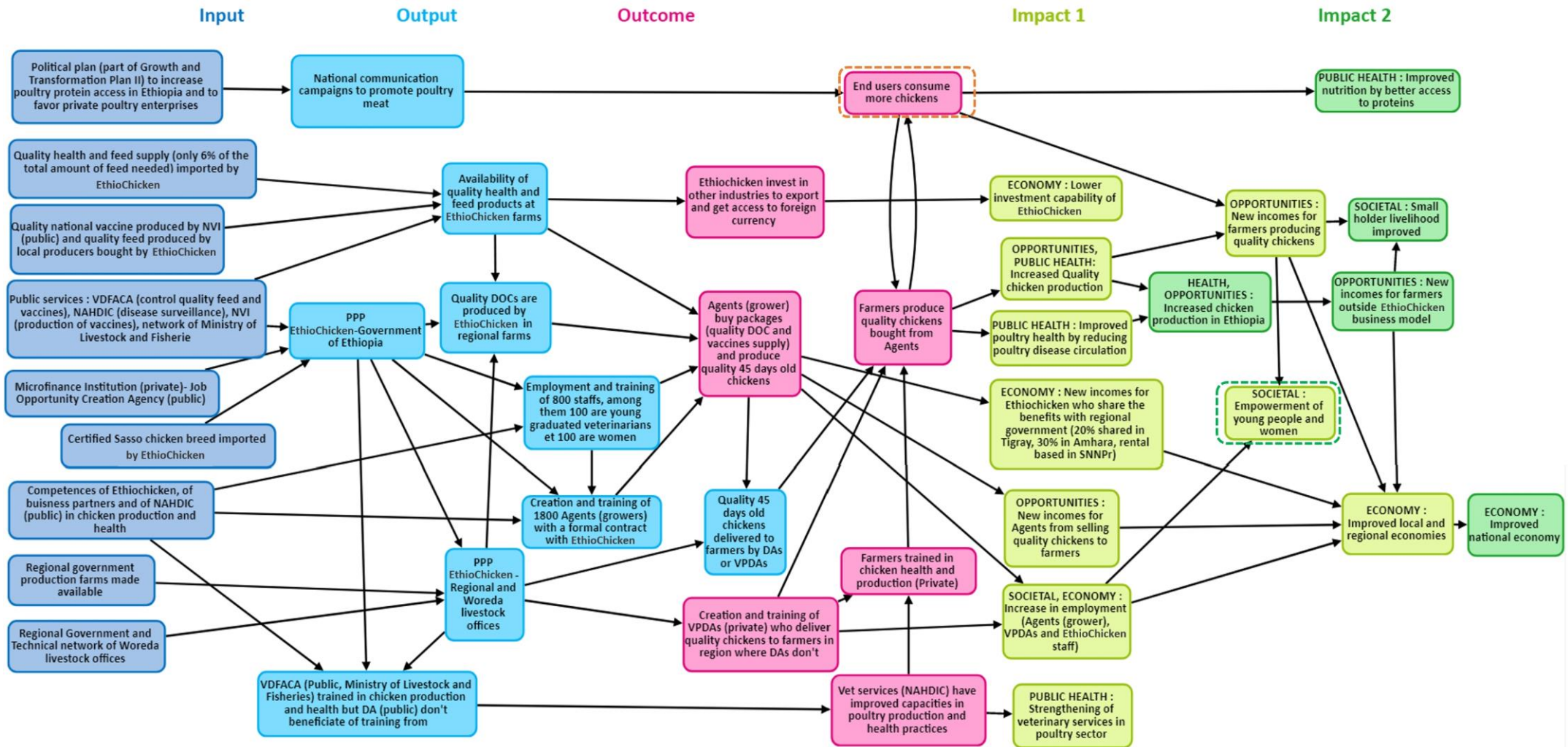


Figure 5. Impact pathway of EthioChicken innovative model and public-private partnership involved in this model: inputs (dark blue); outputs (light blue); PPP at national level (star with N), PPP at regional level (start with R); outcomes (pink) and impacts level 1 (light green), impacts level 2 (dark green). The impacts can be negative (rectangle with dotted red border) or positive (the others). *DA*: public development agents, *DOC*: day old chicks, *EC*: EthioChicken, *NAHDIC*: National animal health diagnostic and investigation centre, *NVI*: National veterinary institute, *PANVAC*: Pan African Veterinary Vaccine Centre of the African Union, *VDFACA*: Veterinary drug and animal feed and administration control authority, *VPDA*: Village poultry development agents, *Woreda*: regions

3.4 Added-value of the public-private partnership to reach the different impacts

The added value of the PPP to reach the different impacts on poultry sector was mentioned by both public and private partners.

- *“We have good relation with this private company, we work with them very closely. EthioChicken have impact on poultry sector, and also, they encourage other private sectors. [...] We want increase poultry production, and EthioChicken are working smoothly, they support our work!”*. [Interview, staff from Ministries of Livestock and Fisheries, regional level, Addis Ababa]
- *“We want to increase the market share of poultry meat (on total livestock meat) from 5% to 30% up to 2030. We have an ambitious plan office, and we want to involve private sectors to achieve our target. [...] Private sector give us eggs and day old chicks and increase the poultry production of the country”*. [Interview, staff from Ministries of Livestock and Fisheries, national level]
- *“Without this partnership with the government we wouldn't have this distribution network in place. So definitively, the channel of distribution is the added value. It is the strongest aspect of this relationship. [...] We both have a common goal which is to distribute more chicken within Ethiopia”*. [Interview, initiator of EthioChicken]

3.5 Limits of the public-private partnership model and improvement scenarii

Several difficulties and limits of the PPP were mentioned. In Ethiopia, the poultry industry is a recent development. The competency of the public veterinary services was limited in the poultry sector because of limited training in poultry science during veterinary studies. The feed and health supplies required for the improved breed of EthioChicken were expensive and difficult to access due to low availability. Finally, the end-consumer market of poultry products was unstable representing a challenge for the stability of the PPP model. Indeed, this is mainly due to religious and cultural practices in Ethiopia: the existing of different fasting periods, up to 200 days per year, during which a significant part of the population does not consume livestock or poultry products in Ethiopia. During those periods all the different actors of the PPP are affected by the decline in the sale of chicks or chickens. Improvement scenarii of the PPP and recommendations emerged during the second stakeholder workshops.

3.5.1 Issues about access to foreign exchange currency

During the time of the study, poultry sector was not a priority for the financial and trade part of the Ethiopian Government, and did not have access to foreign exchange currency. There were also difficulties related to access to land; indeed, the government distributed the land depending on their production development priority (not poultry sector).

There was a disconnection between the Ministry of Trade for import permits and the Veterinary Authority leading to difficulties for delivery of import permits related to veterinary products. This was a limitation for the public veterinary institute (for import of reagents for national production of vaccines, and diagnostic kit test supplies from abroad) and for EthioChicken for the import of premix feed, vaccines when local ones are not sufficient, and of improved parental chicken stock. In 2018, the Ministry of Livestock and Fisheries was developing a draft poultry policy to improve the situation.

One solution proposed was to promote the benefits of poultry sector at national and regional level, so to encourage the government to put products related to the poultry sector on the list of permitted imports and exports. This would allow access to foreign exchange currency and access to the export market. Large production companies like EthioChicken can help promote the poultry sector to the government.

3.5.2 Access to capital for grower agents and farmers

The access to loans and capital for youth employment was limited in terms of the number and amount to be able to start a poultry production activity such as grower agents. Indeed, when grower agents had access to a small amount of financial loan, they had to start with a small number of chicks to raise until chicks were 45 days old and their profit was low. Some of them they were unable to reimburse their credit.

A solution proposed consisted on the demonstration to loans institutions the benefits and the financial requirements for poultry production, in order to convince these institutions to be more inclined to issue credit. Moreover, it would be better to deliver credit directly to young grower agents, according to their needs for poultry production: currently the credits being lent through youth associations (**Appendix 5**).

3.5.3 Poultry management

Many farmers reported having limited knowledge about poultry management and in-some occasions the local veterinary services, through their public development agents, had limited capacity to help them. At the time of the study, veterinary services in Ethiopia had limited numbers of veterinarians specialized in poultry management, the veterinary curriculum in universities not focusing on the poultry sector.

A solution proposed was to improve the knowledge of the local veterinary services on poultry health., Specialized veterinarians would be able to support the smallholder farmers. The curriculum of the veterinary degree could incorporate more courses on poultry management, and the international universities and the private poultry sector could help the government doing so. Also, the government could propose training in poultry management for the public development agents who are already part of the Veterinary Service. Another solution is that the public development agents could be included in the training given by the coordinator from EthioChicken (currently, only the private village poultry development agents are trained). Finally, another solution could be to have a partnership between veterinary public institutions and private actors like EthioChicken to organize trainings on poultry management in national, regional and local veterinary services down to the village (**Appendix 5**).

3.5.4 Limited dual genetics available in the country creating a competitive environment

EthioChicken holds the exclusive right to distribute one improved genetic breed (the Sasso breed) in Ethiopia through a contract with a French poultry genetics company, producers of the breed in question. This exclusive right has led to stigmatisation of EthioChicken by other Ethiopian poultry producers including day old chicks (from other breeds) for sale to farmers. Because of this stigmatisation, EthioChicken did not have access to the association of poultry producers in Ethiopia, limiting its market access. The absence of EthioChicken in the association also decreased the strength of the latter and its lobbying option, EthioChicken being an important actor in poultry production in Ethiopia. The functioning model of other poultry producers was different from EthioChicken's, as they sell chickens at any stage to farmers (not necessarily at 45 days) without the intermediary of grower agents nor the package of vaccines and trainings. This explains the reason farmers tended to adopt the EthioChicken model compared to other models, and to become contracted grower agents. This increased the stigmatisation of EthioChicken by others Ethiopian poultry producers.

One solution would be to promote the access of alternative improved genetic to other Ethiopian poultry producers. However, if other poultry producers provide improved genetics without the full model (health, feed supplies and post-sale services and trainings) this could lead to limited improved production. Without the full model, in the long term, the success of other poultry producers could decrease. The solution would be to promote the 'transfer' of a similar model (the EthioChicken model) through PPPs to other competitors to guarantee the quality and impact of the actions, as is already the case for two poultry producing companies (**Appendix 5**).

4. Discussion

The results of this study describe (i) the history, (ii) the complex process of the public-private partnership between EthioChicken and Ethiopian government, and (iv) societal, economic, and health impacts brought by this collaboration. The participatory impact pathway methodology captured the viewpoints of public and private partners of the PPP, actors who influenced it and actors impacted by it, enabling the transparency of the interests, benefits and constraints of each actors.

4.1 The importance of participatory impact evaluation methodology

The main strength of this study lies in the involvement of different actors in the evaluation process. The participatory approaches allowed the recording of viewpoints from a large number of actors from both public and private sector, actors influencing the PPP and actors impacted by the PPP, including vulnerable actors such as young people and women. The importance of capturing viewpoints of the vulnerable groups to enhance equity in health and well-being is enhance in the protocol for PPP evaluation in public health of the World Health Organization (Donald A. Barr, 2007).

Another strength of the impact pathway methodology lies in the integrated evaluation of a PPP in the veterinary domain. Indeed, this methodology enabled evaluation of the context (thanks to the analysis of the history), evaluation of the process (thanks to the mapping of actors, the identification of inputs and outputs), and evaluation of the results (thanks to the identification of outcomes and identifications and measurement of impacts). Until recently, a limited number of studies have evaluated PPPs in the veterinary domain. As the quality of PPP outcomes and impacts will depend on the quality of its process organization, evaluation frameworks of PPPs in public health advise describing and analysing PPP mechanism.

Elements such as relationships between the two sectors, the financial arrangement, governance structure, and functions of the PPP should be taken into account in the evaluation, in addition to the impacts of the PPP (Donald A. Barr, 2007; Rieker, 2011). The impact pathway methodology that we mobilized allowed us to look at the context, the process of the PPP and its outcomes and impacts (Barret et al., 2018; Douthwaite et al., 2003). PPPs represent a means to achieve objectives and can be transitional, they need to be adapted to their own context and there is no best way to manage them (National Academies of Sciences, 2016). This is why it is important to mobilize an evaluative research approach, such as impact pathway methodology, that seeks to understand the how and why of the results, rather than a normative evaluation approach that would seek to compare the components of the intervention to pre-established standards (Champagne et al., 2011a). The evaluation we conducted of both PPP process and PPP impacts was crucial in order to provide appropriate recommendations on how to improve the PPP.

There is general agreement that PPPs should represent an added value compared to a programme that does not involve PPPs. However, difficulties in monitoring the added value of PPPs have been identified. Indeed, comparing the results of a PPP with an existing or modelled "counterfactual", such as a territory without a PPP or a purely public or purely private alternative, is not an easy task. The multiple factors influencing outcomes, and the marked influence of the context make it almost impossible to perform modelling or find an existing counterfactual (Barlow et al., 2013; Vrangbæk, 2008). The best way to overcome this difficulty is to use participatory approaches and to rely on the opinions of public and private partners and for them to discuss together on this potential added value (Bryson et al., 2015; Kanya et al., 2016), which is what we did. In order to overcome the difficulty of measuring the added value of a PPP, it was important to focus on understanding the causal relation between the implementation of a PPP and its outcomes and impacts, which is what we did using the impact pathway. The representation of the impact pathway also made it possible to visualise which outcomes (and related impacts) depended directly or indirectly on the PPP and to hypothesise that these outcomes in the current situation, without the PPP, would not have been possible.

4.2 The importance of considering the different types of impact

Animal health represents a challenge in terms of public health (Jones et al., 2008), food safety, socio-economic stability (HLPE, 2016) and interaction with the environment (B. Dumont et al., 2019; Steinfeld et al., 2006). We argue that the sanitary as well as economic, business, social and environmental impacts of animal health programs implemented via PPPs or otherwise, must be taken into consideration to promote a sustainable livestock system. The methodology of participatory impact pathway by capturing a diversity of viewpoints allowed to gain a systemic understanding of the PPP evaluated and its contribution to impacts. The positive and negative impacts mentioned by the participants of this study relate to economic, business, and societal aspects (livelihood, women's empowerment, education) and to public health (poultry disease control, strengthening of veterinary services, improving nutrition). Our study showed that the outcomes/impacts of this PPP varied and went beyond the sanitary and animal productivity range. For example, it is interesting to note that two other Ethiopian poultry producers have already adopted the same model as EthioChicken (intermediary grower agents who raise and care for the chicks until they are 45 days old and collaboration with public actors for the distribution of chickens) but with other improved genetic breeds, which can potentially provide second-level impacts. Another example, is the strengthening of the veterinary services, as was captured in this case-study through the trainings of the different actors linked to the veterinary services in poultry health. Bryson et al. (Bryson et al., 2015) argues that PPP should result in "public value" that could not be created without the PPP. In the veterinary domain, one public value would be the strengthening of the veterinary services.

However, we did not investigate further the fear expressed by some farmers of the decrease of their local breeds and of the immune fragility of improved genetic breeds. These elements might have deserved attention. Indeed, the genetic diversity of domesticated animals is also on the list of biodiversity indicators by the European Academies' Science Advisory Council (European Academies' Science Advisory Council, 2004) and the loss of livestock biodiversity is raising sustainability issues (Tisdell, 2003). It is recognized that there is a need to maintain a broader range of animal genetic resources to be able to deal with future uncertainties, such as climate change and zoonotic diseases (Seré et al., 2008). It is normal for any programme to have externalities, consequences not foreseen in the planning and implementation of the program. However, the Food and Agriculture Organisation proposes integrating the externalities as of the planning process to achieve a sustainable programme (Neven, 2014).

Taking account of externalities, by anticipating them and undertaking corrective action of the negative ones, may help the PPP to be stable over time and increase its legitimacy in society. For this case study, the adaptation of this model (which includes training in poultry health care and a distribution model to remote areas) to local breeds rather than or in addition to genetically improved breeds could have been discussed in the workshops. This would also avoid dependence on imports from other countries of genetically improved poultry.

4.3 Importance of collaboration at different levels and trust between partners

The study showed that the PPP between EthioChicken and the Ethiopian governments takes place at different administrative levels: national and regional. This allows EthioChicken and the State to develop the poultry sector in marginal areas. Indeed, as mentioned by Ahuja (Ahuja, 2004b), in their analysis of the economic rationale of sector roles in the provision of animal health services, which stressed the importance of a division of labour between the public and private sectors, the collaboration between the private and public sector is particularly important to reach remote areas.

We showed that each actor derives his own benefit from participating in PPP. However, there are associated constraints, and the participatory workshops allowed the partners to co-develop scenarios to overcome such constraints. The PPP reference guide from the World Bank emphasize the need to compile a complete and transparent list of risks associated with the PPP and to think about risk allocation (World Bank Institute, 2017). The participatory approaches allowed the partners to clearly identify those risks, and thus to be able to limit them.

Finally, participatory evaluation has benefits in itself. Involving the different stakeholders during the evaluation brings out the benefits and constraints of different stakeholders, to increase transparency between the partners, thereby increasing trust and collaboration (BetterEvaluation, 2012a). The literature on PPPs in public health emphasizes the need for partners to understand their mutual motivations and objectives (National Academies of Sciences, 2016), and this exchange during the participatory evaluation helped to clarify people's expectations about various aspects of the PPP. Participatory approaches in evaluation have also proven to be very useful in ensuring the adaptability, acceptability, and relevance of the recommendations and therefore ease the implementation of corrective actions (Calba et al., 2015a). Indeed, actors can share their perception of the PPP and co-design the corrective actions needed to ensure the reach of expected impacts (Barret et al., 2018). The different workshops with the various stakeholders facilitated reflection and analysis of the system in which they are involved.

4.4 The difficulty to differentiate outcomes and impacts

The difference between outcomes and impacts is not easy to determine. The impacts are what remains after the project is completed. In the literature on the evaluation of PPP in the public health and veterinary domain, the difference between outcomes and impacts was established in only one reference (Poupaud et al., Under publication). The framework of the Centers for Disease Control and Prevention (Rieker, 2011) proposed writing the logic model of the partnership by collecting information on a partnership's inputs, activities, outputs, outcomes and impacts and by linking these different elements together, which has been done during this study. However, no further information was given to differentiate the outcomes and impacts. In this case-study, this difficulty was accentuated by the fact that our evaluation was made "in-itinere", as the PPP was not over. So, to be sure that what we called impacts correspond to the long-term results of the PPP, an ex-post evaluation should be done to analyse what remains after the PPP is over (as the PPP can be transitional).

4.5 Limitations

We are aware that some results might have been distorted by several factors and then should be interpreted with caution. The translation of the different records is the first possible limitation, as this may have introduced a certain misinterpretation of opinions. Another limitation of the participatory approach is the subjective form of the method, as it depends on the stakeholders' willingness to respond to questions and interact with researchers (Schmeer, 1999). Stakeholders belonging to the same category may express divergent opinions, and therefore several stakeholders should be included in the interviews.

Due to time constraints, we may not have succeeded in reaching the saturation level for each category of stakeholder (such as actors who influence the development or the adoption of the PPP). However, for the actors at the conception of the PPP and the actors who adopted the PPP we are confident in saying that we reached saturation level. The grower agents included in this study were representative in terms of the proportion of women (25%), and though the average flock size per cycle (n=605) was lower than the average for this category (n=1300), this is unlikely to have influenced the results obtained. Due to time and resource constraints, the grower agents involved were all from the same region (Oromia). Ideally, grower agents should have been from the 4 different regions, but as the system is the same in all 4 regions for this category of actors, this is unlikely to have influenced the results obtained. The smallholder farmers included in this study were representative in terms of the proportion of women (74%), and of the average number of chickens raised (n=27).

Another limit of our study relies on the fact that participatory approaches cannot erase pre-existing social conditions which may hamper the capacity of actors to express themselves freely. Representing the diversity of viewpoints from stakeholders who influence, who are involved in or impacted by the PPP during the evaluation process, was a challenge. The genuine participation of all stakeholders may not have been fully achieved, especially during the workshops, since power structures limit the free expression of marginalised people (Cooke, 2001). However, we believe that the creation of several small groups during the workshops, and the conducting of several individual interviews, limited this self-censorship. Women play an important role in rural areas and especially in poultry raising. We paid attention to respecting the ratio of women for the grower agents and for smallholders during the semi-structured interviews in order to hear their voices. However, the researchers that interviewed them were male, which could have influenced their responses, although they were careful to limit this bias (one of the researchers was Ethiopian and was careful to respect cultural practices).

4.6 Application and perspective

This study allowed us to provide recommendations at policy level. Indeed, the Ministry of Livestock and Fisheries and the Ministry of Finance and Economic Development were present during the workshop. The recommendations related for example (i) to foreign exchange currency access for stakeholders involved in poultry production, (ii) to the need for training in poultry production to be included in the veterinary curriculum, and (iii) to the increase of access to loans to young agents or farmers for the start of a poultry business.

The results of this evaluation, together with other documents and in collaboration with stakeholders involved in PPPs worldwide, were used to develop the OIE PPP Handbook (World Organisation for Animal Health, 2019b) in order to provide a model that could potentially be scaled-up in other countries, when and if relevant, to be able to improve the performance of veterinary services.

This represent an in-depth case study, which can contribute to the scientific discipline of evaluation applied to PPPs in the veterinary domain. This case study represents an in-depth analysis of a PPP corresponding to the cluster 3 “transformative” category in the typology from Galière and al. (Galière et al., 2019a). It would be interesting to have other case-studies related to PPPs in cluster 1 “transactional”, and cluster 2 “collaborative”.

4.7 Conclusion

The diverse impacts (economic, business, society and health) linked to the poultry sectors identified in this study have been made possible by PPPs at the different administrative levels of the country. Further work should be done on PPPs in the veterinary domain to better characterise the respective responsibilities, risks and benefits for each actor involved. Indeed, PPPs in the veterinary domain are spread all over the world and are often complex, dynamic, multilevel systems. The constraints and limits identified during this study require strong communication between public and private actors from different sector, to be solved. This impact pathway methodology, based on participatory evaluation, applied for the first time in the evaluation of a PPP in the veterinary domain, helped to formulate recommendations to improve public-private partnerships. This case study provides context-dependent evaluation outputs of a PPP related to cluster 3 “transformative”, and represents a milestone in building an evaluation framework of PPP in the veterinary domain.

Discussion générale - Perspectives

1. Vue d'ensemble sur la démarche

1.1 Développement d'un cadre théorique d'évaluation opérationnalisable

L'ambition de cette thèse était de développer un cadre d'évaluation intégrée des PPP en santé d'animaux d'élevage. Ce cadre visait à identifier des points d'amélioration des résultats des PPP en matière de santé des humains, des animaux et des écosystèmes, dans une perspective de durabilité des territoires. Ainsi, si les cas d'étude présentés dans ces travaux concernaient des PPP pour la santé d'animaux d'élevage, et non pas des PPP ayant des objectifs s'inscrivant dans le cadre One Health, il nous semble que les objectifs du cadre d'évaluation s'intègrent dans une approche One Health (Rüegg et al., 2017), comprise comme appartenant aux sciences de la durabilité (Clark, 2007; Sidikou et al., 2021). Nous nous sommes appuyés à la fois sur des cadres pré-existants et les thèmes émergeant de l'analyse de 4 cas d'étude, que nous avons mis en dialogue pour aboutir au cadre d'évaluation intégrée proposée dans la **Figure 1**. Les cadres mobilisés étaient principalement ceux des approches réalistes de l'évaluation en santé publique et de la durabilité. Les études de terrain ont, en particulier, nourri les perspectives de l'analyse de contexte, les critères d'évaluation du processus et les types d'impacts considérés. Les études de cas, en tant qu'examen détaillé d'une situation, nous ont permis de développer une compréhension des motivations de mise en place de PPP, de leurs évolutions (structuration, organisation) et de leurs effets sur le territoire. En tant que situations particulières, par un travail d'abstraction, ces cas d'étude visent néanmoins à enrichir une réflexion théorique, améliorant un cadre d'évaluation des PPP de portée générale (Flyvbjerg, 2006).

Le cadre d'évaluation a été développé pour un usage de terrain, par les acteurs du PPP ou dans un but de recherche-action. Pour développer un tel cadre, il paraissait essentiel de considérer la pluralité de points de vue des parties prenantes d'un PPP. Les approches participatives, principalement qualitatives, étaient alors les plus appropriées, permettant de recueillir des opinions, perceptions et interprétations nuancées et diverses. Ces approches ont ainsi permis d'appréhender l'organisation des PPP et leurs effets tels que perçus par ces acteur·rices, favorisant une vision systémique du PPP. Cependant, l'ambition de considérer la pluralité des points de vue des acteur·rices impliqué·es et impacté·es par le PPP n'a été que partiellement atteinte. En effet, dans la majorité des cas d'étude et dans l'élucidation d'expert·es, seuls les points de vue des partenaires impliqué·es dans les PPP, à un niveau central, et dans une moindre mesure à un niveau régional, ont été considérés. Nous y reviendrons dans la suite de la discussion. Ainsi, ce cadre est amené à évoluer suite à la mise en place de nouvelles études qui considèreraient les points de vue des acteur·rices impacté·es par les PPP.

Au final, si nous ne pensons pas avoir clos nos questions de recherche, ces travaux ont apporté les éléments opérationnels recherchés (**Figure 1**). Par la revue de littérature, présentée dans le chapitre 1, les connaissances existantes en santé publique et dans le domaine vétérinaire nous ont permis de proposer un premier cadre d'évaluation. Dans le chapitre 2, à travers une perspective historique du PPP au Paraguay et une analyse de parties prenantes au Laos, deux méthodologies d'analyses du contexte ont été mises en œuvre et discutées, abordant donc notre première question de recherche : « quels éléments du contexte sont à considérer dans l'évaluation des PPP pour la santé des animaux d'élevage ? ». Le chapitre 3, développant un outil d'évaluation du processus, a abordé notre deuxième question de recherche : « quels attributs et propriétés du processus de fonctionnement d'un PPP pour la santé des animaux d'élevage sont à considérer dans l'évaluation ? ». Dans le chapitre 4, la méthodologie du chemin d'impact a été proposée dans une démarche d'évaluation participative afin d'aborder la troisième question de recherche : « quels sont les résultats et impacts permis par des PPP, et comment mesurer la contribution du PPP pour y parvenir ? ». S'intéressant à une diversité de bénéfices, risques et impacts, ce chapitre, en complément du chapitre 1, nous a permis d'initier une réponse à la quatrième question de recherche : « quelles sont les influences des PPP sur les systèmes d'élevage et la durabilité d'un territoire ? », bien que la dimension environnementale n'ait pas été abordée.

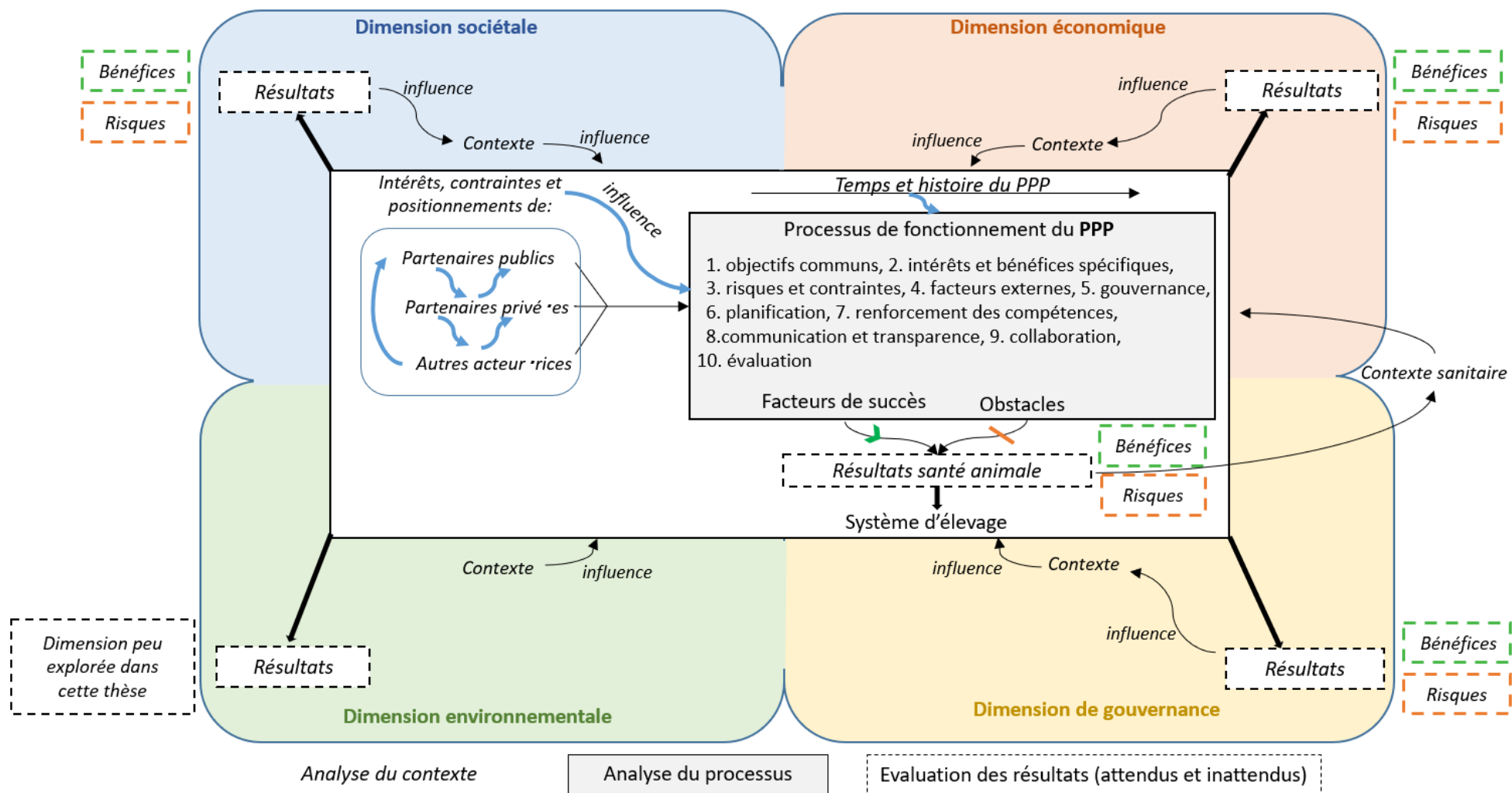


Figure 1 : Proposition d'un cadre d'évaluation intégrée des PPP pour la santé des animaux d'élevage, s'appuyant sur les approches réalistes en évaluation de programmes de santé et sur le cadre de la durabilité. L'analyse du contexte considère les éléments des contextes sociétal, économique, de gouvernance et environnementale. Elle considère l'influence des acteur·rices, leurs intérêts, contraintes, positionnement et liens d'influence et l'influence du temps sur le déroulé du PPP. L'analyse du processus s'intéresse à différents éléments de fonctionnements qui peuvent se regrouper en 10 sections. L'évaluation des résultats s'intéresse aux résultats (bénéfices et risques) directs des PPP sur la santé des animaux d'élevage et indirects sur les dimensions sociétale, économique, de gouvernance et environnementale. Les résultats peuvent influencer le contexte et le processus du PPP. Des pistes d'opérationnalisation sont proposées au long du manuscrit. La dimension environnementale a peu été explorée et il semble intéressant que de futurs travaux s'y intéressent.

1.2 Les difficultés et limites de la démarche : partage d'expérience

Les approches évaluatives mobilisent des cadres théoriques relevant de disciplines différentes en fonction des questions d'évaluation, de la politique dans laquelle s'insère l'évaluation et des critères d'évaluation. Ainsi, ces travaux ont bénéficié de l'aide et des critiques constructives de chercheur·es de différentes disciplines. Plusieurs difficultés sont souvent rencontrées dans les pratiques interdisciplinaires (Kivits et al., 2013). La position de doctorant·es nous semble représenter une expérience singulière de cette interdisciplinarité, avec ses propres exigences et difficultés. Dans cette position d'apprentissage du métier de la recherche, l'investissement en temps apparaît en effet important pour pallier les inévitables lacunes méthodologiques parfois même de cadres fondamentaux, dans l'abord de disciplines nouvelles. Se posent également les problèmes de l'abord de la littérature, de la connaissance des journaux pertinents et du choix des journaux dans lesquels publier, en passant par des sentiments « d'inconfort », de « spécialisation dans rien » et de « manque de légitimité » (Chassé et al., 2020). Ces difficultés ont été atténuées, dans mon cas, grâce au dialogue, avec les membres du comité de thèse, des pairs de différentes disciplines mobilisant des pratiques interdisciplinaires et des doctorant·es traversant les mêmes difficultés.

La mobilisation d'approches interdisciplinaires et participatives a nécessité de faire des choix difficiles et de prioriser des éléments à considérer dans l'évaluation. En effet, les approches participatives sont chronophages car elles demandent de s'intéresser à une diversité de points de vue individuels, d'aller à la rencontre d'acteur·ices (parfois dans des endroits reculés), de créer un climat de confiance, ou encore de mener les entretiens qui peuvent durer plusieurs heures. Il n'a pas toujours été possible de collecter le maximum de variabilité de réponses et il s'est avéré difficile d'atteindre un niveau de saturation pour chaque catégorie d'acteur·rices (Fusch and Ness, 2015). De même, au vu du cadre large mobilisé, il a été difficile de trianguler toutes les données à travers différentes sources ou différents entretiens (Mariner and Paskin, 2000). Par exemple, au Paraguay, des choix ont été faits pour prioriser les catégories d'acteur·rices pour lesquelles le niveau de saturation devait être atteint et les données triangulées. Pour les autres catégories d'acteur·rices et de données, les résultats ont été présentés en considérant cette limite de manière transparente. Au Paraguay, la voie d'entrée dans le cas d'étude peut avoir influencé les données obtenues. J'ai été introduite aux acteurs du PPP par le représentant de l'OIE au Paraguay. Un biais important venait de mes étiquettes, et principalement de l'étiquette institutionnelle « OIE ». L'OIE étant garante de l'attribution de statut lié au contrôle de la fièvre aphteuse, les acteurs m'associant à ce processus étaient réticents à me parler des limites du PPP. Je n'hésitais pas à dire que je n'étais pas employée par l'OIE et que j'étais étudiante. Ainsi, petit à petit, un climat de confiance a pu s'instaurer, et a permis d'atténuer cette réticence.

Cependant, même si j'essayais d'adopter une posture neutre lors des entretiens, mon bagage professionnel et culturel a certainement eu une influence sur les réponses apportées par les personnes interrogées. Le processus d'entretiens se déroule dans une interaction entre la personne interrogée et le ou la chercheur·e et ces deux personnes s'influencent mutuellement. La personne interrogée peut par exemple essayer de chercher à faire plaisir en disant ce qu'elle croit que le ou la chercheur·e aimerait entendre. Mon bagage professionnel et culturel peut aussi influencer les analyses de données. C'est pourquoi, idéalement, des collègues qui n'ont pas mené l'entretien devraient analyser son contenu. Ces collègues seraient plus en mesure de saisir, avec le recul nécessaire, ce qui s'est joué lors de l'entretien dans lequel ils n'étaient pas eux-mêmes impliqués, et d'en dégager alors des enseignements sur l'objet de recherche (Olivier de Sardan, 2009). Cette démarche a pu être menée pour le cas d'étude en Ethiopie, pour lequel j'ai analysé des données qui avaient été récoltées par un stagiaire de master. Cependant, pour des contraintes de ressources humaines, j'ai analysé moi-même les entretiens que j'avais réalisés pour le cas d'étude au Laos et au Paraguay.

La voix d'entrée a aussi rendu difficile la minimisation du biais de genre. Les femmes jouent un rôle important dans l'élevage, mais les instances représentatives de l'élevage, qui abritent les acteurs clés du PPP étudié, telles que les services vétérinaires publics ou l'association de producteurs, sont très largement masculines. Les contraintes de temps m'ont amené à favoriser les échanges avec les acteurs clés du PPP, m'empêchant d'avoir accès à la réalité de l'élevage, et des résultats du PPP sur celui-ci. Finalement, le choix de s'appuyer sur plusieurs cas d'étude impliquait un temps limité de présence sur chaque terrain, limitant ainsi l'approfondissement de notre compréhension des enjeux locaux. Ce temps limité empêchait en outre l'accompagnement des changements suite aux recommandations issues de l'évaluation.

2. Le concept de partenariats public-privé en santé animale

Avant le projet « Progrès Public-Privé » de l'OIE en 2017, les PPP ne bénéficiaient pas de définition officielle en santé animale. En santé publique, des auteur·es avancent que l'institutionnalisation des PPP par l'OMS à la fin des années 1990 a soutenu l'idée d'une réduction du rôle des gouvernements dans la santé. Cela aurait eu une influence sur la politique de santé publique à des niveaux nationaux et locaux (Baru et Nundy, 2008). Il est donc possible que l'institutionnalisation des PPP en santé animale par l'OIE ait une large influence sur les politiques publiques des Services vétérinaires des pays membres. Cette partie de la discussion s'attache ainsi à souligner les enjeux de la mobilisation du concept de PPP en santé animale, notamment par une institution telle que l'OIE, des potentiels risques qui en découlent et des façons de les prévenir ou de les limiter, par exemple à travers l'évaluation.

2.1 La diversité des initiatives comprises sous le concept de PPP

Le concept de PPP est largement mobilisé dans divers secteurs, couvrant une diversité de réalités. En santé publique, les PPP le plus souvent considérés sont des partenariats mondiaux impliquant l'OMS et/ou des entreprises multinationales pour le développement de produits tels que de nouveaux médicaments ou vaccins (Buse and Waxman, 2001; Guilbaud, 2015b). En agriculture, les PPP renvoient principalement à l'externalisation de certaines fonctions par l'Etat, celui-ci confiant à une société privée de grande ampleur la conception, la construction et la maintenance d'une infrastructure publique (Maatala et al., 2017a). Or, ces types de PPP n'ont pas été mentionnés dans le recensement de 2017 par l'OIE des PPP impliquant les services vétérinaires (Galière et al., 2019a). En effet, les fonctions des services vétérinaires ne concernent généralement pas le développement de nouveaux produits ou la construction d'infrastructures (Organisation Mondiale de la Santé Animale, 2021).

Ainsi, dans la définition de l'OIE, les PPP dans le domaine vétérinaire représentent une diversité d'initiatives, qui peuvent être catégorisées en PPP de type 1 dit « transactionnel », de type 2 dit « collaboratif » et de type 3 dit « transformatif », comme l'illustrent les quatre cas d'étude de cette thèse. Le PPP au Paraguay était principalement motivé par l'association de producteurs⁸ engagés dans le contrôle de la fièvre aphteuse pour des enjeux commerciaux. L'association de producteurs précédait la création des services vétérinaires qui ont émergé dans ce même but principal de contrôler la fièvre aphteuse. En Tunisie, le PPP du mandat sanitaire a émergé en 2005, porté par les services vétérinaires qui voulaient améliorer la couverture vaccinale de maladies animales prioritaires. En Ethiopie, le PPP est relativement récent (depuis 2010), et le secteur privé s'appuie sur la structuration des services vétérinaires au niveau local pour livrer des poules de 40 jours vaccinées dans des endroits reculés. Ce PPP participe à l'objectif du Ministère de l'Agriculture de développer la production et la consommation de volaille en Ethiopie. Il est aussi à noter que, si au Paraguay, et plus généralement en Amérique du Sud, le terme de PPP (*alianza publica-privada*) est largement mobilisé dans le domaine vétérinaire, ce terme fait peut-être moins sens dans d'autres contextes sociaux et politiques. Par exemple, dans la base de données OIE, il est possible que certaines initiatives ne soient pas répertoriées car n'étant pas considérées comme des PPP par les pays concernés. De même, dans la revue de littérature, seuls 14 PPP ont été identifiés ; mais il est très probable que des initiatives pourtant pertinentes aient été manquées, n'ayant pas été étiquetées comme « PPP » par les auteur-es.

⁸ Les acteurs du PPP au Paraguay étaient presque exclusivement des hommes.

Finalement, dans la définition de l'OIE, les vétérinaires indépendants sont considérés comme des partenaires privés au même titre que des entreprises. Il existe probablement un risque à catégoriser ces différentes initiatives sous le même terme de PPP car elles impliquent des rapports de force très différents. En santé publique, il a été souligné que la mobilisation du terme PPP considère de fait, des relations de pouvoir égales entre organisations au sein des PPP. Pourtant, les PPP pourraient avoir le potentiel de "déguiser des relations de pouvoir inégales" (Buse and Harmer, 2004). Le terme PPP peut également avoir tendance à supposer une neutralité des objectifs, occultant les arbitrages et les choix sociaux sur lesquels la mise en place de ces PPP repose. La perspective historique de la mise en place du PPP au Paraguay a, par exemple, montré le rôle majeur des éleveurs de bovins tournés vers l'exportation (qui représentent seulement 15% des éleveurs) pour la mise en place du programme de la lutte contre la fièvre aphteuse.

On peut aussi s'interroger sur les effets de l'institutionnalisation du concept PPP dans le domaine vétérinaire, notamment par l'OIE. En santé publique, des auteurs soulignent que l'approbation des PPP par l'Organisation mondiale de la santé, à la fin des années 1990, a eu une influence à des niveaux locaux et nationaux sur la planification et la mise en œuvre des politiques publiques de santé (Baru and Nundy, 2008). Il est donc possible que l'approbation des PPP en santé animale par un organisme tel que l'OIE ait une large influence au niveau des pays membres dans la structuration des services vétérinaires. Ainsi, il serait préférable que l'OIE veille à ne pas construire un discours « gagnant-gagnant » autour de ces PPP, et qu'elle reste attentive aux risques potentiels de ces PPP.

Ces différentes réalités entre secteurs et la diversité interne des PPP dans le domaine vétérinaire demandent à ce que l'on soit particulièrement attentif à décrire de manière précise le PPP évalué. A ce stade de nos recherches, même si l'ambition était de développer un cadre d'évaluation de portée générale, nous ne sommes pas en mesure d'affirmer que le cadre d'évaluation intégrée proposé dans ce manuscrit soit adapté à tous les types de PPP pour la santé des animaux d'élevage. Il est possible que de futures études montrent que, pour certains type de PPP, certains critères ne sont pas adaptés, ou que certains critères nécessitent d'être ajoutés.

2.2 Les risques des PPP

À travers la revue de littérature et les cas d'étude, des bénéfices des PPP ont été montrés dans ce manuscrit, ainsi que des risques. Cependant, notre entrée dans les études de cas ne s'est pas faite à travers des analyses de risques, et il est possible que nous n'ayons pas été en mesure d'identifier certains risques associés aux PPP étudiés, ou que l'identification de certains risques n'ait pas été suivie d'une considération suffisante.

2.2.1 Les risques identifiés mais peu explorés des PPP des cas d'études

Concernant le cas d'étude en Ethiopie, nous n'avons pas approfondi la crainte exprimée par certains agriculteur·rices de la diminution des races locales dans le cheptel national et de la fragilité immunitaire des races génétiques améliorées comme conséquences indirectes du PPP sur le système d'élevage. Pourtant, il semble nécessaire de maintenir la diversité génétique des animaux domestiques afin de pouvoir faire face aux incertitudes futures, telles que le changement climatique et les futures épidémies (Seré et al., 2008). De même, le risque de dépendance à des intrants internationaux, comme la génétique aviaire de grandes compagnies, n'a pas été exploré.

Au Paraguay, en grande partie dû au fait qu'une deuxième phase de terrain n'a pas été permise, deux risques importants n'ont pas pu être explorés. Le premier concerne des risques liés à la dimension environnementale en lien avec la pression de l'élevage sur l'usage des sols et sur la déforestation. En effet, grâce au PPP, le Paraguay a le statut « indemne de fièvre aphteuse avec vaccination » de l'OIE, leur permettant d'exporter leurs produits bovins dans de nombreux pays et rendant l'activité d'élevage attractive financièrement. Ainsi, le cheptel atteint presque 15 millions de têtes aujourd'hui, exerçant une pression sur l'utilisation des sols ayant des conséquences sur le niveau de déforestation. Le deuxième risque est un risque sociétal, cette pression sur l'utilisation des sols ayant des conséquences sur des communautés indigènes ou des associations de petit·es paysan·es qui ont été expulsé·es de certaines terres.

2.2.2 Les risques non identifiés dans les cas d'études mais identifiés dans la revue de littérature

De plus, des risques pour le partenaire public, pour le partenaire privé, ou des risques de favoriser l'intérêt de quelques personnes au détriment de l'intérêt général ont été identifiés dans la revue de littérature.

Les risques pour le partenaire public concernent un potentiel affaiblissement du rôle du secteur public dans ses missions. Dans les cas d'étude, l'affaiblissement du rôle du secteur public dans la conception des politiques de santé animale n'a pas été explicitement étudié. Au Paraguay, l'influence du secteur privé sur les politiques de santé animale a, semble-t-il, toujours existé, avant même l'émergence des services vétérinaires publics. D'un point de vue opérationnel, le PPP au Paraguay a permis le développement des services vétérinaires au niveau local, s'appuyant sur la structuration au niveau local de l'association de producteurs. Le PPP en Ethiopie permet la capacitation des services vétérinaires en santé aviaire. Si les PPP semblent représenter un gain dans la capacité de mise en œuvre de programmes, l'affaiblissement du secteur public dans la conception de ces programmes et les potentielles conséquences pour l'intérêt général, sont un point de vigilance à garder à l'esprit lors des évaluations des PPP.

On peut aussi se demander si ces PPP peuvent augmenter les risques, qui existent déjà, en matière de falsification des données de santé animale par les services vétérinaires. Normalement, chaque Pays membre de l'OIE s'engage à signaler les maladies animales, y compris celles qui sont transmissibles à l'homme, qu'il détecte sur son territoire (l'OIE tient une liste d'environ 120 maladies notifiables). Comme la déclaration de ces foyers peut avoir des conséquences sur la délivrance de statuts sanitaires et donc des conséquences sur le commerce de produits animaux. Les conflits d'intérêt potentiels dans les PPP peuvent ainsi favoriser le fait de passer sous silence certains foyers de maladies.

En santé publique, il a aussi été mentionné qu'à travers des PPP, des bailleurs de fonds peuvent influencer les politiques publiques et ainsi diminuer le rôle du secteur public (Baru and Nundy, 2008). L'influence indirecte des bailleurs de fonds aurait pu être davantage explorée dans le cas d'étude en Ethiopie. EthioChicken est largement soutenu par des fonds extérieurs, comme ceux de la Fondation Bill and Melinda Gates, et son modèle correspond probablement aux idéologies de ces bailleurs. Grâce à ce soutien, EthioChicken est devenu un acteur puissant de la filière avicole en Ethiopie. Par le PPP le liant à l'Etat, il gagne le pouvoir d'influencer les politiques du secteur de la volaille. Des investissements extérieurs, en finançant le partenaire privé ou le PPP, seraient donc en mesure d'influencer les politiques des pays.

Les risques peuvent aussi concerner les partenaires privé-es. Dans le PPP en Tunisie, les vétérinaires mandaté-es n'étaient pas en capacité de négocier une rémunération qu'ils auraient trouvée plus juste. Au Paraguay, jusqu'à il y a peu, le secteur privé pouvait facilement être évincé du programme si un changement de politique survenait, annulant alors les bénéfices de leur investissement en ressources humaines et financières. Cela a motivé le secteur privé à créer un statut de fondation, légalement reconnu, les protégeant pour 10 ans.

Enfin, il existe des risques de conflits d'intérêts pouvant influencer la répartition des bénéfices au profit de quelques personnes et au détriment de l'intérêt général. L'affaiblissement du rôle du secteur public dans les services vétérinaires par le biais de PPP pourrait amener des acteurs privés puissants à se positionner sur certaines fonctions en matière de santé animale. D'autant plus que, durant ces deux dernières décennies, différentes filières d'élevage ont été marquées par une augmentation du processus d'intégration verticale, correspondant à la gestion des activités de production, d'abattage, et de vente par une même entreprise. Par exemple, la concentration économique des filières avicoles et porcines a augmenté (HLPE, 2016). À travers un PPP, de telles entreprises, seraient d'autant plus en mesure d'influencer les politiques publiques dans leurs intérêts privés, possiblement au détriment de l'intérêt général. Les PPP peuvent aussi être source de conflits d'intérêts au moment de la sélection de projets, pouvant être un moyen pour certains acteurs privés d'accéder à des financements publics fléchés (World Bank Institute, 2017).

De plus, selon la Banque mondiale, les PPP peuvent représenter un risque de corruption, c'est-à-dire de l'abus d'une fonction publique à des fins privées, par exemple lors d'un manque de transparence dans les décisions prises au sein de PPP (World Bank Institute, 2017). Au Paraguay, l'évaluation des performances des services vétérinaires de l'OIE de 2009 mettait en garde contre le risque d'une trop grande influence du privé sur la décision publique (OIE, 2009). De manière intéressante, pour les acteurs paraguayens du PPP, ce dernier apparaissait plutôt comme un moyen de lutter contre la corruption des acteurs étatiques, un fait qui semble endémique dans le pays (Miyamae, 2003). En effet, le PPP permet de créer un fonds pour le programme de la fièvre aphteuse ne transitant pas par des structures étatiques, ce qui, selon les acteurs du PPP, empêche le détournement de ces fonds par les politiques.

2.3 Préventions des risques

Contre ces risques nécessite de travailler à la bonne gouvernance des services vétérinaires. Cependant, les PPP sont mis en place justement dans le but de renforcer opérationnellement les services vétérinaires. Or, les faiblesses opérationnelles à combler sont souvent accompagnées de déficits de gouvernance. Les risques d'affaiblissement du secteur public, les conflits d'intérêts et la corruption, sont donc particulièrement importants à considérer dans l'évaluation du processus. L'utilisation régulière de l'outil d'évaluation du processus développé dans le chapitre 3 pourrait aider à identifier et corriger ces risques. Néanmoins, un processus d'évaluation et de correction graduelle ne permettra vraisemblablement pas de corriger des asymétries de pouvoir fortes entre les partenaires. De telles asymétries requerraient un soutien du partenaire le plus faible en dehors du cadre du PPP, idéalement en amont de tout PPP. Des façons complémentaires de prévenir ou corriger ces risques ont été abordées dans la discussion du chapitre 3 : analyses approfondies de la capacité institutionnelle de chaque partenaire, du contrat entre les deux parties, de l'environnement législatif et de la structure de gouvernance du PPP. Pour cela, on pourra s'appuyer sur des ressources et outils complémentaires, notamment de l'OIE. L'évaluation de la performance des Services vétérinaires de l'OIE peut identifier les faiblesses potentielles des services vétérinaires nationaux et aider à prévenir les risques en amont ou pendant la mise en œuvre des PPP (World Organisation for Animal Health, 2019a).

Les expert-es en cadres juridiques du Programme d'appui à la législation vétérinaire de l'OIE peuvent analyser en profondeur les cadres juridiques et proposer des recommandations pour son renforcement dans le cadre d'un PPP (World Organisation for Animal Health, 2020a). S'il est pertinent que le PPP soit officialisé par un contrat, il est par exemple essentiel que les deux partenaires soient capables de défendre clairement leurs propres intérêts, en ayant le degré nécessaire de symétrie de l'information pendant la phase de négociation de ce contrat (Maatala et al., 2017a). Les expert-es du Programme d'appui à la législation vétérinaire pourraient également accompagner les Services vétérinaires lors de l'établissement d'un contrat.

De manière générale, dans le domaine vétérinaire, il est important de veiller à ne pas construire un discours dominant des PPP comme étant "naturels", inévitables et forcément "gagnant-gagnant", comme cela a pu être le cas en santé publique (Buse and Harmer, 2004). Ayant égard des enjeux liés à l'emploi du terme de partenariat tels que soulevés plus haut, certaines formes de collaboration gagneraient à remplacer le concept de "partenariat public-privé" par celui d'une "interaction public-privé". En effet, cela éviterait de déguiser des relations de pouvoir inégales sous le terme "partenariat", sous-entendant une relation gagnante-gagnante, et inviterait à être plus attentif aux intérêts divergents des partenaires, aux opportunités, aux coûts et aux risques de la collaboration (Buse and Harmer, 2004). De façon similaire, il s'agirait de préciser les termes dans les cas où des PPP impliquent des acteurs internationaux, comme l'OIE ou des entreprises multinationales, alors indiquées comme « PPP globaux ». Ces collaborations appellent en effet au développement de cadres spécifiques d'évaluation et d'un cadre juridique international adapté, tenant compte de nouveaux rapports de forces.

Considérant sa dimension d'action publique, pour tout PPP, il faudra considérer la création de valeur pour l'intérêt général au regard de l'investissement, mais aussi la répartition de cette valeur entre les différents acteurs du PPP et éventuellement de la filière concernée. Dans le domaine vétérinaire, la création de valeur publique peut se situer dans le renforcement des services vétérinaires. Ainsi le renforcement des services vétérinaires pourrait être le premier critère d'évaluation dans l'évaluation de PPP. De même, il faudra toujours vérifier dans l'évaluation de PPP, que le PPP évalué s'inscrit dans des enjeux vétérinaires prioritaires du pays tels que définis par les services vétérinaires.

Finalement, il sera nécessaire de continuer le travail entrepris dans ce manuscrit, notamment en continuant d'identifier les risques potentiels associés aux PPP (sanitaire, économique, sociétale, environnementaux ou de gouvernance) et en analysant si certains risques sont plus présents selon les types de PPP. Cette identification des risques pourrait être la base pour le développement d'une grille d'analyse qui faciliterait des analyses de risque dans l'évaluation. Si une analyse de risque est réalisée en amont des évaluations, elle peut permettre d'attirer l'attention sur ces points critiques lors de l'évaluation.

3 L'évaluation des PPP dans le domaine vétérinaire

3.1 Spécificité des évaluations des PPP

Dans le cadre d'évaluation proposé, seule l'analyse du processus (chapitre 3), proposée via le développement d'un outil, est spécifique au PPP. En effet les analyses de contexte (chapitre 2) et les analyses des résultats et impacts (chapitre 4) pourraient très bien être appliquées à d'autres programmes n'impliquant pas de PPP. Ces travaux peuvent donc être mobilisés dans un cadre plus large d'évaluation des programmes en santé animale.

L'autre spécificité de l'évaluation des PPP pourrait résider dans l'analyse de sa valeur ajoutée. Comme mentionnée dans l'introduction, ces travaux n'ont pas porté sur la modélisation de contrefactuel, et nous reviendrons sur ces approches dans les perspectives. Cependant, nous avons quand même essayé de s'intéresser à la valeur ajoutée des PPP dans ces travaux. Deux façons de le faire ont été proposées. La première façon se trouve dans la perspective historique (chapitre 2) qui, en s'intéressant aux étapes de mise en œuvre du programme au Paraguay, a montré que le PPP a toujours été présent même si son organisation et sa gouvernance ont évolué. Au-delà de la perspective historique, les acteurs du secteur public et privé ont tous mentionné que le programme de lutte contre la fièvre aphteuse au Paraguay, et donc ses bénéficiaires, n'auraient pas été possibles sans le PPP. Dans ce cas, la valeur ajoutée se confond avec les bénéfices permis par le PPP. La deuxième façon proposée pour analyser la valeur ajoutée était via la méthodologie du chemin d'impact (chapitre 4), en se concentrant sur la compréhension de la relation causale entre la mise en œuvre d'un PPP et ses résultats et impacts. Ces liens causaux, identifiés par les acteurs impliqués ou impactés par le PPP, permettent de s'assurer, dans une certaine mesure, que les impacts identifiés sont bien attribuables au PPP étudié.

3.2 Opérationnalisation du cadre d'évaluation intégrée

Plusieurs difficultés d'opérationnalisation du cadre d'évaluation intégrée ont été identifiées. Ces difficultés peuvent être illustrées à travers le cas d'étude du PPP au Paraguay.

3.2.1 Mobilisation du cadre d'évaluation intégrée

Le cadre d'évaluation proposé dans ce manuscrit peut être utilisé pour mettre en place une évaluation intégrée des PPP pour la santé des animaux d'élevage. Une première difficulté à mentionner est l'aspect chronophage de la mise en œuvre d'une évaluation intégrée basée sur le cadre proposé. Par exemple, dans aucun de nos cas d'étude, une évaluation intégrée a été complètement réalisée, par manque de temps et de ressources. Si nous pensons que les évaluations intégrées sont importantes pour permettre une vision systémique du PPP mis en place, et ainsi d'être en mesure de considérer les intérêts de diverses parties prenantes, cela peut parfois ne pas s'avérer possible. Une des fonctions de l'évaluation de programmes est de répondre aux besoins des acteur·rices du programme concerné, et il est tout à fait possible qu'en fonction de la question d'évaluation définie avec les parties prenantes, seule une partie du cadre d'analyse soit mobilisée (par exemple seulement une évaluation du processus, ou seulement une évaluation des résultats).

Il nous semble que ce cadre pourrait servir de base également pour l'évaluation d'autres PPP, comme des PPP inscrits dans des approches One Health, ou pour des PPP pour la santé des animaux de compagnie. Des futurs travaux pourraient mobiliser ce cadre pour d'autres PPP et faire évoluer le cadre pour les besoins spécifiques des PPP étudiés (par exemple sur le besoin de rentabilité financière des programmes pour les animaux de compagnie). En revanche, pour d'autres PPP, comme des PPP impliquant des acteurs internationaux ou des PPP pour la construction d'infrastructure, ce cadre d'évaluation devrait être utilisé avec prudence car il n'aborde pas des éléments essentiels à considérer dans ce type de PPP (cadre juridique international, alignement des objectifs sur les priorités nationales, contractualisation de long terme, etc.).

3.2.2 Difficultés de considérer la dimension environnementale

Un point important à considérer est que, dans les cas d'étude, la dimension environnementale était très peu (voire pas) mentionnée spontanément par les acteur·rice·s des PPP. Ainsi, en Ethiopie, où le concept de la durabilité n'a pas été amené par les chercheur·e·s, aucun impact environnemental n'a été mentionné. Au Paraguay, la dimension environnementale n'a été discutée que lorsque je la mentionnais. Loin de susciter de l'intérêt, cette mention provoquait de la réticence et/ou de la méfiance de la plupart des acteurs clé du PPP. Un sentiment de « persécution » des pays du Nord envers les pays du Sud a été énoncée plusieurs fois. Ainsi, suite à un tweet de l'ONU en mars 2020 mentionnant que pour lutter contre le changement climatique il fallait diminuer sa consommation de viande, une réunion « d'urgence » sur « la vérité sur le secteur de production bovine et le changement climatique » a été planifiée dans la capitale du Paraguay. Étaient notamment présents le ministre de l'agriculture et le chef des services vétérinaires.

Il était question du « mensonge international sur la viande », et de la « trahison de l'ONU ». Il était également rappelé que « les pays les plus développés étaient, eux, les responsables du changement climatique avec leur industrialisation », et que c'étaient les pays du Sud qui « sont vulnérables et qui souffrent des conséquences du changement climatique ». On comprend ainsi l'importance de la posture de l'évaluateur·rice, d'autant plus si il·elle vient d'un pays du Nord, pour ne pas susciter un rejet des acteurs censés bénéficier de l'évaluation. Dans ce contexte, il m'a semblé risqué d'organiser des ateliers de co-construction avec des acteur·rices ayant des visions très opposées (comme les acteurs du PPP et des représentants d'organisations luttant pour des lois « zéro déforestation »). Pourtant l'enjeu de déforestation face à l'expansion de l'élevage bovin, tout comme d'autres risques environnementaux, nous semblent essentiels à considérer dans l'évaluation. Ainsi, des pistes pour dépasser ces difficultés sont présentées dans les perspectives.

3.2.3 Evaluation participative : la participation de qui ? Et au service de qui ?

La dimension participative de l'évaluation implique que les résultats de cette évaluation sont influencés par les acteur·rices évalué·es et donc par les enjeux de pouvoirs propres à ces dernier·ères. La question de quel point de vue est à considérer au regard du PPP évalué est donc primordiale dans l'évaluation participative. Selon qui délimite le système (le PPP), au niveau spatial, temporel et social, le constat sur les personnes à considérer dans l'évaluation sera très différent (Mathevet and Bousquet, 2014). Les acteur·rices clés interrogé·es au départ de l'évaluation peuvent grandement influencer le choix des personnes à considérer. Dans le cas d'étude au Paraguay, l'entrée de l'évaluation s'est faite par le représentant de l'OIE au sein des services vétérinaires qui m'a introduite aux acteurs clé du PPP, et cela a eu une influence sur la délimitation du système à étudier. Par exemple, les communautés indigènes et les populations paysannes pauvres, dont les « petits éleveurs », sont des groupes de personnes qui pourraient avoir été indirectement impactés par le PPP, car les « grands éleveurs » jouent un rôle dans le processus de distribution foncière inégalitaire (Larrouqué et al., 2020). Cependant, il semblait délicat de les inclure dans la démarche participative, car les différents acteurs clé du PPP étaient réticents à l'idée de considérer leurs points de vue. D'un point de vue diplomatique, il ne m'a pas semblé adéquat d'aller à l'encontre des limites que les acteurs du PPP m'imposaient implicitement ; du moins je n'ai pas eu l'impression d'avoir les ressources nécessaires pour le faire.

Ainsi, dans le cas du Paraguay, mener une évaluation participative ne s'est pas avéré pertinent pour plusieurs raisons (comme mentionné dans l'introduction, nous ne parlons pas d'évaluation pour ce cas d'étude)⁹. Déjà, les acteurs n'étaient pas demandeurs d'évaluation. Ils ont accepté de nous accueillir pour nous présenter le fonctionnement de leur PPP identifié comme une réussite par l'OIE. D'autre part, des résultats d'évaluation invisibilisant la perception de certains groupes d'acteur·rices aurait probablement renforcé la position de pouvoir des acteurs dominants. En effet, certain·es auteur·es avancent que les approches participatives, mobilisées en ignorant les structures de pouvoir, auraient un risque de renforcer les relations de pouvoir pré-existantes en légitimant des groupes d'acteur·rices dominants (Hildyard et al., 2001; Rigon, 2014). Ces derniers seraient, en effet, en capacité d'influencer davantage les résultats de l'évaluation participative en leur faveur au détriment des groupes marginalisés (Barnaud et Van Paassen, 2013). Par exemple, s'il avait été possible d'organiser un atelier de co-construction (lors d'une deuxième phase de terrain initialement prévue), outre la difficulté diplomatique, il aurait fallu considérer la pertinence d'inviter les groupes d'acteur·rices vulnérables aux ateliers. Dans le contexte d'usage des sols en Amérique du Sud, et notamment au Paraguay, la violence sociale et les pressions exercées sur les plus faibles sont très fortes (Larrouqué et al., 2020). Avec de telles asymétries de pouvoir, la capacité des groupes défavorisés, impactés par les PPP (comme les « petits éleveurs ») à exprimer et à concrétiser leurs intérêts sera limitée, amenant ces groupes à de l'autocensure lors d'ateliers. Le risque aurait été de seulement capturer le point de vue des groupes dominants lors de ces ateliers (Rigon, 2014).

De plus, la dimension participative de l'évaluation, attribuant une valeur à la perception des acteur·rices impliqué·es ou impacté·es par le PPP, peut entraîner les réticences de certain·es acteur·rices, notamment les services vétérinaires, plus habitué·es à des approches quantitatives. Ainsi, si certains résultats de l'évaluation ne vont pas dans le sens souhaité par les acteur·rices du PPP, il·elles peuvent rejeter ces résultats en soulignant le manque de rigueur ou la présence de biais. En effet, les données qualitatives ont un moindre pouvoir de conviction par rapport aux données quantitatives, malgré un même niveau de rigueur (Kohn and Christiaens, 2014). Dans un des cas d'étude, après une restitution des premiers résultats d'évaluation, des tensions ont émergé de la part des acteur·rices clés du PPP au niveau central. L'hypothèse est que ces derniers n'aient pas vu l'intérêt de considérer les points de vue des acteur·rices au niveau régional, et encore moins de co-construire des recommandations avec ces acteur·rices.

⁹ Si une évaluation participative n'a pas été réalisée, les nombreux entretiens individuels (n=72) d'acteurs publics et privés, aux niveaux national, régional et local, ont permis de tester le cadrage d'évaluation et de poser un regard critique sur les défis et opportunités qu'il présente. Le rapport sur la perspective historique a été envoyé aux acteurs et une restitution des résultats de l'analyse des entretiens est prévue en février.

3.2.4 Les dimensions normatives du cadre d'évaluation

Ces derniers commentaires soulignent les tensions qui peuvent survenir de la rencontre des dimensions normatives portées dans la procédure d'évaluation proposée et des enjeux de pouvoir des acteur·rices concerné·es par cette évaluation. La procédure d'évaluation proposée dans cette thèse porte deux dimensions normatives fortes. D'une part, le cadre de la durabilité choisi pour orienter l'évaluation des PPP peut révéler des tensions entre des enjeux économiques et des enjeux de justice sociale ou de respect de l'environnement. Il est à noter que le cadre de la durabilité n'était pas une demande du projet qui abrite cette thèse, mais a été mobilisé par l'équipe de recherche, notamment pour répondre aux enjeux de l'approche One Health, dont l'OIE est porteuse. À noter que les PPP des études de cas, qui existent depuis plusieurs années, comme probablement la majorité des PPP, ont conclu des accords sur des enjeux sanitaires en dehors du cadre de la durabilité.

D'autre part, l'approche participative et systémique apparaît comme normative en cherchant à aborder le système à ses différents niveaux de pouvoirs (Chambers, 1997). Elle est également normative en attribuant une valeur aux dires des acteur·rices, et donc à leurs perceptions des situations et à leurs ressentis.

Il est essentiel que l'évaluation soit volontaire, et que la demande provienne des acteur·rices du PPP. Le rôle de l'évaluateur·rice est d'apporter un regard extérieur sur le PPP qui permettrait aux parties prenantes du PPP d'identifier des points d'amélioration. Si l'évaluation amène de force le cadre de la durabilité, il est possible que les acteurs ne soient alors pas demandeurs d'évaluation, au détriment des objectifs sanitaires. Ainsi, cela pose la question du niveau avec lequel l'évaluateur·rice mobilisera certains principes (comme la mobilisation du cadre de la durabilité ou la prise en compte des personnes vulnérables) dans l'évaluation participative.

3.2.5 Dimension éthique de l'évaluation

Pourtant, d'un point de vue éthique, il semble important de trouver un moyen de considérer les résultats environnementaux et sociétaux sur des groupes vulnérables dans les évaluations de PPP.

Ainsi, il est à considérer que si la demande d'évaluation est faite à l'OIE, les bénéficiaires de l'évaluation seront les services vétérinaires publics et leurs partenaires privé-es. Ces derniers peuvent être en position de pouvoir par rapport à des groupes marginalisés ou vulnérables, ou simplement des acteur·rices du niveau régional ou local. L'évaluateur·rice est ainsi confronté·e à des choix, liés aux cadres d'évaluation mobilisé, à la délimitation du PPP et aux acteur·rices à considérer dans l'évaluation ainsi qu'à la procédure de mise en œuvre, qui influenceront les sorties d'évaluation. La phase initiale d'analyse du contexte et de diagnostic de délimitation du PPP étudié est donc cruciale pour permettre à l'évaluateur·rice de ne pas se faire instrumentaliser d'une part, et/ou pour ne pas faire d'erreur diplomatique d'autre part. Dans certains contextes, il faudra peut-être envisager qu'une évaluation participative n'est pas appropriée. En effet, il me semble que même si des approches participatives sont mises en place pour prendre en compte les points de vue des plus vulnérables, par exemple en favorisant des entretiens individuels avec ces groupes, cela amène le risque que les recommandations des évaluations soient rejetées et n'amènent finalement pas de changement. Certain·es chercheur·es, pour des questions éthiques, revendiquent une posture non neutre et font le choix de contribuer au renforcement des capacités des acteur·rices les plus vulnérables en espérant favoriser l'équité et la durabilité du territoire (d'Aquino, 2002). Cependant, si cela est fait, il y a un risque que les résultats de l'évaluation ne soient pas acceptés au niveau central, et il semble alors essentiel que l'évaluation s'inscrive sur le long terme, par exemple comme outil d'accompagnement. Cela est mentionné dans les perspectives opérationnelles.

4 Application des travaux de thèse

Cette thèse s'insérant dans un projet de l'OIE, les travaux ont été directement valorisés par l'institution. La revue de littérature et le cas d'étude en Ethiopie ont nourri le développement de parties du guide de bonnes pratiques des PPP de l'OIE (World Organisation for Animal Health, 2019b). L'outil d'évaluation du processus a permis de répondre à une demande d'évaluation adressée à l'OIE par les services vétérinaires tunisiens. Cet outil a été présenté dans un cours en ligne élaboré par l'OIE et la Commission européenne de lutte contre la fièvre aphteuse (EuFMD)¹⁰. Les différentes données de la thèse ont aussi été utilisées pour la construction de la deuxième phase du projet porté par l'OIE en collaboration avec le Cirad.

¹⁰ Le cours s'appelle « partenariat public-privé : opportunités pour le contrôle des maladies animales transfrontalières », ou un module sur l'évaluation des PPP y était consacré : <https://rr-europe.oie.int/en/online-training-e-learning/>

Une des ambitions de ce projet est l'accompagnement des pays ayant été orientés vers un renforcement des PPP comme appui ciblé suite au processus d'évaluation de la performance des services vétérinaires. L'évaluation de la performance des services vétérinaires (outil PVS) est un programme phare de l'OIE. Elle est menée sur demande des pays désireux de renforcer leurs services vétérinaires. L'appui ciblé sur les PPP contient notamment une possibilité d'évaluation portant sur un PPP déjà en cours, ou d'évaluation à visée de planification d'un PPP. Le cadre d'évaluation de cette thèse pourrait être mobilisé à cette fin. La deuxième phase du projet abrite aussi une thèse qui a commencé en novembre 2021. Cette thèse se penchera sur la quantification des bénéfices, risques et impacts des PPP et sur l'analyse des coûts. Des premières idées d'indicateurs ont été proposées à la fin du chapitre 4, mais ne couvraient pas la dimension environnementale. Les indicateurs doivent être donnés à titre d'exemple et doivent pouvoir être adaptés à chaque PPP en fonction des enjeux locaux. Il sera aussi intéressant de réfléchir à la manière de relier les impacts à la qualité du processus et d'être en mesure de fournir des recommandations au niveau organisationnel dans le but d'améliorer un impact.

De plus, une base de données, hébergée par le site de l'OIE, est en cours d'élaboration. Cette base de données vise le recensement de divers PPP à travers le monde, à commencer par ceux déjà identifiés dans l'enquête en ligne de 2017, et le partage de divers éléments. Cette base de données serait en accès libre et pourrait servir d'inspiration pour des acteur·rices réfléchissant à implémenter un PPP ou cherchant des pistes d'amélioration pour un PPP. Les cas d'étude de cette thèse pourraient servir à fournir des descriptions détaillées de différents PPP pouvant intéresser des acteur·rices d'autres PPP. Cependant, il est possible que pour certains cas d'études les partenaires s'opposent à la publication des résultats d'évaluation de leur PPP si des risques ou autre points négatifs sont mentionnés. En évaluation, le conflit entre le besoin de partage des résultats d'évaluation pour l'apprentissage commun et le besoin d'assurer la confidentialité des résultats aux demandeurs d'une évaluation est souvent présent.

Il pourrait également être envisagé que tout acteur·rice, même non impliqué·e dans des PPP, puisse venir alimenter cette base de données, renseignant des PPP mis en œuvre sur leur territoire et des bénéfices et risques perçus.

5 Perspectives

5.1 Perspective opérationnelle : l'évaluation comme outil d'accompagnement

Plusieurs défis d'opérationnalisation du cadre d'évaluation intégrée des PPP ont été mis en évidence dans ces travaux, et si les évaluations internes ont pour objectif d'apporter des changements au PPP évalué, la mise en place de changements ne semble pas automatique. Il semblerait que les évaluations « one shot » n'aient que peu de chance d'aboutir à des changements. Ainsi, le rôle de l'évaluation, dont la demande viendrait des acteur·rices du PPP, pourrait se situer dans l'accompagnement.

Cet accompagnement pourrait être mené par une équipe interdisciplinaire d'évaluateur·rices et de chercheur·es, impliquant idéalement des personnes locales. En effet, il semble difficile qu'un·e seul·e évaluateur·rice soit en mesure de fournir une vision systémique du PPP évalué, même via des approches participatives. Cette équipe interdisciplinaire pourrait régulièrement mobiliser le cadre d'évaluation intégré, non pas pour fournir des solutions « clé en main », mais pour être en mesure de fournir des données rigoureuses sur la contribution du PPP à la durabilité du territoire, et de les mettre en discussion avec les parties prenantes (Papazian et al., 2017). De plus, l'évaluation comme accompagnement sur le long terme sera plus à même de permettre la confrontation des points de vue des acteur·rices de différents niveaux hiérarchiques avec un asymétrie de pouvoir, impliqué·es ou impacté·es par le PPP. La démarche d'évaluation pourrait alors inclure des démarches de gestions de conflits (ComMod, 2005). Au lieu de favoriser une approche a-conflictuelle, ces démarches pourraient permettre de réellement considérer les enjeux des groupes plus vulnérables et potentiellement avoir une influence sur l'organisation du PPP évalué, permettant à l'évaluation d'être un vecteur de changement vers plus de durabilité (Brousselle and Butzbach, 2018; Brousselle and Guerra, 2017).

L'OIE pourrait également considérer de favoriser des mises en réseaux régionales d'acteur·rices impliqué·es dans des PPP, basées sur les représentations régionales de l'OIE (Afrique, Amériques, Asie et Pacifique, Europe, Moyen-Orient). Cette mise en réseau permettrait d'encourager des évaluations croisées entre pays. Par exemple, il pourrait être envisagé que des acteurs du PPP du Paraguay, préalablement formés aux approches participatives, puissent évaluer le PPP pour la lutte contre la fièvre aphteuse en Bolivie, et inversement. Ces évaluations pourront être guidées par le cadre proposé dans ces travaux. Par exemple, les critères de l'outil d'évaluation du processus pourraient favoriser un partage d'expériences sur l'organisation et la structuration de leur PPP. Ce co-apprentissage pourrait ainsi bénéficier aux deux pays concernés.

5.2 Perspective de recherche : amélioration du cadre d'évaluation intégrée des PPP

5.2.1 Test du cadre d'évaluation sur d'autres PPP, évolution du cadre et analyse de risques

Dans cette thèse, seuls des PPP implémentés dans des pays du Sud ont été étudiés. Il sera intéressant d'étudier des PPP en santé animale dans des pays du Nord. On pourra alors vérifier si les critères de l'outil d'évaluation du processus restent pertinents et complets, ou si les impacts sont similaires. Les démarches d'évaluations participatives pourraient aussi être accueillies différemment, ce qui pourrait influencer le processus d'évaluation.

De plus, les cas d'étude en Ethiopie et au Paraguay étaient d'emblée considérés comme des PPP « à succès ». Cela a peut-être influencé les critères sélectionnés dans l'outil d'évaluation du processus et les impacts identifiés. En santé publique, il a été souligné que les PPP réussis sont plus souvent mentionnés dans la littérature, créant un biais positif dans l'analyse de ces PPP (Donald A. Barr, 2007). Il sera nécessaire de se pencher également sur la question de PPP qui auraient été initiés mais arrêtés, ou de ceux qui ne parviennent pas à leur objectif, et de se pencher sur les causes de ces échecs. Les études de ces PPP pourraient amener à identifier de nouveaux critères d'évaluation à prendre en compte, notamment des obstacles et des risques des PPP, et pourraient amener à faire évoluer le cadre d'évaluation proposé dans ce manuscrit. Comme mentionné, une grille pour faciliter une analyse de risque en amont de l'évaluation des PPP pourrait être proposée.

5.2.2 Combinaison du cadre avec des évaluations à l'échelle locale, à l'échelle individuelle et à l'échelle des réseaux d'acteur·rices

L'approche d'évaluation proposée dans cette thèse est restée à l'échelle nationale, c'est-à-dire s'intéressant aux effets sur la société ou un groupe de personnes à l'échelle d'un territoire national. Ainsi au Paraguay, le territoire a été posé à l'échelle nationale, échelle à laquelle est implémentée le PPP. Cependant le socio-écosystème de la région du Chaco (plaine boisée à la frontière de la Bolivie et du Brésil) est bien différent que la région de Neembucu Sur (zone humide à la frontière de l'Argentine). L'insertion de l'élevage dans chacun de ces systèmes est ainsi spécifique à chaque région. Il aurait été intéressant d'être en mesure d'analyser les spécificités de l'influence du PPP sur ces socio-écosystèmes, et les spécificités organisationnelles du PPP dans chaque région. A noter que la prise en compte des spécificités régionales dans l'évaluation nécessite plus de moyens et de temps. Cependant, cette option pourrait être envisagée, notamment au vu des politiques de zonage et compartimentation de l'OIE qui peut attribuer un statut sanitaire à une région spécifique d'un territoire national.

L'influence de l'échelle internationale pourrait être considérée de manière plus approfondie. Par exemple, pour le cas d'étude au Paraguay, il serait intéressant de considérer l'influence des politiques menées par les services vétérinaires en Argentine ou au Brésil (pays limitrophes) ou par le centre pan-américain de fièvre aphteuse (PANAFTOSA), ou l'influence de l'Union européenne et de ses exigences sanitaires demandées pour l'importation de viandes, ou de l'OIE et ses évaluations de performances et la délivrance de statuts,.

Même si des perceptions propres à des groupes d'acteur·rices ont pu être recueillies, elles ont surtout permis d'avoir une vision globale de la portée des PPP en question. Cette approche systémique pourrait effacer l'importance du processus de décisions des acteur·rices en lien avec un PPP et des facteurs qui l'influencent, comme les rapports de force entre différents acteur·rices. Cependant, l'échelle individuelle est importante à considérer dans l'évaluation car les acteur·rices sont au centre de tout PPP, et leurs processus de décision influencent son organisation et sa portée. Par exemple, l'adoption et l'utilisation de mesures prévues dans le cadre d'un programme tel qu'un PPP en santé animale par l'éleveur·se sont essentielles au succès du PPP en question (Chilonda et Van Huylenbroeck, 2001). Afin d'être en mesure de fournir des recommandations pour l'amélioration d'un PPP, il sera alors important d'essayer de comprendre la prise de décision des éleveurs de s'impliquer ou non dans un PPP. L'intérêt de se centrer sur l'échelle individuelle n'est pas seulement valable pour les éleveur·ses. Elle l'est également pour tou·tes les acteur·rices impliqué·es directement ou indirectement dans le PPP. Pour ce faire, il nous semble que l'approche fondée sur les moyens d'existence, une approche centrée sur les personnes (United Nations Development Programme, 2015), serait pertinente à mobiliser (**Appendix 2**).

Le processus de décision d'un acteur·rice est aussi influencé par les interactions avec d'autres acteur·rices dont les objectifs, les perceptions, les connaissances et le pouvoir sont différents (Mathevet and Bousquet, 2014). La participation à un PPP pour la santé des animaux d'élevage d'un acteur·rice dépendra alors de son insertion dans le réseau des acteur·rices de la santé animale (par exemple sa confiance dans la structure vétérinaire, l'influence d'autres éleveurs, etc.). Dans l'évaluation des PPP, il serait intéressant de se pencher sur les rapports sociaux et enjeux de pouvoirs que les acteur·rices entretiennent, ce qui n'a été que partiellement abordé dans cette thèse. Une analyse de réseaux sociaux à visée évaluative apparaît également comme d'intérêt (**Appendix 3**).

En santé publique, il a été souligné que des analyses de pouvoir au sein des PPP étaient souvent absentes, considérant de fait, des relations de pouvoir égales entre acteurs et organisations au sein des PPP. Comme nous l'avons mentionné, les analyses émanant d'approches participatives peuvent avoir tendance à « lisser » les rapports de force entre les acteur·rices du PPP. Des analyses se centrant sur les enjeux de pouvoir pourraient renseigner l'évaluation. Dans les PPP, le pouvoir peut être exercé sur la base de la coercition (politique ou financière), de l'autorité et de la légitimité. Une façon d'analyser la distribution de ce pouvoir

réside dans l'étude des accords ou contrats liant les partenaires, ou de la composition des comités de directions et des conseils d'administration, qui constituent souvent les principaux lieux de prise de décision (Buse and Harmer, 2004).

5.2.3 L'évaluation des coûts

Les travaux de cette thèse ne se sont pas penchés sur des évaluations de coûts ou des analyses budgétaires des PPP. De futurs travaux pourraient s'intéresser aux différents coûts de fonctionnement du PPP, ainsi qu'à l'origine de ces fonds et la création de valeur financière à travers le PPP. Il faudra alors considérer la création de valeur au regard des ressources investies, mais aussi la répartition des bénéfices financiers et non financiers entre partenaires public et privé. La Banque mondiale a publié des directives détaillées pour permettre d'identifier les coûts réels de la collaboration et de les mettre en balance avec les avantages (World Bank Institute, 2017). Il est probable que selon les types de PPP évalués, et donc des types de partenaires privé-es impliqué-es dans le PPP (vétérinaires privé-es, associations de producteur·rices ou entreprises), des évaluations des coûts spécifiques aient besoin d'être développées. Par exemple, dans le cas de PPP de type 3 dit « transformatif », il sera nécessaire de mener en parallèle une analyse de la filière concernée par le PPP. Cette analyse de filière permettra de calculer les coûts et bénéfices du PPP et la marge financière dégagée pour chaque type d'acteur·rices de la filière, du secteur public ou privé, ainsi que la répartition de ces coûts et de ces bénéfices entre ces acteur·rices.

5.2.4 La prise en compte des connaissances sur les PPP dans d'autres domaines et les contrefactuels

Cette thèse s'est principalement inspirée des critères et méthodologies d'évaluation des PPP développés en santé publique. Cependant, de futurs travaux pourraient s'intéresser aux cadres établis dans d'autres domaines, et notamment en agriculture. De plus, comme mentionné dans le chapitre 1, une limite importante du domaine de la recherche en évaluation est le manque de publication des évaluations réalisées. Il pourrait être envisagé de faire une étude de la littérature grise des évaluations PPP en santé animale effectuée dans les pays non publiés.

Nous ne nous sommes pas appuyés sur l'élaboration de contrefactuel dans les différents travaux de cette thèse. En revanche, de nombreux·ses auteur·es soutiennent qu'il est essentiel d'inclure un contrefactuel pour permettre une évaluation d'impact. Un contrefactuel permet de comparer les résultats observés à ceux auxquels on s'attendrait si l'intervention n'avait pas été mise en œuvre (le contrefactuel), et donc de comprendre les causes de ces résultats.

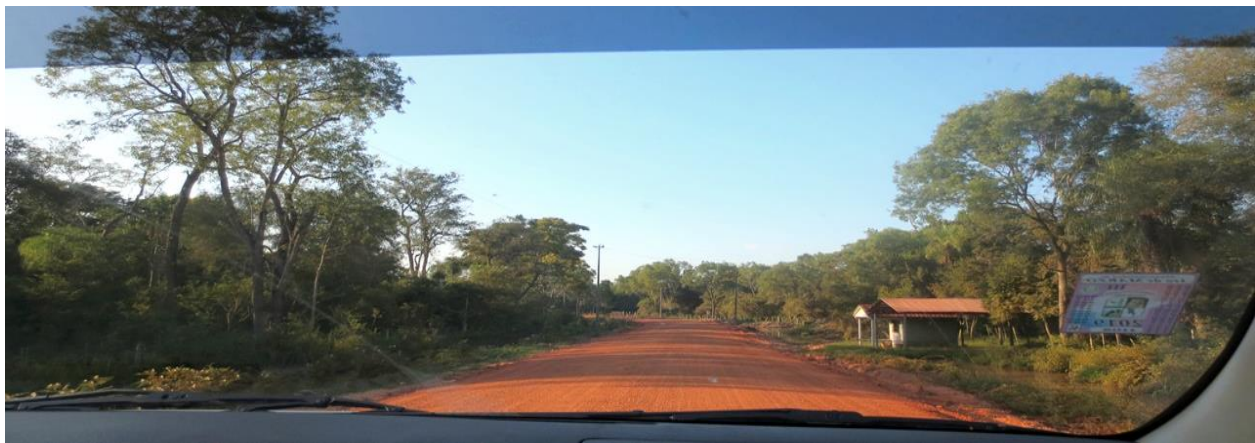
Il existe trois groupes d'options pour élaborer des contrefactuels. Les options expérimentales consistent à développer un contrefactuel à l'aide d'un groupe de contrôle, comme par exemple avec des essais contrôlés randomisés. Cela nécessite d'« attribuer » au hasard des participants pour recevoir l'intervention liée au PPP ou pour faire partie d'un groupe témoin. Cependant, dans le cadre d'évaluation de PPP mis en œuvre de longue date, cette option ne nous semble pas envisageable.

Les options quasi-expérimentales consistent à développer un contrefactuel en utilisant un groupe de comparaison qui n'a pas été créé par randomisation. Par exemple, la méthodologie de « différence dans la différence » compare la différence avant-après pour le groupe bénéficiant de l'intervention de PPP à la différence avant-après pour ceux qui ne l'ont pas reçue. Ces options nécessitent que certaines personnes ne soient pas bénéficiaires des interventions du PPP. Au Paraguay, par exemple, ça n'était pas le cas. La vaccination y étant obligatoire, toutes les éleveur·ses doivent vacciner leurs bovins.

Finalement les options non-expérimentales s'appuient sur une prédiction hypothétique de ce qui se serait passé en l'absence de PPP. Cette prédiction peut être établie par des informateur·rices clé ou à partir d'un contrefactuel logiquement construit en utilisant une ligne de base comme estimation du contrefactuel.

5.2.5 La prise en compte de la dimension environnementale dans l'évaluation des PPP

La dimension environnementale a été peu explorée dans cette thèse. Pour considérer cette dimension dans l'évaluation des PPP en santé animale, les analyses de cycle de vie semblent intéressantes à mobiliser (Bennett et al., 2019). Ces analyses permettraient d'avoir des éléments et indicateurs sur lesquels s'appuyer pour co-construire des recommandations sur le PPP dans l'objectif de diminuer son potentiel effet négatif indirect sur l'environnement. Dans l'**Appendix 1**, l'exemple du cas d'étude du PPP au Paraguay est pris pour proposer une esquisse de protocole et imaginer quelles données auraient été nécessaires, mais aussi les défis que cela aurait pu représenter, notamment pour la co-construction de recommandations. La dimension environnementale pourrait aussi être considérée dans des évaluations ex ante, par exemple avant la mise en place de programmes de santé animale, dont les PPP, dans une volonté de considérer les effets sur le long terme de ces programmes. Dans le cas où ces évaluations ex ante seraient proposées par des chercheur·es ou par l'OIE, il sera nécessaire de veiller à ne pas accentuer le sentiment d'iniquité et les tensions entre pays du Nord et pays du Sud.



Activités parallèles et diffusion des travaux

Activités parallèles

Projets en lien avec l'impact environnemental de la recherche

Si le coût environnemental de la recherche semble éloigné de ce sujet de thèse, c'est dans une posture réflexive sur les pratiques de la recherche que j'aimerais l'aborder. Si la lutte contre le réchauffement climatique est au cœur des sciences de la durabilité, l'impact environnemental de la recherche est souvent peu considéré (Scerri et al., 2020; Verdier et al., 2020). Pourtant, pour avoir une chance de limiter le réchauffement climatique à 2 °C et pour respecter une équité, il faudrait que chaque individu ne « dépense » pas plus de 2 tonnes d'équivalent carbone par an (IPCC, 2018), le reste l'étant au détriment de personnes moins favorisées, et au détriment des générations futures (Carbone4, 2019). Au cours de cette thèse, j'ai été confrontée à des tensions entre ma volonté de réduction de mon impact environnemental et mes objectifs de recherche¹¹. Mon cas est loin d'être isolé, et les agents du Cirad dépensent par exemple en moyenne 7 tonnes d'équivalent CO₂ par an dans leur pratique de recherche. Pour espérer une diminution significative des émissions de gaz à effet de serre, des changements doivent être collectifs (Carbone4, 2019), mais les actions mises en œuvre par les institutions de recherche pour faire évoluer des modes de fonctionnement restent marginales (Anderson, 2013). Ainsi, différents membres de la recherche s'organisent pour réduire l'empreinte de leurs activités (Labos 1point5, 2019). Il semblerait que de nombreuses questions doivent être débattues collectivement : comment s'organiser pour réduire l'impact environnemental de la recherche ? Quels déplacements sont réellement nécessaires ? Comment favoriser une équité entre jeunes et anciens membres du secteur académique ? Ou encore, comment diminuer l'asymétrie de pouvoir entre chercheur·e·s du nord et du sud grâce à de nouvelles pratiques ?

Sur la place de Montpellier, un projet de recherche interdisciplinaire vise à mieux comprendre les différents points de vue individuels, et les positionnements collectifs et institutionnels sur ces questions. Le but est d'accompagner l'émergence d'une communauté scientifique en capacité de problématiser le repositionnement de la recherche face à ces enjeux environnementaux et notamment la recherche en coopération avec les pays en développement et émergents de la zone intertropicale (DiFUSE, 2021).

¹¹ Était-ce nécessaire que j'aie en Guinée pour assister à une formation aux approches participative (2,25 tonnes de CO₂)?; en Indonésie pour aider à la mise en place d'un atelier participatif d'un PPP (7,3 tonnes de CO₂) ?; en Nouvelle-Orléans pour participer à une conférence (4,5 tonnes de CO₂)?; que j'aie en Tunisie pour l'atelier régional sur les PPP organisé par l'OIE (2,1 tonnes de CO₂) ?; ou que j'aie au Paraguay en 2020 pour une mission de terrain de 3 mois (7 tonnes de CO₂)?

- Co-porteuse du projet Di-FUSE: “compréhension de la diversité des points de vue dans la recherche en coopération avec les Suds comme levier d'action pour le changement face aux urgences socio-écologiques” - Maison des Sciences de l’Homme (MSH) SUD, CIRAD, IRD (Institut de recherche pour le développement), Université de Montpellier. Budget de 10 000€. <https://www.mshsud.org/recherche/equipes-projets-msh-sud/239-difuse>.

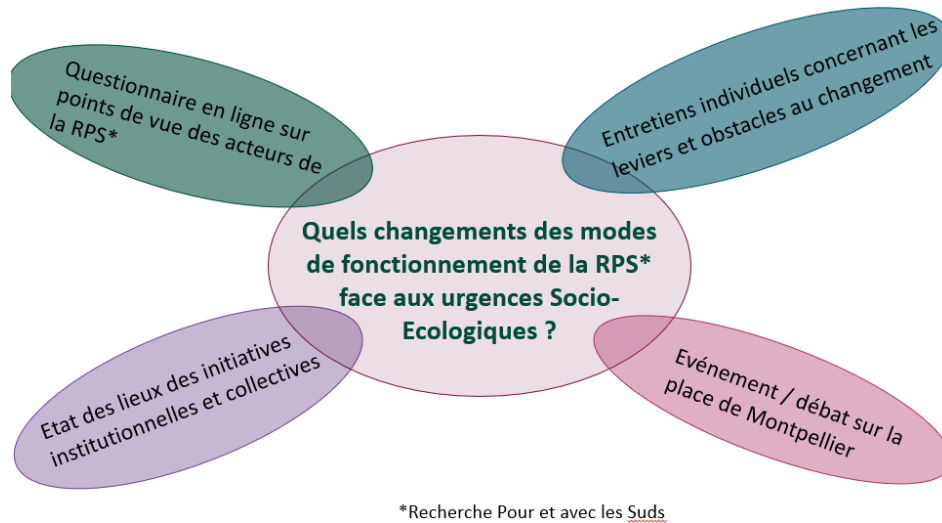


Figure 1 : activités du projet DiFUSE

- Animation de 3 séances et formations de futurs animateurs au jeu sérieux collaboratif « Ma Terre en 180 minutes », après avoir été moi-même formée. Ce jeu a été construit par le monde académique pour construire des scénarios de réduction de son empreinte carbone : <https://materre.osug.fr/>
- Participation au groupe de travail de la cellule responsabilité sociétale des organisations (RSO) du Cirad pour l’élaboration d’une charte sur la mobilité.

Participation à la préparation du congrès « Résilience du territoire Wallon »

Participation à la préparation et l'animation des groupes de travail du congrès « Résilience de la Wallonie face aux risques environnementaux », organisé à la demande de la Ministre wallonne du développement durable, Céline Tellier, et co-présidé par les Professeur·es Maria Mancilla Garcia (Université Libre de Bruxelles) et François Gemenne (Université de Liège). J'étais en charge du groupe de travail 1 sur « le rôle de l'anticipation » et, en binôme avec une personne de la direction du développement durable du gouvernement Wallon, j'ai préparé et animé des réunions regroupant une dizaine d'acteur·rices du secteur public et privé, du milieu académique et de la société civile. Ces 3 réunions ont abouti à un document de travail sous forme de pistes de recommandations pour le gouvernement wallon en termes de méthodologies et de gouvernances, présenté et débattu lors du congrès du 3 décembre. Rapport accessible sur ce site :

<https://developpementdurable.wallonie.be/congres-resilience>

Publications

Publications scientifiques

Articles publiés :

- **Poupaud M**, Putthana V, Patriarchi A, Caro D, Agunos A, Tansakul N, et al. Understanding the veterinary antibiotics supply chain to address antimicrobial resistance in Lao PDR: Roles and interactions of involved stakeholders. *Acta Tropica*. 2021;220: 105943. doi:10.1016/j.actatropica.2021.105943
- **Poupaud M**, Antoine-Moussiaux N, Dieuzy-Labaye I, Peyre M. An evaluation tool to strengthen the collaborative process of the public-private partnership in the veterinary domain. Aslam B, editor. *PLoS ONE*. 2021;16: e0252103. doi:10.1371/journal.pone.0252103
- N’Guessan BN*, **Poupaud M***, Dieuzy-Labaye I, Asfaw YT, Wieland B, Tesfu F, et al. Evaluation of public-private partnership in the veterinary domain using impact pathway methodology: in-depth case study in the poultry sector in Ethiopia. *Front. Vet. Sci*. doi: 10.3389/fvets.2022.735269 * ***These authors contributed equally to this work have and share first authorship.***
- Galière M, Peyre M, Muñoz F, **Poupaud M**, Dehove A, Roger F, et al. Typological analysis of public-private partnerships in the veterinary domain. Clegg SR, editor. *PLoS ONE*. 2019;14: e0224079. doi:10.1371/journal.pone.0224079

Article soumis en cours de relecture par les pairs :

- **Poupaud M**, Galière M, Dieuzy-Labaye I, Antoine-Moussiaux N, Peyre M. Evaluation of public-private partnerships in the veterinary domain: a scoping review.

Publication de vulgarisation (non revue par les pairs)

- **Poupaud, M.**, N’Bocho Guessan, B., Dieuzy-Labaye, I., Peyre, M., 2019. Engaging the actors to ensure impacts of public-private partnerships. *OIE Bull*. URL <https://oiebulletin.com/?panorama=03-6-2019-3-impact-evaluation>

Rapports institutionnels et pour les partenaires

- Rapport sur l’historique d’un PPP pour le contrôle de la fièvre aphteuse au Paraguay « La historia de la asociación público-privada para el control de la fiebre aftosa en Paraguay », novembre 2021, **M. Poupaud**. *Rapport envoyé et présenté aux acteurs du secteur public (services vétérinaires) et privé (association de producteurs)*
- Rapport d’évaluation d’un PPP pour le développement du secteur de la volaille en Ethiopie « Impact assessment of Ethiochicken innovative business model », décembre 2019, **M. Poupaud**, M. Peyre, B.N’guessan, I. Dieuzy-Labaye, B.Wieland. *Rapport envoyé et présenté aux acteur·rices du secteur public (ministère de la santé, et de l’agriculture) et privé (producteur·rices de volaille)*
- Participation au rapport “The OIE PPP Handbook : Guidelines for Public-Private Partnerships in the veterinary domain”, octobre 2019, coordonné par Isabelle Dieuzy-Labaye (OIE), avec l’aide de Nigel Gibbens (Itinerant Vets), Marisa Peyre (Cirad) et la participation de 42 expert·es du secteur public et privé.
- Rapport de l’Organisation des Nations unies pour l’alimentation et l’agriculture (FAO) “Baseline review of practices of veterinary antibiotics use in Lao PDR, including gap analysis and stakeholder mapping, march 2018- august 2018”. Contractor: Flavie Goutard; Research team: **M Poupaud**, V Phouthana, T Lacksivy, S Keopaseuth, N Soulinthone, K Phomvixay, M Vangxeng.

Communications orales

Conférences internationales en présentation orale

- “**International Society for Economics and Social Sciences of Animal Health (ISESSAH) Conference 2021**”, novembre 2021, Malaysia, édition en ligne. “Participatory evaluation to strengthen public-private partnerships in the veterinary domain”
- “**4th Global food security**” conférence, septembre 2020, Montpellier, édition en ligne. « Participatory evaluation to strengthen public-private partnerships related to animal health ».
- “**Society for social studies of science-4S annual meeting 2019: innovations, Interruptions, Regenerations**”, Nouvelle Orléans, USA, Septembre 2019. « *The diversity of impacts brought by sound implementation of public-private partnerships in the Veterinary Domain* ».
- “**Society for social studies of science-4S annual meeting 2019: innovations, Interruptions, Regenerations**”, Nouvelle Orléans, USA, Septembre 2019. « *Mapping and analysis of stakeholders involved in the supply chains of antibiotics in Lao* ».
- “**5th Food Safety Zoonoses Symposium for Asia Pacific**”, Chiang Mai, Thailand, 2018. “*Use of stakeholders mapping and analysis to explore the food animal drugs supply chain in Lao PDR*”

Participation à l’animation d’un atelier lors d’une conférence

- Conférence: “**Society for Veterinary Epidemiology and Preventive Medicine SVEPM Annual conference, online 2021**”. Atelier: “Exploring drivers of change in Antimicrobial Usage through participatory methods”. Présentation: “Stakeholders mapping and analysis: application in Laos” (M. Poupaud, V. Phouthana)

Conférence nationale, présentation orale

- Printemps de baillarguet, Montpellier, France, 2019 « La diversité des impacts permis par la mise en œuvre de partenariats public-privé dans le domaine vétérinaire »

Partages d'expériences et encadrement

Interventions dans des cours de master

Partage d'expériences sur la mobilisation d'approches interdisciplinaires et d'approches participatives dans les modules de cours d'Aurélie Binot « anthropologie de la santé » et « approches intégrées en santé » :

-pour les étudiant·es du master de spécialisation « Gestion Intégrée des Maladies Animales Tropicales » (GIMAT) du Cirad et de l'école nationale vétérinaire de Toulouse en 2020 et 2021

-pour les étudiant·es du master de spécialisation « Gestion intégrée des Risques Sanitaires dans les Pays du Sud » (GIRISS) de l'Université de Liège en 2019 et 2020

- pour les étudiant·es du master « Gestion et surveillances des Emergences Parasitaires et Infectieuses » de l'Université de Montpellier en 2021

Coencadrements de stagiaires

-Anissa Dhaoui, projet OIE-Cirad, évaluation mandat sanitaire en Tunisie

-Abdoulaye Baradji, projet Di-FUSE, analyse de données d'enquête

Participation à un jury de défense de mémoire de master 2

-Master 2 InterRisk, Université de Kasetsart-faculté sciences vétérinaires et Institut nationale polytechnique de Toulouse- école nationale vétérinaire de Toulouse « *effectiveness of pork safety intervention at traditional markets in Cambodia* »

Bibliographie

Références citées dans les sections introduction et objectifs

- Ahuja, V., 2004. The economic rationale of public and private sector roles in the provision of animal health services. *Rev Sci Tech* 23, 33–45. <https://doi.org/10.20506/rst.23.1.1464>
- Al-Hanawi, M.K., Qattan, A.M., 2019. An Analysis of Public-Private Partnerships and Sustainable Health Care Provision in the Kingdom of Saudi Arabia. *Health Serv Insights* 12, 1178632919859008. <https://doi.org/10.1177/1178632919859008>
- Antoine-Moussiaux, N., Peyre, M., Bonnet, P., Bebay, C., Bengoumi, M., Tripodi, A., 2017. The Value Chain Approach in One Health: Conceptual Framing and Focus on Present Applications and Challenges. *Frontiers in Veterinary Science* 4, 206. <https://doi.org/10.3389/fvets.2017.00206>
- Arnstein, S., 1969. A ladder of citizen participation. *Journal of the American Institute of Planners* 4, 216–224.
- Barlow, J., Roehrich, J., Wright, S., 2013. Europe sees mixed results from public-private partnerships for building and managing health care facilities and services. *Health Aff* 32, 146–154. <https://doi.org/10.1377/hlthaff.2011.1223>
- Barr, D.A., 2007. Ethics in public health research: a research protocol to evaluate the effectiveness of public-private partnerships as a means to improve health and welfare systems worldwide. *American Journal of Public Health* 97, 19–25. <https://doi.org/10.2105/AJPH.2005.075614>
- Bennett, R., 2012. Economic rationale for interventions to control livestock disease. *Eurochoices*, Special issue on the economics of animal health. 11, 5–11. <https://doi.org/10.1111/j.1746-692X.2012.00227.x>
- Bloom, B.R., 2007. Sustainable health: A new dimension of sustainability science. *Proceedings of the National Academy of Sciences* 104, 15969–15969. <https://doi.org/10.1073/pnas.0704701104>
- Bordier, M., Delavenne, C., Nguyen, D.T.T., Goutard, F.L., Hendrikx, P., 2019. One Health surveillance: a matrix to evaluate multisectoral collaboration. *Frontiers in Veterinary Science* 6. <https://doi.org/10.3389/fvets.2019.00109>
- Brousselle, A., Buregeya, J.-M., 2018. Theory-based evaluations: Framing the existence of a new theory in evaluation and the rise of the 5th generation. *Evaluation* 24, 153–168. <https://doi.org/10.1177/1356389018765487>
- Brousselle, A., Butzbach, C., 2018. Redesigning public health for planetary health. *The Lancet Planetary Health* 2, e188–e189. [https://doi.org/10.1016/S2542-5196\(18\)30054-8](https://doi.org/10.1016/S2542-5196(18)30054-8)

- Brousselle, A., Guerra, S.G., 2017. Public health for a sustainable future: the need for an engaged ecosocial approach. *Saúde em Debate* 41, 14–21. <https://doi.org/10.1590/0103-11042017s02>
- Bryson, J.M., Crosby, B.C., Stone, M.M., 2015. Designing and implementing cross-sector collaborations: needed and challenging. *Public Adm Rev* 75, 647–663. <https://doi.org/10.1111/puar.12432>
- Bryson, J.M., Patton, M.Q., Bowman, R.A., 2011. Working with evaluation stakeholders: A rationale, step-wise approach and toolkit. *Evaluation and Program Planning* 34, 1–12. <https://doi.org/10.1016/j.evalprogplan.2010.07.001>
- Buse, K., Harmer, A., 2004. Power to the Partners?: The politics of public-private health partnerships. *Development* 47, 49–56. <https://doi.org/10.1057/palgrave.development.1100029>
- Buse, K., Waxman, A., 2001. Public–private health partnerships: a strategy for World Health Organisation. *Bull World Health Organ* 79(8):748–54, 7. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2566497/pdf/11545332.pdf>
- Calba, C., Antoine-Moussiaux, N., Charrier, F., Hendrikx, P., Saegerman, C., Peyre, M., Goutard, F.L., 2015. Applying participatory approaches in the evaluation of surveillance systems: a pilot study on African swine fever surveillance in Corsica. *Prev Vet Med* 122, 389–398. <https://doi.org/10.1016/j.prevetmed.2015.10.001>
- Canadian public health association, 2015. Global change and public health: addressing the ecological determinants of health. Discussion document. URL https://www.cpha.ca/sites/default/files/assets/policy/edh-discussion_e.pdf (accessed 10.17.21).
- Caron, P., 2017. Chapitre 1 - Entre promesses et risques, l’usage du mot territoire dans la pensée du développement agricole. Éditions Quæ.
- Cavicchioli, R., Ripple, W.J., Timmis, K.N., Azam, F., Bakken, L.R., Baylis, M., Behrenfeld, M.J., Boetius, A., Boyd, P.W., Classen, A.T., Crowther, T.W., Danovaro, R., Foreman, C.M., Huisman, J., Hutchins, D.A., Jansson, J.K., Karl, D.M., Koskella, B., Mark Welch, D.B., Martiny, J.B.H., Moran, M.A., Orphan, V.J., Reay, D.S., Remais, J.V., Rich, V.I., Singh, B.K., Stein, L.Y., Stewart, F.J., Sullivan, M.B., van Oppen, M.J.H., Weaver, S.C., Webb, E.A., Webster, N.S., 2019. Scientists’ warning to humanity: microorganisms and climate change. *Nat Rev Microbiol* 17, 569–586. <https://doi.org/10.1038/s41579-019-0222-5>
- Champagne, Contandriopoulos, A.-P., Brousselle, A., Hartz, Z., Denis, J.-L., 2011a. 2. L’évaluation dans le domaine de la santé : concepts et méthodes, in: Les presses de Montréal (Ed.), L’évaluation : concepts et méthodes. Presses de l’Université de Montréal, pp. 49–70. <https://doi.org/10.4000/books.pum.6300>

- Champagne, Contandriopoulos, A.-P., Brousselle, A., Hartz, Z., Denis, J.-L., 2011b. L'évaluation dans la santé : concept et méthode, in: Les Presses de l'Université de Montréal. Montréal, pp. 35–56.
- Charron, D., 2011. Ecohealth research in practice: innovative applications of an ecosystem approach to health.
- Communauté de pratique en approches écosystémiques de la santé (COPEH-Canada), 2013. Approches écosystémiques de la santé [WWW Document]. URL <http://www.copeh-canada.org/fr/a-propos/approches-ecosystemiques-de-la-sante.html> (accessed 7.20.17).
- Debnath, N.C., Schipp, M.A., Alders, R.G., Chadag, M.V., Howden, M., Meza, F., Swai, E.S., Wingett, K., 2021. Planetary boundaries and veterinary services: -EN- Planetary boundaries and veterinary services -FR- Les frontières planétaires et les Services vétérinaires -ES- Límites planetarios y Servicios Veterinarios. *Rev. Sci. Tech. OIE* 40, 439–453. <https://doi.org/10.20506/rst.40.2.3236>
- Dehove, A., Commault, J., Petitclerc, M., Teissier, M., Macé, J., 2012. Economic analysis and costing of animal health: a literature review of methods and importance. *Revue scientifique et technique (International Office of Epizootics)* 31, 605–17, 591–604.
- Delabouglise, A., Dao, T.H., Truong, D.B., Nguyen, T.T., Nguyen, N.T.X., Duboz, R., Fournié, G., Antoine-Moussiaux, N., Grosbois, V., Vu, D.T., Le, T.H., Nguyen, V.K., Salem, G., Peyre, M., 2015. When private actors matter: Information-sharing network and surveillance of Highly Pathogenic Avian Influenza in Vietnam. *Acta Trop* 147, 38–44. <https://doi.org/10.1016/j.actatropica.2015.03.025>
- Dumont, B., Dupraz, P., Donnars, C., 2019. Impacts et services issus des élevages européens. éditions Quae. <https://doi.org/10.35690/978-2-7592-2705-1>
- Dury, S., Bendjebbar, P., Hainzelin, É., Giordano, T., Bricas, N., 2019. Food systems at risk [WWW Document]. Food and Agriculture Organization of the United Nations and Centre de Coopération Internationale en Recherche Agronomique pour le développement and the European Commission. URL <https://www.fao.org/3/ca5724en/CA5724EN.pdf> (accessed 10.25.21).
- European Union Capacity4dev, 2018. Manuel EcoFin [WWW Document]. URL <https://europa.eu/capacity4dev/t-and-m-series/documents/manuel-ecofin-0> (accessed 10.14.21).
- Food and Agriculture Organization of the United Nations, 2020. L'État de la sécurité alimentaire et de la nutrition dans le monde 2020. FAO, IFAD, UNICEF, WFP and WHO. <https://doi.org/10.4060/ca9692fr>
- Food and Agriculture Organization of the United Nations, 1997. Public sector veterinary services [WWW Document]. URL <http://www.fao.org/3/W4338E/w4338e03.htm> (accessed 10.8.21).

- Galière, M., Peyre, M., Muñoz, F., Poupaud, M., Dehove, A., Roger, F., Diezy-Labayé, I., 2019. Typological analysis of public-private partnerships in the veterinary domain. *PLoS One* 14, e0224079. <https://doi.org/10.1371/journal.pone.0224079>
- Guba, E.G., 1981. Criteria for assessing the trustworthiness of naturalistic inquiries. *ECTJ* 29, 75. <https://doi.org/10.1007/BF02766777>
- Guilbaud, A., 2015a. Les partenariats public-privé sanitaires internationaux : diffusion et incarnation d'une norme de coopération, in: De Boeck Supérieur (Ed.), *Mondes En Développement*. pp. 91–104. <https://doi.org/10.3917/med.170.0091>
- Guilbaud, A., 2015b. Les partenariats public-privé sanitaires internationaux : diffusion et incarnation d'une norme de coopération, in: De Boeck Supérieur (Ed.), *Mondes En Développement*. pp. 91–104. <https://doi.org/10.3917/med.170.0091>
- Hendrikx, P., Gay, E., Chazel, M., Moutou, F., Danan, C., Richomme, C., Boue, F., Souillard, R., Gauchard, F., Dufour, B., 2011. OASIS: an assessment tool of epidemiological surveillance systems in animal health and food safety. *Epidemiology and Infection* 139, 1486–1496. <https://doi.org/10.1017/S0950268811000161>
- Hernandez-Aguado, I., Zaragoza, G.A., 2016. Support of public-private partnerships in health promotion and conflicts of interest. *BMJ Open* 6. <https://doi.org/10.1136/bmjopen-2015-009342>
- Herrero, M., Thornton, P.K., Gerber, P., Reid, R.S., 2009. Livestock, livelihoods and the environment: understanding the trade-offs. *Current Opinion in Environmental Sustainability* 1, 111–120. <https://doi.org/10.1016/j.cosust.2009.10.003>
- Hoffmann, L., 2010. Livestock biodiversity. *Rev. sci. tech. Off. int. Epiz.* 73–86. <https://doi.org/10.20506/rst.29.1.1966>
- James, P., Magee, L., Scerri, A., Steger, M., 2015. *Urban Sustainability in Theory and Practice: Circles of Sustainability* (2015), Routledge. ed. Taylor and Francis Group, London and Newyork.
- Johnston, L.M., Finegood, D.T., 2015. Cross-sector partnerships and public health: challenges and opportunities for addressing obesity and noncommunicable diseases through engagement with the private sector. *Annual Review of Public Health* 36, 255–271. <https://doi.org/10.1146/annurev-publhealth-031914-122802>
- Kates, R.W., 2011. What kind of a science is sustainability science? *PNAS* 108, 19449–19450. <https://doi.org/10.1073/pnas.1116097108>
- Knight-Jones, T.J.D., Rushton, J., 2013. The economic impacts of foot and mouth disease – What are they, how big are they and where do they occur? *Preventive Veterinary Medicine* 112, 161–173. <https://doi.org/10.1016/j.prevetmed.2013.07.013>
- Maatala, N., Benabdellah, M., Lebailly, P., 2017. Les partenariats public-privé: fondement théorique et analyse économique 8.

- Mahoney, J.T., McGahan, A.M., Pitelis, C.N., 2009. Perspective—The Interdependence of Private and Public Interests. *Organization Science* 20, 1034–1052. <https://doi.org/10.1287/orsc.1090.0472>
- Martin, M.H., Halachmi, A., 2012. Public-private partnerships in global health: addressing issues of public accountability, risk management and governance. *Public Administration Quarterly* 36(2), 189–212.
- Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S.L., Péan, C., Berger, S., Caud, N., Chen, Y., Goldfarb, L., Gomis, M.I., Huang, M., Leitzell, K., Lonnoy, E., Matthews, J.B.R., Maycock, T.K., Waterfield, T., Yelekçi, Ö., Yu, R., Zhou, B. (Eds.), 2021. AR6 Climate Change 2021: The Physical Science Basis. Contribution of Working Group to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
- Meadows, D.H., Meadows, D.L., Randers, J., Behrens, W.W., 1972. The Limits to Growth [WWW Document]. *Green Planet Blues*. URL <https://www.donellameadows.org/wp-content/userfiles/Limits-to-Growth-digital-scan-version.pdf>
- Müller, Jean-Pierre;, Opplert, Marie;, Pachoud, Carine Morales, Hermes;, Martins, Rogério;, Hubert, Bernard;, Ickowicz, Alexandre;, Lasseur, Jacques;, Blanfort, Vincent;, Tourrand, Jean-François;, Wedderburn, Liz, Under publication. An ontology of livestock grazing systems (DRAFT VERSION).
- Nishtar, S., 2004. Public – private “partnerships” in health – a global call to action. *Health Res Policy Syst* 2. <https://doi.org/10.1186/1478-4505-2-5>
- O’Neill, D.W., Fanning, A.L., Lamb, W.F., Steinberger, J.K., 2018. A good life for all within planetary boundaries. *Nat Sustain* 1, 88–95. <https://doi.org/10.1038/s41893-018-0021-4>
- Organisation Mondiale de la Santé Animale, 2020. Historique de l’OIE. URL <https://www.oie.int/fr/qui-nous-sommes/missions/historique/> (accessed 10.10.21).
- Peyre, M., Roger, F., Goutard, F., 2021. The Evabook: evaluation of animal health surveillance, Under publishement. ed.
- Pham, H.T.T., Peyre, M., Trinh, T.Q., Nguyen, O.C., Vu, T.D., Rukkwamsuk, T., Antoine-Moussiaux, N., 2017. Application of discrete choice experiment to assess farmers’ willingness to report swine diseases in the Red River Delta region, Vietnam. *Preventive Veterinary Medicine* 138, 28–36. <https://doi.org/10.1016/j.prevetmed.2017.01.002>
- Portail National des Archives, 1984. services vétérinaires [WWW Document]. France Archives. URL <https://francearchives.fr/fr/findingaid/ee1acf1871c81e3dc8ffd36d893a742f6167962f> (accessed 10.10.21).
- Pretty, N., Guijt, I., Thompson, J., Scoones, I., 1995. Participatory learning and action: A trainer’s guide. IIED participatory methodology series. IIED (Institut international pour l’environnement et le développement) 270.

- Reich, M.R., Hershey, J.H., Hardy, G.E., Childress, J.E., Bernheim, R.G., 2003. Workshop on Public Health Law and Ethics I & II: the challenge of public-private partnerships (PPPs). *The Journal of Law, Medicine & Ethics* 31, 90–93. <https://doi.org/10.1111/j.1748-720X.2003.tb00766.x>
- Roehrich, J.K., Lewis, M.A., George, G., 2014. Are public-private partnerships a healthy option? A systematic literature review. *Social Science & Medicine* (1982) 113, 110–119. <https://doi.org/10.1016/j.socscimed.2014.03.037>
- Rushton, J., 2007. Animal health economics : where have we come from and where do we go next? *CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources* 2. <https://doi.org/10.1079/pavsnnr20072031>
- Saadi, A., Sahibi, H., Thys, S., Marcotty, T., Filali, H., Amarir, F., Rhalem, A., Kirschvink, N., Antoine-Moussiaux, N., 2021. Stakeholder analysis to improve the national control program of cystic echinococcosis in Morocco. *Preventive Veterinary Medicine* 186, 105227. <https://doi.org/10.1016/j.prevetmed.2020.105227>
- Salve, S., Harris, K., Sheikh, K., Porter, J.D.H., 2018. Understanding the complex relationships among actors involved in the implementation of public-private mix (PPM) for TB control in India, using social theory. *Int J Equity Health* 17, 73. <https://doi.org/10.1186/s12939-018-0785-1>
- Servicio Nacional de Calidad y Salud Animal, 2020. Programa Nacional de Erradicación de la Fiebre Aftosa. [WWW Document]. URL <https://www.senacsa.gov.py/index.php/Temas-pecuarios/sanidad-animal/programas-sanitarios/fiebre-aftosa> (accessed 9.8.21).
- Smith, J., Grace, D., Lee, H.S., 2021. Introduction to “ veterinary services in a changing world: climate change and other external factors”. *Rev. Sci. Tech. OIE* 40, 371–382. <https://doi.org/10.20506/rst.40.2.3230>
- Soussana, J.F., Tallec, T., Blanfort, V., 2010. Mitigation the greenhouse gas balance of ruminant production systems through carbon sequestration in grasslands. *Animal* 4, 334–350. <https://doi.org/10.1017/S1751731109990784>
- Stavros, C., Westberg, K., 2009. Using triangulation and multiple case studies to advance relationship marketing theory. *Qualitative Market Research: An International Journal* 12, 307–320. <https://doi.org/10.1108/13522750910963827>
- Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., de Vries, W., de Wit, C.A., Folke, C., Gerten, D., Heinke, J., Mace, G.M., Persson, L.M., Ramanathan, V., Reyers, B., Sörlin, S., 2015. Planetary boundaries: Guiding human development on a changing planet. *Science* 347, 1259855. <https://doi.org/10.1126/science.1259855>
- Steinfeld, H., de Haan, C., Blackburn, H., 1997. *Livestock - Environment Interactions: Issues and options*. <http://www.fao.org/3/x5305e/x5305e00.htm>

- Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M., de Haan, C., 2006. Livestock's long shadow. Environmental issues and options. <http://www.fao.org/3/a0701e/a0701e00.htm>
- Stemshorn, B.W., Zussman, D., 2012. Financing for public veterinary services to ensure that they meet international standards: -EN- -FR- Financer les services vétérinaires publics afin de s'assurer de leur conformité avec les normes internationales -ES- Financiación de los Servicios Veterinarios públicos para lograr que se ajusten a las normas internacionales. *Rev. Sci. Tech. OIE* 31, 681–688. <https://doi.org/10.20506/rst.31.2.2151>
- Stockholm Resilience Center, 2018. Reconnect to the biosphere [WWW Document]. URL <https://www.stockholmresilience.org/research/research-news/2015-02-19-reconnect-to-the-biosphere.html> (accessed 10.16.21).
- Stockholm Resilience Center, 2015. What is resilience? [WWW Document]. Explaining core concepts. URL <https://www.stockholmresilience.org/research/research-news/2015-02-19-what-is-resilience.html> (accessed 8.2.21).
- Taut, S., Brauns, D., 2003. Resistance to Evaluation: A Psychological Perspective. *Evaluation* 9, 247–264. <https://doi.org/10.1177/13563890030093002>
- The high level panel of experts on food security and nutrition, 2016. Sustainable agricultural development for food security and nutrition: what roles for livestock? 140. <https://www.unscn.org/uploads/web/news/HLPE-Report-10-EN.pdf>
- The United Nations, 2015. Sustainable development goals.
- United Nations Environment Programme, 2017. The Emissions Gap Report 2017: A UN Environment Synthesis Report, The Emissions Gap Report. UN. <https://doi.org/10.18356/1cf881fb-en>
- van Veen, T.W.S., de Haan, C., 1995. Trends in the organization and financing of livestock and animal health services. *Preventive Veterinary Medicine* 25, 225–240. [https://doi.org/10.1016/0167-5877\(95\)00540-4](https://doi.org/10.1016/0167-5877(95)00540-4)
- Vigne, M., Vayssières, J., Wassenaar, T., Avadí, A., Corson, M.S., 2017. Chapitre 32 - Évaluer la capacité des systèmes de production à répondre aux enjeux du développement durable des territoires. Editions Quæ.
- White, M.A., 2013. Sustainability: I know it when I see it. *Ecological Economics, Sustainable Urbanisation: A resilient future* 86, 213–217. <https://doi.org/10.1016/j.ecolecon.2012.12.020>
- Widdus, R., 2005. Public-private partnerships: an overview. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 99, 1–8. <https://doi.org/10.1016/j.trstmh.2005.06.005>
- World Organisation for Animal Health, 2020a. Veterinary Legislation Support [WWW Document]. URL <https://www.oie.int/en/solidarity/options-for-targeted-support/veterinary-legislation-support/> (accessed 4.28.20).

World Organisation for Animal Health, 2020b. Septième plan stratégique de l'oie pour la période 2021-2025. URL https://web.oie.int/download/SG/2021/F_88SG_14.pdf

World Organisation for Animal Health, 2019a. OIE tool for the evaluation of performance of veterinary services (No. Seventh Edition). World Organisation for Animal Health, Paris, France.

World Organisation for Animal Health, 2019b. The OIE PPP Handbook: guidelines for public-private partnerships in the veterinary domain [WWW Document]. URL https://www.oie.int/publicprivatepartnerships/ppp/en/Handbook_en.html (accessed 3.11.20).

World Organisation for Animal Health (OIE), 2019. Strengthening veterinary services through the OIE PVS pathway [WWW Document]. URL <https://www.oie.int/app/uploads/2021/03/20190513-business-ca>

Références citées dans le chapitre 1

- Adams, W.M., 2006. The Future of Sustainability: Re-thinking Environment and Development in the Twenty-first Century [WWW Document]. Portal IUCN (the world conservation union). URL <https://portals.iucn.org/library/sites/library/files/documents/Rep-2006-002.pdf> (accessed 8.30.21).
- Ahuja, V., 2004. The economic rationale of public and private sector roles in the provision of animal health services. *Rev Sci Tech* 23, 33–45. <https://doi.org/10.20506/rst.23.1.1464>
- Allen, W., 2019. Planning, monitoring and evaluation - closing the loop. Learning for sustainability. URL <https://learningforsustainability.net/plan-monitor-evaluate/> (accessed 4.22.20).
- Arksey, H., O'Malley, L., 2005. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology* 8, 19–32. <https://doi.org/10.1080/1364557032000119616>
- Bardosh, K.L., 2016. Deadly flies, poor profits, and veterinary pharmaceuticals: sustaining the control of sleeping sickness in Uganda. *Med Anthropol* 35, 338–352. <https://doi.org/10.1080/01459740.2015.1101461>
- Barlow, J., Roehrich, J., Wright, S., 2013. Europe sees mixed results from public-private partnerships for building and managing health care facilities and services. *Health Aff* 32, 146–154. <https://doi.org/10.1377/hlthaff.2011.1223>
- Barr, D.A., 2007. A research protocol to evaluate the effectiveness of public–private partnerships as a means to improve health and welfare systems worldwide. *Am J Public Health* 97, 19–25. <https://doi.org/10.2105/AJPH.2005.075614>
- Bennett, R., 2012. Economic rationale for interventions to control livestock disease. *Eurochoices*, Special issue on the economics of animal health. 11, 5–11. <https://doi.org/10.1111/j.1746-692X.2012.00227.x>
- Bloom, B.R., 2007. Sustainable health: A new dimension of sustainability science. *Proceedings of the National Academy of Sciences* 104, 15969–15969. <https://doi.org/10.1073/pnas.0704701104>
- Blundo-Canto, G., Devaux-Spatarakis, A., Mathé, S., Faure, G., Cerdan, C., 2020. Using a Participatory Theory Driven Evaluation Approach to Identify Causal Mechanisms in Innovation Processes. *New Dir Eval* 2020, 59–72. <https://doi.org/10.1002/ev.20429>
- Breuer, E., Lee, L., De Silva, M., Lund, C., 2016. Using theory of change to design and evaluate public health interventions: a systematic review. *Implementation Science* 17. <https://doi.org/10.1186/s13012-016-0422-6>
- Brousselle, A., Champagne, F., 2011. Program theory evaluation: Logic analysis. *Eval Program Plann* 34, 69–78. <https://doi.org/10.1016/j.evalprogplan.2010.04.001>

- Bryson, J.M., Crosby, B.C., Stone, M.M., 2015. Designing and implementing cross-sector collaborations: needed and challenging. *Public Adm Rev* 75, 647–663. <https://doi.org/10.1111/puar.12432>
- Buse, K., Waxman, A., 2001. Public–private health partnerships: a strategy for World Health Organisation. *Bull World Health Organ* 79(8):748–54, 7. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2566497/pdf/11545332.pdf>
- Calba, C., Antoine-Moussiaux, N., Charrier, F., Hendriks, P., Saegerman, C., Peyre, M., Goutard, F.L., 2015. Applying participatory approaches in the evaluation of surveillance systems: a pilot study on African swine fever surveillance in Corsica. *Prev Vet Med* 122, 389–398. <https://doi.org/10.1016/j.prevetmed.2015.10.001>
- Cavicchioli, R., Ripple, W.J., Timmis, K.N., Azam, F., Bakken, L.R., Baylis, M., Behrenfeld, M.J., Boetius, A., Boyd, P.W., Classen, A.T., Crowther, T.W., Danovaro, R., Foreman, C.M., Huisman, J., Hutchins, D.A., Jansson, J.K., Karl, D.M., Koskella, B., Mark Welch, D.B., Martiny, J.B.H., Moran, M.A., Orphan, V.J., Reay, D.S., Remais, J.V., Rich, V.I., Singh, B.K., Stein, L.Y., Stewart, F.J., Sullivan, M.B., van Oppen, M.J.H., Weaver, S.C., Webb, E.A., Webster, N.S., 2019. Scientists’ warning to humanity: microorganisms and climate change. *Nat Rev Microbiol* 17, 569–586. <https://doi.org/10.1038/s41579-019-0222-5>
- De Pinho Campos, K., Cohen, J.E., Gastaldo, D., Jadad, A.R., 2019. Public-private partnership (PPP) development: Toward building a PPP framework for healthy eating. *Int J Health Plann Manage* 34, e142–e156. <https://doi.org/10.1002/hpm.2714>
- Delabougli, A., Dao, T.H., Truong, D.B., Nguyen, T.T., Nguyen, N.T.X., Duboz, R., Fournié, G., Antoine-Moussiaux, N., Grosbois, V., Vu, D.T., Le, T.H., Nguyen, V.K., Salem, G., Peyre, M., 2015. When private actors matter: Information-sharing network and surveillance of Highly Pathogenic Avian Influenza in Vietnam. *Acta Trop* 147, 38–44. <https://doi.org/10.1016/j.actatropica.2015.03.025>
- Dione, M.M., Traoré, I., Kassambara, H., Sow, A.N., Touré, C.O., Sidibé, C.A.K., Séry, A., Yena, A.S., Wieland, B., Dakouo, M., Diall, O., Niang, M., Fomba, C.O., Traoré, M., Fall, A., 2019. Integrated approach to facilitate stakeholder participation in the control of endemic diseases of livestock: the case of peste des petits ruminants in Mali. *Front Vet Sci* 6. <https://doi.org/10.3389/fvets.2019.00392>
- Dumont, B., Ryschawy, J., Duru, M., Benoit, M., Chatellier, V., Delaby, L., Donnars, C., Dupraz, P., Lemauviel-Lavenant, S., Méda, B., Vollet, D., Sabatier, R., 2019. Review: Associations among goods, impacts and ecosystem services provided by livestock farming. *Animal* 13, 1773–1784. <https://doi.org/10.1017/S1751731118002586>
- Dury, S., Bendjebbar, P., Hainzelin, É., Giordano, T., Bricas, N., 2019. Food systems at risk [WWW Document]. Food and Agriculture Organization of the United Nations and Centre de Coopération Internationale en Recherche Agronomique pour le développement and the European Commission. URL <https://www.fao.org/3/ca5724en/CA5724EN.pdf> (accessed 10.25.21).

- Galière, M., Peyre, M., Muñoz, F., Poupaud, M., Dehove, A., Roger, F., Dieuzy-Labayé, I., 2019. Typological analysis of public-private partnerships in the veterinary domain. *PLoS ONE* 14, e0224079. <https://doi.org/10.1371/journal.pone.0224079>
- Hamill, L., Picozzi, K., Fyfe, J., von Wissmann, B., Wastling, S., Wardrop, N., Selby, R., Acup, C.A., Bardosh, K.L., Muhanguzi, D., Kabasa, J.D., Waiswa, C., Welburn, S.C., 2017. Evaluating the impact of targeting livestock for the prevention of human and animal trypanosomiasis, at village level, in districts newly affected with *T. b. rhodesiense* in Uganda. *Infectious Diseases of Poverty* 6, 16. <https://doi.org/10.1186/s40249-016-0224-8>
- Hellowell, M., 2019. Are public-private partnerships the future of healthcare delivery in sub-Saharan Africa? Lessons from Lesotho. *BMJ Global Health* 4, e001217. <https://doi.org/10.1136/bmjgh-2018-001217>
- Herrero, M., Thornton, P.K., Gerber, P., Reid, R.S., 2009. Livestock, livelihoods and the environment: understanding the trade-offs. *Current Opinion in Environmental Sustainability* 1, 111–120. <https://doi.org/10.1016/j.cosust.2009.10.003>
- James, P., Magee, L., Scerri, A., Steger, M., 2015. *Urban Sustainability in Theory and Practice: Circles of Sustainability* (2015), Routledge. ed. Taylor and Francis Group, London and New York.
- Johnston, L.M., Finegood, D.T., 2015. Cross-sector partnerships and public health: challenges and opportunities for addressing obesity and noncommunicable diseases through engagement with the private sector. *Annual Review of Public Health* 36, 255–271. <https://doi.org/10.1146/annurev-publhealth-031914-122802>
- Jones, K.E., Patel, N.G., Levy, M.A., Storeygard, A., Balk, D., Gittleman, J.L., Daszak, P., 2008. Global trends in emerging infectious diseases. *Nature* 451, 990–993. <https://doi.org/10.1038/nature06536>
- Kanya, C., Shearer, J., Asiimwe, G., Carnahan, E., Salisbury, N., Waiswa, P., Brinkerhoff, J., Hozumi, D., 2016. Evaluating global health partnerships: a case study of a Gavi HPV vaccine application process in Uganda. *International Journal of Health Policy and Management* 6, 327–338. <https://doi.org/10.15171/ijhpm.2016.137>
- Kostyak, L., Shaw, D.M., Elger, B., Annaheim, B., 2017. A means of improving public health in low- and middle-income countries? Benefits and challenges of international public-private partnerships. *Public Health* 149, 120–129. <https://doi.org/10.1016/j.puhe.2017.03.005>
- Lei, X., Liu, Q., Escobar, E., Philogene, J., Zhu, H., Wang, Y., Tang, S., 2015. Public-private mix for tuberculosis care and control: A systematic review. *Int. J. Infect. Dis.* 34, 20–32. <https://doi.org/10.1016/j.ijid.2015.02.015>
- Lubroth, J., Rweyemamu, M.M., Viljoen, G., Diallo, A., Dungu, B., Amanfu, W., 2007. Veterinary vaccines and their use in developing countries. *Rev Sci Tech* 26, 179–201. <https://pubmed.ncbi.nlm.nih.gov/17633302/>

- Maatala, N., Benabdellah, M., Lebailly, P., 2017. Les Partenariats Public-Privé : Fondement théorique et analyse économique. *Rev. Mar. Sci. Agron. Vét.* 192–199.
- Mahoney, J.T., McGahan, A.M., Pitelis, C.N., 2009. Perspective—The Interdependence of Private and Public Interests. *Organization Science* 20, 1034–1052. <https://doi.org/10.1287/orsc.1090.0472>
- Maiti, S., Jha, S.K., Garai, S., 2011. Performance of public-private-partnership model of veterinary services in West Bengal. *Indian Res. J. Ext. Edu* 11, 1–5.
- Martin, M.H., Halachmi, A., 2012. Public-private partnerships in global health: addressing issues of public accountability, risk management and governance. *Public Administration Quarterly* 36(2), 189–212.
- Nepstad, D.C., Stickler, Almeida, 2006. Globalization of the Amazon Soy and Beef Industries: Opportunities for Conservation. *Conserv Biol* 20. <https://doi.org/10.1111/j.1523-1739.2006.00510.x>
- Nishtar, S., 2004. Public – private “partnerships” in health – a global call to action. *Health Res Policy Syst* 2. <https://doi.org/10.1186/1478-4505-2-5>
- Peyre, M., Vourc’h, G., Lefrançois, T., Martin-Prevel, Y., Soussana, J.-F., Roche, B., 2021. PREZODE: preventing zoonotic disease emergence. *The Lancet* 397, 792–793. [https://doi.org/10.1016/S0140-6736\(21\)00265-8](https://doi.org/10.1016/S0140-6736(21)00265-8)
- Pham, H.T.T., Peyre, M., Trinh, T.Q., Nguyen, O.C., Vu, T.D., Rukkwamsuk, T., Antoine-Moussiaux, N., 2017. Application of discrete choice experiment to assess farmers’ willingness to report swine diseases in the Red River Delta region, Vietnam. *Preventive Veterinary Medicine* 138, 28–36. <https://doi.org/10.1016/j.prevetmed.2017.01.002>
- Poupaud, M., Antoine-Moussiaux, N., Dieuzy-Labaye, I., Peyre, M., 2021. An evaluation tool to strengthen the collaborative process of the public-private partnership in the veterinary domain. *PLoS ONE* 16, e0252103. <https://doi.org/10.1371/journal.pone.0252103>
- Rieker, P., 2011. Partnership evaluation: guidebook and resources (Evaluation Technical Assistance Document). Centers for Disease Control and Prevention (CDCP), Division of Nutrition, Physical Activity, and Obesity.
- Roehrich, J.K., Lewis, M.A., George, G., 2014. Are public-private partnerships a healthy option? A systematic literature review. *Social Science & Medicine* (1982) 113, 110–119. <https://doi.org/10.1016/j.socscimed.2014.03.037>
- Rushton, J., 2007. Animal health economics : where have we come from and where do we go next? *CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources* 2. <https://doi.org/10.1079/pavsnr20072031>
- Salve, S., Harris, K., Sheikh, K., Porter, J.D.H., 2018. Understanding the complex relationships among actors involved in the implementation of public-private mix (PPM) for TB control in

- India, using social theory. *Int J Equity Health* 17, 73. <https://doi.org/10.1186/s12939-018-0785-1>
- Soussana, J.F., Tallec, T., Blanfort, V., 2010. Mitigation the greenhouse gas balance of ruminant production systems through carbon sequestration in grasslands. *Animal* 4, 334–350. <https://doi.org/10.1017/S1751731109990784>
- Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M., de Haan, C., 2006. Livestock's long shadow. *Environmental issues and options*. <http://www.fao.org/3/a0701e/a0701e00.htm>
- The high level panel of experts on food security and nutrition, 2016. Sustainable agricultural development for food security and nutrition: what roles for livestock? 140. <https://www.unscn.org/uploads/web/news/HLPE-Report-10-EN.pdf>
- Tricco, A.C., Lillie, E., Zarin, W., O'Brien, K.K., Colquhoun, H., Levac, D., Moher, D., Peters, M.D.J., Horsley, T., Weeks, L., Hempel, S., Akl, E.A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M.G., Garritty, C., Lewin, S., Godfrey, C.M., Macdonald, M.T., Langlois, E.V., Soares-Weiser, K., Moriarty, J., Clifford, T., Tunçalp, Ö., Straus, S.E., 2018. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of Internal Medicine* 169, 467–473. <https://doi.org/10.7326/M18-0850>
- Vrangbæk, K., 2008. Public–private partnerships in the health sector: the Danish experience. *Health Economics, Policy and Law* 3, 141–163. <https://doi.org/10.1017/S1744133108004465>
- World Bank Institute, 2017. Public-private partnerships reference guide [WWW Document]. World Bank Group. URL <https://ppp.worldbank.org/public-private-partnership/library/ppp-reference-guide-3-0> (accessed 3.11.21).
- World Organisation for Animal Health, 2020. Public–private partnership and perspectives in the veterinary domain. *Bulletin de l'OIE* 2019, 1–2. <https://doi.org/10.20506/bull.2019.3.3037>

Références citées dans le chapitre 2

- Antonio Esteban Vasconcellos Portas, 2008. Responsabilidad y experiencia del sector privado en la alianza para la salud animal. URL http://www.arp.org.py/images/files/Responsabilidad%20y%20experiencias%20del%20sector%20privado%20en%20la%20alianza%20para%20la%20salud%20animal_%20ING_%20ANTONIO%20VASCONCELLOS.ppt (accessed 9.10.21).
- Asociación Rural del Paraguay, 2011. Historia de la ganadería paraguaya. URL [https://www.arp.org.py/images/files/HISTORIA%20DE%20LA%20GANADERIA%20PARAGUAYA%20PRESENTACION\(1\).pdf](https://www.arp.org.py/images/files/HISTORIA%20DE%20LA%20GANADERIA%20PARAGUAYA%20PRESENTACION(1).pdf) (accessed 9.8.21).
- Astudillo, V., 1997. Participación social en la erradicación de la fiebre aftosa en América del Sur [WWW Document]. Pan American Health Organization. URL <https://iris.paho.org/handle/10665.2/51272> (accessed 9.2.21).
- Centro Panamericano de Fiebre Aftosa, 2018. Informe de situación de los programas de erradicación de la fiebre aftosa en Sudamérica y Panamá, año 2018 [WWW Document]. URL https://iris.paho.org/bitstream/handle/10665.2/51789/informesituacion2018_spa.pdf?sequence=1&isAllowed=y (accessed 9.10.21).
- Centro Panamericano de Fiebre Aftosa, 2012. Informe de situación de los programas de erradicación de la fiebre aftosa: continente Americano, 2012 [WWW Document]. URL https://iris.paho.org/bitstream/handle/10665.2/50133/informesituacion_spa.pdf?sequence=1&isAllowed=y
- Centro Panamericano de Fiebre Aftosa, 1989. Situación de los programas de control de la fiebre aftosa. América del Sur, 1989 [WWW Document]. URL <https://iris.paho.org/handle/10665.2/50199> (accessed 10.9.21).
- Centro Panamericano de Fiebre Aftosa, P., 2018. historic of PANAFTOSA: Panaftosa Compromiso con la erradicación de la fiebre aftosa en las Américas desde 1951. URL <https://www.paho.org/es/file/75247/download?token=PahoHwSj> (accessed 9.8.21).
- Comisiones de Salud Animal, Mesa Coordinadora, 2012. Tercer periodo de vacunación 2012 , basado en la Resolución2031/12. URL <http://www.arp.org.py/images/files/TERCER%20PERIODO%20DE%20VACUNACION%202012.pdf>
- Correa Melo, E., Lopez, A., 2002. Control de la fiebre aftosa: la experiencia americana. Rev. Sci. Tech. OIE 21, 689–698. <https://doi.org/10.20506/rst.21.3.1352>
- Facultad de Ciencias Veterinarias, 2021. Antecedentes de las Ciencias Veterinarias en el Paraguay. – Facultad de Ciencias Veterinarias. URL <http://www.vet.una.py/web/index.php/institucional/historia/antecedentes-de-las-ciencias-veterinarias-en-el-paraguay/> (accessed 10.19.21).
- Food and Agriculture Organization of the United Nations, 2012. La fiebre aftosa provoca enormes pérdidas económicas en Paraguay | Agronoticias: Agriculture News from Latin America and

- the Caribbean [WWW Document]. URL <http://www.fao.org/in-action/agronoticias/detail/en/c/493524/> (accessed 9.26.21).
- Gobierno Nacional de Paraguay, 2017. Decreto del Poder Ejecutivo N° 7331/2017 Por el cual se aprueban los estatutos sociales de la entidad denominada “ fundacion servicios de salud animal (Fundassa)” [WWW Document]. <https://www.fundassa.org/storage/documentos/1600356648551.pdf>. URL (accessed 10.22.21).
- Gobierno Nacional de Paraguay, 2004. Ley 2426 que crea Servicio Nacional de Calidad y Salud Animal. URL <https://www.bacn.gov.py/leyes-paraguayas/365/ley-n-2426-crea-servicio-nacional-de-calidad-y-salud-animal-senacsa>;
- Gobierno Nacional de Paraguay, 1996. Ley 808 - Que declara obllgatorio el programa nacional de eradicacion de la fiebre aftosa en todo el territorio nacional [WWW Document]. URL <https://www.bacn.gov.py/leyes-paraguayas/2334/ley-n-808-declara-obligatorio-el-programa-nacional-de-erradicacion-de-la-fiebre-aftosa-en-todo-el-territorio-nacional>
- Gobierno Nacional de Paraguay, 1977. Ley 675 que crea el servicio nacional de salud animal [WWW Document]. URL <https://www.bacn.gov.py/leyes-paraguayas/2475/ley-n-675-crea-el-servicio-nacional-de-salud-animal-senacsa> (accessed 9.9.21).
- Gobierno Nacional de Paraguay, 1967. Ley 1267 Que crea el Servicio Nacional de Lucha contra la Fiebre Aftosa. URL <https://www.csj.gov.py/cache/lederes/R-5-091967-L-1267-1.pdf> (accessed 10.22.21).
- Jori, D.F., 2012. Sustained Training Mission, Foot and Mouth Disease Control Paraguay, 1st (june-july 2012) [WWW Document]. URL <https://agritrop.cirad.fr/566660/> (accessed 10.25.21).
- Organizacion panamerica de la salud, 1970. Resúmen de la situación de los programas de control de fiebre aftosa, 1970 [WWW Document]. URL https://iris.paho.org/bitstream/handle/10665.2/51157/RICAZ425_spa.pdf?sequence=1
- Organización Panamericana de la Salud, 1999. Situación de los programas de erradicación de la fiebre aftosa. América del Sur, 1999 [WWW Document]. URL <https://iris.paho.org/handle/10665.2/50143> (accessed 9.2.21).
- Rosenberg, F.J., Goic, R., 1973. Programas de control y prevención de la fiebre aftosa en las Américas. Bol Cent Panam Fiebre Aftosa;12, Organización Panamericana de la Salud. <https://iris.paho.org/handle/10665.2/50427>
- Salud, O.P. de la, 2007. Situación de los programas de erradicación de la fiebre aftosa: América del Sur, 2007 [WWW Document]. URL <https://iris.paho.org/handle/10665.2/50221> (accessed 9.2.21).
- SENACSA y FUNDASSA, 2017. Acuerdo marco de cooperacion entre el servicio nacional de calidad y salud animal (SENACSA) y la fundación de servicios de salud animal (Fundassa).
- Servicio Nacional de Calidad y Salud Animal, 2020. Programa Nacional de Erradicación de la Fiebre Aftosa. [WWW Document]. URL <https://www.senacsa.gov.py/index.php/Temas-pecuarios/sanidad-animal/programas-sanitarios/fiebre-aftosa> (accessed 9.8.21).

World Organisation for Animal Health, 2020. Official Disease Status. OIE - World Organisation for Animal Health. URL <https://www.oie.int/en/what-we-do/animal-health-and-welfare/official-disease-status/> (accessed 9.9.21).

World Organisation for Animal Health, O., 2014. Programa de Apoyo a la Legislación Veterinaria Informe de la Misión de Identificación. URL <https://www.oie.int/app/uploads/2021/03/finalreport-vlsp-identification-paraguay.pdf> (accessed 9.29.21).

Références citées dans le chapitre 3

- Ahuja, V., 2004. The economic rationale of public and private sector roles in the provision of animal health services. *Rev Sci Tech* 23, 33–45. <https://doi.org/10.20506/rst.23.1.1464>
- Allen, W., 2019. Planning, monitoring and evaluation - closing the loop. Learning for sustainability. URL <https://learningforsustainability.net/plan-monitor-evaluate/> (accessed 4.22.20).
- Allen, W., Grant, A., Earl, L., MacLellan, R., Waipara, N., Mark-Shadbolt, M., Ogilvie, S., (Lisa) Langer, E.R., Marzano, M., 2018. The use of rubrics to improve integration and engagement between biosecurity agencies and their key partners and stakeholders: a surveillance example, in: Urquhart, J., Marzano, M., Potter, C. (Eds.), *The Human Dimensions of Forest and Tree Health*. Springer International Publishing, Cham, pp. 269–298. https://doi.org/10.1007/978-3-319-76956-1_11
- Allen, W., Ogilvie, S., Blackie, H., Smith, D., Sam, S., Doherty, J., McKenzie, D., Ataria, J., Shapiro, L., MacKay, J., Murphy, E., Jacobson, C., Eason, C., 2014. Bridging disciplines, knowledge systems and cultures in pest management. *Environmental Management* 53, 429–440. <https://doi.org/10.1007/s00267-013-0180-z>
- Babiak, K., Thibault, L., 2009. Challenges in multiple cross-sector partnerships. *Nonprofit and Voluntary Sector Quarterly* 38, 117–143. <https://doi.org/10.1177/0899764008316054>
- Barr, D.A., 2007. A research protocol to evaluate the effectiveness of public–private partnerships as a means to improve health and welfare systems worldwide. *Am J Public Health* 97, 19–25. <https://doi.org/10.2105/AJPH.2005.075614>
- Barret, D., Blundo Canto, G., Dabat, M.-H., Devaux-Spatarakis, A., Faure, G., Hainzelin, E., Mathé, S., Temple, L., Toillier, A., Triomphe, B., 2018. *Impress methodological guide to ex post impact of agricultural research in developing countries*. Cirad. <https://doi.org/10.19182/agritrop/00006>
- BetterEvaluation, 2012. Participatory Evaluation. URL https://www.betterevaluation.org/en/plan/approach/participatory_evaluation (accessed 2.4.21).
- Bordier, M., Delavenne, C., Nguyen, D.T.T., Goutard, F.L., Hendrikx, P., 2019. One Health surveillance: a matrix to evaluate multisectoral collaboration. *Frontiers in Veterinary Science* 6. <https://doi.org/10.3389/fvets.2019.00109>
- Bryson, J.M., Crosby, B.C., Stone, M.M., 2015. Designing and implementing cross-sector collaborations: needed and challenging. *Public Adm Rev* 75, 647–663. <https://doi.org/10.1111/puar.12432>

- Calba, C., Antoine-Moussiaux, N., Charrier, F., Hendriks, P., Saegerman, C., Peyre, M., Goutard, F.L., 2015a. Applying participatory approaches in the evaluation of surveillance systems: a pilot study on African swine fever surveillance in Corsica. *Prev Vet Med* 122, 389–398. <https://doi.org/10.1016/j.prevetmed.2015.10.001>
- Calba, C., Goutard, F.L., Hoinville, L., Hendriks, P., Lindberg, A., Saegerman, C., Peyre, M., 2015b. Surveillance systems evaluation: a systematic review of the existing approaches. *BMC Public Health* 15. <https://doi.org/10.1186/s12889-015-1791-5>
- Calba, C., Goutard, F.L., Vanholme, L., Antoine-Moussiaux, N., Hendriks, P., Saegerman, C., 2016. The added-value of using participatory approaches to assess the acceptability of surveillance systems: the case of bovine tuberculosis in Belgium. *PLoS One* 11, e0159041. <https://doi.org/10.1371/journal.pone.0159041>
- Champagne, F., Contandriopoulos, A.-P., Brousselle, A., Hartz, Z., Denis, J.-L., 2011. L'évaluation dans la santé : concept et méthode, in: Les Presses de l'Université de Montréal. Montréal, pp. 35–56.
- Cooke, B., 2001. The social psychological limits of participation, in: *Participation: The New Tyranny?* Zed Books, London, pp. 102–121.
- Douthwaite, B., Kuby, T., van de Fliert, E., Schulz, S., 2003. Impact pathway evaluation: an approach for achieving and attributing impact in complex systems. *Agricultural Systems* 78, 243–265. [https://doi.org/10.1016/S0308-521X\(03\)00128-8](https://doi.org/10.1016/S0308-521X(03)00128-8)
- Fusch, P.I., Ness, L.R., 2015. Are we there yet? Data saturation in qualitative research, in: *The Qualitative Report*, NSU Library. Florida, pp. 1408–1416.
- Galière, M., Peyre, M., Muñoz, F., Poupaud, M., Dehove, A., Roger, F., Dieuzy-Labaye, I., 2019. Typological analysis of public-private partnerships in the veterinary domain. *PLoS ONE* 14, e0224079. <https://doi.org/10.1371/journal.pone.0224079>
- Hendriks, P., Gay, E., Chazel, M., Moutou, F., Danan, C., Richomme, C., Boue, F., Souillard, R., Gauchard, F., Dufour, B., 2011. OASIS: an assessment tool of epidemiological surveillance systems in animal health and food safety. *Epidemiology and Infection* 139, 1486–1496. <https://doi.org/10.1017/S0950268811000161>
- Koschmann, M.A., Kuhn, T.R., Pfarrer, M.D., 2012. A communicative framework of value in cross-sector partnerships. *Academy of Management Review* 37, 332–354. <https://doi.org/10.5465/amr.2010.0314>
- Maatala, N., Benabdellah, M., Lebailly, P., 2017. Les Partenariats Public-Privé : Fondement théorique et analyse économique. *Rev. Mar. Sci. Agron. Vét.* 192–199.
- Mansuri, G., 2004. Community-based and driven development: a critical review. *The World Bank Research Observer* 19, 1–39. <https://doi.org/10.1093/wbro/lkh012>

- National Academies of Sciences, 2016. The role of public-private partnerships in health systems strengthening: workshop summary. Washington, DC, p. 126. <https://doi.org/10.17226/21861>
- Neven, D., 2014. Developing sustainable food value chains. Guiding principles. Food and Agriculture Organization of the United Nations, Rome.
- Oakden, J., 2013. Evaluation Rubrics: how to ensure transparent and clear assessment that respects diverse lines of evidence. BetteEvaluation.
- Peyre, M., Hendriks, P., Thanh, H.P.T., Huu, D.D., Goutard, F., Desvaux, S., Roger, F., 2011. Evaluation of surveillance systems in animal health: the need to adapt the tools to the contexts of developing countries, results from a regional workshop in South East Asia. *Epidemiologie et santé animale*. URL <https://core.ac.uk/display/46677920>
- Peyre, M., Hoinville, L., Njoroge, J., Cameron, A., Traon, D., Goutard, F., Calba, C., Grosbois, V., Delabouglise, A., Varant, V., Drewe, J., Pfeiffer, D., Häsler, B., 2019. The RISKSUR EVA tool (Survtool): a tool for the integrated evaluation of animal health surveillance systems. *Prev Vet Med* 173, 104777. <https://doi.org/10.1016/j.prevetmed.2019.104777>
- Poupaud, M., Galière, M., Dieuzy-Labayé, I., Antoine-Moussiaux, N., Peyre, M., Under publication. Toward a framework for the evaluation of public-private partnerships in the veterinary domain: a scoping review. Under publication.
- Poupaud, M., N'Bocho Guessan, B., Dieuzy-Labayé, I., Peyre, M., 2019. Engaging the actors to ensure impacts of public-private partnerships. *OIE Bulletin*. URL <https://oiebulletin.com/?panorama=03-6-2019-3-impact-evaluation> (accessed 4.17.20).
- Reddy, Y.M., Andrade, H., 2010. A review of rubric use in higher education. *Assessment & Evaluation in Higher Education* 35, 435–448. <https://doi.org/10.1080/02602930902862859>
- Reinsberg, B., Stubbs, T., Kentikelenis, A., King, L., 2019. Bad governance: how privatization increases corruption in the developing world: How privatization increases corruption. *Regulation & Governance*. <https://doi.org/10.1111/rego.12265>

Références citées dans le chapitre 4

- Ahuja, V., 2004. The economic rationale of public and private sector roles in the provision of animal health services. *Rev Sci Tech* 23, 33–45. <https://doi.org/10.20506/rst.23.1.1464>
- Alders, R.G., Ali, S.N., Ameri, A.A., Bagnol, B., Cooper, T.L., Gozali, A., Hidayat, M.M., Rukambile, E., Wong, J.T., Catley, A., 2020. Participatory Epidemiology: Principles, Practice, Utility, and Lessons Learnt. *Frontiers in Veterinary Science* 7, 876. <https://doi.org/10.3389/fvets.2020.532763>
- Allen, W., 2019. Planning, monitoring and evaluation - closing the loop. Learning for sustainability. URL <https://learningforsustainability.net/plan-monitor-evaluate/> (accessed 4.22.20).
- Barlow, J., Roehrich, J., Wright, S., 2013. Europe sees mixed results from public-private partnerships for building and managing health care facilities and services. *Health Aff* 32, 146–154. <https://doi.org/10.1377/hlthaff.2011.1223>
- Barr, D.A., 2007. A research protocol to evaluate the effectiveness of public–private partnerships as a means to improve health and welfare systems worldwide. *Am J Public Health* 97, 19–25. <https://doi.org/10.2105/AJPH.2005.075614>
- Barret, D., Blundo Canto, G., Dabat, M.-H., Devaux-Spatarakis, A., Faure, G., Hainzelin, E., Mathé, S., Temple, L., Toillier, A., Triomphe, B., 2018. Impress methodological guide to ex post impact of agricultural research in developing countries. Cirad. <https://doi.org/10.19182/agritrop/00006>
- BetterEvaluation, 2012. Participatory Evaluation. URL https://www.betterevaluation.org/en/plan/approach/participatory_evaluation (accessed 2.4.21).
- Bryson, J.M., Crosby, B.C., Stone, M.M., 2015. Designing and implementing cross-sector collaborations: needed and challenging. *Public Adm Rev* 75, 647–663. <https://doi.org/10.1111/puar.12432>
- Bryson, J.M., Patton, M.Q., Bowman, R.A., 2011. Working with evaluation stakeholders: A rationale, step-wise approach and toolkit. *Evaluation and Program Planning* 34, 1–12. <https://doi.org/10.1016/j.evalprogplan.2010.07.001>
- Calba, C., Antoine-Moussiaux, N., Charrier, F., Hendriks, P., Saegerman, C., Peyre, M., Goutard, F.L., 2015. Applying participatory approaches in the evaluation of surveillance systems: a pilot study on African swine fever surveillance in Corsica. *Prev Vet Med* 122, 389–398. <https://doi.org/10.1016/j.prevetmed.2015.10.001>
- Campenhoudt, L. van, Marquet, J., Quivy, R., 2017. Analyse de contenu, in: *Manuel de Recherche En Sciences Sociales*. Dunod, Paris, p. p 298-304.

- Central Statistical Agency Of Federal Democratic Republic Of Ethiopia, 2021. Agricultural sample survey 2020/21 [2013 E.C.], volume II, report on livestock and livestock characteristics. URL https://www.statsethiopia.gov.et/wp-content/uploads/2021/05/REVISED_2013.LIVESTOCK-REPORT.FINAL-1.pdf (accessed 11.2.21).
- Central Statistical Agency Of Federal Democratic Republic Of Ethiopia, 2018. Agricultural sample survey 2017/18 [2013 E.C.], volume II, report on livestock and livestock characteristics. URL <https://www.statsethiopia.gov.et/wp-content/uploads/2020/02/Agricultural-Sample-Survey-Livestock-Poultry-and-Beehives.pdf> (accessed 11.2.21).
- Champagne, F., Contandriopoulos, A.-P., Brousselle, A., Hartz, Z., Denis, J.-L., 2011. L'évaluation dans la santé : concept et méthode, in: Les Presses de l'Université de Montréal. Montréal, pp. 35–56.
- Cooke, B., 2001. The social psychological limits of participation, in: Participation: The New Tyranny? Zed Books, London, pp. 102–121.
- de Janvry, A., Dustan, A., Sadoulet, E., 2010. Recent Advances in Impact Analysis Methods for Ex-post Impact Assessments of Agricultural Technology: Options for the CGIAR. University of California at Berkeley, USA.
- Delabougliše, A., Dao, T.H., Truong, D.B., Nguyen, T.T., Nguyen, N.T.X., Duboz, R., Fournié, G., Antoine-Moussiaux, N., Grosbois, V., Vu, D.T., Le, T.H., Nguyen, V.K., Salem, G., Peyre, M., 2015. When private actors matter: Information-sharing network and surveillance of Highly Pathogenic Avian Influenza in Vietnam. *Acta Trop* 147, 38–44. <https://doi.org/10.1016/j.actatropica.2015.03.025>
- Douthwaite, B., Kuby, T., van de Fliert, E., Schulz, S., 2003. Impact pathway evaluation: an approach for achieving and attributing impact in complex systems. *Agricultural Systems* 78, 243–265. [https://doi.org/10.1016/S0308-521X\(03\)00128-8](https://doi.org/10.1016/S0308-521X(03)00128-8)
- Dumont, B., Ryschawy, J., Duru, M., Benoit, M., Chatellier, V., Delaby, L., Donnars, C., Dupraz, P., Lemauiel-Lavenant, S., Méda, B., Vollet, D., Sabatier, R., 2019. Review: Associations among goods, impacts and ecosystem services provided by livestock farming. *Animal* 13, 1773–1784. <https://doi.org/10.1017/S1751731118002586>
- European Academies' Science Advisory Council, 2004. A users' guide to biodiversity indicators. URL https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2005/9667.pdf (accessed 3.30.21).
- Fusch, P.I., Ness, L.R., 2015. Are we there yet? Data saturation in qualitative research, in: The Qualitative Report, NSU Library. Florida, pp. 1408–1416.

- Galière, M., Peyre, M., Muñoz, F., Poupaud, M., Dehove, A., Roger, F., Dieuzy-Labaye, I., 2019. Typological analysis of public-private partnerships in the veterinary domain. *PLoS One* 14, e0224079. <https://doi.org/10.1371/journal.pone.0224079>
- Glenn, J.C., 2003. Participatory methods, in: *Futures Research Methodology Version 3.0, Futures Research Methodology*. Millenium Project, p. chapter 23.
- Hendriks, P., Gay, E., Chazel, M., Moutou, F., Danan, C., Richomme, C., Boue, F., Souillard, R., Gauchard, F., Dufour, B., 2011. OASIS: an assessment tool of epidemiological surveillance systems in animal health and food safety. *Epidemiology and Infection* 139, 1486–1496. <https://doi.org/10.1017/S0950268811000161>
- Jones, K.E., Patel, N.G., Levy, M.A., Storeygard, A., Balk, D., Gittleman, J.L., Daszak, P., 2008. Global trends in emerging infectious diseases. *Nature* 451, 990–993. <https://doi.org/10.1038/nature06536>
- Kamya, C., Shearer, J., Asiimwe, G., Carnahan, E., Salisbury, N., Waiswa, P., Brinkerhoff, J., Hozumi, D., 2016. Evaluating global health partnerships: a case study of a Gavi HPV vaccine application process in Uganda. *International Journal of Health Policy and Management* 6, 327–338. <https://doi.org/10.15171/ijhpm.2016.137>
- Mariner, J.C., Paskin, R., 2000. *Manual on participatory epidemiology: methods for the collection of action-oriented epidemiological intelligence*, FAO animal health manual. Food and Agriculture Organization of the United Nations, Rome.
- Ministry of Agriculture, Livestock Resources Development Sector, 2015. Ethiopia livestock master plan. Roadmaps for growth and transformation - a contribution to the Growth and Transformation Plan II (2015-2020) [WWW Document]. URL https://www.researchgate.net/publication/283781705_Ethiopia_livestock_master_plan_Roadmaps_for_growth_and_transformation (accessed 11.1.21).
- National Academies of Sciences, 2016. The role of public-private partnerships in health systems strengthening: workshop summary. Washington, DC, p. 126. <https://doi.org/10.17226/21861>
- Neven, D., 2014. *Developing sustainable food value chains. Guiding principles*. Food and Agriculture Organization of the United Nations, Rome.
- Poupaud, M., Galière, M., Dieuzy-Labaye, I., Antoine-Moussiaux, N., Peyre, M., Under publication. Toward a framework for the evaluation of public-private partnerships in the veterinary domain: a scoping review. Under publication.
- Rieker, P., 2011. *Partnership evaluation: guidebook and resources (Evaluation Technical Assistance Document)*. Centers for Disease Control and Prevention (CDCP), Division of Nutrition, Physical Activity, and Obesity.
- Rushton, J., 2007. *Animal health economics : where have we come from and where do we go next?* CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources 2. <https://doi.org/10.1079/pavsnr20072031>

- Sadler, G.R., Lee, H.-C., Lim, R.S.-H., Fullerton, J., 2010. Research Article: Recruitment of hard-to-reach population subgroups via adaptations of the snowball sampling strategy. *Nursing & Health Sciences* 12, 369–374. <https://doi.org/10.1111/j.1442-2018.2010.00541.x>
- Schmeer, K., 1999. Stakeholder analysis guidelines. Policy Toolkit for Strengthening Health Sector Reform 48. https://www.academia.edu/28157521/Stakeholder_Analysis_Guidelines
- Seré, C., van der Zijpp, A., Persley, G., Rege, E., 2008. Dynamics of livestock production systems, drivers of change and prospects for animal genetic resources. *AGRI* 42, 3–24. <https://doi.org/10.1017/S1014233900002510>
- Springer-Heinze, A., Hartwich, F., Henderson, J.S., Horton, D., Minde, I., 2003. Impact pathway analysis: an approach to strengthening the impact orientation of agricultural research. *Agricultural Systems, Learning for the future: Innovative approaches to evaluating agricultural research* 78, 267–285. [https://doi.org/10.1016/S0308-521X\(03\)00129-X](https://doi.org/10.1016/S0308-521X(03)00129-X)
- Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M., de Haan, C., 2006. Livestock's long shadow. Environmental issues and options. <http://www.fao.org/3/a0701e/a0701e00.htm>
- Taut, S., Brauns, D., 2003. Resistance to Evaluation: A Psychological Perspective. *Evaluation* 9, 247–264. <https://doi.org/10.1177/13563890030093002>
- The high level panel of experts on food security and nutrition, 2016. Sustainable agricultural development for food security and nutrition: what roles for livestock? 140. <https://www.unscn.org/uploads/web/news/HLPE-Report-10-EN.pdf>
- Tisdell, C., 2003. Socioeconomic causes of loss of animal genetic diversity: analysis and assessment. *Ecological Economics* 45, 365–376. [https://doi.org/10.1016/S0921-8009\(03\)00091-0](https://doi.org/10.1016/S0921-8009(03)00091-0)
- Trading Economics, 2019. Ethiopia Rural Population [WWW Document]. Trading economics. URL <https://tradingeconomics.com/ethiopia/population> (accessed 5.2.19).
- USDA Foreign agricultural service, 2017. Ethiopia's demand for chicken meat is expected to grow [WWW Document]. Global agricultural information network. URL <https://www.fas.usda.gov/data/ethiopia-ethiopias-demand-chicken-meat-expected-grow> (accessed 7.18.18).
- Vrangbæk, K., 2008. Public–private partnerships in the health sector: the Danish experience. *Health Economics, Policy and Law* 3, 141–163. <https://doi.org/10.1017/S1744133108004465>
- World Bank Institute, 2017. Public-private partnerships reference guide [WWW Document]. World Bank Group. URL <https://ppp.worldbank.org/public-private-partnership/library/ppp-reference-guide-3-0> (accessed 3.11.21).
- World Organisation for Animal Health, 2020. Public–private partnership and perspectives in the veterinary domain. *Bulletin de l'OIE* 2019, 1–2. <https://doi.org/10.20506/bull.2019.3.3037>

World Organisation for Animal Health, 2019. The OIE PPP Handbook: guidelines for public-private partnerships in the veterinary domain [WWW Document]. URL https://www.oie.int/publicprivatepartnerships/ppp/en/Handbook_en.html (accessed 3.11.20).

Références citées dans la discussion (dont annexes) et dans la partie « activités parallèles »

- Anderson, K., 2013. Hypocrites in the air: Should climate change academics lead by example? URL <https://kevinanderson.info/blog/hypocrites-in-the-air-should-climate-change-academics-lead-by-example/> (accessed 10.11.21).
- Barr, D.A., 2007. A research protocol to evaluate the effectiveness of public–private partnerships as a means to improve health and welfare systems worldwide. *Am J Public Health* 97, 19–25. <https://doi.org/10.2105/AJPH.2005.075614>
- Baru, R.V., Nundy, M., 2008. Blurring of boundaries: public-private partnerships in health services in India. *Econ Polit Wkly* 43, 62–71. <https://doi.org/10.2307/40277081>
- Bennett, B., Figuié, M., Vigne, M., Charles, C., Pamela, K., 2019. Beef value chain analysis in Zimbabwe. European Commission, Value Chain Analysis for development.
- Brousselle, A., Butzbach, C., 2018. Redesigning public health for planetary health. *The Lancet Planetary Health* 2, e188–e189. [https://doi.org/10.1016/S2542-5196\(18\)30054-8](https://doi.org/10.1016/S2542-5196(18)30054-8)
- Brousselle, A., Guerra, S.G., 2017. Public health for a sustainable future: the need for an engaged ecosocial approach. *Saúde em Debate* 41, 14–21. <https://doi.org/10.1590/0103-11042017s02>
- Buse, K., Harmer, A., 2004. Power to the Partners?: The politics of public-private health partnerships. *Development* 47, 49–56. <https://doi.org/10.1057/palgrave.development.1100029>
- Buse, K., Waxman, A., 2001. Public–private health partnerships: a strategy for World Health Organisation. *Bull World Health Organ* 79(8):748–54, 7. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2566497/pdf/11545332.pdf>
- Carbone4, 2019. Faire sa part ? Pouvoir et responsabilité des individus, des entreprises et de l'état face au réchauffement climatique,. URL <https://www.carbone4.com/wp-content/uploads/2019/06/Publication-Carbone-4-Faire-sa-part-pouvoir-responsabilite-climat.pdf> (accessed 10.10.21).
- Chambers, R., 1997. *Whose reality counts?: Putting the first last*. Intermediate Technology Publication, London.
- Chambers, R., Conway, G.R., 1991. Sustainable rural livelihoods: practical concepts of the 21st century. IDS Discussion Paper 296.
- Chassé, P., Cogos, S., Fouqueray, T., 2020. La thèse interdisciplinaire en sciences de l'environnement, des défis à relever et des opportunités à saisir : regards de doctorants. *Nat. Sci. Soc.* 28, 159–168. <https://doi.org/10.1051/nss/2020037>
- Chilonda, P., Van Huylenbroeck, G., 2001. A conceptual framework for the economic analysis of factors influencing decision-making of small-scale farmers in animal health management.

- Revue scientifique et technique (International Office of Epizootics) 20, 687–700.
<https://doi.org/10.20506/rst.20.3.1302>
- Clark, W.C., 2007. Sustainability Science: A room of its own. PNAS 104, 1737–1738.
<https://doi.org/10.1073/pnas.0611291104>
- Cleaver, F., 2001. Institutions, agency and the limitations of participatory approaches to development. *Participation: the new tyranny?* 36–55.
- d’Aquino, P., 2002. Le territoire entre espace et pouvoir : pour une planification territoriale ascendante. *Espace géographique* 31, 3. <https://doi.org/10.3917/eg.311.0003>
- Dick, M., Abreu da Silva, M., Dewes, H., 2015. Life cycle assessment of beef cattle production in two typical grassland systems of southern Brazil. *Journal of Cleaner Production* 96, 426–434. <https://doi.org/10.1016/j.jclepro.2014.01.080>
- DiFUSE, 2021. DIFUSE: La compréhension de la diversité des points de vue dans la recherche pour le développement comme levier d’action pour le changement face aux Urgences Socio-Ecologiques [WWW Document]. URL <https://www.mshsud.org/recherche/equipes-projets-msh-sud/239-difuse> (accessed 11.28.21).
- Fauster, O., 2019. Master thesis from the module Project Management: “Participatory Development: Putting the First First and the Last Last?” King’s Department of International Development, United Kingdom.
- Flyvbjerg, B., 2006. Five misunderstandings about case-study research. *Qualitative Inquiry* 12, 219–245. <https://doi.org/10.1177/1077800405284363>
- Fusch, P.I., Ness, L.R., 2015. Are we there yet? Data saturation in qualitative research, in: *The Qualitative Report*, NSU Library. Florida, pp. 1408–1416.
- Galière, M., Peyre, M., Muñoz, F., Poupaud, M., Dehove, A., Roger, F., Dieuzy-Labaye, I., 2019. Typological analysis of public-private partnerships in the veterinary domain. *PLoS One* 14, e0224079. <https://doi.org/10.1371/journal.pone.0224079>
- Guilbaud, A., 2015. Les partenariats public-privé sanitaires internationaux : diffusion et incarnation d’une norme de coopération, in: De Boeck Supérieur (Ed.), *Mondes En Développement*. pp. 91–104. <https://doi.org/10.3917/med.170.0091>
- Hildyard, N., Hegde, P., Wolvekamp, P., Reddy, S., 2001. Pluralism, participation and power: joint forest management in India. *Participation* 56–71.
- IPCC, 2018. IPCC Special Report on the Impacts of Global Warming of 1.5 °C above Pre-industrial Levels and Related Global Greenhouse Gas Emission Pathways in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty. URL <https://www.ipcc.ch/sr15/> (accessed 11.26.21).
- IPCC, 2006. Guidelines for National Greenhouse Gas Inventories. URL <https://www.ipcc.ch/report/2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/> (accessed 12.9.21).

- Kivits, J., Fournier, C., Mino, J.-C., Frattini, M.-O., Winance, M., Lefève, C., Robelet, M., 2013. Benchmarks for interdisciplinary health and social sciences research: contributions of a research seminar. *Sante Publique* 25, 579–586.
- Kohn, L., Christiaens, W., 2014. Les méthodes de recherches qualitatives dans la recherche en soins de santé : apports et croyances. *Reflète et perspectives de la vie économique* 67–82.
- Labos 1point5, 2019. Labos 1.5 est une initiative nationale portée par un collectif académique pluridisciplinaire qui cherche à mieux comprendre et réduire l'impact environnemental des activités de recherche. URL <https://labos1point5.org/> (accessed 11.25.21).
- Larrouqué, D., Mereles Pintos, R., Tamayo Belda, E., 2020. Les organisations paysannes au Paraguay: Acteurs oubliés de la transition démocratique (1989-2019). *Revue internationale des études du développement* N°244, 97. <https://doi.org/10.3917/ried.244.0097>
- Maatala, N., Benabdellah, M., Lebailly, P., 2017. Les partenariats public-privé: fondement théorique et analyse économique 8.
- Mariner, J.C., Paskin, R., 2000. Manual on participatory epidemiology: methods for the collection of action-oriented epidemiological intelligence, FAO animal health manual. Food and Agriculture Organization of the United Nations, Rome.
- Mathevet, R., Bousquet, F., 2014. Résilience et environnement : penser les changements socio-écologiques. Buchet.Chastel, Paris.
- Miyamae, M.R.M., 2003. Corruption in paraguay. *Revue internationale de droit penal* 74, 527–533.
- OIE, 2009. OIE PVS FinalReport Paraguay (not publicly available).
- Organisation Mondiale de la Santé Animale, 2021. Rôle des Services vétérinaires. URL <https://www.oie.int/fr/ce-que-nous-faisons/initiatives-mondiales/securite-sanitaire-des-aliments/role-des-services-veterinaires/> (accessed 12.5.21).
- Papazian, H., Queste, J., Bommel, P., Bousquet, F., 2017. Chapitre 31 - Le chercheur et le territoire : accompagner la complexité. Éditions Quæ.
- Rigon, A., 2014. Building Local Governance: Participation and Elite Capture in Slum-upgrading in Kenya. *Development and Change* 45, 257–283. <https://doi.org/10.1111/dech.12078>
- Rüegg, S.R., McMahon, B.J., Häsler, B., Esposito, R., Nielsen, L.R., Ifejika Speranza, C., Ehlinger, T., Peyre, M., Aragrande, M., Zinsstag, J., Davies, P., Mihalca, A.D., Buttigieg, S.C., Rushton, J., Carmo, L.P., De Meneghi, D., Canali, M., Filippitzi, M.E., Goutard, F.L., Ilieski, V., Milićević, D., O'Shea, H., Radeski, M., Kock, R., Staines, A., Lindberg, A., 2017. A Blueprint to Evaluate One Health. *Front. Public Health* 5. <https://doi.org/10.3389/fpubh.2017.00020>
- Scerri, E.M.L., Kühnert, D., Blinkhorn, J., Groucutt, H.S., Roberts, P., Nicoll, K., Zerboni, A., Orijemie, E.A., Barton, H., Candy, I., Goldstein, S.T., Hawks, J., Niang, K., N'Dah, D., Petraglia, M.D., Vella, N.C., 2020. Field-based sciences must transform in response to COVID-19. *Nat Ecol Evol* 4, 1571–1574. <https://doi.org/10.1038/s41559-020-01317-8>

-
- Sidikou, D.I., Irabor, T.-J., Bonfoh, B., Binot, A., Faulx, D., Vandenberg, O., Leyens, S., Antoine-Moussiaux, N., 2021. Teaching and learning for change: analysis of a post-graduate One Health program. *Sustain Sci.* <https://doi.org/10.1007/s11625-021-01053-3>
- The high level panel of experts on food security and nutrition, 2016. Sustainable agricultural development for food security and nutrition: what roles for livestock? 140. <https://www.unscn.org/uploads/web/news/HLPE-Report-10-EN.pdf>
- United Nations Development Programme, 2015. Application of the Sustainable Livelihoods Framework in Development Projects.
- Verdier, V., Dangles, O., Charvis, P., Cury, P., 2020. Et si on cherchait autrement ? Plaidoyer pour une science de la durabilité. *The Conversation*.
- World Bank Institute, 2017. Public-private partnerships reference guide [WWW Document]. World Bank Group. URL <https://ppp.worldbank.org/public-private-partnership/library/ppp-reference-guide-3-0> (accessed 3.11.21).
- World Organisation for Animal Health, 2019. The OIE PPP Handbook: guidelines for public-private partnerships in the veterinary domain [WWW Document]. URL https://www.oie.int/publicprivatepartnerships/ppp/en/Handbook_en.html (accessed 3.11.20).

Annexes

Annexes du chapitre 1

Appendix 1. Protocol of the review process

a. Search of Online Databases

- Choosing keywords for search strings
- Search using three databases: Medline via PubMed, Cab Abstract via Ebsco, and Embase
- Include also the database of the World Organisation for Animal Health

b. Steps to review

- Use equation request for searches in PubMed, CAB Abstract, and Embase
- Import references into reference manager
- Delete duplicates
- Screen articles based on title and abstracts according to inclusion/exclusion criteria
- Remove excluded articles
- Retrieve full papers of “included articles”
- Documents are then assessed based on the full text by researchers according to inclusion/exclusion criteria
- Data extraction using template

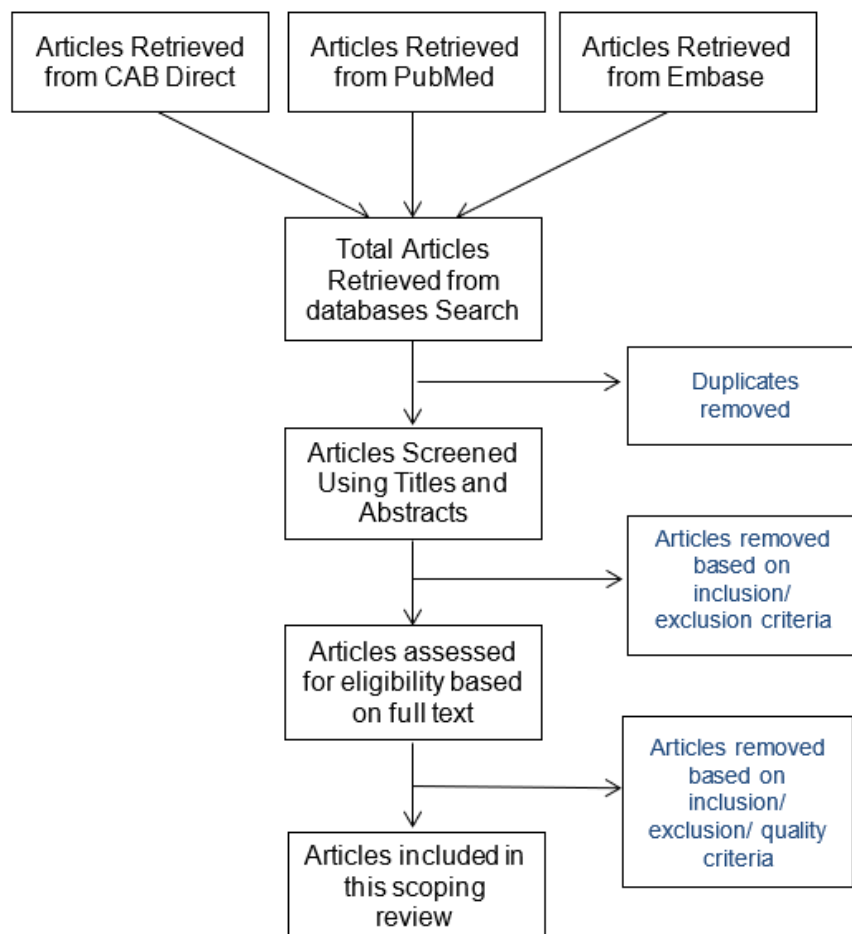


Figure 1 of Appendix 1. Flow diagram representing the different steps for the identification of relevant studies

c. Concepts used in the search equation

Three concepts should be mobilized:

1. Public-private partnership
2. Veterinary domain (restricted to services or product delivery for surveillance, prevention, or control of zoonotic or animal contagious diseases)
3. Public health (restricted to services or product delivery for surveillance, prevention, or control of zoonotic or human contagious diseases).

Data base	1. Public-Private Partnerships
PubMed (thesaurus based on MeSH® terms)	"Public-Private Sector Partnerships"[Mesh]
CAB abstract (free language)	"Partnership, Public-Private Sector" OR "Partnerships, Public-Private Sector" OR "Public Private Sector Partnerships" OR "Public-Private Sector Partnership" OR "Public Private Sector Partnership" OR "Partnership, Public Private" OR "Partnerships, Public Private" OR "Private Partnership, Public" OR "Private Partnerships, Public" OR "Public Private Partnerships" OR "Public-Private Partnership" OR "Partnership, Public-Private" OR "Partnerships, Public-Private" OR "Public-Private Sector Cooperation" OR "Cooperation, Public-Private Sector" OR "Public Private Sector Cooperation" OR "Public-Private Sector Cooperations" OR "Public-Private Cooperation" OR "Cooperation, Public-Private" OR "Public Private Cooperation" OR "Public-Private Cooperations"
Embase (thesaurus based on Emtree® term)	'public-private partnership'/exp
Data base	2. Public Health (services or product delivery for surveillance, prevention, or control of zoonotic or human contagious diseases)
PubMed (thesaurus based on MeSH® terms)	Zoonoses[Mesh] OR "Epidemiology"[Mesh] OR "Preventive Medicine"[Mesh] OR "Disease Eradication"[Mesh] OR "Disease Transmission, Infectious"[Mesh] OR "Endemic Diseases"[Mesh] OR "Communicable Disease Control"[Mesh] OR "Population Surveillance "[Mesh] OR "Primary Prevention"[Mesh] OR "Secondary Prevention"[Mesh]
CAB abstract (free language)	"public health" OR "community health" OR "community health program" OR "community health programme" OR "health, public" OR "international health" OR "national health" OR "national health programmes" OR "national health programs" OR "national health project" OR "Health, Community" OR "Epidemiology" OR "Social Epidemiology" OR "Epidemiologies, Social" OR "Epidemiology, Social" OR "Social Epidemiologies" OR "Preventative Medicine" OR "Medicine, Preventative" OR "Medicine, Preventive" OR "Preventive Care" OR "Care, Preventive" OR "Preventative Care" OR "Care, Preventative" OR "communicable disease control" OR "disease elimination" OR "disease re-emergence" OR "mandatory testing" OR "mass immunization" OR "Disease Eradications" OR "Eradication, Disease" OR "Eradications, Disease" OR "Disease Eliminations" OR "Elimination, Disease" OR "Eliminations, Disease" OR "infectious disease medicine" OR "Disease Transmission, Infectious" OR "Pathogen Transmission" OR "Transmission, Pathogen" OR "Transmission, Infectious Disease" OR "Infectious Disease Transmission" OR "Communicable Disease Transmission" OR "Disease Transmission, Communicable" OR "Transmission, Communicable Disease" OR "Infection Transmission" OR "Transmission, Infection" OR "Transmission of Infectious Disease" OR "Infectious

	Disease Transmission, Horizontal” OR “Horizontal Transmission of Infectious Disease” OR “Pathogen Transmission, Horizontal” OR “Horizontal Transmission of Infection” OR “Infection Horizontal Transmission” OR “Infection Transmission, Horizontal” OR “Community Transmission” OR “Community Transmissions” OR “Transmissions, Community” OR “Community Spread” OR “Person-to-Person Transmission” OR “Person to Person Transmission” OR “Transmission, Person-to-Person” OR “Droplet Transmission of Infectious Disease” OR “Droplet Transmission, Infectious Disease” OR “Infectious Disease Droplet Transmission” OR “Autochthonous Transmission” OR “Autochthonous Transmissions” OR “Transmission, Autochthonous” OR “Transmissions, Autochthonous” OR “Close-Contact Transmission” OR “Close Contact Transmission” OR “Close-Contact Transmissions” OR “Transmission, Close-Contact” OR “Close-Contact Infectious Disease Transmission” OR “Close Contact Infectious Disease Transmission” OR “Endemic Diseases” OR “Disease, Endemic” OR “Diseases, Endemic” OR “Endemic Disease” OR “” OR “Public Health Practice[Mesh]” OR “Communicable Disease Control, Population Surveillance, Primary Prevention, Secondary Prevention, “ OR “Health Practice, Public” OR “Health Practices, Public” OR “Practice, Public Health” OR “Practices, Public Health” OR “Public Health Practices” OR “Mass drug administration” OR “” OR “Zoonosis” OR “Zoonoses” OR “Zoonotic Infectious Diseases” OR “Disease, Zoonotic Infectious” OR “Diseases, Zoonotic Infectious” OR “Infectious Disease, Zoonotic” OR “Infectious Diseases, Zoonotic” OR “Zoonotic Infectious Disease” OR “Zoonotic Infections” OR “Infection, Zoonotic” OR “Infections, Zoonotic” OR “Zoonotic Infection” OR “Zoonotic Spillover” OR “Spillovers, Zoonotic” OR “Zoonotic Spillovers” OR “Zoonotic Diseases” OR “Disease, Zoonotic” OR “Diseases, Zoonotic” OR “Zoonotic Disease”
Embase (thesaurus based on Emtree® term)	'public health'/exp OR 'epidemiology'/exp OR 'preventive medicine'/exp OR 'disease control'/exp OR 'infectious disease medicine'/exp OR 'primary prevention'/exp OR 'secondary prevention'/exp OR 'mass drug administration'/exp OR 'zoonosis'/exp
Data base	3. Veterinary domain (services or product delivery for surveillance, prevention, or control of zoonotic or animal contagious diseases)
PubMed (thesaurus based on MeSH® terms)	"veterinary" [Subheading] OR "Animal Diseases"[Mesh] OR "Pets"[Mesh]OR "Animals, Wild"[Mesh] OR "Veterinarians"[Mesh]
CAB abstract (free language)	“Veterinary Practice Management” OR “Practice Management Services, Veterinary” OR “Practice Management, Veterinary” OR “Practice Management Services, Veterinary” OR “animal care hospital” OR “animal hospital” OR “hospitals, animal” OR “military veterinary service” OR “veterinarian clinic” OR “veterinarian hospital” OR “veterinary care clinic” OR “veterinary care hospital” OR “veterinary hospital” OR “veterinary practice” OR “veterinary service” OR “veterinary service, military” OR “veterinary medicine” OR “Medicine, Veterinary” OR “legislation, veterinary” OR “Veterinary Legislation” OR “Legislations, Veterinary” OR “Veterinary Legislations” OR “Societies, Veterinary” OR “Veterinary Society” OR “Society, Veterinary” OR “Veterinary Societies” OR “Veterinary Hospital Societies” OR “Hospital Societies, Veterinary” OR “Hospital Society, Veterinary” OR “Societies, Veterinary Hospital” OR “Society, Veterinary Hospital” OR “Veterinary Hospital Society” OR “Veterinarian” OR “veterinarians” OR “animal disease” OR “Animal Diseases” OR “Diseases, Animal”
Embase (thesaurus based on Emtree® term)	'veterinary clinic' OR 'veterinary medicine' OR 'legislation, veterinary' OR 'veterinarian' OR 'animal disease'

d. Search equations for the different databases

Database	Search equation syntax
PubMed	((("Zoonoses"[Mesh] OR "Epidemiology"[Mesh] OR "Preventive Medicine"[Mesh] OR "Disease Eradication"[Mesh] OR "Disease Transmission, Infectious"[Mesh] OR "Endemic Diseases"[Mesh] OR "Communicable Disease Control"[Mesh] OR "Population Surveillance "[Mesh] OR "Primary Prevention"[Mesh] OR "Secondary Prevention"[Mesh]) OR ("veterinary" [Subheading] OR "Animal Diseases"[Mesh] OR "Veterinarians"[Mesh])) AND "Public-Private Sector Partnerships"[Mesh])
CAB abstracts	(("public health" OR "community health" OR "community health program" OR "community health programme" OR "health, public" OR "international health" OR "national health" OR "national health programmes" OR "national health programs" OR "national health project" OR "Health, Community" OR "Epidemiology" OR "Social Epidemiology" OR "Epidemiologies, Social" OR "Epidemiology, Social" OR "Social Epidemiologies" OR "Preventative Medicine" OR "Medicine, Preventative" OR "Medicine, Preventive" OR "Preventive Care" OR "Care, Preventive" OR "Preventative Care" OR "Care, Preventative" OR "communicable disease control" OR "disease elimination" OR "disease re-emergence" OR "mandatory testing" OR "mass immunization" OR "Disease Eradications" OR "Eradication, Disease" OR "Eradications, Disease" OR "Disease Eliminations" OR "Elimination, Disease" OR "Eliminations, Disease" OR "infectious disease medicine" OR ""Disease Transmission, Infectious" OR "Pathogen Transmission" OR "Transmission, Pathogen" OR "Transmission, Infectious Disease" OR "Infectious Disease Transmission" OR "Communicable Disease Transmission" OR "Disease Transmission, Communicable" OR "Transmission, Communicable Disease" OR "Infection Transmission" OR "Transmission, Infection" OR "Transmission of Infectious Disease" OR "Infectious Disease Transmission, Horizontal" OR "Horizontal Transmission of Infectious Disease" OR "Pathogen Transmission, Horizontal" OR "Horizontal Transmission of Infection" OR "Infection Horizontal Transmission" OR "Infection Transmission, Horizontal" OR "Community Transmission" OR "Community Transmissions" OR "Transmissions, Community" OR "Community Spread" OR "Person-to-Person Transmission" OR "Person to Person Transmission" OR "Transmission, Person-to-Person" OR "Droplet Transmission of Infectious Disease" OR "Droplet Transmission, Infectious Disease" OR "Infectious Disease Droplet Transmission" OR "Autochthonous Transmission" OR "Autochthonous Transmissions" OR "Transmission, Autochthonous" OR "Transmissions, Autochthonous" OR "Close-Contact Transmission" OR "Close Contact Transmission" OR "Close-Contact Transmissions" OR "Transmission, Close-Contact" OR "Close-Contact Infectious Disease Transmission" OR "Close Contact Infectious Disease Transmission" OR "Endemic Diseases" OR "Disease, Endemic" OR "Diseases, Endemic" OR "Endemic Disease" OR "" OR "Public Health Practice[Mesh]" OR "Communicable Disease Control, Population Surveillance, Primary Prevention, Secondary Prevention, " OR "Health Practice, Public" OR "Health Practices, Public" OR "Practice, Public Health" OR "Practices, Public Health" OR "Public Health Practices" OR "Mass drug administration" OR "" OR "Zoonosis" OR "Zoonoses" OR "Zoonotic Infectious Diseases" OR "Disease, Zoonotic Infectious" OR "Diseases, Zoonotic Infectious" OR "Infectious Disease, Zoonotic" OR "Infectious Diseases, Zoonotic" OR "Zoonotic Infectious Disease" OR "Zoonotic Infections" OR "Infection, Zoonotic" OR "Infections, Zoonotic" OR "Zoonotic Infection" OR "Zoonotic Spillover" OR "Spillovers, Zoonotic" OR "Zoonotic Spillovers" OR "Zoonotic Diseases" OR "Disease, Zoonotic" OR "Diseases, Zoonotic" OR "Zoonotic Disease"))

OR ((“Veterinary Practice Management” OR “Practice Management Services, Veterinary” OR “Practice Management, Veterinary” OR “Practice Management Services, Veterinary” OR “animal care hospital” OR “animal hospital” OR “hospitals, animal” OR “military veterinary service” OR “veterinarian clinic” OR “veterinarian hospital” OR “veterinary care clinic” OR “veterinary care hospital” OR “veterinary hospital” OR “veterinary practice” OR “veterinary service” OR “veterinary service, military” OR “veterinary medicine” OR “Medicine, Veterinary” OR “legislation, veterinary” OR “Veterinary Legislation” OR “Legislations, Veterinary” OR “Veterinary Legislations” OR “Societies, Veterinary” OR “Veterinary Society” OR “Society, Veterinary” OR “Veterinary Societies” OR “Veterinary Hospital Societies” OR “Hospital Societies, Veterinary” OR “Hospital Society, Veterinary” OR “Societies, Veterinary Hospital” OR “Society, Veterinary Hospital” OR “Veterinary Hospital Society” OR “Veterinarian” OR “veterinarians” OR “animal disease” OR “Animal Diseases” OR “Diseases, Animal”)) AND ((“Partnership, Public-Private Sector” OR “Partnerships, Public-Private Sector” OR “Public Private Sector Partnerships” OR “Public-Private Sector Partnership” OR “Public Private Sector Partnership” OR “Public-Private Partnerships” OR “Public Private Partnership” OR “Partnership, Public Private” OR “Partnerships, Public Private” OR “Private Partnership, Public” OR “Private Partnerships, Public” OR “Public Private Partnerships” OR “Public-Private Partnership” OR “Partnership, Public-Private” OR “Partnerships, Public-Private” OR “Public-Private Sector Cooperation” OR “Cooperation, Public-Private Sector” OR “Public Private Sector Cooperation” OR “Public-Private Sector Cooperations” OR “Public-Private Cooperation” OR “Cooperation, Public-Private” OR “Public Private Cooperation” OR “Public-Private Cooperations”))

Embase ('public health'/exp OR 'epidemiology'/exp OR 'preventive medicine'/exp OR 'disease control'/exp OR 'infectious disease medicine'/exp OR 'primary prevention'/exp OR 'secondary prevention'/exp OR 'mass drug administration'/exp OR 'zoonosis'/exp OR 'veterinary clinic' OR 'veterinary medicine' OR 'legislation, veterinary' OR 'veterinarian' OR 'animal disease') AND 'public-private partnership'/mj

e. The two databases used to classify and analyze the documents in this scoping review.

Documents were classified as evaluation if they were presenting methodologies for setting and designing the evaluation, analyzing the data, and/or presenting the results of the evaluation (Brousselle and Champagne, 2011). The categories used in each database emerged as an iterative process during the reading of the full text of documents. Once the categories had been determined, the documents were read once more to classify the corresponding criteria of each document into categories.

Databases	Categories
First database for documents describing PPP evaluations	<ul style="list-style-type: none"> -goal of evaluation -methodology for data collection -type of data analysis -challenges and recommendations of evaluation -type of evaluation: <ul style="list-style-type: none"> evaluation of the context evaluation of the process evaluation of the outcomes evaluation of the cost

	-evaluation criteria used
Second database for documents presenting important criteria to consider in the evaluation process	-obstacles -key success factors -positive outcomes (benefits) -negative outcomes (drawbacks) -impacts

f. Definitions of the concepts used in this study.

-Key success factors are defined as criteria of the context or the process that favour the achievement of PPP objectives.

-Obstacles are criteria that limit the implementation and success of the PPP. Internal obstacles are linked to the collaboration process, planning or governance process of the PPP. External obstacles are linked to the context of implementation or to the evaluation.

-Outcomes are the results of an intervention (BetterEvaluation, 2015); the *benefits* of PPPs are the positive outcomes of PPPs, and the *drawbacks* are the negative outcomes of PPPs.

Appendix 2. List of references of the 37 documents selected for this study and presented in the results

A. Documents describing PPP evaluation (n=18)

• Public Health (n=14)

1. Bakibinga, P. et al. The effect of enhanced public-private partnerships on maternal, newborn and child health services and outcomes in Nairobi-Kenya: the PAMANECH quasi-experimental research protocol. *BMJ Open* 4, (2014).
2. Baku, R. V. & Madhurima Nundy. Blurring of boundaries: public-private partnerships in health services in India. *Econ Polit Wkly* 43, 62–71 (2008).
3. Biermann, O., Eckhardt, M., Carlford, S., Falk, M. & Forsberg, B. C. Collaboration between non-governmental organizations and public services in health - a qualitative case study from rural Ecuador. *Glob Health Action* 9, 32237 (2016).
4. Gharaee, H. et al. Analysis of Public-Private Partnership in Providing Primary Health Care Policy: An Experience From Iran. *J Prim Care Community Health* 10, 215013271988150 (2019).
5. Kaboru, B. B. Uncovering the potential of private providers' involvement in health to strengthen comprehensive health systems: A discussion paper. *Perspect. Public Health* 132, 245–252 (2012).
6. Kempe, A. et al. Effectiveness of primary care-public health collaborations in the delivery of influenza vaccine: A cluster-randomized pragmatic trial. *Prev. Med.* 69, 110–116 (2014).
7. Konduri, N., Delmotte, E. & Rutta, E. Engagement of the private pharmaceutical sector for TB control: Rhetoric or reality? *J. pharm. policy pract.* 10, (2017).
8. Kulshrestha, N. et al. Public-private mix for TB care in India: Concept, evolution, progress. *Indian J Tuberc* 62, 235–238 (2015).
9. Laktabai, J. et al. Innovative public-private partnership to target subsidised antimalarials: a study protocol for a cluster randomised controlled trial to evaluate a community intervention in Western Kenya. *BMJ Open* 7, (2017).
10. Nishtar, S. Public – private 'partnerships' in health – a global call to action. *Health Res Policy Syst* 2, (2004).
11. Prashanth, N. S. Public-private partnerships and health policies. *Econ Polit Wkly* 46, 13–15 (2011).
12. Roehrich, J. K., Lewis, M. A. & George, G. Are public-private partnerships a healthy option? A systematic literature review. *Social Science & Medicine* (1982) 113, 110–119 (2014).
13. Widdus, R. Public-private partnerships for health: their main targets, their diversity, and their future directions. *Bull World Health Organ* 79, 713–720 (2001).
14. Widdus, R. Public-private partnerships: an overview. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 99, 1–8 (2005).

- **Veterinary domain (n=4)**

1. Dione, M. M. et al. Integrated approach to facilitate stakeholder participation in the control of endemic diseases of livestock: the case of peste des petits ruminants in Mali. *Front Vet Sci* 6, (2019).
2. Hamill, L. et al. Evaluating the impact of targeting livestock for the prevention of human and animal trypanosomiasis, at village level, in districts newly affected with *T. b. rhodesiense* in Uganda. *Infectious Diseases of Poverty* 6, 16 (2017).
3. Maiti, S., Jha, S. K. & Garai, S. Performance of public-private-partnership model of veterinary services in West Bengal. *Indian Res. J. Ext. Edu* 11, 1–5 (2011).
4. The OIE data base describing 97 PPP case studies in the veterinary domain, retrieved in the context of the collaborative work undertaken between OIE and Cirad on PPP in the veterinary domain between 2017 and 2019. The methodology for collecting information in this OIE database is described elsewhere (Galière et al., 2019a)

B. Documents mentioning relevant criteria for evaluation (excluding the ones also describing evaluation), n=20

- **Public health, n=9**

1. Albis, M. L. F., Bhadra, S. K. & Chin, B. Impact evaluation of contracting primary health care services in urban Bangladesh. *BMC Health Serv Res* 19, 854 (2019).
2. Alonazi, W. B. Exploring shared risks through public-private partnerships in public health programs: a mixed method. *BMC Public Health* 17, (2017).
3. Baig, M. B., Bhuputra Panda, Das, J. K. & Chauhan, A. S. Is public private partnership an effective alternative to government in the provision of primary health care? A case study in Odisha. *J Health Manag* 16, 41–52 (2014).
4. Barr, D. A. A research protocol to evaluate the effectiveness of public-private partnerships as a means to improve health and welfare systems worldwide. *Am J Public Health* 97, 19–25 (2007).
5. Hellowell, M. Are public-private partnerships the future of healthcare delivery in sub-Saharan Africa? Lessons from Lesotho. *BMJ Global Health* 4, e001217 (2019).
6. Lei, X. et al. Public-private mix for tuberculosis care and control: A systematic review. *Int. J. Infect. Dis.* 34, 20–32 (2015).
7. Salve, S., Harris, K., Sheikh, K. & Porter, J. D. H. Understanding the complex relationships among actors involved in the implementation of public-private mix (PPM) for TB control in India, using social theory. *Int J Equity Health* 17, 73 (2018).
8. Sutton, B. S. Evaluation of the public-private mix: how economics can contribute to tuberculosis control. *Expert Rev Anti Infect Ther* 8, 489–491 (2010).
9. Vrangbæk K 2008. Public-private partnerships in the health sector: the Danish experience. *Health Economics, Policy and Law* 3, 141–163.

- **Veterinary domain, n=11**

1. Ahuja, V. The economic rationale of public and private sector roles in the provision of animal health services. *Rev Sci Tech* 23, 33–45 (2004).
2. Asseldonk, M. A. P. M. van & Bergevoet, R. H. M. Cost and responsibility sharing arrangements in the EU to prevent and control notifiable veterinary and phytosanitary risks. *CAB Reviews* 9, 1–10 (2014).
3. Bardosh, K. L. Deadly flies, poor profits, and veterinary pharmaceuticals: sustaining the control of sleeping sickness in Uganda. *Med Anthropol* 35, 338–352 (2016).
4. Bennett, R. Economic rationale for interventions to control livestock disease. *Eurochoices* 11, 5–11 (2012).
5. Black, P. F. Good governance of animal health systems and public-private partnerships: an Australian case study. *Rev Sci Tech* 31, 699–708 (2012).
6. Donado-Godoy, P. et al. The establishment of the Colombian Integrated Program for Antimicrobial Resistance Surveillance (COIPARS): a pilot project on poultry farms, slaughterhouses and retail market. *Zoonoses and Public Health* 62, 58–69 (2015).
7. Galière, M. et al. Typological analysis of public-private partnerships in the veterinary domain. *PLoS ONE* 14, e0224079 (2019).
8. Lubroth, J. et al. Veterinary vaccines and their use in developing countries. *Rev Sci Tech* 26, 179–201 (2007).
9. The OIE database describing 97 PPP case studies in the veterinary domain, retrieved in the context of the collaborative work undertaken between OIE and Cirad on PPP in the veterinary domain between 2017 and 2019. The methodology for collecting information in this OIE database is described elsewhere (Galière et al., 2019a)
10. Voss, S. J. et al. Incorporating risk communication into highly pathogenic avian influenza preparedness and response efforts. *Avian Diseases* 56, 1049–1053 (2012).
11. Waiswa, C. & Wangoola, M. R. Sustaining Efforts of Controlling Zoonotic Sleeping Sickness in Uganda Using Trypanocidal Treatment and Spray of Cattle with Deltamethrin. *Vector Borne Zoonotic Dis.* 19, 613–618 (2019).

Appendix 3. Objectives of the PPPs described in the documents analyzed in this scoping review in the public health (n=23) and livestock health (n=14). The list of references of the 37 documents selected for this study is provided in Supplementary file S2.

*Some documents present one PPP with multiple objectives or present multiple PPPs.

Main objective of the PPP	Documents from public health (n=23)*	Documents from livestock health (n=14)*
Livestock or zoonotic or human infectious diseases control (vaccination, eradication program)	7 (Widdus, 2005; Sutton, 2010; Kaboru, 2012; Lei et al., 2015; Kulshrestha et al., 2015; Konduri et al., 2017; Salve et al., 2018)	6 (Lubroth et al., 2007b; Bennett, 2012; Voss et al., 2012; Black, 2012; Waiswa and Wangoola, 2019; Galière et al., 2019; Dione et al., 2019) + OIE db (49/97 CS)
Livestock or zoonotic or human infectious diseases surveillance (including antimicrobial resistance)	2 (Sutton, 2010; Lei et al., 2015)	6 (Voss et al., 2012; Black, 2012; Asseldonk and Bergevoet, 2014; Donado-Godoy et al., 2015; Galière et al., 2019) + OIE db (30/97 CS)
Better veterinary or health services delivery (for any type of mission)	17 (Widdus, 2001, 2005; Nishtar, 2004; Barr, 2007; Baku and Madhurima Nundy, 2008; Vrangbæk, 2008; Prashanth, 2011; Kaboru, 2012; Baig et al., 2014; Bakibinga et al., 2014; Roehrich et al., 2014; Biermann et al., 2016; Alonazi, 2017; Salve et al., 2018; Hellowell, 2019; Gharaee et al., 2019; Albis et al., 2019)	5 (Ahuja, 2004; Maiti et al., 2011; Bardosh, 2016; Galière et al., 2019) + OIE db (37/97 CS)
Better veterinary or health product access	5 (Nishtar, 2004; Widdus, 2005; Barr, 2007; Kempe et al., 2014; Laktabai et al., 2017)	6 (Lubroth et al., 2007b; Bardosh, 2016; Hamill et al., 2017; Galière et al., 2019; Dione et al., 2019) + OIE db (14/97 CS)

Appendix 4. Description of the evaluation case studies of public-private partnerships for public health and livestock health, presented in documents analysed in the scoping review (n=18).

In this study, PPP was restricted to services or product delivery for surveillance, prevention, or control of human, or zoonotic or animal contagious diseases. The list of references of the 37 documents selected for this study is provided in Appendix 2.

	Type of articles	Framework	Evaluation goal	Collection of data	Type of analysis
Public Health					
(Albis et al., 2019)	Research article: evaluation of specific PPP	Health outcomes evaluation	-Assess the progress	-Questionnaires -Documents reviews	-Measure of indicators -Comparative (alternative strategies)
(Alonazi, 2017)	Research article: evaluation of specific PPP	Individual centered-risk (clinical and non-clinical consequences for individuals)	-Guide policies	-Documents reviews -Participatory approaches	-Descriptive -Measure of indicators
(Baig et al., 2014)	Research article: evaluation of specific PPP	Health outcomes evaluation and perception of end-users	-Assess the progress	-Documents review -Interviews -Direct observation	-Measure of indicators -Comparative (alternative strategies)
(Bakibinga et al., 2014)	Research article: evaluation of specific PPP	Health outcomes; Cost effectiveness; Access and demand	-Assess the progress	-Interviews -Direct observation -Documents review	-Descriptive -Measure of indicators
(Barr, 2007)	Overview article	Specific to PPP: research protocol	-Assess progress	Not mentioned	-Descriptive -Measure of indicators
(Biermann et al., 2016)	Research article: evaluation of specific PPP	Perception of outcomes by beneficiaries	-Assess the progress	-Interviews	-Descriptive (content analysis)
(Gharaee et al., 2019)	Research article: evaluation of specific PPP	Perception of PPP policy by stakeholders	-Guide policies	-Documents review -Interviews	-Descriptive (content analysis) -Measure of indicators
(Kempe et al., 2014)	Research article: evaluation of specific PPP	Health outcomes evaluation and barrier for collaboration	-Assess the progress -Lobbying	-Questionnaires -Interviews	- Measure of indicators -Descriptive -Comparative (alternative strategies)
(Lei et al., 2015)	Research article: systematic review	Health outcomes evaluation	-Assess the progress -Propose strategies for improvement	-Documents reviews (systematic review of evaluations)	-Measure of indicators
(Laktabai et al., 2017)	Research article: evaluation of specific PPP	Health outcomes evaluation	-Assess the progress -Propose strategies for improvement	-Questionnaires	-Descriptive - Measure of indicators

(Roehrich et al., 2014)	systematic review	Specific to PPP : Multi-dimensional framework	-Research -Guide policies	Not mentioned	-Documents review
(Salve et al., 2018)	Research article: evaluation of specific PPP	Bourdieu's "theory of practice" to understand the relationship between partners	-Research -Strategies for improvement -Strengthen the PPP -Guide policies	-Participatory approaches	-Descriptive -Sociological
(Sutton, 2010)	Research article: overview article	Microeconomic theory based on externalities	-Guide policies	Not mentioned	Not mentioned
(Vrangbæk, 2008)	Research article: PPPs assessment in a country	Specific to PPP : Risk-based	-Guide policies -Lobbying	Not mentioned	-Descriptive -Comparative (alternative strategies) -Assessment of risk factors
Livestock Health					
(Dione et al., 2019)	Research article: evaluation of specific PPP	Innovative platform framework to address complex agricultural problems	-Assess the progress -Lobbying	-Documents reviews -Participatory approaches -Interviews -Sampling	-Descriptive - Measure of indicators -Vaccination coverage
(Hamill et al., 2017)	Research article: evaluation of specific PPP	Not mentioned	-Assess the progress -Lobbying	-Sampling	-Prevalence
(Maiti et al., 2011)	Research article: evaluation of specific PPP	Not mentioned	-Propose strategies for improvement	-Questionnaires	-Grading
OIE database	Grey literature, evaluation of specific PPPs (43/97 case-studies)	Not mentioned	Not mentioned	Not mentioned	-Descriptive -Measure of indicators

Appendix 5. Criteria to evaluate the context and the process of public-private partnerships mentioned in all documents analysed during the scoping review. The documents are related to PPPs in public health (n= 23) and to PPPs for livestock health (n=14). All associated references are presented in the supplementary file S2. *Some documents mentioned several key success factors or obstacles categories.

		Categories	Key success factors		Obstacles	
			Public Health	Livestock health	Public Health	Livestock health
Context		Societal context: PPP socially acceptable	2 (Baru and Nundy, 2008)	-	-	-
		Economic context: PPP justification (added value), Infrastructure, market system	2 (Donald A. Barr, 2007) (Widdus, 2001)	1 (Galière et al., 2019b)	2 (Donald A. Barr, 2007; Kulshrestha et al., 2015)	2 (Bardosh, 2016; Galière et al., 2019b)
		Governance context: Legislative and political framework	10 (Baig et al., 2014; Donald A. Barr, 2007; Baru and Nundy, 2008; Kaboru, 2012; Konduri et al., 2017; Kulshrestha et al., 2015; Lei et al., 2015; Nishtar, 2004; Salve et al., 2018; Vrangbæk, 2008)	3 (Dione et al., 2019; Donado-Godoy et al., 2015; Galière et al., 2019b)	7 (Alonazi, 2017; Baig et al., 2014; Donald A. Barr, 2007; Nishtar, 2004; Prashanth, 2011; Salve et al., 2018; Vrangbæk, 2008)	1 (Bardosh, 2016)
		Environmental context Total (context)	0 11*	0 3*	0 8*	0 2*
Process	Objective	Common goal	1 (Donald A. Barr, 2007)	1 (Galière et al., 2019b)	1 (Donald A. Barr, 2007)	-
		Mutual benefits	2 (Donald A. Barr, 2007; Hamill et al., 2017)	1 (Galière et al., 2019b)	1 (Donald A. Barr, 2007)	-

	Alignment with national priorities Total (process, objective)	1 (Nishtar, 2004) 3*	- 1*	- 1*	- 0
Governance	Nature of agreement, negotiation contract	6 (Donald A. Barr, 2007; Baru and Nundy, 2008; Kaboru, 2012; Kulshrestha et al., 2015; Lei et al., 2015; Roehrich et al., 2014)	-	5 (Donald A. Barr, 2007; Baru and Nundy, 2008; Kulshrestha et al., 2015; Lei et al., 2015; Roehrich et al., 2014)	-
	Inclusiveness in decision-making process	6 (Alonazi, 2017; Baru and Nundy, 2008; Kaboru, 2012; Roehrich et al., 2014; Salve et al., 2018; Vrangbæk, 2008)	-	4 (Nishtar, 2004; Roehrich et al., 2014; Salve et al., 2018; Vrangbæk, 2008)	1 (Dione et al., 2019)
	Funding and human resources availability and repartition	5 (Baig et al., 2014; Donald A. Barr, 2007; Lei et al., 2015; Roehrich et al., 2014; Salve et al., 2018)	1 (Galière et al., 2019b)	5 (Donald A. Barr, 2007; Lei et al., 2015; Nishtar, 2004; Roehrich et al., 2014; Salve et al., 2018)	2 (Dione et al., 2019; Galière et al., 2019b)
	Transparency of decision and activities implemented	1 (Nishtar, 2004)	2 (Black, 2012; Galière et al., 2019b)	1 (Lei et al., 2015)	-
	Adaptability of the PPP Total (process, governance)	1 (Alonazi, 2017) 13*	- 2*	1 (Alonazi, 2017) 9*	- 2*
Pla	Regular risks identification	3	-	2	-

		(Donald A. Barr, 2007; Nishtar, 2004; Vrangbæk, 2008)		(Donald A. Barr, 2007; Vrangbæk, 2008)	
	Communication between partners	5 (Alonazi, 2017; Biermann et al., 2016; Kaboru, 2012; Lei et al., 2015; Roehrich et al., 2014)	2 (Donado-Godoy et al., 2015; Galière et al., 2019b)	-	2 (Dione et al., 2019; Galière et al., 2019b)
	Dissemination knowledge, information sharing with external actors	4 (Biermann et al., 2016; Kaboru, 2012; Lei et al., 2015; Roehrich et al., 2014)	1 (Donado-Godoy et al., 2015)	1 (Roehrich et al., 2014)	-
	Role and responsibility of partners	5 (Donald A. Barr, 2007; Kaboru, 2012; Lei et al., 2015; Salve et al., 2018; Widdus, 2001)	2 (Black, 2012; Galière et al., 2019b)	6 (Donald A. Barr, 2007; Baru and Nundy, 2008; Biermann et al., 2016; Kulshrestha et al., 2015; Lei et al., 2015; Salve et al., 2018)	1 (Galière et al., 2019b)
	Planning of activities	1 (Lei et al., 2015)	-	2 (Baru and Nundy, 2008; Kempe et al., 2014)	-
	Distribution and efficiency of administrative tasks		1 (Galière et al., 2019b)	2 (Baru and Nundy, 2008; Kempe et al., 2014)	1 (Galière et al., 2019b)
	Distribution of ownership of PPP outputs	-	1 (Donado-Godoy et al., 2015)		-
	Capacity building, training	3 (Johnston and Finegood, 2015; Kulshrestha et al., 2015; Lei et al., 2015)	1 (Galière et al., 2019b)	2 (Alonazi, 2017; Kulshrestha et al., 2015)	1 (Dione et al., 2019)

	Evaluation of the PPP	2 (Lei et al., 2015; Nishtar, 2004)	1 (Galière et al., 2019b)		1 (Galière et al., 2019b)
	Total (process, planning)	11*	3*	9*	2*
Collaboration	Power relationship between partners	3 (Donald A. Barr, 2007; Roehrich et al., 2014; Salve et al., 2018)		3 (Baru and Nundy, 2008; Nishtar, 2004; Salve et al., 2018)	
	Inclusiveness in planning, in the implementation of activities	2 (Konduri et al., 2017; Salve et al., 2018)		1 (Salve et al., 2018)	
	Understanding of partner culture	2 (Prashanth, 2011; Salve et al., 2018)		2 (Lei et al., 2015; Salve et al., 2018)	
	PPP structure	1 (Biermann et al., 2016)		1 (Biermann et al., 2016)	
	Partners' satisfaction/trust between partners			1 (Kulshrestha et al., 2015)	
	Partner's involvement	1 (Roehrich et al., 2014)	1 (Galière et al., 2019b)	1 (Roehrich et al., 2014)	1 (Galière et al., 2019b)
	Total (process, collaboration)	6*	1	7*	1

Appendix 6. Potential positive outcomes (benefits) and negative outcomes (drawbacks) of public-private partnerships mentioned in documents analysed during the scoping review.

The documents are related to PPPs in public health (n= 23) and to PPPs for livestock health (n=14). All associated references are presented in Appendix 2.

CS: case studies; OIE db: database form World Organization for Animal Health. *Some documents mentioned several outcomes categories

	Outcomes categories	Benefits / positive outcomes		Risks / negative outcomes	
		Public health	Livestock health	Public health	Livestock health
Health	Expertise, skills	4 (Albis et al., 2019; Bakibinga et al., 2014; Gharaee et al., 2019; Widdus, 2001)	2 (Maiti et al., 2011) + OIE db (18 CS)	1 (Vrangbæk, 2008)	
	Quality of actions (case detection, case management, treatment outcomes)	4 (Albis et al., 2019; Baig et al., 2014; Gharaee et al., 2019; Lei et al., 2015)	5 (Ahuja, 2004b; Hamill et al., 2017; Maiti et al., 2011; Voss et al., 2012) + OIE db (16 CS)	1 (Vrangbæk, 2008)	
	Coverage of the services	8 (Albis et al., 2019; Baig et al., 2014; Biermann et al., 2016; Gharaee et al., 2019; Kempe et al., 2014; Konduri et al., 2017; Kulshrestha et al., 2015; Lei et al., 2015)	3 (Ahuja, 2004b; Dione et al., 2019) + OIE db (76 CS)		
	Food security		1 OIE db (3 CS)		
	Total documents	10 *	6*	1*	
Society	Vulnerable groups, externalities and public value	2 (Donald A. Barr, 2007; Sutton, 2010)	2 (Dione et al., 2019) + OIE db (3 CS)	1 (Donald A. Barr, 2007)	

	Regulations and public responsibilities		1 OIE db (11 CS)	2 (Baru and Nundy, 2008; Vrangbæk, 2008)	
	Equity of outcomes	5 (Baig et al., 2014; Donald A. Barr, 2007; Gharaee et al., 2019; Kaboru, 2012; Lei et al., 2015)		1 (Donald A. Barr, 2007)	
	Total documents	6*	2*	4*	0
Economy	Resources and cost of the PPP	3 (Gharaee et al., 2019; Vrangbæk, 2008; Widdus, 2001)	1 (Black, 2012)	1 (Vrangbæk, 2008)	
	Reduction of risks		1 OIE db (22 CS)		
	Timely execution of activities	3 (Albis et al., 2019; Kempe et al., 2014; Roehrich et al., 2014)	1 OIE db (24 CS)	2 (Roehrich et al., 2014; Vrangbæk, 2008)	-
	Market access		2 (Ahuja, 2004b) + OIE db (4 CS)		
	Employment	3 (Gharaee et al., 2019; Kaboru, 2012; Roehrich et al., 2014)	1 OIE db (13 CS)		
	Oligo/monopolies			1 (Vrangbæk, 2008)	
	Total documents	7*	3*	2*	0
Governance	Quality of the process and trust between partners	3 (Gharaee et al., 2019; Kempe et al., 2014; Roehrich et al., 2014)	2 (Voss et al., 2012) + OIE db (52 CS)	1 (Nishtar, 2004)	1 (Asseldonk and Bergevoet, 2014)

Accountability and corruption	1 (Kaboru, 2012)		2 (Baru and Nundy, 2008; Roehrich et al., 2014; Vrangbæk, 2008)	1 (Ahuja, 2004b)
Merging of interest or conflict of interest		1 OIE db (15 CS)	2 (Roehrich et al., 2014; Vrangbæk, 2008)	1 (Bardosh, 2016)
Total documents	4	2*	4*	3

Annexes du chapitre 2

Appendix 1. Interview guide for the semi-structured interviews with key actors of the PPP in Paraguay

Introduccion

Me llamo Mariline Poupaud, soy veterinaria y estoy haciendo una tesis en evaluación de programas de salud animal con el centre de investigación CIRAD y la universidad de Lieja. Mi tesis es parte de un proyecto que se llama progreso público-privado de la OIE. Es una iniciativa de tres años (nov. 2016-2019) .

Mi trabajo en este proyecto consiste en hacer una evaluación participativa de los impactos del programa de la erradicación de la fiebre aftosa y el valor añadido de la APP para alcanzar esos impactos. Me gustaría aprender más sobre el programa y la APP, su historia, cómo funciona y cuáles son sus percepciones de sus impactos.

Tengo permiso de SENACSA y FUNDASSA para hacer esta investigación. Todo lo que me digas será anónimo. Bajo ninguna circunstancia diré su nombre públicamente, ni a otros miembros de los proyectos.

La entrevista debería durar alrededor de una hora, pero por favor, hágame saber si desea interrumpirla en cualquier momento. ¿Puedo grabar la conversación?

Información general sobre la entrevista

Código de la entrevista:	Nivel (N: Nacional; R: Regional; L: Local) / Número único	Fecha de la entrevista:	
Nombre del entrevistador:		Nombre del tomador de notas:	
Grabado	<input type="checkbox"/> Yes / <input type="checkbox"/> No	Nombre del archivo de grabación:	

General información sobre el entrevistado

Nombre, apellido:		Posición:	
Datos de contacto	correo:	Celular:	Ubicación (comisione)

TEMAS	PREGUNTAS
Contexto del país: ganadería / salud animal	
Ganadería organización: mayor/ menor productores Leche/ Carne Exportación / mercado interno	¿Puede describirme las características de la ganadería en su región?
¿Se han producido cambios en la organización del sector ganadero en los últimos años? ¿Sabes por qué?	
Ración típica de alimento para el ganado	
Importancia de la ganadería en esta comisión desafíos de la ganadería	
¿Veterinarios? ¿Zootécnicos? ¿Otros?	1- ¿Puede describirme las características de la organización de la salud animal? 2- ¿Cómo está estructurada y funciona la Fundassa/Senacsa?
¿Se han producido cambios en la organización del sector de la salud animal? ¿Sabes por qué?	
Estructura y organización de la Fundassa/Senacsa Funcionamiento	
Programa de fiebre aftosa y el APP historia	
Nacimiento del proyecto de erradicación	¿podría presentarse y contarme su historia con el programa de la fiebre aftosa en su región?
Motivo(s) del proyecto: ¿obligación? ¿Motivación de los ganaderos?	
¿Objetivo(s) del proyecto (desde el principio hasta ahora si se ha modificado en el tiempo)?	
¿Motivo(s) de la alianza?	¿Sobre el nacimiento del APP?
¿Objetivo de la alianza?	
Recursos humanos y cualificaciones	1-Podría decirme más sobre sus recursos humanos? 2-¿cómo se le paga? ¿Cómo se paga a los técnicos?
CREACIÓN DE ALIANZAS	
Reclutamiento de actores que trabaja para el programa? ¿cómo se seleccionan entre los que han pasado la evaluación?	¿Cómo se organiza la alianza?
Motivaciones para participar	
Organización de la colaboración público-privada: relación con el senacsa	
Funciones y responsabilidades	¿Tenía usted algunas aprensiones antes de comprometerse con este programa? ¿Esta asociación? ¿Por qué?
Identificación de riesgos	
indicador de resultado	¿Cómo sabrás que esta asociación funciona bien? ¿Por qué?
FUNCIONAMIENTO DE LA ASOCIACIÓN	

Colaboración	<p>1-Háblame del funcionamiento de esta APP?</p> <p>2- ¿Cuál es su percepción de este funcionamiento?</p> <p>3-¿Hay algo que pueda sugerir para hacerlo más eficiente?</p>
Comunicación	
Gobierno	
Transparencia	
Participación de los actores	
Puntualidad	
Confianza y respeto entre actores	
Gestión del riesgo	
Resultados del proyecto y participación de la colaboración de la APP	
Impactos sociales (orgullo/ cambio en la organización del sector ganadero/problema de acceso a la tierra) ¿Indicadores?	<p>1-Puede decirme cuáles son los resultados de este proyecto?</p> <p>2-Como ayuda la APP a lograr esos resultados?</p>
Impactos económicos (empleo, productividad) ¿Indicadores?	
¿Impactos por el gobierno sobre la salud animal? (¿más confianza, mejor comunicación en la salud animal? cambio de política?) ¿Indicadores?	
¿Impactos sobre el medio ambiental? (¿cambio en la organización del sector ganadero?) ¿Indicadores?	
Desafíos	<p>¿Cuáles son los retos de este proyecto? ¿De esta APP?</p> <p>¿Por qué?</p>

Appendix 2. Article “Understanding the veterinary antibiotics supply chain to address antimicrobial resistance in Lao PDR: roles and interactions of involved stakeholders”

Cette étude a été publiée dans la revue Acta Tropica
<https://doi.org/10.1016/j.actatropica.2021.105943>

M. Poupaud^{1,2*}, V. Putthana³, A. Patriarchi⁴, D. Caro⁴, A. Agunos^{4,5}, N. Tansakul², F. L. Goutard^{1,2}

¹UMR ASTRE, Université de Montpellier, CIRAD, INRAE, Montpellier, France

² Faculty of Veterinary Medicine, Kasetsart University, Bangkok, Thailand

³ Faculty of Agriculture, National University of Laos, Vientiane, Lao PDR

⁴ Regional Office for Asia and the Pacific, Food and Agriculture Organization of the United Nations, Bangkok, Thailand.

⁵Center for Foodborne, Environmental and Zoonotic Infectious Diseases, Public Health Agency of Canada, Guelph, Ontario.

Highlights

- Qualitative and quantitative methods captured perception of stakeholders of the veterinary antibiotics supply chain
- Simplified theory of change was used to explore opportunities to adapt and reduce antibiotics use under the new regulations
- 23 categories of stakeholders forming various legitimacies, connections and resources were identified
- Majority of antibiotics on farms were classified as critically important antibiotics for human medicine
- Mitigating AMR risks require dialogue and engagement between stakeholders from public and private sector

Abstract

In response to the global call to mitigate risks associated with antimicrobial resistance (AMR), new regulations on the access and use of veterinary antibiotics are currently being developed by the Lao government. This study aims to explore how the implementation of these new regulations might effectively reduce and adapt the sale, distribution and use of veterinary antibiotics in Lao PDR. To this end, we used the theory of change, framing the AMR issue within the context of the stakeholder groups involved in the veterinary antibiotics supply chain.

Qualitative and quantitative methods were used to collect data, based on questionnaires (n=36 antibiotic suppliers, n=96 chicken farmers, n=96 pig farmers), and participatory tools such as a workshop (n =10 participants), semi-structured interviews (n=20), and focus group discussions (n =7 participants). The stakeholders’ understanding of the AMR issue and potential challenges related to the implementation of new regulations regarding access and use of antibiotics, were also investigated.

We mapped the veterinary antibiotic supply chain in Lao PDR, and analysed the roles and interactions of its stakeholders. Twenty-three groups of stakeholders representing the private and the public sectors were identified. Many informal and formal links connected these stakeholder groups within this supply chain. The lack of veterinarian-farmer interaction and the evolving nature of the veterinary antibiotics supply chain accentuated the challenges of achieving behaviour change through regulations. Most of the antibiotics found on farms were categorized by the World Health Organisation's as critically important antibiotics used in human medicine. We argue that AMR risk mitigation strategy requires dialogue and engagement, between private and public sectors, involved in the importation, distribution, sale and use of veterinary antibiotics. This study further highlighted that AMR is a complex adaptive challenge requiring multi-sectoral approach. We believed that a sustainable approach to reduce and adapt veterinary antibiotics use should be prepared in collaboration with stakeholders from private and public sectors, in addition to the new regulations. This collaboration should start with the co-construction of a common understanding of AMR issue and of the objectives of new regulations.

1. Introduction

Antimicrobial resistance (AMR) partly originates from the use of antimicrobials, such as antibiotics, in terrestrial and aquatic animals. The use of antibiotics on animals exerts a selection pressure on bacteria, favouring the selection of resistant genes in the food chain (Bennani et al., 2020). Some studies suggests that interventions to reduce antibiotic use in food animals are associated with a decrease of antibiotic-resistant bacteria in human populations, particularly population in proximity to food animals (Tang et al., 2017). Antibiotics are pervasively used in food animal in Southeast Asia, where AMR is widely prevalent (Boeckel et al., 2015). In Southeast Asia, potential drivers of increasing AMR include weak or non-existent regulatory frameworks on antibiotic usage, weak enforcement guidelines and low levels of AMR awareness among both vendors and users. AMR mitigation measures in the veterinary sectors are lagging far behind those implemented in the human health sector (Goutard et al., 2017).

In Lao People's Democratic Republic (Lao PDR), the livestock sector shows significant growth potential. Livestock production also plays an important role in the household economy of poor rural populations (The World Bank Group, 2017). Most livestock producers are smallholders (more than 85%) and subsistence farming remains widespread despite the increasing demand for livestock and livestock products (Ministry of Agriculture and Forestry, 2011). In Vientiane City, the country's capital, the demand for animal products is increasing (Burgos et al., 2008). The private sector is responding to market demands for pigs and poultry, with a number of them setting up farms close to cities (Burgos et al., 2008). This increase in demand, is often associated with an increased demand for antibiotics for prophylactic or treatment uses. The high impact of infectious disease on the livestock population (World Organisation for Animal Health, 2018) and limited access to veterinary services compounds the problem of antibiotic misuse. The veterinary governmental authorities may not cover all relevant aspects of regulations on veterinary antibiotics (i.e the authorization, registration, import, production, labelling, distribution, sale and use) (Bastiaensen et al., 2011). While human antibiotics may only be purchased with a doctor's prescription, as mandated by law (Food & Drug Department, Ministry of Health, Lao PDR, 2011), there are no specific laws or guidelines on the use of veterinary antibiotics (Ministry of Agriculture and Forestry, 2016). Although quantitative data on AMR are scarce in Lao PDR, bacteria isolated from pigs and humans in Lao PDR have been found to carry different AMR genes in Vientiane capital city (Thu et al., 2019). These issues highlight the importance of addressing the AMR problem in Lao PDR by considering access and use of antibiotics in food animal.

In 2015, the World Health Assembly of the United Nations declared AMR to be a global threat and urged all countries to develop multi-sectoral National Action Plans on AMR, including a plan for food animals (World Health Organization, 2015). In 2018, the Lao PDR government developed a new decree that includes new regulations on usage and access to veterinary antibiotics, part of the National Action Plan (Ministry of Health and Ministry of Agriculture and Forestry, 2019).

This decree, part of the Law on Livestock production and Veterinary matter, was signed by the Lao Prime Minister in 2020 (Ministry of Agriculture and Forestry, 2020). At the time of the study, the decree was not implemented and not enforced.

The international AMR Global Action Plan provided recommendations acknowledging that people, including farmers, are using antibiotics irresponsibly. These recommendations aim at mitigating the spread of AMR by changing farmer behaviour, through regulation and awareness raising (Food and Agriculture Organization of the United Nations, 2016; World Health Organization, 2015). However, these approaches are struggling to deliver effective results (Hinchliffe et al., 2018). Regulations on antibiotics do not systematically give rise to appropriate use. For example, the regulation about the prescription request for the sale and purchase of human antibiotics from “National Drug Policy” faced challenges in its implementation. It was adopted by the Ministry of Health in 1993 in response to the increasing number of private pharmacies, and have gone through successful policy formulation (Jönsson et al., 2015). However, the medical prescription law has been undermined because it is not strictly followed or implemented (Paphassarang et al., 2002). Indeed, the interests and power of different stakeholders can influence the implementation of regulations. This occurs namely when stakeholders are asked to change their practices despite the dissonance between their interests and the new regulations (Gilson and Raphaely, 2008; Zimmermann and Maennling, 2007). The Lao PDR government may face challenges in the implementation and enforcement of new veterinary antibiotics regulations on usage and access it is developing.

To assess the potential of AMR risk-reduction strategies, the AMR frame can be broadened to consider the perspective of stakeholder groups, where key relations operate and influence individual strategies (Hinchliffe et al., 2018). Groups are composed of interconnected stakeholders, some of whom have strong connections with certain stakeholders, while being poorly connected with others. The AMR issue is thus considered as a complex adaptive challenge (Hinchliffe et al., 2018). A complex adaptive system is “a collection of individual agents with freedom to act in ways that are not always predictable, and whose actions are interconnected so that one agent’s actions changes the context for other agents” (Plsek and Greenhalgh, 2001). For this reason, to explore the opportunities toward adaptation and reduction of the sale and use of veterinary antibiotics under new regulations, it is interesting to use the “theory of change” (Brest, 2010; Breuer et al., 2016). This consists of elucidating the causal links between inputs, outputs, outcomes and impacts in a given context (i.e, the impact pathway), while providing an explicit understanding of the assumptions underlying these links (**Figure 1**).

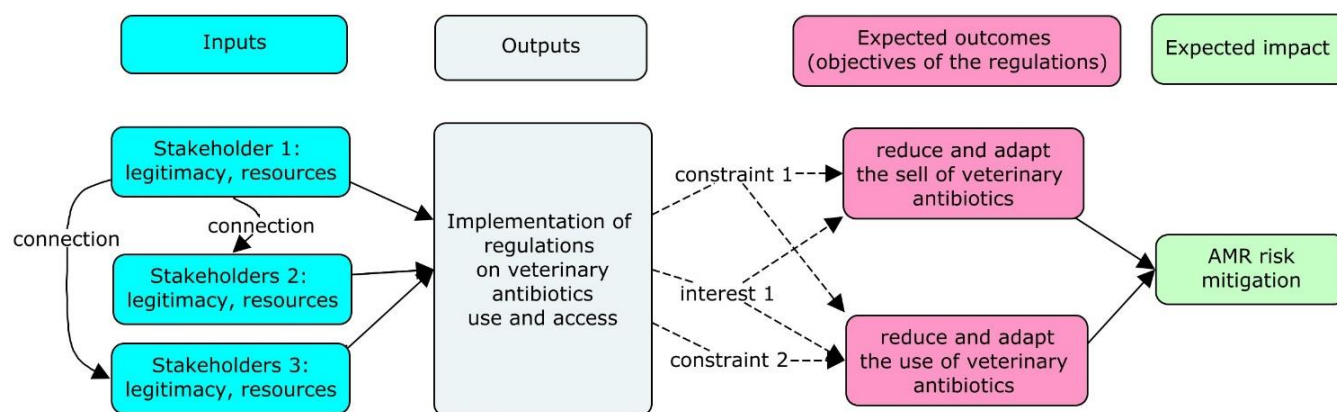


Figure 1: Using a simplified theory of change to develop an impact pathway to explore the opportunities of effectively adapt and reduce the sale and use of veterinary antibiotics. The inputs (turquoise blue) are the stakeholder groups involved in the veterinary antibiotics supply chain and their existing interactions. The outputs (light blue) are the implementation of the new regulations on access and use of veterinary antibiotics. The expected outcomes (pink) are the objectives of new regulations: the reduced and appropriate sale and use of veterinary antibiotics. The expected impact (green) is the AMR risk mitigation. The constraints and interests of the stakeholders, related the new regulations to be implemented, might hamper the causal link between outputs and expected outcomes. The causal link between expected outcomes and expected impacts will not be explored in this study.

The theory of change is part of the logic of place-based governance. Place-based governance is a type of governance that takes into account the uncertainty of the evolving situation, and that seeks the best possible participation of

stakeholders in collective action and the adaptation of decision-making according to the evolving situation (Chhotray and Stoker, 2009). One of the starting points of the theory of change, within our context, is to identify all the stakeholders related to the veterinary antibiotics supply chain. The theory of change also implies that all stakeholders share the same objective (expected outcomes) and the same vision of expected impacts.

In this paper, we explore opportunities for effectively reducing and adapting sale and use of veterinary antibiotics by implementing new regulations on access and use of veterinary antibiotics. For this, we propose to (i) identify the stakeholders and their existing interactions within the veterinary antibiotics supply chain (the inputs), (ii) and investigate their perceptions of the AMR issue (expected impact) and objective of the new regulations (expected outcomes), including the potential constraints and interests regarding the implementation of the new regulations (the outputs). The causal link between expected outcomes and expected impacts will not be explored in this study. This paper also aims to demonstrate the interest of analysing the AMR issue as a complex adaptive system.

2. Materials and methods

A methodological approach based on participatory stakeholder mapping and analysis was used (Saadi et al., 2021; Schmeer, 1999; Zimmermann and Maennling, 2007).

2.1 Study area

The study was conducted in two provinces, Vientiane Capital and Vientiane Province. Both provinces were selected for their high number of farms, according to data from the Ministry of Agriculture and Forestry (2017) (Department of Livestock and Fisheries office, Ministry of Agriculture, 2017). These provinces are near Vientiane City, the country's capital.

2.2 Research instrument and sampling strategy

The study was conducted from March to July 2018 using a mixed method (qualitative and quantitative approaches). Our analyses were conducted in three different steps: (i) step 1, the “mapping of the supply chain”, in which we identified the different groups of stakeholders in the veterinary antibiotics supply chain and their role and interactions, (ii) step 2, determination of “stakeholder positions”, in which we analysed stakeholders interests and constraints regarding two new planned regulations, (iii) and step 3, identification of “opinions and practices”, in which we explored the opinions and practices of public sector, independent private antibiotic suppliers and farmers regarding AMR and the use of antibiotics.

Box 1. Rationale for the selection of two new regulations for step 2 of this study.

A decree* “decree on veterinary medicine, No 199/GoL” was developed in 2018, as part of the National action plan on AMR. Several regulations were developed as part of the implementation of the decree. It was signed and approved in 2020. At the time of the study, the decree was not finalized. In order to identify and understand the planned regulations, a semi-structured interview with a key informant from national veterinary government authorities, responsible of veterinary legislation in Lao PDR was realized. Two planned regulations mentioned by the key informant were selected and used in step 2 of this study. This selection allowed stakeholder analysis focused on a specific and “definable” policy (Schmeer, 1999). One of the regulation selected related to prescription requirement for the sale of veterinary antibiotics. A second regulation related to the need of veterinarian to oversee the agricultural retail outlet or veterinary pharmacies. The selected regulations affected antibiotics suppliers and farmers who were deemed to have important roles in the veterinary antibiotics supply chain.

*The decree is now accessible for people who have created a free account on the Lao trade portal website: <https://www.laotradeportal.gov.la/index.php?r=site/display&id=1945>

Table 1 summarises the research tools used and the sampling strategies. Overall, purposive sampling, non-probability snowballing sampling and multi-stage cluster sampling were used to select study participants. Government ministers and village leaders were asked to assist in identifying study participants. Tools included a participatory workshop, semi-structured interviews, focus group discussions and survey questionnaires. The original questionnaires and focus group discussion guides were in English. These were translated into Lao and translated back into English to confirm context and clarity.

Table 1. Research tools and sampling strategies of the three different steps of the study: mapping of the supply chain, stakeholders' positions and opinions and practices steps.

¹*Legitimacy* was defined according to the type of channel the stakeholder was using to import and/or sell antibiotics: or formal i.e., controlled and monitored by the government and for which stakeholders pay taxes, or informal. Their level of *resources* was described by their level of knowledge on antibiotic use, good practices and AMR, their qualifications (e.g., education, training, area of expertise) and their ability to provide advice on good practices for antibiotic use. The *connection* was defined by the number of interactions they had within the veterinary antibiotics supply chain at the time of the study.

²The two regulations investigated were : (1) Regulation concerning the sale of veterinary antibiotics - it states that vendors are not allowed to sell veterinary antibiotics without a prescription from veterinarian/veterinary village worker officials (veterinary village workers are local technicians with some training provided by the government on drug dispensation and who provide animal health extension services to farmers). (2) Regulation concerning the business license for veterinary antibiotic retail outlets - it requires that veterinary pharmacies/agricultural retail outlets selling veterinary antibiotics, need to have at least one veterinarian or veterinary village worker approved by the government to oversee that retail outlet.

	Step 1: Mapping of the supply chain	Step 2: Stakeholder positions	Step 3: Opinions and practices
Goal	-To identify the different groups of stakeholders in the veterinary antibiotics supply chain -To understand their roles and interactions	-To crosscheck our previous results -To analyse stakeholder positions regarding two new planned regulations ²	-To crosscheck our previous results -To explore the opinions on AMR and practices regarding the use of antibiotics
Method	Qualitative	Qualitative	Quantitative
Research tool	Participatory workshop following a previously-prepared guide covering: (i) the identification of stakeholders, (ii) the mapping of the supply chain, (iii) scoring of the level of legitimacy, resources and connections ¹ of each category of stakeholder (23) (Supplementary Table 1)	-Semi-structured interviews, following a previously-prepared checklist covering: (i) the use of antibiotics and awareness of AMR; and (ii) the stakeholder's position regarding the two new regulations (Supplementary Table 2) -Focus group discussions, following previously-prepared checklist (Supplementary Table 3)	Questionnaire containing closed and open-ended questions (36 questions for suppliers, 42 for farmers) with dichotomous (yes/no) and categorical outcomes; covering the following areas: (i) socio-demographics, (ii) farm characteristic (only for farmers), (iii) opinions toward antibiotic use and antibiotic resistance, (iv) and practices regarding antibiotic use and antibiotic resistance. The questionnaires were pre-tested among farmers (N = 5) and antibiotic suppliers (N=2), they were simplified according to the results of the pre-test.
Target population	Key informants based on their knowledge of the veterinary antibiotics supply chain	Nine groups of stakeholders, based on their level of legitimacy, connection and resources ¹ they were given in step 1: private foreign farmers, technicians and private multinational company farmers, independent farmers, independent antibiotics suppliers (middlemen, owners and staff of agricultural retail outlet, veterinary village workers, private veterinarians, human pharmacists), and public provincial veterinarian	-Independent antibiotics suppliers (owners and staff of agricultural retail outlet, veterinary village workers, private veterinarians) -Independent poultry and pig farmers in backyard and semi-intensive systems. These systems represent up to 85% of the existing farms in Lao (Ministry of Agriculture and Forestry, 2011) and according to staff from the veterinary governmental authorities the highest level of antibiotic use is found in poultry and pigs (Department of Livestock and Fisheries office, Ministry of Agriculture, 2017)

Location	<p>-The workshop took place in the capital city</p>	<p>-In retail outlets, offices or households of two districts in Vientiane Capital (Xaythany and Naxaythong) and three districts in Vientiane Province (KeoOudom, Thoulakom and Phonhong) because of logistical constraints</p> <p>-The focus group discussion took place in the capital city</p>	<p>-Two districts in Vientiane Capital (Xaythany and Naxaythong) and three districts in Vientiane Province (KeoOudom, Thoulakom and Phonhong) were selected because of logistical constraints; these districts have a large number of farms (Department of Livestock and Fisheries office, Ministry of Agriculture, 2017)</p>
Sampling	<p>Purposively selected with the help of members of the ministry of agriculture and two researchers of the faculty of agriculture</p>	<p>-Directly identified by the key informants of step 1; and</p> <p>-Non-probability snowball sampling, i.e., some interviewees assisted the researchers in identifying the next set of interviewees.</p> <p>-Several stakeholders of the same group to crosscheck information and to reach a saturation level (Fusch and Ness, 2015)</p>	<p>A multistage cluster sampling method was used: 1 to 15 villages were randomly selected for each of the 5 districts. The village chiefs helped us identify relevant respondents meeting the selection criteria. Participants included in the survey were above the age of 18 and gave their oral consent.</p>
Participants	<p>10 participants :</p> <p>-representatives from veterinary governmental authorities who supervise livestock production and health in their administrative level (2 at national, 2 at provincial and 4 at district level)</p> <p>-informants directly involved in the veterinary antibiotics supply chain (one private veterinarian and one veterinary pharmacy owner)</p>	<p>-20 (5 females and 15 males) individual semi-structured interviews, including: 1 public veterinarian, 3 members of staff from private companies, 3 private foreign farmers, 11 independent suppliers, 4 independent farmers, (Supplementary Table 4)</p> <p>-focus group discussion among 7 persons from private sector (1 female and 6 males), including: 2 members of staff from private companies, 2 independent farmers, 3 independent antibiotic suppliers (Supplementary Table 4)</p>	<p>-36 antibiotics suppliers: 4 public veterinarians, 17 owners or staff from agricultural retail outlets, 4 private veterinarians, and 11 veterinary village workers</p> <p>-96 chicken farmers and 96 pig farmers</p>

2.3 Data collection

Data collection was conducted in three different steps.

Step 1: mapping of the supply chain: Two researchers (a French female veterinarian and a Lao male veterinarian) and four facilitators (three female and one male, all veterinary lecturers) conducted the participatory workshop. The facilitators were trained to moderate, observe and take notes during the workshop. Discussions were conducted in Lao language, ensuring that all stakeholders took part in the discussions. The meeting lasted around 3 hours.

Step 2: stakeholders' positions: The semi-structured individual interviews lasted from 15 to 35 minutes. Two research assistants conducted the interviews, one in Chinese and one in Lao. A focus group discussion, which lasted around three hours, was also conducted to review and verify the veterinary antibiotics supply chain. Participants also reviewed categories of stakeholders and their level of legitimacy, resources and connections within the supply chain. The stakeholders' interest and constraints regarding the two new regulations were discussed and compared.

Step 3: opinions and practices: Two principal investigators and 11 students interviewed antibiotics suppliers and farmers and entered answers on electronic devices with Sphinxdeclic® (Le Sphinx) software. They were previously trained on interviewing study participants and entering answers on their electronic devices. Photos were taken of products (e.g., veterinary drugs and feeds) that independent farmers were willing to show during the field interviews.

2.4 Data processing and analysis

Workshop outputs such as drawings and notes were documented using photographs. Recorded discussions during group or individual semi-structured interviews (Lao or Chinese) were transcribed and translated into English. To improve reliability of the interpretations, another researcher reviewed the transcripts before analysis.

The drawn schema of the veterinary antibiotics supply chain developed during the *step 1: mapping of the supply chain* was reproduced on CmapTools® (IHMC) software. Depending on the level of legitimacy, resources and connections, the research team selected the groups of stakeholders to include in the step “stakeholder positions” (Schmeer, 1999).

The transcripts from *step 2: stakeholder positions* (semi-structured interviews and focus group discussions) were coded. Two themes were identified: (i) improvement of supply chain mapping, (ii) and stakeholders' positions regarding the two new regulations. The data related to improvement of supply chain mapping allowed us to confirm the mapping of the veterinary antibiotics supply chain as well as the level of legitimacy, resources and connections of nine categories of stakeholders involved in this step. The data related to stakeholder's positions were analysed using content analysis. Two codes were identified in relation to their opinion on two new regulations: the informant's potential interest and their potential constraints. The stakeholder constraints were further classified into three sub-codes:

- (a) possible lack of knowledge on the effectiveness of the new regulations, or regarding their potential for AMR reduction;
- (b) possible lack of capacity, such as lack of alternatives or lack of human or material resources enabling the implementation and enforcement of the new regulations;
- (c) possible lack of will to apply the new regulations for economic (such as the competitiveness of their business or their farm products), trust (such as lack of trust in the government or the accessibility of veterinary services) or personal reasons (Schmeer, 1999).

Codes and sub-codes were assigned manually by the first author of this study without using a computer program.

The questionnaires were analysed using descriptive statistics with R(x64, 3.5.1)®. Statistical association between variables were explored performing chi-square tests; statistical significance being set at p-value of 0.05.

3. Results

3.1 The veterinary antibiotic supply chain in Lao PDR

We identified 23 categories of stakeholders belonging to the veterinary antibiotics supply chain in Lao PDR. “International stakeholders” (n=4) played a role in technical, financial and legislative support; they also played a role in AMR-related research. The stakeholders from the “public sector: Lao government” group (n=8) were from different Ministries. They were responsible for laws and enforcement, control of antibiotics importation and distribution, education of future stakeholders (such as veterinarians) and AMR research projects. The national veterinary governmental authorities were part of the Ministry of Agriculture and Forestry and oversaw the government veterinary authorities at province and district levels. The stakeholders of the private sector were involved in the importation, distribution and use of veterinary antibiotics (n=12), and could be split into three main groups: “private multinational companies”, “private foreign farmers” and “independent private actors: antibiotics suppliers and antibiotics users” (Figure 2).

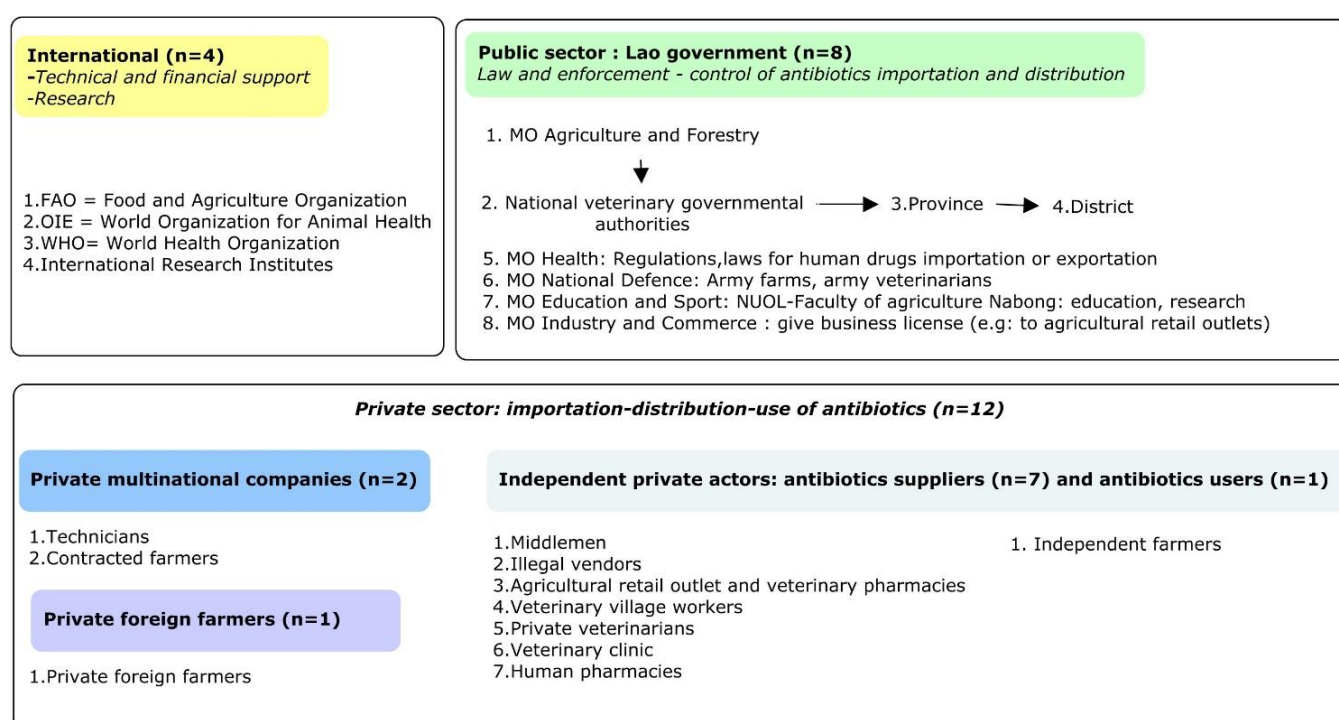


Figure 2: Presentation of the different groups of stakeholders involved in the veterinary antibiotics supply chain in Lao PDR in 2018. Stakeholders belong to international organization (yellow square), public sector (green square) and private sector (dark blue, light blue and violet squares). MO=Ministry of.; NUOL=National University of Laos

Lao PDR did not produce any veterinary antibiotics, so these antibiotics were mostly imported from Thailand, Vietnam and China, with a few imports from South Korea (**Figure 3**). National veterinary governmental authorities controlled the veterinary supply unit, a public inventory of antibiotics, and provided antibiotics to the province and district veterinary governmental authorities and sold antibiotics to the private sector. The National veterinary governmental authorities would appear to import only around 20% of the veterinary antibiotics entering the country, while the rest were imported by the private sector (**Figure 3**). The payment of taxes to the government at the Laotian border was the sole legal obligation related to veterinary antibiotics, and corresponded to the formal channel. Many of the stakeholders did not pay taxes when importing antibiotics (informal channel), which indicated non-regulated activity. Human antibiotics from some human pharmacies were sold for veterinary usage, without prescription, which was forbidden by law (informal channel) (**Figure 3**).

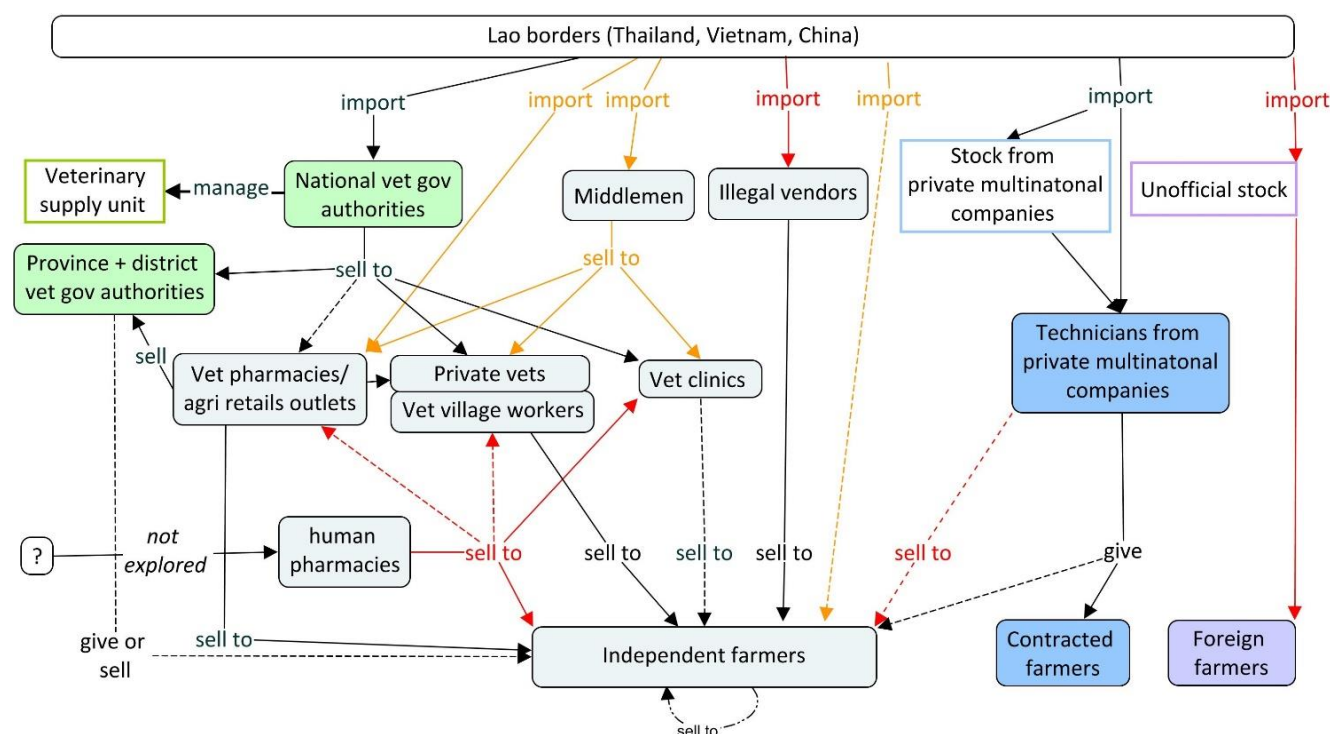


Figure 3: Mapping of veterinary antibiotics supply chain in Vientiane capital and Vientiane Province, Lao PDR in 2018. Stakeholders were from public sector (green squares) and private sector (dark blue square=private multinational companies, violet squares=private foreign farmers, light blue squares=independent private antibiotics suppliers and users). Formal channels (black arrows) correspond to the supply chain of the stakeholders who paid the veterinary antibiotics taxes to the government, in contrast to informal channels (red arrows). Other informal channels were the sale of human antibiotics from human pharmacies for veterinary usage or the sale of veterinary antibiotics from private companies to independent farmers. Stakeholders could alternate between formal and informal channel (orange arrow). Dotted arrows correspond to infrequent supply chain. The provenance of human antibiotics has not been explored. Vet= veterinary. Vet gov= veterinary governmental.

Different level of legitimacy, resources and connections were attributed to stakeholders (**Table 2**). The public sector, Lao government group, was not further investigated because it was rated as legitimate and well-resourced, and its connection in the supply chain was weak.

The private sector stakeholders were involved in the importation, distribution and use of antibiotics. The private sector stakeholders represented three weakly connected groups operating in parallel, which were further investigated (Figure 3):

- (1) Technicians from private multinational companies working with contracted farmers of the same company and using antibiotics from parent companies.
- (2) Private foreign farmers with few contacts with other stakeholders, importing antibiotics directly from their home country.
- (3) Independent private actors such as independent antibiotics suppliers and independent users (farmers), representing another group linked to the government veterinary authorities.

Table 2. Classification of stakeholders of the veterinary antibiotics supply chain from the public and private sector in Lao PDR in 2018, according to their legitimacy, resources, and connections.

“+++” = strong; “+” = medium; “-” = weak; “?”=undetermined.

Legitimacy was defined according to the type of channel the stakeholder was using to import and/or sell antibiotics: or formal i.e., controlled and monitored by the government and for which stakeholders pay taxes, or informal. Their level of resources was described by their level of knowledge on antibiotic use, good practices and AMR, their qualifications (e.g., education, training, area of expertise) and their ability to provide advice on good practices for antibiotic use. The connection was defined by the number of interactions they had within the veterinary antibiotics supply chain.

Stakeholders of the veterinary antibiotics supply chain	Positions and core functions of the stakeholders		
	Legitimacy	Resources	Connections
Public sector-Lao government			
-Ministry of Agriculture and Forestry	+++	+++	+
-National veterinary governmental authorities	+++	+++	+
-Province and district veterinary governmental authorities	+++	+++	+
-Ministry of Health	+++	+++	-
-Ministry of Education	+++	+++	+
-Ministry of National Defence (army farms and army veterinarians)	+++	+++	+
Private sector			
<i>Private multinational companies:</i>			
-technicians	+++	+++	+
-contracted farmers	+++	+	-
<i>Private foreign farm owners:</i>			
-private foreign farmer	-	?	-
<i>Independent private antibiotics suppliers</i>			
-middlemen	+ or -	-	+++
-illegal vendors	-	-	+
-owner or staff of agricultural retail outlet	+	+	+++
-veterinary village workers	+	+	+++
-private veterinarians	+	+++	+
-veterinarians in veterinary clinics	+	+++	+
-human pharmacists	-	+	+++
<i>Independent private antibiotics users</i>			
-independent farmers	+	+	+++

3.2 *Private multinational companies*

Three private multinational companies were identified. They had large-scale swine and poultry farms that imported veterinary antibiotics from their parent company (e.g., Thailand and China). One multinational company had several inventory of veterinary antibiotics in Lao PDR. The antibiotics were imported through formal channels and private multinational companies declared their inventory. These companies were scored with a strong level of legitimacy and resources (**Table 2**).

Contracted farmers working for private multinational companies obtained antibiotics from technicians employed by the company. They claimed that they followed the company's recommendations for the use of antibiotics. Farmers within these integrated systems were not allowed to use any other antibiotics than those provided by their contracting company. They mentioned that they had good access to advice from technicians during disease outbreaks. They appeared indifferent to the new regulations (**Supplementary Table 5**). The technicians interviewed had completed post-secondary education and had benefited from AMR awareness actions led by their companies. Some companies already had internal policies on AMR mitigation (Charoen Pokphand Foods, 2017).

"I don't sell the antibiotics; I only support the farmer by giving advice and treatment if needed. I only take care of pigs. [...] I don't earn more if I treat the pigs, and I have a fixed salary. I have a Master's degree in Animal Production. In Lao, there are only seven people employed in this company who are authorised to give advice on antibiotics usage. [...] I am not worried about AMR because my company already encourages farmers to use only small quantities of antibiotics, it has a project for decreasing the ABU for every farm. [...] The Lao government should apply these regulations, so the pigs will be drug-free! [Interview, a male technician from a multinational company, Vientiane Capital province]

This integrated group seemed isolated from other actors, however, antibiotics from these companies could be sold by the technicians to independent farmers outside the integrated system, through informal channels.

"Another way to gain access to antibiotics is through the employees of multinational companies that also have private businesses and resell antibiotics to other farmers. But they did not give advice or anything. The drugs may have been thrown away by the company as the expiry date was close and the staff take them. But the company is not aware of this." [Interview, a male independent Lao fish farmer, Vientiane Province]

3.3 *Private foreign farmers*

Private foreign farmers were classified as informal stakeholders with a weak level of legitimacy among other stakeholders, who perceived them as big antibiotic users (**Table 2**).

"Those farmers do not eat their own pigs but eat the pigs from [Lao] local production. Their pigs are toxic food as they use too many drugs!" [Interview, a male member of province staff within the veterinary government authorities]

Foreigners, mostly from China, invested in the country and were involved into pig and freshwater fish production. They contributed to the overall production of meat/fish in the country.

"These foreign farmers have been widely present in my district for approximately 10 years and produce up to 80% of the total number of pigs in this district." [Interview, female staff of the veterinary governmental authorities at district level, Vientiane Capital province]

While production data, number of farms, and volume of antibiotics imported and used were largely unknown, some Lao farmers claimed that foreign farms affected the market prices of animal products.

"We are in conflict with these farmers because they decrease the price of fish and pig products on the market!" [Interview, an independent male Lao fish farmer, Vientiane Province]

The three Chinese fish-farmers interviewed reported that they imported veterinary antibiotics directly from China. This was another informal channel of veterinary antibiotics entering Lao PDR. They also mentioned that Chinese farmer groups had their own feed company in Vientiane Capital. It was unclear if veterinary antibiotics were used in the feeds they produce. The Chinese farmers were aware of AMR but did not consider it to be a problem. They claimed that their overall use of antibiotics was negligible. They never relied on services provided by the district or provincial government veterinary authorities. They expressed objections to the new regulation on prescription requirement to buy antibiotics. They claimed that inaccessibility of antibiotics will impact negatively on fish mortality and overall business performance (**Supplementary Table 5**).

“(if this regulation is applied) I will stop my business! Here, the vets don’t know anything about fish disease and can’t give me advice! I totally disagree with the need of a prescription to buy medicine! [...] In my farm, AMR is not a problem because I only use a little [...]. I only use enrofloxacin, amoxicillin and vitamins,” [Interview, a female foreign fish farmers, Vientiane Capital province]

These farmers were not directly linked with other actors in the antibiotics supply chain. Most of the antibiotic leaflets were in Chinese and there were no Lao translations. Lao farmers did not use these antibiotics because they could not read the labels or instructions.

3.4 Independent antibiotics suppliers (connected with public sector)

Seven types of independent antibiotic suppliers were identified: middlemen, illegal vendors, owners and staff of agricultural retail outlets or veterinary pharmacies, private veterinarians, veterinary village workers, veterinary clinic and human pharmacies (**Figure 1**)

Two groups, the middlemen and illegal vendors, were scored with a medium level of legitimacy and were identified by the other stakeholders as potential opponents to the two new regulations, as they were difficult to monitor. Illegal vendors were mentioned as never paying taxes and mainly selling veterinary antibiotics to farmers through direct marketing. The sale of antibiotics could be their only source of income. A middleman was an individual who imported veterinary antibiotics deemed for his “own use” but would subsequently sell them to veterinary pharmacies, agricultural retail outlets and farmers. The profiles of these middlemen were multi-fold, such as fully employed by a shop, occasional importers, or independent farmers. Middlemen seemed to be the key stakeholders who interacted with most of the other stakeholders and privileged informal channels (i.e., not paying tax), failing to declare the antibiotics at the border control point (**Supplementary Table 5**).

“Middlemen are like an army of ants bringing veterinary antibiotics into Laos” [Participatory workshop – step 1, private veterinarian]

Four groups of the independent antibiotic suppliers: the owners of agricultural retail outlets, private veterinarians, veterinarians in veterinary clinics and veterinary village workers, were scored with a medium level of legitimacy, and they reported that they supported the new regulations (**Supplementary Table 5**). Among the 36 surveyed (4 public veterinarians and owner and staff of agricultural retail outlets, private veterinarians and veterinary village workers), almost half started their activity less than 5 years ago, showing the dynamics of these activities and the evolving nature of the veterinary antibiotics supply chain (**Table 3**). A large majority were male, having a high school or higher education, and about half were between 30 and 50 years old (**Table 3**). Most of them stated that antibiotics were essential for farmers, and about 20% of them even declared that antibiotics were required as growth promoters. A large majority were concerned about AMR and recognised that they have a role to play in AMR mitigation and that news regulations were needed (**Table 3**).

Table 3. The socio-demographic characteristics of the private independent antibiotics suppliers and the public veterinarians surveyed in the step “opinions and practices”, their statement on the need of antibiotics in food animals and their concern for AMR, N=36.

Antibiotics suppliers' characteristics	%	Antibiotics suppliers' characteristics	%
1. Gender		2. Age	
Male	83.3	Young (15 – 30 years)	13.9
Female	16.7	Middle (31 – 50 years)	44.4
3. Education		Old (51 – 65 years)	
Completed master's	16.7	4. Careers	
Completed technical studies or bachelor's	33.3	Public veterinarian from district governmental authorities	11,2
High School	30.6	Agricultural retail outlets	41,7
Middle School	11.1	Private veterinarians	16,7
No school or elementary school	8.4	Veterinary village workers	30.6
5. Experience in selling antibiotics			
Less than 5 years	44.4		
More than 5 years to 10 years	22.2		
Over 10 years	33.3		
Statement about the need of antibiotics in food animals	%	Statement about their concern for AMR	%
1. They are necessary for disease prevention	80.6	1. I am concerned by AMR problems	69.5
2. It is not possible for a farmer to raise animals without antibiotics	61,1	2. I have a role to play in the fight against AMR	91.7
3. Antibiotics are necessary as growth promoters	19.4	3. New regulations need to be implemented in Lao	80.6

The agricultural retail outlets surveyed stated that they obtained antibiotics through middlemen (2/17), foreigner distributor antibiotics companies (6/17) and other agricultural retail outlets (9/17) (**Figure 4**). None declared to buy antibiotics from the public sector (veterinary government authorities). During the interviews, some of them declared that they ordered antibiotics to be delivered to the Thai border, or that they owned a store of antibiotics in Thailand. These stakeholders stated that they sold veterinary antibiotics over the counter without a prescription or veterinary supervision. They generally thought that farmers used too many antibiotics to treat their animals and that it was necessary to control the quantity of antibiotics used by each farmer. The interviewees were mainly in favour of the new regulations, viewing them as a business opportunity:

“If I employ a veterinarian, it will be really good [*sic*] for my shop, I will earn more reputation, high credit. There will be a one-hour queue to get into my shop! It would be better, because I have been working for a long time, so I have experience, but I don't have any proper qualifications, sometimes I don't know how to help farmers! [...] I am not afraid about spending money to employ a vet because I am sure I will have many more clients. I even thought about doing this before the regulations.” [Interview, owner of an agricultural retail outlets, Vientiane Capital province]

The veterinary village workers were technicians trained by the public sector (provincial or district veterinary governmental authorities). They stated that they treated animals and sold veterinary products such as vaccines to farmers, but few antibiotics. During the questionnaire survey, they stated that they obtained antibiotics from the public sector (veterinary supply unit, 1/11), or the private sectors such as agricultural retail outlets (8/11), private veterinarians (1/11), or middleman (1/11) (**Figure 4**). They declared that they had another job at the same time (e.g., farming, business). They reported their limited ability to provide advice to producers. They mentioned that they were aware of AMR thanks to their own experience in the field and various information sessions (e.g., in the University of Agriculture). They thought it was a good idea that veterinary governmental authorities start to fight against AMR and hoped to receive training to be able to write prescriptions.

“I don’t earn much money by helping farmers, and I give my own treatment, I never sell antibiotics to them. Most of the time I am a farmer, I grow rice. [...] I would be really interested in receiving some training from veterinary governmental authorities to have the right to write a prescription. I am too isolated at the moment, I don’t receive any help from the government. [...] 3 or 4 years ago, there were about 100 cows in my village, but now they are about 400 cows. Last year, there was a disease outbreak and I was left alone to deal with it. I couldn’t help everybody!” [Interview, a veterinary village worker, Vientiane Capital province]

The private veterinarians surveyed stated that they obtained antibiotics from the private sector, such as agricultural retail outlets (1/4), middleman (2/4), and human pharmacies (1/4) (**Figure 4**). The owner of the veterinary clinic interviewed appeared to be supportive of the anticipated changes in veterinary antibiotics laws and its enforcement. He believed that it would not affect his business, seeing an opportunity to increase his legitimacy to sell antibiotics.

The independent private antibiotics suppliers interacted with the public sector (**Figure 3 and 4**). The public veterinarians from the district governmental authorities surveyed obtained antibiotics from the national governmental authorities (veterinary supply, 2/4), agricultural retail outlets (1/4) and human pharmacies (1/4) (**Figure 4**).

The independent antibiotics suppliers interacted with the independent users (farmers) by selling them antibiotics or advising them on the use of antibiotics (**Figure 3**).

3.5 Independent antibiotic users, farmers (connected with public sector)

Most of the surveyed farmers were full-time, which showed that they relied solely on livestock production for their income. Most of the farmers were female, with a level of education split between no school, primary school, secondary school or high school (**Table 4**). Most chicken farmers were more than 50 years old, while many pig farmers were between 30 and 50 years old. About a third of the pig farmers had less than 10 years of experience in the business while about quarter of them started less than two years ago. This shows the diversity of livestock experience among the survey participants and the dynamics of farm activities.

Table 4. The socio-demographic characteristics of the independent chicken and pig farmers surveyed in the step “opinions and practices”; N (chickens)= 96, N (pigs)=96

Population	Chicken farmers (%)	Pig farmers (%)
	%	%
1.Location		
Vientiane Capital	80.2	52.1
Vientiane Province	19.8	47.9
2.Gender		
1.Male	36.8	37.5
2.Female	63.2	62.5
3.Age		
Young (15 – 30)	6.2	10.5
Middle (31 – 50)	41.2	63.2
Old (51 – 65)	51.5	26.3
4.Education		
Illiterate/no school	16.7	11.6
Primary school	38.5	25.3
Secondary school	18.8	24.2
High School or vocational studies	21.9	31.9
University or above	4.2	7.4
5.Careers		
Full time farmers	68.7	68.7
Independent worker	10.3	13.7
Governmental staff	10.3	8.4
Retired, housewife	10.3	9.5
6.Age of this activity		
Less than 2 year	14.4	25.5
More than 2 years to 10 years	22.6	37.5
Over 10 years	62.5	37.5

Surveyed independent farmers had flocks of between 7 and 200 chickens (mean of 57 heads) and herds between 2 and 160 pigs (mean of 20 heads). Most of farmers (60%) also kept other animals (**Table 5**). Most of the chicken flocks were free range or both caged and free-range while most of the pig herds were kept in pens or stables. Indigenous breeds were predominant for chickens, whereas pigs were equally distributed between indigenous, exotic, and cross breeds. Some of the farmers used commercial feed, however no antibiotics figured in the ingredients of the commercial feed found in the farms surveyed (**Table 5**).

About half of the farmers declared that a health problem had occurred in their flock within the past 12 months. Only a few of the farmers could name the disease: avian influenza, fowl cholera, Newcastle disease, acute death and enteric disease in chickens; and enteric disease and classical swine fever in pigs. A minority declared that they vaccinate their chicken flocks (19.6%) or pig herds (44.6%) (**Table 5**).

Table 5. The farm characteristics, and opinion and practices on antibiotic use and antimicrobial resistance of the independent chicken and pig farmers surveyed in the step “opinions and practices”; n (chickens)= 96, n (pigs)=96

Farm characteristic, opinion and practices	Chickens (%)	Pigs (%)	Farm characteristic, opinion and practices	Chickens (%)	Pigs (%)
1. How the animals are kept?			2. Other animals kept at the farm (several answers possible)		
- Pens or stable	17.4	75.50	-None	32.6	27.4
- Mix: pens and free range	38	20.2	- Pigs	10.5	-
- Free-range	42.7	1.1	- Chickens	-	20
- Cage	2.1	-	- Ducks	47.4	55.8
			- Buffaloes/cows	23.2	20
			- Other	7.4	10.5
3. Use of antibiotics or vaccines			4. Species of animal kept		
Antibiotics	48.9	60.0	- Indigenous	94.8	33.7
Vaccination	19.6	44.6	- Exotic	5.2	28.4
			- Cross breed	4.1	36.8
5. Health problem in the flock/herd last 12 months			5.2 If yes, name of the last disease		
Yes	58.8	46.9	-Acute death	35.3	-
5.1 If yes, how many disease events during the last 12 months?			- Fowl cholera	4.9	-
→1	86.0	80.6	- Newcastle	5.9	-
→2	5.3	16.7	- Avian Influenza	5.9	-
→3 or more	8.8	2.8	-Diarrhoea (E.coli, salmonellosis)	4.9	47.6
			-Classical swine fever	-	9.5
6. When facing a disease, what do you first do?			7. Opinion on the need of antibiotic use in their livestock		
-Isolate the sick animals	56.2	24.5	-When they have any abnormal symptoms	81.2	85.9
-Treat the sick animals with antibiotics by themselves	31.2	25.5	-When they do not show any improvement in growth	44.3	34.5
-Call a veterinarian or a veterinary village worker	13.5	41.5	-When the animals in other farms within the village start to get sick	75.0	86.6
-Ask relatives or other farmers for advice	6.2	9.6	-When farmers or a relative advises them to use it	62.6	61.3
8. Seek advice before using antibiotics?			9. Source of antibiotics (for those who used them)		
1.yes	81.4	89.0	-Agricultural retail outlets	67.6	43,2
8.1 If yes, to whom?			-Human pharmacies	22.1	35.8

-Veterinarians or veterinary village workers	37.1	68.5	-Veterinarians/ veterinary village workers	8.9	21.0
-Agricultural retail outlets	31.4	21.9	-Illegal vendor	1.5	0.0
-Relatives or other farmers	18.5	21.9			

In the event of disease outbreak, a minority of the farmers declared that they first called a veterinarian or a veterinary village worker, and about a quarter said that they treated their sick animals with antibiotics by themselves. Around half of the farmers declared that they used antibiotics for their animals (more in pig farms than chicken farms). The utilisation of antibiotics was associated to the breed of the pigs: farmers who kept indigenous pigs used less antibiotic than farmers who kept exotic breeds (p -value <0.01). It was also correlated to the number of chickens kept; chicken farmers with less than 10 chickens tended to use less antibiotic ($p < 0.01$) (**Table 5**). The majority of the antibiotics found at the farms (16/29 in chicken farms and 54/73 in pig farms) were critically important antibiotics used in human medicine, such as amoxicillin, ampicillin, gentamicin, enrofloxacin, norfloxacin, ciprofloxacin, tylosin, or combinations of spiramycin-tylosin-colistin and penamicillin-streptomycin (World Health Organization, 2019) (**Table 6**).

Table 6. Classification of the antibiotics found in the surveyed chicken and pig farms at the time of the farm visit. Classification was done according to the list of critically important antimicrobials for human medicine from World Health Organization (**World Health Organization, 2019**). This classification relies on two criteria C1 and C2. C1: The antibiotic class is the sole, or one of limited available therapies, to treat serious bacterial infections in people. C2: The antibiotic class is used to treat infections caused by bacteria possibly transmitted from non-human sources, or with resistance genes from non-human sources. The critically important antibiotics for human medicine are antibiotics classes which meet both C1 and C2. The highly important antibiotics for human medicine are antibiotics classes which meet either C1 or C2. *Some of the antibiotics found in the farms surveyed could not be identified, either because they were written in Chinese or because the photos taken were of poor quality.

Grouping of antibiotics	Antibiotic class	Antibiotic agent	Chicken farms (n)	Pig farms (n)
Critically important	Penicillin	Amoxicillin	4	17
		Ampicillin	5	0
	Aminoglycosides	Gentamicin	1	9
	Fluoroquinolones	Enrofloxacin	1	9
		Norfloxacin	2	1
		Ciprofloxacin	0	1
	Macrolides	Tylosin	0	2
Macrolides and polymyxins combination	Spiramycin-tylosin-colistin	1	0	
Combination of <i>highly critically important</i> Penicillin and aminoglycosides combination	<i>Penamecillin-streptomycin</i>	2	15	
<i>Highly important</i>	Tetracyclines	<i>Oxytetracycline</i>	10	14
		<i>Chlortetracycline</i>	2	0
	Amphenicols and tetracyclines combination	<i>Thiamphenicol-oxytetracycline</i>	0	2
-	Undetermined*	Undetermined *	1	3
		Total (N)	29	73

The farmers stated that antibiotics were necessary for their livestock for several reasons: presence of abnormal signs, growth problems, sick neighbouring animals, or depending on advice from relatives.

Most of the farmers surveyed mentioned that before using antibiotics, they sought advice from veterinarians or veterinary village workers (mainly the pig farmers), agricultural retail outlets, or relatives/other farmers (**Table 5**). In some districts, there were commodity-specific associations, such as the broiler farmers' association or the fish farmers association. Within these associations, farmers mentioned that they were able to better market their products (e.g., restaurants, hotels, local market), to discuss strategies to optimise profits (i.e., strategic marketing such as scheduled marketing of products ensuring a consistent supply that matches the local demand), to share their experiences of diseases and to give advice on how to treat animals.

“We (members of the broiler group) share the restaurants where we sell the meat. We always discuss our experience of a disease and how to treat it. In this group, we have a big farm owner and he has a great deal of knowledge, he is an unofficial veterinary village worker: he goes to the farms and give advice. [...] Those regulations are not a good idea. The antibiotics are really helpful for the farms, if we don't use them, the chicken will die, or grow slowly!” [Interview, broiler farmer and chief of the broiler group of one district, Vientiane Province]

There were many ways for an independent farmer to obtain antibiotics. The most common practices mentioned during the survey were the purchase of antibiotics from agricultural retail outlets, then human pharmacies and then from a veterinarians or veterinary village workers (Table 5, Figure 4). A farmer might also sell his antibiotics within his network (e.g., neighbours, other farmers). Current regulations on access to antibiotics was unclear amongst farmers. There was a general lack of awareness as to whether they were using antibiotics in line with the regulations.

“I don’t really know if what I am doing is legal or not because the regulations are not at all clear for me”
 [Focus group discussion, independent pig farmers]

Almost all the farmers interviewed had heard about AMR. They all agreed that new regulations were needed and they wanted to improve their antibiotic use practices by having access to veterinary diagnostics. However, farmers interviewed stated that they had poor access to veterinarian advice. They reported that veterinarians and staff from the veterinary governmental authorities were difficult to reach and seem concerned that this new regulation would lead to restricted access to antibiotics.

“I think it will be really difficult to apply this law [...] I am really afraid that this process will take a really long time and that veterinarians will not be available. Vets are difficult to reach, they don’t answer the phone, especially in rural area. A few farmers have already had a bad experience where the vet never came to their farms. [...] That’s why most of the time we try to treat sick animals by ourselves, if not, our animals die, and the disease can spread really quickly.” [Interview, independent poultry farmer, Vientiane Capital province]

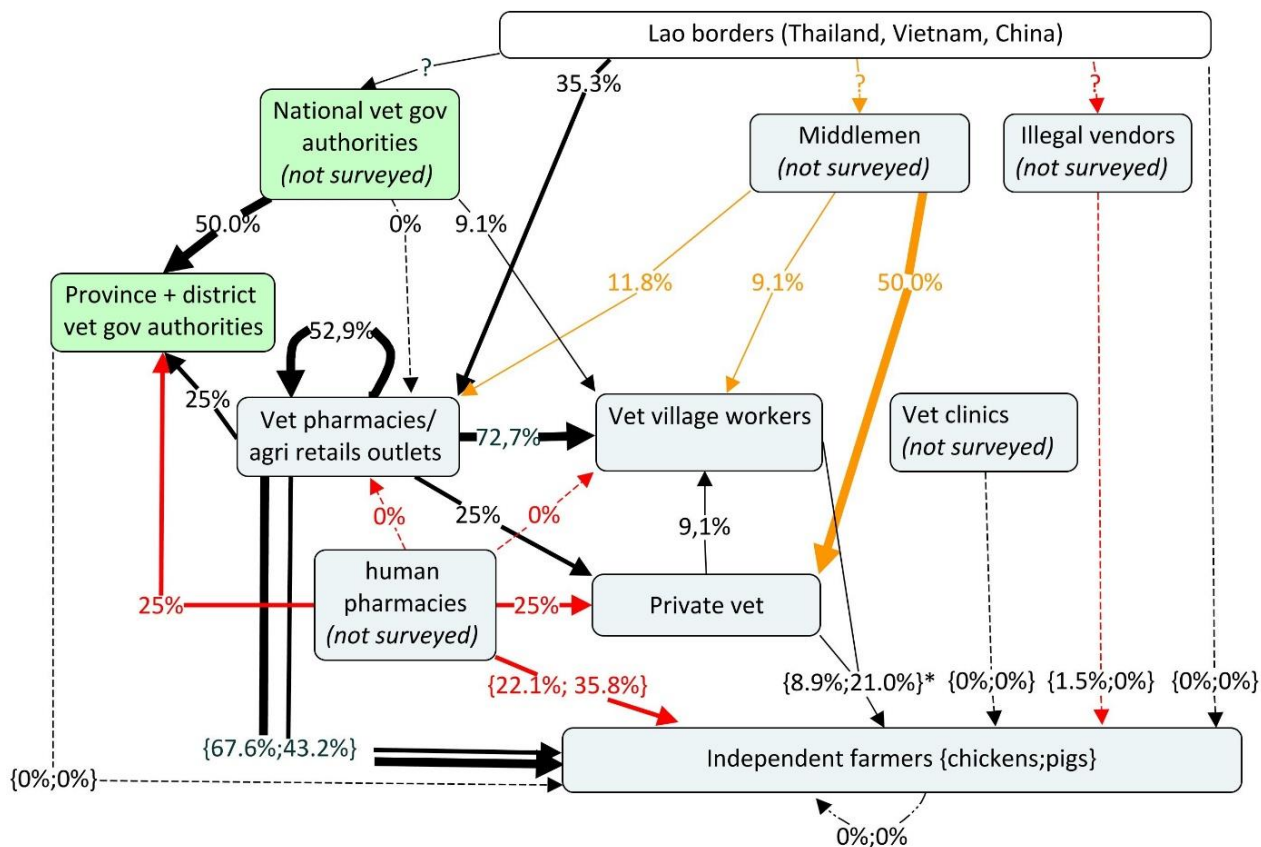


Figure 4. Quantification of supply chain of the public sector and independent private actors groups based on the data obtained from the questionnaires. Those data were obtained during the step 3 opinions and practices: N = 4 public veterinarians at district level, N = 17 agricultural retail outlets, N = 4 private veterinarians, N = 11 veterinary village workers. The percentage results should be interpreted with caution, as the number of actors surveyed was relatively small. Only the farmers who mentioned buying antibiotics were included: N = 73/96 chicken farmers, and N = 83/96 pig farmers. The interrogation points mean that the data were not investigated. Dotted arrow: <2% of related survey participant mentioned this channel, thin arrow: 3-21%, intermediate arrow: 22-49%, thick arrow: >50. For the colors of the arrows and squares, see Figure 3. *the private veterinarians and veterinary village workers were not differentiated in the questionnaires for farmers as the farmers did not always distinguish them

4. Discussion

The nature of this study was exploratory, with the aim of obtaining an overall picture of the stakeholder groups related to the issue of AMR in food animals in Lao PDR (Hinchliffe et al., 2018). This study brought some understanding of the inputs of this complex adaptive system, i.e. the stakeholder groups within the veterinary antibiotic supply chain and their interactions. This study also explored the stakeholder's perception of AMR and AMR mitigation (expected impact) and of the objective of new regulations (expected outcomes). This study also investigated the stakeholders' interests and constraints they would face if the new regulations on access and use of antibiotics were implemented (the outputs) in relation to their livelihood strategies.

4.1 The stakeholder groups (inputs) and their vision of the expected outcomes and expected impact

The inputs of this complex adaptive system were composed of 23 categories of stakeholders involved in the veterinary antibiotics supply chain, with different level of legitimacy and resources. These stakeholders operated in four main groups which were weakly connected.

The stakeholders from the group "public sector" were poorly investigated.

The stakeholders from the group "private multinational companies" shared the objective of AMR mitigation. The stakeholders from the group "private foreign farmers" were not concerned with the issue of AMR. The foreign farmers also showed a general mistrust towards veterinary government authorities. As there is very little data on private foreign farmers, it would be important to organise a census of them. This would enable a better investigation of the dynamics of this group (i.e., farmers practices and strategies, group of influence) and further investigation of the overall role of the importation channel (estimated quantity, quality of products, other players involved). Even if this group appears to be completely independent from other stakeholders, their farm products are sold in Lao PDR markets and seem to influence the local economy and demand. We may draw the hypothesis that this "informal channel" influences the strategies of local farmers in their attempt to remain competitive, and thus, influencing their decision making related to antibiotics use.

The stakeholders from the private independent group were independent antibiotics suppliers and independent farmers. They shared the objective of AMR mitigation but also mentioned the important need to use antibiotics in food animals, including those that are deemed as critically important to human medicine.

4.2 The potential interest and constraints among stakeholders that might influence the causal link between the output and the expected outcomes

The stakeholders involved in the "private multinational companies" group stated that they were supportive of the anticipated changes in AMU regulations. They appeared to have the capacity and experience to adapt to regulatory changes. Their economic strategies would be strengthened by increasing their legitimacy in the food chain in Lao PDR. The advantageous position that multinationals can take in the implementation of new regulations was studied in the pig sector during changing governance of AMR in Denmark (Food and Agriculture Organization of the United Nations, 2019; Jacobsen et al., 2006) and during the avian influenza episode in Vietnam in 2003 (Figuié et al., 2013). The private foreign farmers positioned themselves clearly against the new regulations. Our study also highlighted the crucial role of middlemen in the veterinary antibiotics importation process. Middlemen were hard to monitor and were potential opponents of new regulations.

The owners of agricultural retail outlets were supportive of new regulations and claimed that they would employ qualified veterinarians. This might only be true for big shops. Smaller shop owners may continue selling antibiotics illegally because of the cost of hiring a full-time licensed veterinarian.

Independent farmers were not opposed to new regulations, but they were concerned and have doubts as to the feasibility of implementing them (e.g., asking for a prescription to buy antibiotics). In line with the framework proposed by Lhermie et al. (2017), we have highlighted several elements that influenced the farmers' decision-making process to buy and use antibiotics. These elements may concern the farmer, for example, his appreciation of the risk of disease in his environment, his experiment and his attitude towards risk (Lhermie et al., 2017). Indeed, the treatment strategies of farmers depended on contextual elements, such as the disease outbreak among their flocks/herd or in neighbouring flocks/herds. Others elements may concern the institutional environment, such as the multi-national companies with contracted farmers, the presence of veterinary governmental authorities or veterinary village workers (Lhermie et al., 2017). Farmers mentioned the weak presence of veterinary services in rural area, and depending on their perceptions of epidemic risks and on their past experience, farmers felt forced to treat their animals. It would be necessary to provide veterinary extension services and training of veterinary village workers to support the farmers. This represents a needed additional output, in parallel to the development of the new regulations.

In our study, the decision-making process to buy and use antibiotics among independent farmers was also influenced by their relatives/family groups and farmers' association groups (Masud et al., 2020) and by the need for high productivity ("otherwise our chickens will not grow"). The need of productivity may be linked to the competitiveness of their products on the market. The need to remain competitive to survive in the economic market was not proposed in the framework of Lhermie et al. (2017), but we assume that in our study this element was important. A better understanding of the strategies of farmers, their groups of influence and their rearing practices (e.g., multi-species production, free-range production, and waste management) would help to construct a sustainable AMR mitigation plan.

4.3 Limitations of the study and perspectives

We are aware that some results might have been distorted by several factors and should hence be interpreted with caution. The translation of the different recordings and the subjective form of the method, which is based on stakeholders' willingness to respond to questions and interact with researchers, limits the reliability of our results (Schmeer, 1999). The categorisation of the key, primary and secondary stakeholders is somewhat subjective and could differ according to the composition of the research team. However, this should not affect the main conclusions regarding the stakeholders investigated. We only interviewed 2 "middlemen" stakeholders: as their activity is informal, most people interviewed denied that they acted as "middlemen". For private foreign farmers, we only interviewed fish farmers as the Chinese pig farmers refused to be interviewed. Language was a clear barrier for the research team in understanding the role of the private foreign farmers and importers because most of them do not speak Lao. The opinion of other stakeholders on private foreign farmers and the visit of their farms would lead us to believe that their position is similar to that of the fish farmers. Finally, the survey area is close to the border of Thailand and may not be reflective of the other provinces of Lao PDR, such as provinces bordering China, where the composition of multinational private companies could be different. This limited study nevertheless illustrated the highly dynamic and heterogeneous nature of stakeholders involved in the veterinary supply chain in Lao PDR.

The provenance of human antibiotics sold by human pharmacies and accessed by farmers has not been explored. Furthermore, the public sector has not been fully investigated (semi-structured interview=1, questionnaires=4), and future studies should focus on veterinary governmental authorities at different levels (national, district, local). The questionnaire survey did not include contracted farmers from private companies, private foreign farmers, neither fish nor bovine farmers and those population should be investigated.

4.4 Governance of AMR mitigation

By considering the AMR issue in the light of stakeholder groups, this study identified some key elements that might influence the success of the implementation of new veterinary antibiotic regulations. Beyond the description of the veterinary antibiotics supply chain, we investigated three groups of stakeholders, and the relations and connections

that influenced their decision-making on antibiotics. We also highlighted that these groups are dynamic and evolve with the context. Consistent with other low-income countries with weak enforcement of veterinary regulations, the sales of veterinary or human antibiotics for veterinary use, were largely over the counter (Mutua et al., 2020; Shryock, 2012). We believe that under current conditions in Lao PDR, relying solely on regulatory enforcement of veterinary antibiotic sales and use may not be enough. Several stakeholders indicated accessing human antibiotics in human pharmacies without prescription, including staff of district veterinary governmental authorities, even if it is forbidden by law. Furthermore, our study highlighted the lack of farmer knowledge regarding current regulations on access to antibiotics; low awareness of existing laws and regulations among the population of Lao PDR is also reported in another study (Jönsson et al., 2015).

We believed that an appropriate AMR governance system should be based on place based governance that takes into account the uncertainty around changes and builds upon multi-stakeholder inputs to establish an effective AMR risk reduction strategy (Chhotray and Stoker, 2009; Hinchliffe et al., 2018). Moreover, a study for the health sector reform in Lao PDR showed that diverse stakeholder groups should be involved in policy design and implementation in order to increase the probability of a sustainable and successful reform (Phillips et al., 2016).

Indeed, it would seem that policies would be more successful if it were recognised that they require the active participation of stakeholders and if the latter were actively involved in the process of drafting and implementing the policies (Salve et al., 2018). A place based governance would allow the construction a common understanding of AMR strategy (the expected impact) by truly involving the stakeholders identified, engaging them in dialogue about the objective of new regulations. It would be interesting to learn from similar experiences (Zaidi et al., 2015). We argue that stakeholders involved in the veterinary antibiotics supply chain should be included in developing an AMR strategy, including stakeholders from the public and private sector, involved in the importation and in the sale of antimicrobials such as antibiotics. To expect successful implementation of the new regulations, we believe that the public sector (i.e the Lao government and the veterinary government authorities), would have to collaborate with the private sector (private multinational companies, independent antibiotics suppliers, independent farmers) and monitor the informal stakeholders. Other studies have shown the important role played by the private sector in veterinary program, such as in the surveillance of Highly Pathogenic Avian Influenza in Vietnam (Delabouglise et al., 2015). Since 2019, studies have focused on collaboration between public and private sector to manage animal health programs. These collaborations are called public-private partnerships in the veterinary field (Galière et al., 2019a). It would be interesting to identify public-private partnerships that aim to adapt and reduce the sale and use of veterinary antibiotics in Southeast Asian countries, to learn from their collaborative experiences.

4.5 Theory of change

The use of theory of change is becoming increasingly popular in the public health field, but, to our knowledge, has not been applied to an AMR mitigation program (Breuer et al., 2016). In particular, theory of change has not yet been applied to an AMR mitigation program in the veterinary sector, although its value has been noted (Mutua et al., 2020). This study represents the first attempt to use the theory of change for AMR mitigation in the veterinary domain. However, we used a simplified theory of change, as the link between outcomes and impacts was not explored. Furthermore, the impact pathway was not made explicit during the study and was drawn by the researchers during data analysis. It would be necessary to co-develop the impact pathway and co-explicit the causal links between inputs, outputs, outcomes and impacts with stakeholders identified in this study. Our study represent an ex-ante analysis of the situation, and the theory of change can be mobilized in itinere or ex post, to have a follow-up of the intervention program (Blundo Canto et al., 2018).

4.6 Conclusion

Contrary to studies focusing on the irrational use of antibiotics by farmers, this study adopted the perspective of multiple stakeholders, seeking to anticipate difficulties in the implementation of new regulations related to access and use of veterinary antibiotics. By applying a simplified theory of change we were able to analyse the situation as a

complex adaptive system and thus to reinforce the consideration of the different stakeholders. Further participatory methods would be required to obtain a more complex theory of change, which would reflect the issues at stake and elicit ways of overcoming the obstacles to the desired changes. We believed that a sustainable strategy to reduce AMR risks should be co-constructed with the stakeholders identified. The dialogue and engagement of identified public and private sector stakeholders, would allow for the development of context-specific strategies. We also argue that research teams should use of the theory of change to support governments and stakeholders in implementing AMR mitigation plans, such as the reduced and appropriate use and sale of veterinary antibiotics.

References

- Bastiaensen, P., Kamakawa, A., Varas, M., 2011. World Organization for Animal Health Performance of veterinary services : Evaluation of the veterinary services of the Lao Peoples' Democratic Republic [WWW Document]. URL https://rr-asia.oie.int/wp-content/uploads/2020/05/pvs_laos_followup.pdf (accessed 4.9.21).
- Bennani, H., Mateus, A., Mays, N., Eastmure, E., Stärk, K.D.C., Häsler, B., 2020. Overview of evidence of antimicrobial use and antimicrobial resistance in the food chain. *Antibiotics* 9, 49. <https://doi.org/10.3390/antibiotics9020049>
- Blundo Canto, G., Barret, D., Faure, G., Hainzelin, E., Monier, C., Triomphe, B., 2018. ImpreS ex ante. An approach for building ex ante impact pathways. https://agritrop.cirad.fr/587546/1/guide_impress_ex_ante_eng.pdf
- Boeckel, T.P.V., Brower, C., Gilbert, M., Grenfell, B.T., Levin, S.A., Robinson, T.P., Teillant, A., Laxminarayan, R., 2015. Global trends in antimicrobial use in food animals. *Proc. Natl. Acad. Sci.* 112, 5649–5654. <https://doi.org/10.1073/pnas.1503141112>
- Brest, P., 2010. The power of theories of change. *Stanf. Soc. Innov. Rev.* <http://sc4ccm.jsi.com/wp-content/uploads/2016/07/The-Power-Of-Theories-Of-Change.pdf>
- Breuer, E., 2016. Using theory of change to design and evaluate public health interventions: a systematic review 17.
- Burgos, S., Otte, J., Rolland-Host, D., 2008. Poultry, HPAI and livelihoods in Lao People's Democratic Republic - A review [WWW Document]. URL http://94.126.106.9/r4d/PDF/Outputs/HPAI/wp10_IFPRI.pdf%5Cnhttp://r4d.dfid.gov.uk/PDF/Outputs/HPAI/wp05_2008.pdf (accessed 4.23.21).
- Charoen Pokphand Foods, 2017. Global vision for antimicrobial use stewardship in food animals, Bangkok, Thailand [WWW Document]. URL https://www.cpfworldwide.com/en/sustainability/policy/Global_Vision_for_Antimicrobial_en.pdf (accessed 4.2.20).
- Chhotray, V., Stoker, G., 2009. Governance: From Theory to Practice, in: *Governance Theory and Practice*. Palgrave Macmillan UK, London, pp. 214–247. https://doi.org/10.1057/9780230583344_10
- Delabougli, A., Dao, T.H., Truong, D.B., Nguyen, T.T., Nguyen, N.T.X., Duboz, R., Fournié, G., Antoine-Moussiaux, N., Grosbois, V., Vu, D.T., Le, T.H., Nguyen, V.K., Salem, G., Peyre, M., 2015. When private actors matter: Information-sharing network and surveillance of Highly Pathogenic Avian Influenza in Vietnam. *Acta Trop.* 147, 38–44. <https://doi.org/10.1016/j.actatropica.2015.03.025>

- Department of Livestock and Fisheries office, Ministry of Agriculture, 2017. Statistics on farms in 2017 [WWW Document]. URL data available on request : laodlf@gmail.com
- Drugs laws and regulations [WWW Document], n.d. . Minist. Health Lao PDR Food Drug Dep. URL http://www.fdd.gov.la/showContent_en.php?contID=30 (accessed 6.20.18).
- Figuié, M., Pham, A.T., Moustier, P., 2013. Grippe aviaire dans la filière. La réorganisation du secteur agro-industriel au Vietnam. *Rev. Agric. Environ. Stud. - Rev. Etudes En Agric. Environ.* 94, 397–420. <https://ideas.repec.org/a/rae/jourae/v94y2013i4p397-420.html>
- Food & Drug Department, Ministry of Health, Lao PDR, 2011. Drug and Medical Product Law (English language) [WWW Document]. URL http://www.fdd.gov.la/showContent_en.php?contID=30 (accessed 10.19.18).
- Food and Agriculture Organization of the United Nations, 2019. Tackling antimicrobial use and resistance in pig production: lessons learned in Denmark [WWW Document]. <https://doi.org/10.18356/9d63b715-en>
- Food and Agriculture Organization of the United Nations, 2016. The FAO action plan on antimicrobial resistance 2016-2020. Food and Agriculture Organization of the United Nations, Rome.
- Fusch, P.I., Ness, L.R., 2015. Are we there yet? Data saturation in qualitative research, in: *The Qualitative Report*, NSU Library. Florida, pp. 1408–1416.
- Galière, M., Peyre, M., Muñoz, F., Poupaud, M., Dehove, A., Roger, F., Dieuzy-Labayé, I., 2019. Typological analysis of public-private partnerships in the veterinary domain. *PLoS ONE* 14, e0224079. <https://doi.org/10.1371/journal.pone.0224079>
- Gilson, L., Raphaely, N., 2008. The terrain of health policy analysis in low and middle income countries: a review of published literature 1994-2007. *Health Policy Plan.* 23, 294–307. <https://doi.org/10.1093/heapol/czn019>
- Goutard, F.L., Bordier, M., Calba, C., Erlacher-Vindel, E., Góchez, D., de Balogh, K., Benigno, C., Kalpravidh, W., Roger, F., Vong, S., 2017. Antimicrobial policy interventions in food animal production in South East Asia. *BMJ* 358, j3544. <https://doi.org/10.1136/BMJ.J3544>
- Hinchliffe, S., Butcher, A., Rahman, M.M., 2018. The AMR problem: demanding economies, biological margins, and co-producing alternative strategies. *Palgrave Commun.* 4. <https://doi.org/10.1057/s41599-018-0195-4>
- Jacobsen, L.-B., Jensen, H.G., Lawson, L.G., 2006. Sector- and economy-wide effects of terminating the use of antimicrobial growth promoters in Denmark. *Acta Agric. Scand. Sect. C — Food Econ.* 3, 1–11. <https://doi.org/10.1080/16507540600680234>
- Jönsson, K., Phoummalaysith, B., Wahlström, R., Tomson, G., 2015. Health policy evolution in Lao People's Democratic Republic: context, processes and agency. *Health Policy Plan.* 30, 518–527. <https://doi.org/10.1093/heapol/czu017>
- Lhermie, G., Gröhn, Y.T., Raboisson, D., 2017. Addressing antimicrobial resistance: an overview of priority actions to prevent suboptimal antimicrobial use in food-animal production. *Front. Microbiol.* 7. <https://doi.org/10.3389/fmicb.2016.02114>
- Masud, A.A., Rousham, E.K., Islam, M.A., Alam, M.-U., Rahman, M., Mamun, A.A., Sarker, S., Asaduzzaman, M., Unicomb, L., 2020. Drivers of antibiotic use in poultry production in Bangladesh: dependencies and dynamics of a patron-client relationship. *Front. Vet. Sci.* 7. <https://doi.org/10.3389/fvets.2020.00078>
- Ministry of Agriculture and Forestry, 2020. Decree on veterinary medicine, No 199/GoL [WWW Document]. URL <https://www.laotradeportal.gov.la/index.php?r=site/display&id=1945> (accessed 4.23.21).

- Ministry of Agriculture and Forestry, 2016. Law on Livestock Production and Veterinary Matters (Amended) No. 08/NA dated 11 November 2016.
- Ministry of Agriculture and Forestry, 2011. Lao Census of Agriculture 2010/11 - Analysis of Selected Themes.
- Ministry of Health, Ministry of Agriculture and Forestry, 2019. National strategic plan on antimicrobial resistance in Lao PDR 2019-2023.
- Mutua, F., Sharma, G., Grace, D., Bandyopadhyay, S., Shome, B., Lindahl, J., 2020. A review of animal health and drug use practices in India, and their possible link to antimicrobial resistance. *Antimicrob. Resist. Infect. Control* 9. <https://doi.org/10.1186/s13756-020-00760-3>
- Paphassarang, C., Wahlström, R., Phoummalaysith, B., Boupha, B., Tomson, G., 2002. Building the national drug policy on evidence – a cross sectional study on assessing implementation in Lao PDR. *Southeast Asian J Trop Med Public Health* 33, 7.
- Phillips, S., Pholsena, S., Gao, J., Oliveira Cruz, V., 2016. Stakeholder learning for health sector reform in Lao PDR. *Health Policy Plan.* 31, 910–918. <https://doi.org/10.1093/heapol/czw010>
- Plsek, P.E., Greenhalgh, T., 2001. Complexity science: the challenge of complexity in health care. *BMJ* 323, 625–628. <https://doi.org/10.1136/bmj.323.7313.625>
- Saadi, A., Sahibi, H., Thys, S., Marcotty, T., Filali, H., Amarir, F., Rhalem, A., Kirschvink, N., Antoine-Moussiaux, N., 2021. Stakeholder analysis to improve the national control program of cystic echinococcosis in Morocco. *Prev. Vet. Med.* 186, 105227. <https://doi.org/10.1016/j.prevetmed.2020.105227>
- Salve, S., Harris, K., Sheikh, K., Porter, J.D.H., 2018. Understanding the complex relationships among actors involved in the implementation of public-private mix (PPM) for TB control in India, using social theory. *Int. J. Equity Health* 17, 73. <https://doi.org/10.1186/s12939-018-0785-1>
- Schmeer, K., 1999. Stakeholder analysis guidelines. *Policy Toolkit Strength. Health Sect. Reform* 48. https://www.academia.edu/28157521/Stakeholder_Analysis_Guidelines
- Shryock, T.R., 2012. Impact assessment of risk management interventions. *Rev. Sci. Tech. OIE* 31, 10. <http://dx.doi.org/10.20506/rst.31.1.2112>
- Tang, K.L., Caffrey, N.P., Nóbrega, D.B., Cork, S.C., Ronksley, P.E., Barkema, H.W., Polachek, A.J., Ganshorn, H., Sharma, N., Kellner, J.D., Ghali, W.A., 2017. Restricting the use of antibiotics in food-producing animals and its associations with antibiotic resistance in food-producing animals and human beings: a systematic review and meta-analysis. *Lancet Planet. Health* 1, e316–e327. [https://doi.org/10.1016/S2542-5196\(17\)30141-9](https://doi.org/10.1016/S2542-5196(17)30141-9)
- The World Bank Group, 2017. Lao People’s Democratic Republic - systematic country diagnostic. Priorities for ending poverty and boosting shared prosperity (No. 112241- LA). The World Bank.
- Thu, W.P., Sinwat, N., Bitrus, A.A., Angkittittrakul, S., Prathan, R., Chuanchuen, R., 2019. Prevalence, antimicrobial resistance, virulence gene, and class 1 integrons of *Enterococcus faecium* and *Enterococcus faecalis* from pigs, pork and humans in Thai-Laos border provinces. *J. Glob. Antimicrob. Resist.* 18, 130–138. <https://doi.org/10.1016/j.jgar.2019.05.032>
- World Health Organization, 2019. Critically important antimicrobials for human medicine, 6th revision [WWW Document]. WHO. URL <http://www.who.int/foodsafety/publications/antimicrobials-sixth/en/> (accessed 4.12.21).

-
- World Health Organization, 2015. Global action plan on antimicrobial resistance [WWW Document]. WHO. URL <http://www.who.int/antimicrobial-resistance/publications/global-action-plan/en/> (accessed 11.18.18).
- World Organisation for Animal Health, 2018. World Animal Health Information System [WWW Document]. URL http://www.oie.int/wahis_2/public/wahid.php/Countryinformation/Animalsituation (accessed 11.18.18).
- Zaidi, M.B., Dreser, A., Figueroa, I.M., 2015. A collaborative initiative for the containment of antimicrobial resistance in Mexico. *Zoonoses Public Health* 62, 52–57. <https://doi.org/10.1111/zph.12166>

Annexes du chapitre 3

Appendix 1. The scoring guide of the evaluation tool for the public-private partnership process.

Section 1: objective(s) of the PPP

Criteria	Quality attribute
Scoring the criteria	Score & comment
1.1 Common objective(s)	Operationality
<p>All partners (public and private actors) must co-construct and define the overall objective(s) to be achieved and the service to be delivered.</p> <p>Score 0: The partners do not agree on the definition of the common objective(s) to be achieved or the services to be provided. These objectives have not been co-constructed.</p> <p>Score 1: The partners do not agree on the definition of the common objective(s) to be achieved (which have not been co-constructed) or on the services to be provided.</p> <p>Score 2: The partners partly agree on the definition of the common objective(s) to be achieved but not on the services to be delivered</p> <p>Score 3: All partners agree on the common objective(s) to be achieved which was co-constructed and on the services to be delivered.</p>	
1.2 Formalization of the common objective	Stability
<p>Level of formalization of the common objective of the PPP (MoU, Letter of Agreement, Oral consent etc.).</p> <p>Score 0: Absence of formalization or lack of formalisation, which hinders the proper process of PPPs.</p> <p>Score 1: Formalized objectives warrant significant additional details.</p> <p>Score 2: Formalized objectives warrant minor additional details.</p> <p>Score 3: Well-detailed, fully formalized objectives of the PPP are written in a document recognized by all the partners.</p>	
1.3 Position of the partners regarding this common objective	Acceptability
<p>The common objective should be transparent and understood by each partner. It should satisfy each partner regarding his/her own strategies, needs and benefits.</p> <p>Score 0: Some of the partners are not satisfied with the common objective which lacks transparency.</p> <p>Score 1: Only one type of partner is satisfied with the common objective.</p> <p>Score 2: All types of partners are partly satisfied with the common objective and each partner understands the common objective.</p> <p>Score 3: All types of partners are fully satisfied with the common objective which is transparent.</p>	
1.4 Added value of the PPP	Stability; Relevance;
<p>The PPP should represent an added value to reach the common objective(s) of the program (it has been considered that only one sector conduct this program, but in this case the objective could not be reach or would entail more difficulties).</p> <p>Score 0: This PPP does not provide a clear added value; on the contrary it represents a constraint to reach the common objective(s) of the program.</p> <p>Score 1: The PPP is not a clear added value to reach the common objective.</p> <p>Score 2: The PPP is an added value to reach the common objective even if this common objective can be reach by one partner alone.</p> <p>Score 3: The PPP is a clear added value for the program and the common objective cannot be reached without the partner(s).</p>	

Section 2. Specific interest / benefits

2.1. The specific interest of the different partners	Relevance; Acceptability
<p>The different partners have specific interest and expected benefits in enrolling in the PPP. These specific interests should be explicit, transparent, formalized (if appropriate) and understood by the other partners. The specific interests shouldn't hinder the achievement of the common objective.</p> <p>Score 0: Lack of identification of the specific interest of the different partners. Score 1: The specific interests of some of the partners are not explicit and transparent. Score 2: The specific interests of all the partners have been identified and discussed between partners. Score 3: All partners' specific interests are identified, formalized (if appropriate) and understood and accepted by the other partners.</p>	
2.2 Allocation of benefits and other outputs (ownership)	Relevance; Acceptability; Inclusiveness
<p>The PPP may have differing benefits for the public and private sectors. The partners should be satisfied with the allocation of benefits and other outputs (such as products, intellectual rights, property rights). The allocation of benefits and outputs should be formalized if appropriate. The profit and loss related to the program of each partner should be transparent.</p> <p>Score 0: One of the partners thinks that the other partner gets many more benefits than they do and is not satisfied with their own benefits. The allocation of PPP outputs has not been specified OR it does not satisfy some partner(s). Score 1: The allocation of the specific benefits and PPP outputs has been partly discussed (not formalized) and does not satisfy some partners. Score 2: The partners are partly satisfied with the allocation of benefits and of the other outputs. Score 3: All partners are highly satisfied with the allocation of benefits and outputs, which is also properly formalized.</p>	
2.3. Achievement of goal(s) of the Veterinary Service	Relevance
<p>The PPP should help to reach the goal(s) previously defined by the veterinary services (VS).</p> <p>Score 0: The PPP does not help the VS to reach one of their goals; on the contrary it represents a constraint to reach one of their goals. Score 1: The PPP does not help the VS to reach one of their goals. Score 2: The goal(s) of the VS has been planned to be achieved through the help of the PPP. Score 3: The goal(s) of the VS has been achieved through the help of the PPP.</p>	
2.4. Achievement of goal(s) of the private sector	Relevance
<p>The PPP can help to reach the goal(s) previously defined by the private sector.</p> <p>Score 0: The PPP does not help the private sector to reach one of their goals; on the contrary it represents a constraint to reach one of their goals Score 1: The PPP does not help the private sector to reach one of their goals. Score 2: The goal(s) of the private sector has been planned to be achieved through the help of the PPP Score 3: The goal(s) of the private sector has been achieved through the help of the PPP</p>	

Section 3. Risks and constraints

3.1. Risks and constraints of getting involved in the PPP	Stability, Adaptability
<p>The different partners could have specific constraints/risks (financial, societal, etc.) in engaging in this PPP: these should be identified, discussed and understood by the partners.</p> <p>Score 0: Lack of identification of the constraints/risks of the different partners.</p> <p>Score 1: A minority of partners have identified their potential constraints/risks.</p> <p>Score 2: A majority of partners have identified their potential constraints/risks.</p> <p>Score 3: All partners have identified their potential constraints/risks.</p>	
3.2. Allocation of the constraints	Acceptability; Inclusiveness
<p>The PPP may have differing constraints (financial, societal, etc.) for the public and/or private sectors, and the partners should be satisfied by the allocation of these constraints.</p> <p>Score 0: One partner thinks that the other partner has fewer constraints or risks than they do and is not satisfied with their own constraints or risks.</p> <p>Score 1: One partner thinks that the other partner has far fewer constraints or risks than they do but is still satisfied with their own constraints or risks.</p> <p>Score 2: The partners are partly satisfied with the distribution of constraints or risks.</p> <p>Score 3: All partners are highly satisfied with the distribution of constraints or risks.</p>	
3.3. Change of practices	Operationality, Adaptability
<p>The achievement of the common objective may require a change in the practices (e.g. change or ban of the use of medicines, change in farming techniques, change in vaccination planning, etc.) of a specific population (veterinarians, technicians, farmers, etc.). These changes should be anticipated, accepted and accompanied if needed. The population concerned by the changes should be consulted from the beginning of the process.</p> <p>Score 0: The potential changes of practices of population(s) have not been anticipated.</p> <p>Score 1: The potential changes of practices of population(s) have been anticipated but not discussed with the concern population.</p> <p>Score 2: The potential changes of practices of population(s) have been anticipated, discussed with the concerned population but not accompanied.</p> <p>Score 3: The potential changes of practices of population(s) have been anticipated, discussed and accepted from the beginning of the process by the concerned population and accompanied if needed.</p>	
3.4 Negative costs to the society	Stability; Relevance
<p>Every initiative can carry some negative societal cost (e.g. constraints on a category of partners), economic cost (e.g. financial competitiveness with other partners, competitiveness for resource) or environmental cost (contamination)/ biodiversity cost (loss of wild or domestic animal or plant biodiversity). These costs should be anticipated in order to be minimized.</p> <p>Score 0: The partners pay no attention to negative costs to the society of the PPP.</p> <p>Score 1: The partners have partly identified negative costs to the society.</p> <p>Score 2: The partners have partly identified negative costs to the society and take them into account in the PPP modalities.</p> <p>Score 3: The partners have identified all the negative costs to the society and found a way to overcome them.</p>	
3.5 Conflicts of interest	Stability, Acceptability
<p>Potential conflicts of interests pose potential risks for a PPP. The potential conflicts of interests should be anticipated and all the procedures should be planned to avoid these potential conflicts of interests.</p> <p>Score 0: Conflicts of interests threaten the PPP.</p> <p>Score 1: Potential conflicts of interests have not been identified.</p> <p>Score 2: Potential conflicts of interests have been identified but a clear procedure to avoid them has not been put in place.</p> <p>Score 3: Potential conflicts of interests have been identified and all the procedures to avoid them are put in place.</p>	

Section 4. Analysis of the context and external factors

4.1 Relevance of common objective and of strategy regarding the context	Relevance
<p>The common objective(s) should be relevant regarding the health (public and animal health, food safety), socio-economic, environmental and institutional (breeding policy, local politics, national politics etc.) context.</p> <p>Score 0: The epidemiological, socio-economic, environmental and institutional contexts have not been analysed.</p> <p>Score 1: The contexts have been analysed but some major contradictions have been identified between the common objective and the contexts.</p> <p>Score 2: Some minor contradictions have been identified between the common objective and the contexts.</p> <p>Score 3: The common objective of the PPP is fully coherent with the all the dimensions of the analysed contexts and serves the common good.</p>	
4.2. International, regional, national and local laws	Operationality
<p>Legal obligations, laws and constraints from international organizations, regions, the country or localities are understood and properly applied by all partners and a public partner is responsible to ensure application of the laws. The public partner should ensure that the PPP is lawful and that any legal obligations or constraints are understood and properly implemented by all parties.</p> <p>Potential need for regulatory and / or policy changes that might be required to implement the PPP should be considered and anticipated.</p> <p>Score 0: International, regional, national and local guidance have not been identified and some guidelines are not respected.</p> <p>Score 1: Some major discrepancies are identified between the objective and purpose of the PPP or the actions of some partners and international, regional, national and local guidance.</p> <p>Score 2: Some minor discrepancies are identified between the objective and purpose of the PPP or the actions of some partners and regional, national and local guidance.</p> <p>Score 3: The objective and purpose of the PPP and the actions of the partners are coherent with the international, regional, national and local guidance.</p>	
4.3 Potential threats of the PPP and mitigation	Stability; Operationality
<p>Some external factors related to the context (epidemiological such as a pandemic, institutional such as political change or insecurity, socio-economic such as fluctuating market or civil society expectations, environmental such as extreme weather risks etc.) can threaten the stability of the PPP. For example, lack of appropriate infrastructures (such as road, water, electricity, etc.) could represent constraints for the proper implementation of the PPP. However, the PPP can also have the power to remediate these failures, to respond to these constraints. These should be anticipated and mitigation strategy for these potential threats put in place.</p> <p>Score 0: The potential threats have not been identified.</p> <p>Score 1: The potential threats have been partially identified but the strategy to overcome them has not been discussed.</p> <p>Score 2: The potential threats have been analysed and a strategy to overcome them has been discussed but not implemented.</p> <p>Score 3: The potential threats have been analysed and the strategy of implementation of PPP activities is based on the prevention of these potential risks.</p>	

4.4 Organisation of private and public sectors	Stability; Operationality
<p>Lack of organization of the private sector (supply chain, market channel, producer association) and/or the public sector (official veterinary services) could represent constraints for the proper implementation of the PPP. However, the PPP can also aim to improve the organization of the public and/or private sector.</p> <p>Score 0: Private and/or public sector organization is a major constraint and the PPP cannot improve this organization.</p> <p>Score 1: Private and/or public sector organization is a minor constraint and the PPP cannot improve this organization.</p> <p>Score 2: Private and/or public sector organization is not a constraint for the PPP OR private and/or public sector organization is a minor constraint and the PPP can improve this organization.</p> <p>Score 3: The PPP is a strength to improve private and/or public sector organization.</p>	
4.5 Analysis of pre-existing PPPs	Relevance
<p>If other PPP in the same geographical area or with similar objectives exist, the analysis of their key success factors, obstacles and outcomes could be helpful for implementing the good process practices of this PPP.</p> <p>Score 0: Other PPP have not been identified.</p> <p>Score 1: Other relevant PPP have been identified but not analysed.</p> <p>Score 2: Other relevant PPP have been identified and analysed.</p> <p>Score 3: Other relevant PPP have been identified, analysed, and the partners from the different PPP shared their experiences about key success factors, obstacles and outcomes.</p>	

Section 5. Governance of the PPP

5.1. Formalization of the PPP (contracts, sanitary mandate)	Stability; Acceptability
<p>The terms of the rationale of the PPP should be formalized if appropriate, either in a formal contract or in an alternative form appropriate to the PPP (MoU, Letter of Agreement, Oral consent etc.). It should be considered that a high level of formalization is not necessarily the most appropriate (for example the high degree of formality of an early collaborative PPP would put off potential partners). Score 0: There is no contract/text or agreement and this hinders the proper process of PPP. Score 1: There is an unofficial agreement which would warrant a greater level of formalization to favour a better process. Score 2: There is an official agreement but it is not signed by all partners Score 3: The level of formalization of the PPP is fully adapted and allows for a proper process.</p>	
5.2. Knowledge of the terms of the PPP (contract) and endorsement by all the partners	Stability; Acceptability
<p>The different partners should be aware of the terms of the contract and understand them all. The documents where the terms of the PPP are formalized (if appropriate) are endorsed by all partners from different sectors. Score 0: There is no contract/text OR there is a contract/text but some partners are not aware of it, and it is endorsed by none of the partners or only from one type of partner. Score 1: The terms of the agreement are understood and endorsed only by some of the partners (less than half). Score 2: The terms of the agreement are partially understood by the partners and are endorsed by most of the partners. Score 3: The terms of the agreement are fully understood and endorsed by all relevant partners.</p>	
5.3. Shared decision-making process	Acceptability; Adaptability; Inclusiveness
<p>Shared decision making with equality in the power relationship can represent a key success factor of the PPP, recognizing that some decisions can be entirely the responsibility of one partner. However, such decisions should be made in consultation with the other PPP partners and with full transparency and understanding of how that decision impacts all the relevant actors. It should be considered that shared decision making is time-consuming and costly, and may not be necessary for all decisions. Score 0: All the decisions are only taken by one type of partner and imposed on the other partners. Score 1: Few decisions are taken in collaboration and there is a need to set up a mechanism for shared decision making. Score 2: A mechanism for shared decision making is set up but could be improved. Score 3: A mechanism for shared decision making is set up and the partners are satisfied with it.</p>	
5.4. Opportunities of private parties' involvement	Adaptability; Inclusiveness
<p>If the proposal is initiated by the public party, it should ensure that relevant private partners have equal opportunities for engagement in a new PPP, respecting the country market rules. The public sector should propose a transparent call for tender process. If a proposal is initiated by the private sector, fair access is still a consideration for the public sector, subject to the specificity of the project and the laws of the country. As a minimum, the public sector should ensure that all relevant private sector actors are aware of the possibility of engaging in a PPP. Score 0: There was no call for tender, a direct contract was formed with one private partner previously selected AND/OR the PPP was initiated by the private sector and the public sector did not communicate to other private sector actors. Score 1: There was an oriented call for tender and only a few of the relevant private sector actors were aware of the possibility of engaging in a PPP AND/OR the PPP was initiated by the private sector and the public sector communicated in a non-transparent manner to other private sector actors.</p>	

<p>Score 2: There was an oriented call for tender but most of the relevant private sector actors were aware of the possibility of engaging in a PPP AND/OR the PPP was initiated by the private sector and the public sector weakly communicated the possibility of engaging in a PPP to other private sector actors.</p> <p>Score 3: Open transparent call for tender and all relevant private sector actors are aware of the possibility of engaging in a PPP AND/OR the PPP was initiated by the private sector and the public sector communicated the possibility of engaging in a PPP to other private sector actors in a transparent manner.</p>	
5.5. Funding & human resource availability	Stability; Operationality
<p>Funding and human resources (HR) should be available and sufficient. If an external source is providing money, the PPP should plan how to be autonomous and viable when the other source stops. The stability of human resources must be anticipated, as some people may evolve in their career and no longer be able to fulfil their role in the PPP.</p> <p>Score 0: The question of funding and HR availability <u>is a major constraint</u> for the different partners and hinders the proper conducting of PPP activities.</p> <p>Score 1: The question of funding and HR availability <u>is a regular constraint</u> in conducting the PPP's activities, or they <u>depend entirely on an external source</u> (catalysers e.g. UN, Private foundations etc...) with no plan to become autonomous.</p> <p>Score 2: The conducting of the PPP <u>is only weakly constrained</u> by funding and HR availability or it depends <u>partly on an external source</u> with a plan to become autonomous in the short term.</p> <p>Score 3: The different partners are fully satisfied with the funding and HR availability for conducting their activities in the PPP, <u>the PPP is financially viable</u>.</p>	
5.6. Funding and human resource allocation	Acceptability
<p>The allocation of funding and HR should be planned in advance and agreed on by the partners.</p> <p>Score 0: The question of funding and HR allocation is a major concern for some partners and hinders the proper conducting of its activities.</p> <p>Score 1: The question of funding and HR allocation is a regular concern for some partners.</p> <p>Score 2: Some partners are not totally satisfied by the funding and HR allocation between the different partners.</p> <p>Score 3: All partners are fully satisfied with the funding & HR allocation between the different partners.</p>	
5.7. Compatibility with the veterinary services mandate	Relevance
<p>The public partner(s) must ensure that the service(s) to be delivered falls within their VS statutory or political mandate and fulfils the intention of that mandate. The mandate should not be weakened and the public sector must continue to bear full responsibility for the VS mandate with complete independence.</p> <p>Score 0: The services to be delivered go against the intention of the VS mandate or the role of the private encroaches on the role of the public.</p> <p>Score 1: The services to be delivered do not take into account the intention of the veterinary services mandate.</p> <p>Score 2: The services to be delivered are partly aligned and partly help to fulfil the intention of the veterinary services mandate.</p> <p>Score 3: The services to be delivered are totally aligned and help to fulfil the intention of the veterinary services mandate.</p>	

Section 6. Planning and responsibilities of the PPP

6.1. Division of roles and responsibilities	Operationality; Acceptability
<p>The role of each partner should be properly defined. Formalisation of the partner's areas of action in the PPP should be specified in the contract if appropriate, i.e. the tasks they are assigned regarding collaboration and coordination of PPP. An organizational chart of the PPP can provide a useful element to understand who depends on whom, who decides for whom.</p> <p>Score 0: The role and responsibility of the PPP partners are not properly defined and this hinders the proper process of the PPP.</p> <p>Score 1: The role and responsibility of the PPP partners are partly defined but lack major details.</p> <p>Score 2: The role and responsibility of the PPP partners are set out in a document but the definitions sometimes lack clarity, details or the description of areas of responsibility of some partners.</p> <p>Score 3: The role and responsibility of the PPP partners are framed by a document (official document if appropriate) leaving no ambiguity in the relations between them.</p>	
6.2. Potential other partners	Stability; Adaptability; Inclusiveness
<p>Stakeholder mapping, to ensure that the relevant or impacted (potential blocker) actors have been identified and consulted, should be carried out regularly during the PPP. Some of the identified actors could be involved in the PPP to ensure the stability of the initiative and to favour positive results.</p> <p>Score 0: No stakeholder mapping has been carried out. Some relevant partners are missing but have not been properly identified.</p> <p>Score 1: No stakeholder mapping has been carried out. Some partners have been identified as missing but no plan is designed to integrated them in the partnership.</p> <p>Score 2 : Incomplete stakeholder mapping has been carried out. Some partners have been identified as missing but no plan is designed to integrated them in the partnership.</p> <p>Score 3: Complete stakeholder mapping has been carried out, and is regularly updated. If appropriate, the relevant partners have already been identified and planned to be included in the PPP. Or, the questions has been raised but the partners agree that no other partners are needed.</p>	
6.3. Inclusion of vulnerable group	Inclusiveness; Adaptability
<p>PPPs should enhance equity in terms of their outcomes (economy, health, well-being etc.). This can be done by truly involving all the beneficiaries, including the vulnerable group (indigenous, women, young people, etc.) during the conception phase of the PPP to consider their interest, or at a minimum by inviting them to meetings or workshops.</p> <p>Score 0: The PPP favours the exclusion of vulnerable groups.</p> <p>Score 1: The PPP does not consider the interest of vulnerable groups.</p> <p>Score 2: The PPP considers the interest of vulnerable groups and invites some of their representatives to meetings or workshops.</p> <p>Score 3: The PPP aim to enhance equity in terms of their outcomes (economy, health, well-being etc.) and truly involve all the beneficiaries, including vulnerable groups (indigenous, women, young people, etc.) during the conception phase of the PPP to consider their interest.</p>	

6.4. Defined duration	Operationality; Stability;
<p>The duration of the partnership should be predefined by both types of partner, with the possibility of extending the period or renewing the PPP if appropriate under predefined renewal conditions (e.g. if deemed appropriate following joint evaluation).</p> <p>Score 0: The duration term of the PPP has not been discussed and defined.</p> <p>Score 1: The duration term is partly defined OR the duration term is fixed, without the possibility of extending the PPP.</p> <p>Score 2: The duration of the PPP is predefined and agreed by both partners, but the conditions to extend the period have not been defined or are unclear.</p> <p>Score 3: The duration of the PPP is predefined and agreed by both partners, with the possibility of extending the period under predefined renewal conditions.</p>	
6.5. Modes of implementation of PPP activities	Stability; Adaptability
<p>The implementation modes for PPP activities should be flexible to meet partners' needs. By proposing a diversity of modes of implementation for activities, the PPP can satisfy a higher number of partners.</p> <p>Score 0: A single mode of implementation is proposed to the partners.</p> <p>Score 1: A dominant mode of implementation is proposed to the partners.</p> <p>Score 2: Several modes of implementation are proposed to the partners but still do not satisfy the partners' need.</p> <p>Score 3: Several modes of implementation are proposed to the partners and satisfy the partners' need.</p>	
6.6. Joint work plan	Operationality; Adaptability
<p>A detailed joint work plan for the activities to be implemented and the roles and responsibilities of each partners regarding those activities should be jointly drawn up by the partners. The elements of this work plan should be modifiable to enable PPP adaptability.</p> <p>Score 0: No joint work plan</p> <p>Score 1: There is a work plan but it has been devised by one type of partner and does not satisfy all the partners.</p> <p>Score 2: A work plan has been devised but could be improved.</p> <p>Score 3: A detailed joint work plan has been devised, with elements being modifiable to enable PPP adaptability.</p>	

Section 7. Competencies and trainings

7.1 Confidence in other partners' competencies and satisfaction of partners about their own competencies	Acceptability; Inclusiveness
<p>The partners should feel confident about their partner competencies to fulfil the common objective(s). The different partners should be satisfied with their own competencies to reach the common objective(s); the partners must be able to inscribe their role.</p> <p>Score 0: Partners don't trust their partner competencies to reach the common objective; and the partners are not satisfied with their competencies, nor do they feel confident about their abilities to inscribe the roles.</p> <p>Score 1: Partners don't trust their partner competencies to reach the common objective; <u>or</u> the partners are not satisfied with their competencies and don't feel confident about their abilities to inscribe the roles.</p> <p>Score 2: The partners do not fully trust their partner competencies but are confident that those competencies can improve (through training for example). The partners are partly satisfied with their competencies and are confident that these competencies can improve.</p> <p>Score 3: All the partners trust their partner competencies to reach the common objective(s). The partners fully trust their own competencies to reach the overall objective.</p>	
7.2 Organisation of trainings and capacity building	Operationality, Relevance, Adaptability
<p>Well designed and well planned trainings should be organized for operating partners if needed. An initial capacity assessment can be made to plan the trainings. Funding for trainings should be planned. The Veterinary Service, as well as private technical skills can be reinforced by the PPP through organized training.</p> <p>Score 0: No training for operating partners involved in collaborative activities is planned. The VS do not participate in any training and this hinders the proper process of the PPP.</p> <p>Score 1: Trainings for operating partners involved in collaborative activities are planned but more trainings are required.</p> <p>Score 2: Trainings for operating partners involved in collaborative activities are planned/have been conducted but the partners are not fully satisfied with the content.</p> <p>Score 3: Training for operating partners involved in collaborative activities is fully designed and planned in detail and the concerned partners are fully satisfied with the content. The VS benefit from trainings (if appropriate) which build their capacity and reinforce the trust of its partner.</p>	
7.3 Accessibility and frequency of trainings	Operationality; Inclusiveness
<p>The training organized should be at an appropriate frequency and should be accessible to all operating partners, to all partners that feel the need to improve their competencies.</p> <p>Score 0: Trainings organized are not accessible for the majority of the operating partners.</p> <p>Score 1: Trainings organized are accessible to everyone but only a few of the partners participate and the frequency is not appropriate.</p> <p>Score 2: Trainings are organized in a relevant timeframe and most of the partners participate .</p> <p>Score 3: All relevant partners participate regularly in the trainings.</p>	

Section 8. Communication and transparency of the PPP

8.1. Internal communication	Operationality; Acceptability; Adaptability; Inclusiveness;
<p>The PPP must have an agreed internal communication strategy. The frequency of meetings is to be assessed according to the need of the partners.</p> <p>Score 0: The partners have <u>no mechanisms</u> for internal communication with each other.</p> <p>Score 1: The partners maintain <u>informal channels</u> for internal communication with each other; meetings are rarely and insufficiently organized for the purposes of the partners.</p> <p>Score 2: The partners maintain a <u>formal internal communication mechanism</u> with each other, meetings are organized but at a frequency that appears insufficient to meet the needs of the partners.</p> <p>Score 3: Meetings are regularly organized, the interested parties maintain a <u>formal internal communication mechanism</u> with each other and <u>actively consult</u> with and solicit feedback regarding proposed and current activities.</p>	
8.2. Agreement in resolution modalities in case of conflict	Stability
<p>A manner to resolve potential conflict(s) between partners should be identified: which partner/jurisdiction to contact, how to resolve this conflict?</p> <p>Score 0: No potential conflict resolution strategy.</p> <p>Score 1: No official potential conflict resolution strategy has been developed but an informal strategy has proved sufficient for the moment.</p> <p>Score 2: A potential conflict resolution strategy has been developed but it is not known by all the partners.</p> <p>Score 3: An official potential conflict resolution strategy has been developed. Every partner knows whom to address, and what to do in case of conflict.</p>	
8.3 Communication with other parties, political entities and end users	Acceptability, Inclusiveness, Adaptability,
<p>The partners should keep other parties informed (such as beneficiaries and end users, actors impacted) in a transparent, effective and timely manner, of PPP activities and results, since the beginning of the process. Furthermore, the partners should inform the executive and political level about PPP activities and results in a transparent, effective and timely manner, in order to be able to discuss the potential need for a change of regulations and to promote the positive results of the PPP.</p> <p>Score 0: The PPP have no mechanism in place to inform other parties of PPP activities and results.</p> <p>Score 1: The PPP have informal communication mechanisms with other parties.</p> <p>Score 2: The PPP maintain an official contact point for communication but it is not always up-to-date in providing information.</p> <p>Score 3: The PPP contact point for communication provides up-to-date information, accessible via the Internet and other appropriate channels, on activities and results.</p>	
8.4 Transparency	Inclusiveness; stability
<p>All parties must ensure that the actions of the PPP are developed with appropriate transparency for all stakeholders at every level (allocation of outputs, of benefits, allocation of risk, modalities of action, activities of each partner etc.).</p> <p>Score 0: The transparency is <u>insufficient</u> at most levels.</p> <p>Score 1: The transparency is sufficient at <u>some</u> levels.</p> <p>Score 2: The transparency is sufficient in <u>most</u> levels.</p> <p>Score 3: The transparency of the actions developed and the process of collaboration in the PPP is appropriate <u>at all levels</u>.</p>	

Section 9. Collaboration in the PPP and satisfaction of the partners?

9.1. Willingness to collaborate and partners' acceptance of their own roles	Acceptability; Inclusiveness
<p>The partners should be happy/satisfied to collaborate with their partners and the PPP must have an agreed stakeholder engagement, which includes an appropriate approval process (formalisation of rationale behind the willingness to collaborate in this PPP).</p> <p>The different partners should be satisfied with their own roles in the partnership and their tasks and with the recognition of their role by the other partners.</p> <p>Score 0: The partners are <u>unsatisfied</u> with collaborating with the other partner(s) and their willingness to collaborate has never been formalized; the partners are really unsatisfied with their own role (either because they seek more responsibilities, because their role is not socially recognized etc.)</p> <p>Score 1: Only <u>some</u> partners are fully satisfied with collaborating with the other partner(s). Some of the partners are satisfied with their own role and with the recognition of their roles by the other partner.</p> <p>Score 2: <u>Most</u> of the partners are fully satisfied with collaborating with the the other partner(s). Most of the partners are satisfied with their own role and with the recognition of their roles by the other partner.</p> <p>Score 3: <u>All</u> the partners are fully satisfied with collaborating with their partners and their willingness to collaborate is formalized. All the partners are satisfied with their own role, and with the recognition of their roles by the other partner.</p>	
9.2. Level of involvement of partners	Acceptability
<p>Partners should be satisfied about the engagement of other partners in their assigned areas of action, role and responsibilities in the PPP.</p> <p>Score 0: None of the partners are satisfied with the involvement of the other partner(s).</p> <p>Score 1: <u>Some</u> partners are satisfied or partly satisfied with the involvement of the other partner(s).</p> <p>Score 2: <u>Most</u> partners are satisfied or partly satisfied with the involvement of the other partner(s).</p> <p>Score 3: <u>All</u> the partners are fully satisfied with the level of involvement of the other partner(s).</p>	
9.3. Capacity building in PPPs and/or existence of champion(s)	Operationality; Adaptability
<p>The existence of senior capacity builder(s) for PPP best practices, and/or champion(s) (individuals with strong communication skills who are knowledgeable and enthusiastic about the PPP), at regional, national, or local level, may help to promote an enabling environment and a good collaboration process.</p> <p>Score 0: There are no champions and no seniors.</p> <p>Score 1: There are no champions and no seniors but a process of recruitment and training has been initiated.</p> <p>Score 2: There is a champion and/or a senior who partly promotes an enabling environment and a good collaboration process.</p> <p>Score 3: Both senior(s) and champion(s) promote an enabling environment and a good collaboration process.</p>	

Section 10. Monitoring and evaluation of the PPP

10.1. Internal monitoring of the PPP	Operationality; Adaptability	Stability;
<p>The different PPP partners should frequently monitor the progress of the program and discuss the main conclusion and ways to improve the PPP. They should be able to adapt the process and activities regarding the results of internal monitoring.</p> <p>Score 0: No internal monitoring has been done, nor is planned.</p> <p>Score 1: Internal monitoring has been done by only one type of partner and the other partners are not kept informed, internal monitoring does not cover all the relevant areas of the PPP.</p> <p>Score 2: Internal monitoring has been done by only one type of partner and the other partners are kept informed, the internal monitoring covers almost all the relevant areas of the PPP.</p> <p>Score 3: Internal monitoring is done regularly by all the relevant partners, and the results allow for positive change.</p>		
10.2. Agreed indicators for joint internal monitoring	Acceptability; Adaptability	
<p>The partners must agree on how the PPP is monitored, and on the choices of indicators for internal evaluation. The indicators should be SMART (specific, achievable, measurable, relevant, time-bound). These results indicators can be linked to the strategies of the country, of the veterinary services or of other private sectors in order to strengthen the visibility of PPP activities (for example livestock development strategies, sustainable development goals, employment).</p> <p>Score 0: Most partners are not satisfied with the indicators developed or no indicators have been developed.</p> <p>Score 1: Indicators have been developed but only one sector is satisfied with the indicators.</p> <p>Score 2: Indicators have been developed and validated by the PPP partners, but not all the partners agree with the methodology of internal evaluation and its frequency.</p> <p>Score 3: The indicators have been developed in conjunction with all the partners. The indicators developed are SMART and address all areas of PPP). All the partners agree with the methodology of internal evaluation and its frequency.</p>		
10.3. External evaluations	Operationality; Adaptability	Acceptability;
<p>External evaluation helps to promote positive changes in the PPP. Partners must agree on how the PPP is evaluated, and on the choices of indicators for external evaluation.</p> <p>Score 0: No external evaluation of the PPP has been performed.</p> <p>Score 1: The PPP has been evaluated but it goes back quite far in time AND / OR the method used is very incomplete or unrecognized and did not help to favour positive change.</p> <p>Score 2: The PPP has already been the subject of several evaluations but their frequency needs to be improved and / or the methodology used is incomplete.</p> <p>Score 3: The PPP is subject to external evaluations according to a recognized and complete methodology which helped to favour positive changes, and the partners are satisfied by the frequency.</p>		

Annexes du chapitre 4

Appendix 1. Poultry population in Ethiopia, per region, and produced by EthioChicken in 2018.

	Total poultry population *	Poultry population produced by EthioChicken**
Tigray	6,190,640	2,384,858
Amhara	17,705,026	3,058,432
Oromia	19,014,114	5,355,333
Southern Nations, Nationalities, and People's region	10,491,131	6,214,696
Total of the four regions	53,400,911	17,013,319
Ethiopia	56,056,778	17,013,319

*those data come from:

Central Statistical Agency of Federal Democratic Republic of Ethiopia. Agricultural sample survey 2017/18 [2013 E.C.], volume II, report on livestock and livestock characteristics. (2018) Available at: <https://www.statsethiopia.gov.et/wp-content/uploads/2020/02/Agricultural-Sample-Survey-Livestock-Poultry-and-Beehives.pdf> [Accessed November 2, 2021]

**Internal data from EthioChicken

Appendix 2. Checklists used for the individual semi-structured interviews of the stakeholders of the case study.

1. Check list for actors at the conception of the PPP

THEMES	TOPICS	QUESTIONS
BUILDING of the PPP	Recruitment of partners	1-How did you define that a partner is good to work with? 2-What are you expectations from each partner?
	Motivations to participate	
	Commitment of partners	Is there a formal document about all your partnerships process?
	Organization of the public-private partnership	
	Roles and responsibilities	
	Time commitment	1-Did you have some apprehensions before weaving this partnership? Why? 2-What attitude do you have in front of these kinds of apprehensions?
	legality of the partnership	
	Risk identification	
	Risk awareness	How will you know that this partnership run well? Why?
	Risk allocation	
Performance indicators		
FUNCTIONING of the PPP	Collaboration	1-Tell me about the functioning of this PPP? 2-how do you make it work? What is your perception of this functioning?
	Communication	
	Management /Leadership	3-Is there something that you could suggest to make it more efficient?
	Governance structure	
	Transparency	
	Actors involvement	
	Promptness	
	Trust and respect	
Risk management		
OUTPUTS of the PPP	Action plans and interventions	Could you please tell me what these partnerships brought (output) to your Enterprise?
	Partnership's goals	Did these contributions from these partnerships meet your expectation? Why?
	Impact (what, where, how, whom and when)	What are the benefits, chages or impacts bought by this PPP?
	Perceived efficiency (resource efficiency to meet objectives)	
	Benefit and sustainability	
	Policy changes	
	Changes in the physical environment	
	Changes in the social environment	
	Changes in health indicators	
	Changes in financial income	
Others changes		

2. Check list for the operational public and private partners of the PPP

Themes	Questions
Poultry production	1) Could you tell me about the importance of poultry production? 2) Could you tell me about any issues in poultry farming? - <i>Could you tell me about the situation before?</i> - <i>Why is it better/ worse now?</i>
Role in the PPP and in EthioChicken mode,	3) What is your involvement in the PPP between EthioChicken and the Ethiopian government ? - How does the PPP works? EthioChicken model? What do they do exactly? - What is your role? Who are you in contact with? - Why did you accept working with them? - Do you have any agreement with the different people you work with in the program? With the poultry producers? Which kind of agreement? (check for any written agreement)
Interactions with other stakeholders	4) Could you tell me about your relationship with the farmers, the government, the development agents and the village poultry development agent? - Who do you work with the most? Why? How?
Benefits of the PPP	5) What do you get (as benefit) from this model of EthioChicken and Ethiopian government? Comparing to the past? 6) What does this program brings to your community? The poultry producers? Others? (e.g. women groups?)
Limits and scenario of improvement	7) Is there any issue? Which services do you want EthioChicken or Ethiopian government to improve? - Why? - How? 8) If you had a message to address to EthioChicken Company, what will you say to them? Why?

3. Checklist for the actors who adopted the model (farmers)

Themes	Questions
Poultry production	<p>1) Could you describe your poultry production activity? Who is taking care of your production? Could you tell me about any issues you have with your poultry farming? What difficulties do you encounter?</p> <p>2) Could you tell me about the importance of poultry production for you? What do you get from breeding chickens? Why is it important for you? what do you do with this money? (e.g. get children to school; buy school furniture's; buy things for the house...)</p>
Participation in the EthioChicken model	<p>3) Could you tell me about your involvement with EthioChicken?</p> <ul style="list-style-type: none"> - How does it work for you (EthioChicken program)? Who are you in contact with (who sell them the chickens and help them with their production)? - What do they do exactly? - Why did you accept working with them? - Do you have any written agreements? Which ones? Other type?
Interactions with other stakeholders	<p>4) Are you involved in producer association? Which ones?</p> <p>5) Could you tell me about your relationship with the agents/ the development agents and the village poultry development agent?</p> <ul style="list-style-type: none"> - Who do you work with the most? Why?
Benefits of the PPP	<p>6) What do you get (as benefit) from this program of EthioChicken? Comparing to the past (or before)?</p>
Limits and scenario of improvement	<p>7) Is there any issues? What do you want EthioChicken to improve as service?</p> <ul style="list-style-type: none"> - Why? - How? <p>8) If you had a message to address to EthioChicken Company, what will you say to them? Why?</p>

Appendix 3. The different codes that emerged from the reading of the transcripts and used for the data analysis. PPP: public-private partnership

Codes	Sub codes
Context	Poultry production in Ethiopia Story of the public-private partnership
Partners of the PPP	Ethiopian Government Business partner Independent private actors
Functioning of the PPP	PPP process and contracts
Importation of inputs	Importation and input pathway: Chicken Importation and input pathway: Vaccines Importation and input pathway: feed
Trainings organized in the PPP	Training pathway: public veterinarians Training pathway: private veterinarians Training pathway: farmers
Production and delivery of the day old chick and 42 days old chicks	Production Pathway (AGENT) Delivery pathway to grower agents and intermediary Delivery at farmers' level
Benefits of the PPP	Women empowerment/livelihood Employment Competencies; improvement of services Food security; livestock productivity; disease control Profit/revenue; optimisation/efficiency Collaboration / trust between government and private
Limits and solutions proposed	Problem of importation Solution proposed / recommendation: importation Low considering of poultry sector by the government Solution proposed / recommendation: government Problem of capital (farmers; agent) Solution proposed / recommendation: capital Problems of poultry consumption/ market Solution proposed / recommendation: consumption market Problems of poultry production Solution proposed / recommendation: production Problem of transportation ; input Solution proposed / recommendation: input Problem between actors Solution proposed / recommendation: problem between actors Solution proposed / recommendation: other
Added value of the PPP	Private and Public Point of view Public Point of view Private Point of view Farmers Point of view
Key success factors of the PPP	Conditions for success/ key success factors

Appendix 4. Number of participants of the participatory impact pathway evaluation are stakeholders from different administrative levels of the public-private partnership between EthioChicken and the Ethiopian government: public and private partners of the partnerships, actors who influence it and actors impacted by it.

Categories of actors	Actors	Administrative level	Semi-structured interviews (individual and focus group)	Workshops		
				1st	2nd	3rd
<i>Private actors</i>						
Independent actors	Grower agents (growers of 45 days-old chickens)	District	8 in one focus group	3	3	-
	Village poultry development agents	Ward (kebelle)	2	1	6	-
	Smallholders farmers (buyers of 45 days old chickens)	Ward (kebelle)	19 and 4 in one focus group	1	2	-
EthioChicken	Managing director and sales manager	National	2	2	2	12
	Farm hatchery, farm site, farm breeding and sale manager	Regional	4	6	7	-
	Area sales manager, district (woreda) coordinator	District	2	3	2	-
Poultry Producers and Processers Association	Members of the association	National	1	-	2	1
Microfinance Institution	Staff of the Operation department	National and regional	2	2	2	5
<i>Public actors</i>						
Actors from public veterinary services and other actors of Ministry of Livestock and Fisheries*	Poultry production director, and Coordinator of public-private partnerships	National	2	1	2	2
	Regional livestock officer	Regional	1	-	4	4
	Head, vice head and livestock expert of districts	District	3	3	-	-
	Development agents	Ward (kebelle)	3	2	2	-
Ministry of Health	Department of Public Health	National	-	-	2	2
Researchers	Social Scientist	International (ILRI)	1	-	-	-
	Animal genetics and breeding		2	1	1	-
	Veterinary Science, Animal production	National (Ethiopian University)	1	1	1	-

Pan-African Vaccines Control	Diagnostic department	International	1	-	2	-
Job Opportunity Creation Agency	Deputy director of agency Officer in rural department	National	1	-	-	-
		Regional	1	-	2	-
National Animal Health Diagnostic Investigation Center, public veterinary services	Associate researcher in virology, bacteriology and serology	National	2	-	2	1
National Veterinary Institute, public veterinary services	Head of research department	National	1	-	2	-
Veterinary Drug, Animal Feed, Administration Control Authority	Department of veterinary drug quality standard registration	National	1	-	2	1
Total			52 and 12 in focus group	26	48	18
			64			

*The Ministry of Livestock and Fisheries was merged with Ministry of Agriculture since April 2018.

Appendix 4. Benefits, limits and solutions proposed during the second workshop for each actor involved in the national and regional public-private partnerships between the Ethiopian government and EthioChicken.

*Sasso breed is a dual-purpose improved genetic breed from Hendrix genetics.

Actors	Benefits for the actors	Limits	Solutions (in regards with the partnership)
EthioChicken (private)	<p>PPP National</p> <ul style="list-style-type: none"> -Access to National Animal Health Diagnostic and Investigation Centre surveillance disease and training of the agents and farmers for free -Loan to agents through Microfinance Institutions and Job opportunity creation agency 	<p>PPP National</p> <ul style="list-style-type: none"> -EthioChicken holds earned exclusivity of Sasso breed: <ul style="list-style-type: none"> • stigmatization and suspicious feeling from competitors • non access to Poultry producer association=limit market access; - No access to foreign exchange currency threatens the stability of the activity: 	<p>PPP National</p> <ul style="list-style-type: none"> -Exclusivity right of Sasso breed* is an asset to EthioChicken -Access of improved genetics to other producers; Sasso has given improved genetics to farms in one region (which is directly under monitoring of Sasso genetic breeder). -Poultry production needs to become a priority industry for Ministry of Finance and Economic Development to have access to foreign exchange currency /export market (scenario 1)
	<p>PPP Regional</p> <ul style="list-style-type: none"> -Increase market access (through development agent; Village poultry development agents); -Increase market demand (satisfaction of the farmers); -Increase reputation from quality products; -Improved profits (chicken sales); 	<p>PPP Regional</p> <ul style="list-style-type: none"> - Instability of the market (fasting period) 	<ul style="list-style-type: none"> -The government is promoting chicken meat consumption
Government (national) (public)	<p>PPP National</p> <ul style="list-style-type: none"> -Increase in national chicken production (improved national economy) participates to the achievement of the Growth and transformation plan II. -Increase in employment (young veterinarians enrolled by EthioChicken, agents and their paid staff, Village poultry development agents) -Increase in profit through the sales of national vaccines (National veterinary institute) -Increase sales of local crops to EthioChicken. 	<p>PPP National</p> <ul style="list-style-type: none"> -National economy protection (limited foreign exchange currency import) that threat the stability of the actions and therefore its long-term impacts 	<p>PPP National</p> <ul style="list-style-type: none"> -Poultry production needs to become a priority industry for the government to have access to foreign exchange currency/export market;

Government (regional) (public)	PPP Regional -Increase in national chicken production (improved regional economy) -Improved trust from poultry consumers (quality chickens + prices regulation) -Increased in regional budget (from share of business profit with EthioChicken due to the rent of regional farm) -Improve local employment (Village poultry development agents, grower agents)	PPP Regional -Village poultry development agents threaten the PPP at regional level with livestock offices and development agents (stability of this specific partnership)	PPP Regional -EthioChicken to function more independently at local level could be positive (no influence on the overall impact); this part of the partnership could be seen as transitional (which is already the case in some regions)
Government (development agents) (public)	PPP Regional -Increase income; -Improve trust by farmers (higher competences)	PPP Regional -The knowledge of development agents about poultry management is low -Sort of negative relationship between development agents and agent	PPP National and regional -Training of the development agent
Grower agents (45 day old chicken producers) (private)	PPP Regional -Improved chicken production (better production; lower mortality); -Improved employment access (lower investment risks); -Improved security feeling (lower risks and stress); -Increased incomes (better production; market access guarantee); -Improved competences (poultry production and health) trough training	PPP National -Limited access to loan and capital PPP Regional - Market unstability (consumption problem due to cultural fasting practices) -High price of inputs (feed) -Delay in money collection by development agent and Village poultry development agent	PPP National -Access to more capital -The government is promoting the consumption of chicken meat
Farmers (private)	PPP Regional -Increase in chicken production (better production; lower mortality); -Increased incomes; -Improve security feeling (lower risks and stress); -Improve trust by consumer (quality products); -Improved competences (poultry production and health)	PPP National -Limited access to feed -Limited access to health service -Limited access to land PPP Regional -Low management capacity -Low breeding identification (some farmers prefer meat, some eggs)	PPP National -Establishment of feed manufacturing enterprises by private sector with support from government -Increase poultry feed availability (feed shops in localities) by privates with support from government. -Access to more capital

		-Market unstability (consumption problem due to cultural fasting practices)	-Improve development agent competencies who can help farmer -The government is promoting consumption of chicken meat
National crop producers (private)	PPP National -Increased market demand and increased income	PPP National -Sustainability of the activity is threatened due to food supply shortage (not enough crops compared to the demand) and problem to land access	PPP National -The government could provide incentives for the sector to grow to increase maize and soya bean production - The government could use prospective crop production estimates to meet the local industry consumption so that only excess product is exported
National Vaccine Institute (public)	PPP National -Increased incomes for National veterinary institute (huge demand of vaccines from EthioChicken)	PPP National - High cold chain constraints and reagents supply issues (no foreign exchange currency access) for National veterinary institute -Local vaccines are expensive (3 to 4x more than international vaccines) -Conflict of interest among different private vaccines producers	PPP National -Poultry production needs to become a priority industry for Ministry of Finance and Economic Development to have access to foreign exchange currency/export market; -National veterinary institute could only produce vaccines that are not global vaccines internationally supplied
Microfinance institutions (public-private) and Job opportunity creation agency (public)	PPP National -Strengthening of their activity and results/impact: higher income. -better results (lower risk business; training supported by EthioChicken)	PPP National -Their knowledge about poultry management is low and the credits give to farmers is low -Sometimes the young agent do not have the capacity to reimburse the loan	PPP National -Increase knowledge of Microfinance Institutions in poultry management and increase the loan amount
Hendrix genetics (private)	PPP National -Improved reputation (from performance of their breed; linked to quality production) PPP Regional	PPP National -Problem of importation because of Avian Influenza in France so EthioChicken have to import from Brazil -Exclusivity contract with EthioChicken = limited Ethiopian market	PPP National -Access of improved genetics to other producers but risk of losing market;

	-Improved trust of their breed by farmers: could lead to other market access (e.g. Kroiler, Hubbard, Tetra, Aviagen Range Red)		
National Animal Health Diagnostic and Investigation center (public)	PPP National -Facilitate National animal health diagnostic and investigation centre agent surveillance and control activity	PPP National - Diagnostic kit test supply issues for National Animal Health Diagnostic and Investigation Centre no foreign exchange currency access	PPP National -Poultry production needs to become a priority industry for Ministry of Finance and Economic Development to have access to foreign exchange currency/export market;
Other poultry producers (private)	PPP National -Possible improvement of the sale of their chicken (growth poultry industry market + consumer demands)	PPP National Loss of production market (higher risk business for agents and farmers), agents goes to EthioChicken because of better breed (faster and more resistant to disease and technical support from Vet)	PPP National -Access of improved genetics to other producers and adoption of EthioChicken model
Poultry producer association (private)	PPP National -Increased power due to stronger poultry industry (through government action and EthioChicken business)	PPP National -EthioChicken is not in the association because other poultry producers have suspicious feeling about EthioChicken and its exclusivity right on Sasso breed; <ul style="list-style-type: none"> • Weakness their power (lower lobbying options) 	PPP National -Both parties agree (public and EthioChicken) that it would strengthen the poultry industry if EthioChicken was part of the poultry producer association - EthioChicken can introduce other producers to other breeding houses with similar genetics but the breeding houses themselves set criteria for supply to a breeder farm.,

Annexes de la discussion

Appendix 1. Les analyses de cycle de vie pour l'évaluation des PPP en santé animale : esquisse de protocole pour le PPP au Paraguay

Préambule

Les analyses de cycle de vie visent à traduire les consommations de ressources et les émissions entraînées par le cycle de vie d'un produit (comme la viande) ou d'un secteur (comme l'élevage) en impacts environnementaux pertinents et compréhensibles (Bennett et al., 2019). Dans l'analyse de cycle de vie, chaque flux environnemental entraîné par une étape du cycle de vie du produit en question est relié à un impact environnemental correspondant. Concernant l'élevage, ces impacts peuvent trouver leur origine dans différentes étapes de la filière : agriculture, abattage, transformation, transports, vente au détail (Bennett et al., 2019). Les impacts environnementaux peuvent représenter les dommages causés à l'environnement et à la société. Les trois domaines de protection couramment utilisés sont : (i) la santé humaine (exprimée en DALY (Disability Adjusted Life Years)), (ii) la qualité des écosystèmes (exprimée en espèce*année) et (iii) l'épuisement des ressources (exprimé en dollars). Ces trois domaines de protection se composent de plusieurs catégories d'impact. Par exemple, la santé humaine sera influencée par des impacts sur le réchauffement climatique (comme le taux de méthane ou de dioxyde de carbone émis par l'élevage) ou la formation de particules fines dans l'atmosphère. La qualité des écosystèmes peut être endommagée par l'utilisation des terres, le réchauffement climatique, l'eutrophisation aquatique (qui peut être liée à l'excès de nitrate présent dans les déjections des animaux), ou la consommation d'eau. L'épuisement des ressources peut concerner l'épuisement des énergies fossiles ou l'épuisement des minéraux (Dick et al., 2015).

L'analyse du cycle de vie suit généralement 4 étapes : (1) définir le cadre de son analyse : objectif général, unité fonctionnelle et système étudié ; (2) faire un inventaire de données : collecter les données et étudier leur qualité ; (3) étudier les impacts : choix des catégories d'impacts, caractérisation des émissions et de la consommation, normalisation et pondération ; (4) interprétation : identification des sources majeures d'impacts et comparaison avec d'autres analyses. On peut en envisager une cinquième étape qui serait (5) la communication des résultats.

1. Le cadre de l'analyse

L'objectif de ces analyses, dans un cadre d'évaluation de PPP en santé animale, pourrait être de mesurer les impacts indirects du programme sur l'environnement. L'hypothèse sous-jacente est que les programmes de santé animale, dont les PPP, influencent les systèmes d'élevage à l'échelle des territoires et donc l'impact de l'élevage sur l'environnement. Il peut y avoir des changements d'organisation de filière, ou de taille du cheptel. Au Paraguay, le statut indemne de fièvre aphteuse obtenu par le biais d'un PPP, a permis le développement de filière pour l'exportation de la viande bovine. La taille du cheptel est passée d'environ 1 million en 1967 à 14 millions en 2019. Cette augmentation est principalement liée à la possibilité d'export grâce au statut indemne de fièvre aphteuse. On peut émettre l'hypothèse que cette augmentation du cheptel, principalement élevée de manière extensive, émet une pression sur l'usage des terres, sur le niveau de déforestation ou sur l'eutrophisation des sols. Il est à noter que le programme de lutte contre la fièvre aphteuse a probablement eu aussi un effet sur l'augmentation de la productivité par animal (la fièvre aphteuse fait perdre des capacités reproductives et de production). Cet effet est cependant très difficile à mesurer, étant donné le nombre de facteurs influençant la productivité, et notamment la génétique, le pâturage. Deux analyses de cycle de vie pourraient alors être faites : une se basant sur les données de 1967 (avant la mise en place du programme de lutte de fièvre aphteuse) et une se basant sur les données de 2020. Cela permettrait d'avoir une idée de l'impact indirect du programme de lutte contre la fièvre aphteuse. On peut aussi imaginer que ces analyses soient faites de manière régulière, comme outil d'accompagnement, pour permettre des recommandations aux acteur·rice·s du PPP afin de limiter ces impacts indirects sur l'environnement. Dans le cadre de PPP pas encore mis en place, ces analyses peuvent être réalisées en ex ante, pour essayer d'anticiper (et donc établir des mesures pour les amoindrir) les impacts sur l'environnement par l'influence que le PPP pourrait avoir sur le système d'élevage.

Le système : dans le cadre d'évaluation des PPP, il semblerait que le système adapté pour les analyses de cycle de vie soit le système d'élevage au niveau d'un territoire. Au Paraguay, le cheptel à l'échelle du territoire serait considéré. Cependant, les impacts seront regardés au niveau du territoire, mais aussi au niveau global (comme les émissions de gaz à effet de serre et le changement climatique). Ensuite, il faudra déterminer où s'arrête le système étudié : à la sortie de la ferme, ou jusqu'à la vente (et donc considérer le transport à l'échelle nationale, les abattoirs, les chambres froides « frigoreficos », les points de vente et d'exports).

L'unité fonctionnelle : l'unité fonctionnelle ne serait donc pas « par kg de viande », ni « par hectare » (comme il est fréquent de rencontrer) mais « par cheptels nationaux ». Dans le cheptel national, plusieurs typologies d'élevage pourront être considérées. Au Paraguay, il serait intéressant de

représenter au moins deux types d'élevage : d'une part, les « grands éleveurs » (« ganaderos mayores » en espagnol), possédant plus de 100 bovins et jusqu'à plusieurs milliers, et les « petits éleveurs » (« ganaderos menores » en espagnol), possédant moins de 100 bovins. Les sous-produits de la viande qui sont valorisés, comme le cuir ou les fumures, pourraient être également considérés. Considérer les sous-produits diminuerait l'impact environnemental du troupeau, car le troupeau n'est pas seulement considéré pour la production de viande, mais également de ses sous-produits.

2. Les données

Au Paraguay, il aurait été nécessaire dans un premier temps de décrire les différentes filières et les pratiques d'élevage. Au niveau des fermes, il aurait fallu s'intéresser à la consommation d'énergie, même si celle-là était probablement moindre (les bovins pâturent toute l'année, les fermes n'ont que très peu de bâtiments et de mécanisation, les éleveurs se déplaçant souvent à cheval), et à tous les intrants (alimentation, eau). Même si l'eau utilisée pour abreuver les bovins au Paraguay est principalement de l'eau pluviale, il faut en tenir compte, car c'est de l'eau qui n'est pas utilisée par l'écosystème. Il aurait bien sûr fallu quantifier l'utilisation des terres par la filière de viande bovine. Les bovins du Paraguay sont principalement nourris sur pâturage d'herbes natives ou améliorées. Au cours de ces dernières années, un système d'engraissement se développe, basé sur du maïs et du soja, et il aurait fallu en tenir compte pour les calculs (en considérant l'utilisation d'engrais et/ou des pesticides pour la production de céréales). Comme les bovins sont principalement élevés de manière extensive, il aurait été intéressant de considérer la capacité de séquestration de dioxyde de carbone par le pâturage. Le type de pâturage (prairies humides, prairies natives/prairies plantées, etc.) aurait alors été important à considérer. Le taux de déforestation et le type de forêt, pour permettre l'élevage bovin, aurait été à considérer, mais également de reforestation (et du type de reforestation). Les dynamiques de déforestation auraient aussi été à considérer. La déforestation émettant beaucoup de carbone en une fois, mais le développement de nouvelle forêt stocke du carbone, et au bout de 25 à 30 ans un équilibre est atteint. Il est souvent difficile de se procurer des données de qualité sur le terrain. Des données de références, par exemple sur la production d'énergie, la production d'engrais et la production de pesticides sont accessibles dans différentes bases de données disponibles sur le logiciel Simapro®.

3. Le calcul des impacts

Comme mentionné, il serait intéressant de présenter les résultats en termes de santé humaine, qualité de l'écosystème et déplétion des ressources. Pour le calcul des impacts en fonction de la consommation d'énergie et des flux produits, il est possible d'utiliser les lignes directrices du groupe d'experts intergouvernemental sur l'évolution du climat (IPCC, 2006).

4. Interprétation

L'interprétation des impacts sur l'environnement devra se faire en regard du PPP en santé animale étudié. De nouvelles questions de recherche seront alors soulevées. Quel est le chemin de causalité entre le programme et la trajectoire du système d'élevage amenant à ces impacts ? Dans quelles mesures le PPP aurait pu éviter ou atténuer ces impacts ? De plus, l'interprétation devra toutes les limites de l'approche (est-ce que la séquestration du carbone par les prairies a été considérée ? est-ce que les taux de déforestation considérés sont réellement dus à l'élevage ? Est-ce que les données « standardisées » utilisées correspondent bien au système d'élevage étudié ? Est-ce que certaines externalités de l'élevage, positives ou négatives, ont été oubliées ?). Finalement, les impacts devront être interprétés au regard du contexte du territoire étudié. Par exemple, au Paraguay, il sera important de considérer que dans certaines régions, l'utilisation des terres pour l'élevage ne pourrait pas être attribuée ni à l'agriculture ni à l'habitat car ce sont des zones inondables. Il sera également important de considérer l'importance de l'élevage dans leur économie formelle et informelle et leur culture. Finalement, les impacts ne seront pas les mêmes en fonction de la typologie d'élevage étudiée et pourraient être interprétés séparément.

5. Communication et recommandations

Idéalement, ces analyses devront être faites de manière participative et demandées par les acteur·rices. Plusieurs difficultés seront à dépasser pour que les PPP considèrent la dimension environnementale dans la trajectoire projetée des PPP. La considération d'impacts indirects sur le long terme, qui ne sont pas attribuables à une cause précise, et qui ne sont pas forcément « visibles » à un niveau local (comme les effets sur le système d'élevage qui a un effet sur le changement climatique) est difficile. De plus, la mise en place de mesures permettant une diminution des impacts environnementaux n'aura que des effets partiels et non palpables. Il faudra évidemment considérer tout ce qui existe déjà dans le pays. Par exemple, au Paraguay, une loi « zéro-déforestation » existe dans la partie orientale du pays, et une loi interdisant la déforestation de 45 % des forêts d'une propriété privée existe dans la partie occidentale. Une chambre de viande durable, réunissant des acteur·rices du secteur public et privé et des ONG, existe déjà. Les recommandations devront être faites aux acteur·rices du PPP en santé animale. Une des recommandations aurait pu être que le PPP travaille avec cette chambre de viande durable, cette dernière pouvant alors bénéficier de réseau national et local du PPP pour la fièvre aphteuse. Il sera alors essentiel que les recommandations soulignent les gains potentiels pour les acteur·rices locaux·ales dans des changements de pratiques, par exemple de conduite d'élevage (économie de quantité d'eau, restauration de leur écosystème, etc.).

Appendix 2. Les évaluations des PPP en santé animale à l'échelle individuelle basée sur l'approche des moyens d'existence : esquisse de protocole

L'approche fondée sur les moyens d'existence considère que les moyens d'existence sont liés à la disponibilité d'un ensemble de biens et de services qui varient dans le temps et dans l'espace et qui se répartissent en cinq catégories de capital : humain, naturel, social, financier et physique. Le capital humain représente les compétences, les connaissances, les capacités à travailler et à être en bonne santé et détermine la capacité à utiliser les quatre autres types de capital. Le capital naturel comprend toutes les ressources naturelles à disposition de l'acteur. Le capital financier représente les ressources financières que les gens utilisent pour atteindre leurs objectifs. Le capital physique comprend les infrastructures de base et les actifs de production nécessaires. Le capital social englobe les ressources sociales sur lesquelles les personnes se basent et agissent, y compris les notions de réseaux et de connectivité, d'appartenance à des groupes formels, de relations de confiance, de réciprocité et d'échanges (Chambers and Conway, 1991; United Nations Development Programme, 2015). Les stratégies d'existence mises en œuvre par les populations seront alors très différentes selon les capitaux dont elles disposent, leur accès et d'autres éléments contextuels (United Nations Development Programme, 2015).

Dans le cadre de l'évaluation d'un PPP à l'échelle individuelle, cette approche permettrait de s'intéresser à l'influence du PPP sur la place de l'élevage dans les moyens d'existence d'un·e acteur·rice. En fonction de la place de l'élevage dans les cinq différents capitaux, le PPP aura des effets différents pour l'acteur·rice en question. La décision d'un acteur·rice de participer à un PPP pourrait dépendre de la place de l'élevage dans ses moyens d'existence (**Figure 1**). L'évaluation individuelle, sur base de l'approche des moyens d'existence, aurait pu être utilisée pour le cas d'étude au Paraguay. On aurait pu, par exemple, particulièrement s'intéresser aux acteur·rices « réticents » à la vaccination de fièvre aphteuse. Mieux comprendre la place de l'élevage dans les moyens d'existence de certain·es éleveur·ses, aurait pu permettre de formuler des recommandations pour favoriser une adhésion au programme de lutte contre la fièvre aphteuse. Par exemple, il peut être envisagé de proposer une intervention concomitante à la vaccination de leurs bovins qui leur semble plus directement avantageuse (traitement antiparasitaire, conseils en alimentation ou autres).

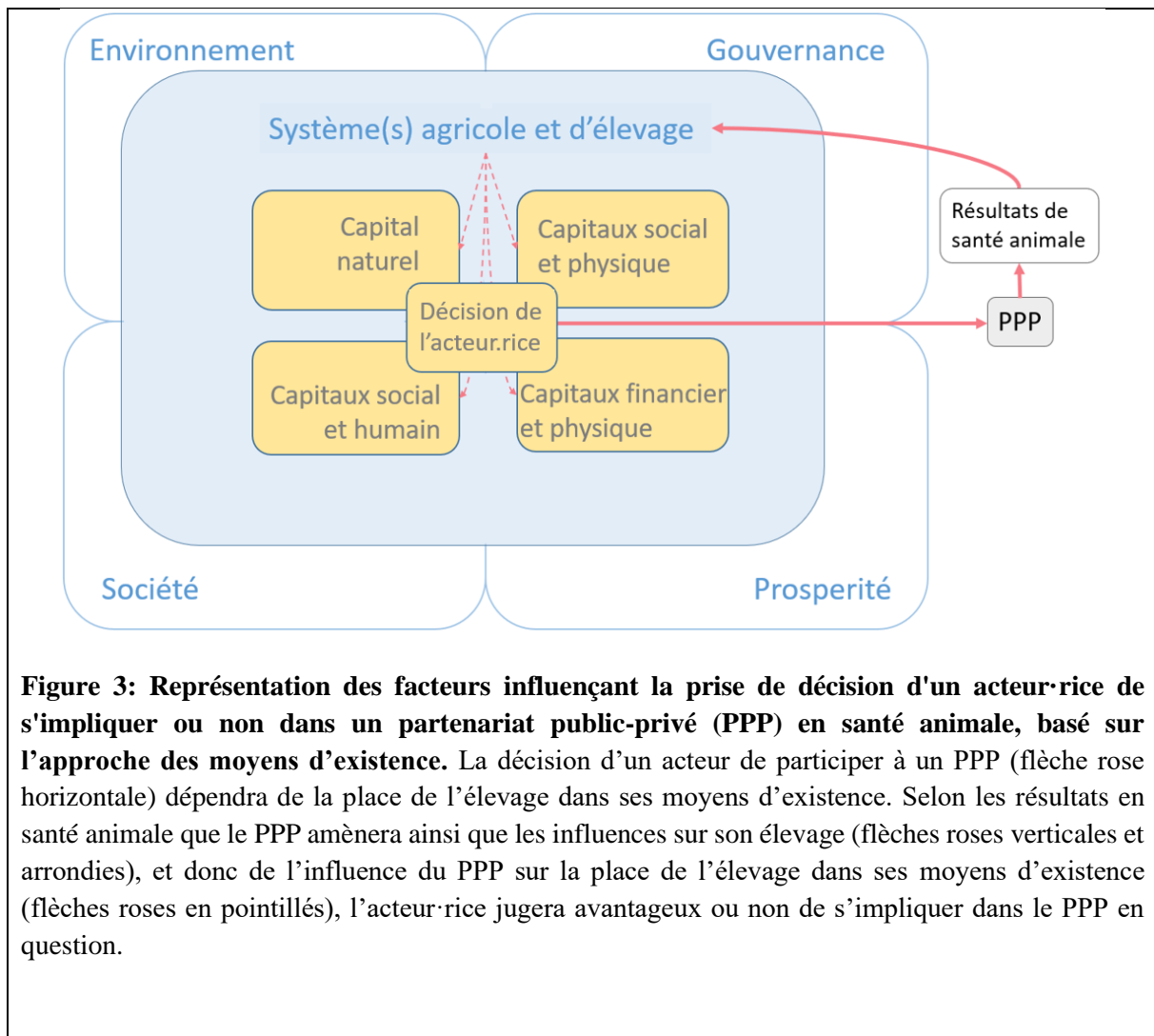
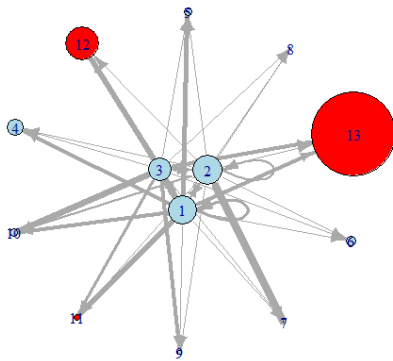


Figure 3: Représentation des facteurs influençant la prise de décision d'un acteur·rice de s'impliquer ou non dans un partenariat public-privé (PPP) en santé animale, basé sur l'approche des moyens d'existence. La décision d'un acteur de participer à un PPP (flèche rose horizontale) dépendra de la place de l'élevage dans ses moyens d'existence. Selon les résultats en santé animale que le PPP amènera ainsi que les influences sur son élevage (flèches roses verticales et arrondies), et donc de l'influence du PPP sur la place de l'élevage dans ses moyens d'existence (flèches roses en pointillés), l'acteur·rice jugera avantageux ou non de s'impliquer dans le PPP en question.

Appendix 3. Les évaluations des PPP en santé animale à l'échelle des réseaux d'acteur·rices : esquisse de protocole

Dans l'évaluation de PPP, il pourrait être intéressant de faire une analyse des réseaux sociaux à visée évaluative. Ces analyses font appel à la théorie des graphes et au calcul matriciel. Les « nœuds » pourraient représenter des groupes d'acteur·rices du PPP ou impacté·es par le PPP. Les « liens » pourraient représenter des flux d'informations ou de services (déclaration de maladie, conseils de prise en charge, etc.) rendus possibles grâce au PPP. Cela pourrait permettre de rendre compte de la structure des échanges entre les différents acteur·rices interconnectés du PPP. De plus, cette représentation en réseau nous aurait permis de mieux comprendre les jeux stratégiques entre acteur·rices qui auraient pu influencer leurs décisions de s'impliquer ou non dans un PPP : sa place dans le réseau, le nombre de lien qui le lie à d'autres acteur·rices. Une des valeurs ajoutées d'un PPP pourrait résider dans la création de liens entre les différentes catégories d'acteur·rices, permettant la circulation et les échanges d'informations ou d'autres biens échangeables (**Figure 2**).

Situation avec PPP



Situation sans PPP

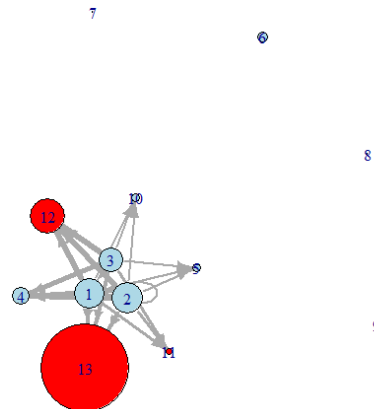


Figure 4 : Représentation des liens entre acteur·rices des Services vétérinaires publics (nœuds en rouge) et des acteur·rices privé·es (nœuds en bleu) dans un PPP fictif en santé animale (image à gauche). L'épaisseur des liens (les flèches) représente la quantité de flux d'informations. L'image à droite est la modélisation des liens entre acteur·rices sans les liens qui ont été permis par le PPP.

Presses de la Faculté de Médecine vétérinaire de l'Université de Liège

4000 Liège (Belgique)

D/2022/0480/3

ISBN 978-2-87543-187-5

