# PE&RC PhD PROJECT PROPOSAL
*Please read the appendix with instructions first*

| 1. GENERAL PROJECT INFORMATION | |
|---|---|
| Main PE&RC affiliated Institute / University | Wageningen University & Research (WUR) |
| Main PE&RC research group | Plant Production Systems Group (PPS) |
| Other PE&RC groups involved | |
| Project Title (English) | A value chain approach to agro-ecological intensification of smallholders' crop-livestock farming systems in southern Mali. |
| Project duration | FROM 01/01/17 TO 31/12/20 |
| Where will the research be conducted (country) | Mali |
| At which University will the thesis be defended? | WUR |
| Funding source(s) for this project (1, 2, or 3?) | 3 (external) (strikethrough)<br>Name of funding source: McKnight Foundation |

| 2. THE PhD CANDIDATE | |
|---|---|
| Full name of the PhD candidate | Arouna Dissa |
| Gender | MALE |
| Nationality | Malian |
| Date of birth | 18/05/1987 |
| Period of appointment | FROM 01/01/17 TO 31-12-20 |
| Hours per week | 40 |

| 3. SUPERVISION | | | | |
|---|---|---|---|---|
| **Project role** | **Name + title** | **Specialisation** | **Organisation** | **Hours/week** |
| Promotor | 1. Prof. Dr. Ken E. Giller | Farming Systems Research | PPS | |
| Daily supervisor | 1. Dr. Ir. Katrien Descheemaeker | Crop-livestock systems, modelling and participatory approaches | PPS | |
| Advisor | 1. Dr. Ousmane Mama Sanogo<br><br>2. Dr. Jos Bijman<br><br><br>3. Dr. Ir. Maja Slingerland | Crop-livestock farming systems of Southern Mali<br>Horizontal and vertical coordination in agrifood value chains.<br>Food security and development with farming systems as unit of analysis | « Institut d'Economie Rurale (IER)» in Mali<br>Department of Social Science (WUR)<br>PPS | |
| Technician | | | | |
| Other | | | | |

| 4. COLLABORATION | | |
|---|---|---|
| **Type of organisation** | **Name of organisation** | **Name + title of collaborator(s)** |
| University | 1.WUR | |
| Research Institute | 1. ICRISAT<br>2. IER (NARES) | Dr. Myriam Adam<br>Dr. Ousmane Mama Sanogo |
| Government agency | | |
| Others (e.g., FAO,WHO) | 1. AMEDD (NGO) | Ousmane Dembele and Arouna Bayoko, |

| 5. ETHICS |
|---|

| Will vertebrates be used in animal experiments? | NO |
|---|---|
| Are there other ethical issues to be considered with respect to this project? | NO |
| If YES, please elaborate: | |

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*In case a peer-reviewed full project proposal is available (e.g., NWO or EU), please send that proposal along together with the reviewers comments and the acceptance letter.*

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**6. SUMMARY** (max. 250 words)

The increasing population of southern Mali, in combination with the complex challenges posed by the rain-fed nature of agriculture, climate change and natural resource degradation, put smallholder farmers under pressure to produce more food and improve their livelihoods.

However, the raising population also offers opportunities to farmers to gain more income from increasing food demand in certain value chains, such as livestock and cereals. Among the food value chain actors farmers often represent a weaker or disadvantaged party in terms of resources and negotiation power (e.g. Bitzer et al., 2015; Trienekens, 2011), and their interests and priorities may be overlooked.

Agro-ecological intensification (AEI) is seen as a promising pathway to increase agricultural productivity and nutritious food production while maintaining healthy ecosystems and equitably improving livelihoods. However, the adoption rate of AEI options is often disappointing among smallholders.

The overall aim of this study is to contribute to improving smallholder livelihoods through a better understanding of the role of market participation and co-innovation among value chain stakeholders. The study will combine farming system and value chain approaches in iterative learning cycles with farmers and other stakeholders. By so doing, it will focus on promising value chains and AEI options that are tailored to the local specific context. Specifically, this study seeks to (1) investigate constraints and opportunities for the collaboration of farmers with other value chain stakeholders; (2) adapt existing farm management tools to foster the collaboration; (3) understand the importance of the communication strategy being used to facilitate dialogue among value chain stakeholders; and (4) examine the influence of co-innovation in value chain partnerships.

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**7. DETAILED DESCRIPTION OF THE RESEARCH PLAN** (max. 2500 words + 1 page literature list)

**Background:**

The population in southern Mali is growing fast, particularly in the cotton zone production of Koutiala district reaching a growth rate of 3.4 % for certain households (Falconnier, 2016) with a density of 70 people/km$^2$, (RGPH, 2009). The increasing population density in urban and rural areas will require that farmers produce more food to meet the additional demand. This situation will also lead to more food demand in certain food value chains, especially for meat and milk (e.g. de Ridder et al., 2015; Poccard-Chapuis et al., 2007), as well as for cereals (Falconnier et al., 2015).

However, agricultural production in this region is challenged by the scarcity (e.g. land) and degradation of natural resources. Furthermore, climate change is likely to add supplementary challenges with increased production risks. In this regard, Agro-ecological intensification (AEI) is seen as a promising way to increase agricultural productivity and nutritious food production while maintaining healthy ecosystems and equitably improving livelihoods (e.g. Wezel et al., 2015). According to these co-authors AEI concept gives more attention to the system approach and integrates more cultural and social dimensions in its design compare to similar concepts, such as sustainable intensification and ecological intensification.

AEI options comprise technologies targeted to various components of the farming systems and include also farm management, institutional arrangements and marketing improvements. In the past, relevant AEI (e.g. intensification and diversification of crops and stall feeding of cows during the dry season) options and information have been provided to farmers and policy makers (e.g. Falconnier et al., 2016; Sanogo, 2011; Traore, 2014). However, despite their potential, adoption of new options remains low in west Africa in general (Ndjeunga et al., 2005), and in particular in southern Mali.

**Problem statement:**
Research has looked into the reasons behind the limited adoption of new options by farmers (e.g. Feder et al. (1985); Marra et al. (2003)). In southern Mali, these reasons include (1) high farming risk, which limits the use of new options for which farmers have to invest or change practices; (2) poor market participation in the presence of high transaction costs due to market imperfections (e.g. Williamson, 1979) which limits also the collaboration among stakeholders in value chains (e.g. farmers, agri-businesses, traders and consumers); (3) poor farm management capacities and lack of information on improvement options (P. Dorward et al., 2007a) limiting the use of these options in collaborative opportunities; and (4) the modes of governance being implemented by the stakeholders to support their collaboration (e.g. Klein, 2000; Trienekens, 2011).

Hence, beyond the biophysical and technological dimensions in which the development of most agricultural technologies has taken place, there are also institutional (information and market facilities), economic (cash flow and profitability) and socio-cultural (preferences, habits, aspirations) dimensions playing a role in adoption processes (Dogliotti et al., 2014; Leonardo et al., 2015; Schut et al., 2016).

Access to markets and (market) institutions offer promising options for producers and consumers in search of improving their livelihoods (e.g. Barrett, 2008; Mather et al., 2013). However, due to various constraints (e.g. high farming risk, poor farm management capacities and market linkages), farmers often do not take full advantage from markets in developing countries. Desirable market access can be achieved by addressing constraints at both farm and higher levels (Barrett, 2008; Olwande et al., 2015). At the farm level, heterogeneity among smallholders (e.g. resource endowments and farming objectives), as well as trade-offs (Klapwijk et al., 2014) and synergies in resource use should be recognised, by using for example farming systems analysis (FSA). At a higher level, building up institutional infrastructure (e.g. Giller et al., 2008) may be an appropriate solution, which can be achieved using a value chain approach (VCA). In this respect, a combination of a value chain approach with farming systems analysis seems well-positioned to link smallholder farmers into relevant food value chains in their specific context.

Riisgaard et al. (2011) defines a value chain as "actors connected along a chain producing, transforming and bringing goods and services to end-consumers through a sequenced set of activities". The authors underscored that well-functioning value chain partnership requires coordination among its stakeholders. A possible strategy to facilitate coordination between multiple actors is to involve them in co-innovation process. Bitzer et al. (2015) consider the concept of co-innovation as « innovations that combine technological, organisational and institutional changes and that encompass different actors in and around the value chain». For instance, it can include agreeing on product quality or output contracting among chain stakeholders. Therefore, the co-innovation can be seen as agreements made or activities undertaken among stakeholders of value chains for better collaboration.

However, co-innovation involves actors that do not necessarily have the same interests, motivations, resources and power. As such, it requires a communication strategy that facilitates dialogue and negotiation between stakeholders (Chambers et al., 1993; Giller et al., 2008), by confronting them with, not only, the consequences of their choices and priorities, but also with new options to achieve a common vision in their collaboration. This raises the question "what kind of information do individual actors need to attain common understanding, and negotiate a vision for further collaboration in the food value chain?" In this respect, information from the scientific domain can play an important role (Giller et al., 2008). Scientists may contribute to the co-innovation by providing new insights, information and feedback into the dialogue among stakeholders (Anderies et al., 2004). As different values and interests are at stake in a negotiation process, scientists must operate in a different manner than the usual dominant mode and seek transparency (Funtowicz et al., 1993, Giller et al., 2008). Such engagement process can take shape in the form of iterative cycles of co-learning (Descheemaeker et al., 2016; Falconnier et al., 2017).

**Research question, objectives and hypotheses**
Given the challenges faced by smallholder farmers to produce more food to sustain their livelihoods within the risky environment of southern Mali, this study seeks to better understand the role of collaboration between farmers and other value chain actors in agro-ecological intensification, farming risk mitigation and decision-making at farm level in southern Mali.

The following specific objectives and hypotheses will be used to answer this research question.

***Objective 1:*** To investigate opportunities and constraints associated with the collaboration between farmers and other stakeholders in major value chains in southern Mali.
   ***Hypothesis***: Risk and uncertainty rooted in institutional and economic constraints are the primary

reasons of limited investment of smallholders and other stakeholders in the major value chains in southern Mali.

***Objective 2:*** To adapt existing farm management tools for better market participation of smallholders in southern Mali.

    ***Hypothesis***: Farm planning and budgeting tools tailored to the specific context of southern Mali help farmers to effectively match their farm operations with market participation objectives.

***Objective 3:*** To understand the importance of scientific information provision in the co-innovation process.

    ***Hypothesis***: A communication strategy tailored to the demands of various value chain actors fosters a common understanding and collaboration between farmers and other stakeholders in southern Mali.

***Objective 4:*** Examine the influence of improved collaboration among value chain stakeholders on changes at farm level (e.g. resource allocation and equity), as well as at value chain level in southern Mali.

    ***Hypothesis***: Co-innovation increases the use of AEI options and leads to farm-level changes in multiple dimensions

**Methodology**

This research is part of the second phase of the project "Pathways to Agro-ecological intensification in southern Mali" which covers a three-year period, from 2017 to 2019. The project currently intervenes in six villages, of which three villages were covered already during an earlier first phase ("old villages"), while in this second phase it extended to three additional villages ("new villages"). The study will rely on the co-learning process implemented by the project combining on-farm trials, workshops, focus group discussions and surveys with relevant stakeholders. The research strategy follows yearly iterative cycles of Describing, Explaining, Exploring and Designing (DEED) (Falconnier et al., 2017).

My research starts (**Error! Reference source not found.**) with a description and explanation of the current dynamics, constraints and opportunities in relevant value chains in the region (objective 1); concurrently existing farm management tools will be adapted to the local context so that farmers can use them to improve farm planning towards market participation (objective 2). Stakeholders will be involved in the iterative cycles of dialogue and negotiation to explore collaborative opportunities (objective 3). During this process information on the potential effects of AEI solutions will fuel the discussions to facilitate co-innovations among value chain stakeholders. The farm-level as well as the chain-level effects of the co-innovations (objective 4) will be monitored during the process.
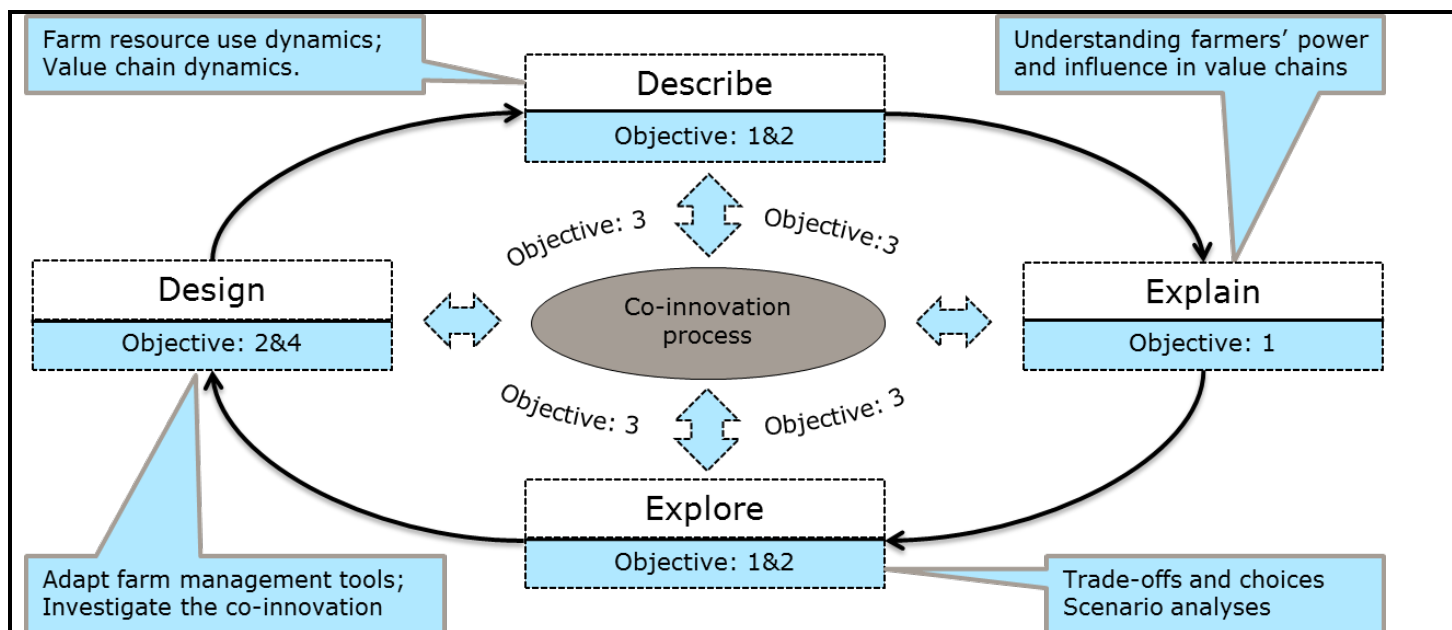
**Figure 1:** Co-innovation as part of the DEED-cycle (adapted from Descheemaeker et al. (2016)).

**Objective 1:**
Incentive to invest in value chain partnership depends heavily on the modes of governance being implemented among its participants to support production and exchange (Klein, 2000). However, smallholders often represent a disadvantage/weak links among agricultural value chains stakeholders (e.g. Donovan et al., 2015; Trienekens, 2011) that may come from institutional and economics constraints . This research will consider modes of governance in the major agricultural value chains in southern Mali to understand, and then explain reasons (e.g. opportunities, constraints, and risks) behind mechanisms that govern collaboration between farmers and other chain stakeholders, in order to gain insights for an increased bargaining position of smallholders in their local context.

**Research question 1:** Which constraints and opportunities shape the collaboration between farmers and other stakeholders in the major value chains within the crop-livestock farming systems in southern Mali?

This research will be conducted on cotton, maize, milk and sheep value chains, because they represent major source of income for different groups of farmers in southern Mali, and also are a combination of different farming objectives (e.g. for cash and/or food) for smallholders. Our approach will rely on qualitative diagnosis of value chains that using key informant interviews, focus group discussions (FGD), semi-structured interviews, and desk review (scientific publications, project and administrative documents) to describe in detail the governance structure of the value chains. A workshop will bring together stakeholders (e.g. all those actors who have a stake in the performance of the value chains) to list constraints, then discuss them, and finally classify them according to their importance in fostering or limiting the incentive to invest in the chain partnership for different farm types. In addition, risk, uncertainty, and collaborative opportunities in these value chains will be qualitatively investigated during this workshop, and then stakeholders will be ranked according to their interest in and influence on the collaboration opportunities using scale indicators (e.g. very small to large interest in and influence on). After a direct interview techniques will be used to investigate the effect of farmers' risk attitude and perception of riskiness of uncertainty in collaborative opportunities in the VCs. Furthermore, maps of the interdependent relationship among value chain stakeholders will be established. The chosen value chains will be compared with the cotton value chain as a reference, as this is the most important cash generator for farmers in the region, and a strongly regulated value chain that has been established since 1974. The comparison will take into account organisational arrangement, economies of scales, risk and uncertainty.

**Objective 2:**
When participating in markets (of goods, credit, and labour), a challenge for smallholders is to comply with participation requirements (e.g. timely delivery, product quality, etc.). Effective market participation may require them to use farm management tool, in particular in the uncertain environment (e.g. climate variability and price volatility) of southern Mali. In this respect, the decision making behaviour of these farmers may be locally embedded in the socio-ecological context (Singh et al., 2016) and may follow a sequential (or tactical) pathway as season progress because new information becomes available (A.

Dorward, 1999). Moreover, sequential or tactical decisions may be motivated for achieving strategic objectives (e.g. cultivate more cash crops next season). This study aims to adapt existing tools (e.g. Guidance of Management in Farms (Kebé et al., 1999) and a field manual for rain-fed agriculture management (P. Dorward et al., 2015)) to the decision making requirements of smallholders in southern Mali for desirable market participation.

**Research question 2:** How should existing tools be adapted so that they can be used by smallholders in farm planning towards market participation?

Using key informant interviews and focus group discussions (FGD) in the project villages, the research will first investigate the current resource use dynamics at farm level in order to adapt the existing farm management tools to the local context of southern Mali. Particular attention will be paid to identify the information needs of farmers when participating in value chains; in the same time existing farm planning and budgeting tools will be inventoried, adapted, and tested with smallholder farmers in their local contexts. For this, from 2017 to 2019 the use and usefulness of the adapted tool will be discussed with farmers throughout the season on a regular basis (before, during and after the season). Furthermore, the tool will be discussed with other chain stakeholders (e.g. traders and input suppliers) as well as with actors (e.g. advisors and NGOs workers) intervening in the region before and after the season, for further improvement.

The research will be conducted gradually throughout the duration of the study, by starting in 2017 with twelve farmers from the four farm types (Falconnier et al., 2016) in the project villages  and by adding yearly four new farmers to reach at the end twenty in total. In the first year the tool "guidance of management in farms" will be implemented, followed by plenary sessions during which farmers will present individually the past season results for an exam in order to gain insights from them and the ways to integrate inputs of other tools in the adapted tool. In 2018, sixteen farmers will fully implement the adapted tool, and then after the season a second round of the plenary sessions will be organised. In the same way the adapted tool integrating suggestions from the previous season and will be fully implemented by twenty farmers in 2019.

The communication will rely on Participatory Learning and Action (PLA) approaches (e.g. Galpin et al. (2000) and P. Dorward et al. (2007b)), in addition to the co-learning cycles implemented by the project. Also, a decision tree diagram will be used to monitor the decision making pathway along the season. Moreover, an evaluation form will be designed based on the theory of qualitative model evaluation and learning (e.g. Sempore et al., 2015), and used in regular evaluations. Furthermore, the usefulness of the new tool in managing sequential or tactical and strategic decisions will be investigated by monitoring the number of those objectives encountered and for which concrete decisions have been taken.

**Objective 3:**
Value chains (e.g. maize, milk and sheep) in southern Mali are often characterised by lack of dialogue and interaction among stakeholders, which may limit their collaboration. Using a communication approach this research aims to co-learn with value chain stakeholders the effectiveness of this stragegy in fostering dialogue and negotiation among the stakeholders for a desirable collaboration. Smallholder farmers represent in general a weaker segment in these value chains. Consequently our approach seeks to strengthen their bargaining position and to give relevant information to other value chain stakeholders.

Working with farmers involved in the project activities in selected value chains, our communication strategy is rooted in an interactive and interdisciplinary research framework, which uses workshops in iterative cycles and visits of demonstration fields of AEI options, organized by an NGO partner (ONG AMEDD). During these meetings, the dialogue between stakeholders is fuelled with scientific information generated through integrated analysis combining trade-off and cost benefit analysis.

**Research question 3:** How can scientific information be conveyed to value chain actors to support a dialogue and negotiation process?

Dialogue among chain stakeholders is key driver for a common understanding, and subsequent improved collaboration. However, participants (e.g. stakeholders and facilitators) in the dialogue need to have a common basis (i.e. same understanding of a topic) for open and fruitful discussions. The common basis can be fostered using, for example, local metaphors, indigenous knowledge and observations from the surrounding environment (e.g. demographic pressure on land resources).

Our research approach will first identify questions raised by stakeholders, try to answer them, and then

feed findings and relevant information into the dialogue between stakeholders (Anderies et al., 2004). Different stakeholders should be more interested in information related to their concerns and claims (Giller et al., 2008). Therefore, our research will find out ways to effectively package and convey the information to individual stakeholder, and then investigate the effectiveness of our communication approach. In this respect, a participatory qualitative assessment approach (e.g. Horton et al., 2011) will be used to prepare a plan of implementation, as well as a change model (e.g. Figure 2), and then monitor information during the process (e.g. Alvarez et al., 2010; Douthwaite et al., 2007). The monitoring will include the importance of our approach as well as its influences on decision making, types of information individual stakeholders are interested in, common understanding of topics covered, number of questions raised as well as number of concrete actions (e.g. agreement on quality and delivery time) undertaken. At the end perceptions of stakeholders on selected outcomes will be investigated using scale appreciations (e.g. from no to substantial progress).
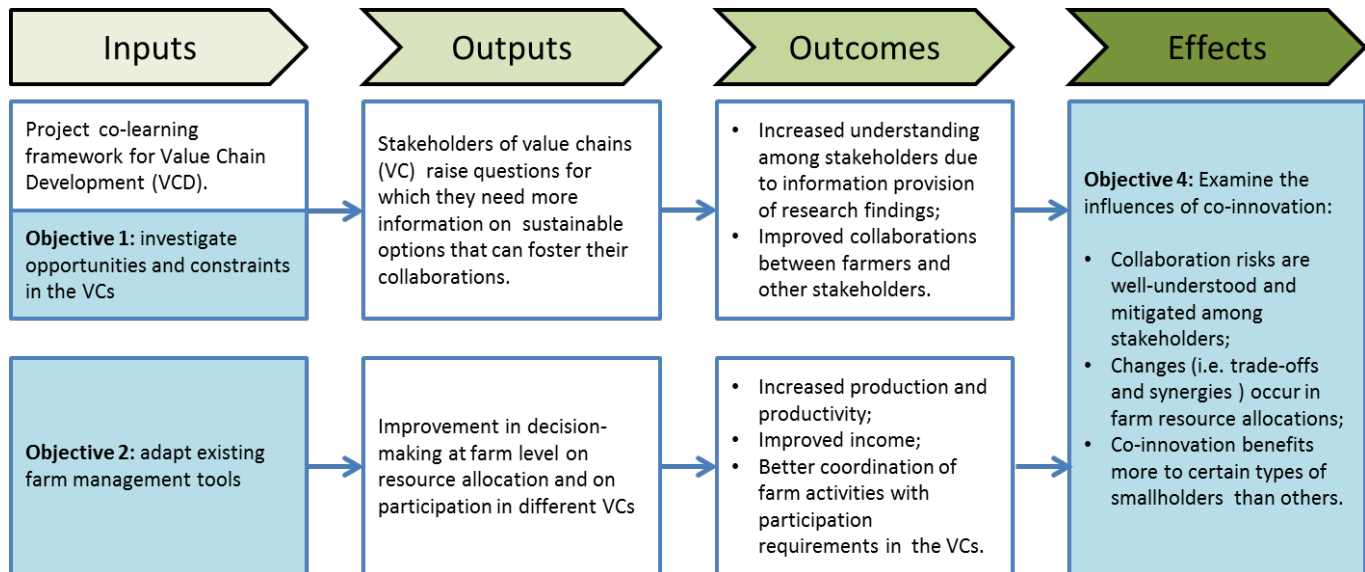
| Inputs | Outputs | Outcomes | Effects |
|---|---|---|---|
| Project co-learning framework for Value Chain Development (VCD). **Objective 1**: investigate opportunities and constraints in the VCs | Stakeholders of value chains (VC) raise questions for which they need more information on sustainable options that can foster their collaborations. | • Increased understanding among stakeholders due to information provision of research findings; • Improved collaborations between farmers and other stakeholders. | **Objective 4**: Examine the influences of co-innovation: • Collaboration risks are well-understood and mitigated among stakeholders; • Changes (i.e. trade-offs and synergies ) occur in farm resource allocations; • Co-innovation benefits more to certain types of smallholders than others. |
| **Objective 2**: adapt existing farm management tools | Improvement in decision-making at farm level on resource allocation and on participation in different VCs | • Increased production and productivity; • Improved income; • Better coordination of farm activities with participation requirements in the VCs. | |

**Figure 2: a brief overview of the model of change of our general framework**

**Objective 4:**
In southern Mali, common farming risks are related to climate variability and price volatility. As such, smallholders may be interested in AEI options to deal with these risks (e.g. towards crop diversification and intensification). Also other value chain stakeholders may develop risk mitigation mechanisms towards diversification of sourcing. Furthermore, also joint risk mitigation mechanisms, such as contracting, are possible. Besides, heterogeneity (e.g. in resource endowments) among famers plays an important role in participation in value chain partnership. Therefore, this study seeks to investigate the effect of improved collaboration on changes among value chain stakeholders. Furthermore, special attention will be given to its contribution to changes in farm resource allocation as well as in the wealth distribution among different farm types established in southern Mali.
**Research question 4:** To what extent does co-innovation influence the risk mitigation measures by various value chain stakeholders, and the changes (e.g. resource allocation and wealth distribution) at farm level?

The assessment strategy will rely on mixed methods using an asset-based approach (e.g. Orr et al., 2015; Rogers et al., 2009; Sheck et al., 2013). This approach allows a broader understanding of changes in value chains both at farm and value chain levels. Its main strength is the recognition that smallholders sustain their livelihoods by participating simultaneous in several value chains. Our investigation will cover the maize, milk and sheep value chains because they were prioritized by farmers in the project villages, also they represent promising income generating alternative in case of failure in cotton sector (major income source). The study will cover 48 farmers selected in the 6 villages of the project, in addition to other chain stakeholders involved in the co-innovation process. Sample of farmers will include randomly the four farm types from the project villages. Data will be collected on both quantitative and qualitative aspects. The collection methods will encompass individual surveys of chain stakeholders with semi-structured questionnaires and periodic household data collection, focus group discussion with farmers and other chain stakeholders. Quantitative data will be collected iteratively from 2017 to 2019 on farm resource allocation, farm management planning and decisions (see Figure 2), the use of AEI options, farm household characteristics and assets indicators. Besides, a triangulation of the information from the different sources will be conducted and discussed with chain stakeholders as input to the co-innovation process. Changes

indicators will be defined in a participatory approach with value chain stakeholders. According to Vaidya et al. (2014) the bottom-up definition of indicators is helpful because it generates a comprehensive list of indicators which may reduce conflict, building trust and improve social learning.

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## 8. TIME TABLE OF THE PROJECT AND WORK PROGRAMME

| No. | Activities | Schedule (quarter per year) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2017 | | | | 2018 | | | | 2019 | | | | 2020 | | | |
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 1 | Literature review and research proposal writing | ▓ | ▓ | ▓ | | | | | | | | | | | | | |
| 2 | Research objective 1 | | | | | | | | | | | | | | | | |
| 2.1 | Taking contact avec with key stakeholders of value chains | | | | ▓ | | | | | | | | | | | | |
| 2.2 | Data collection on functioning of value chains | | | | | ▓ | | | | | | | | | | | |
| 2.3 | Writing article 1 | | | | | ▓ | ▓ | | | | | | | | | | |
| 3. | Research objective 2 | | | | | | | | | | | | | | | | |
| 3.1 | Diagnosis of farm resource use, inventory of existing tools | | | | ▓ | ▓ | | | | | | | | | | | |
| 3.2 | Participatory workshop for adapting existing tools (yearly) | | | | | | ▓ | | | | ▓ | | | ▓ | | | |
| 3.3 | Testing of adapted tool and collecting(yearly) | | | | | | | ▓ | | | | ▓ | | ▓ | | | |
| 3.4 | Writing article 2 | | | | | | | | | | | | ▓ | ▓ | | | |
| 4 | Research objective 3 | | | | | | | | | | | | | | | | |
| 4.1 | Implementation of communication strategy using project framework | | | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | | | | |
| 4.2 | Data collection and monitoring throughout negotiation process | | | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | | | | |
| 4.3 | Writing article 3 | | | | | | | | | ▓ | ▓ | ▓ | ▓ | | | | |
| 5 | Research objective 4 | | | | | | | | | | | | | | | | |
| 5.1 | Data collection and monitoring throughout co-innovation process | | | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | | | | |
| 5.2 | Writing article 4 | | | | | | | | | | | | | ▓ | ▓ | | |
| 6 | Thesis writing | | | | | | | | | | | | | | | | |
| 6.1 | Compiling, editing, and then submitting | | | | | | | | | | | | | | ▓ | ▓ | ▓ |

| **9. SOCIETAL RELEVANCE** |
|---|
| This research will provide insights on how to better integrate agro-ecological solutions into the market and the institutional environment of smallholders in developing countries. Furthermore, it will develop useful farm management tool which will help farmers in decision-making at farm level as well as coordinate farm activities with their participations in value chains. |

| **10. DATA MANAGEMENT** (max. 250 words) |
|---|
| This research is part of the second phase of the project "Pathways to Agro-ecological Intensification in Southern Mali" for a three-year period (2017-2019). It's implemented by a consortium of organisations, namely Wageningen University and Research (WUR), International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Institut d'Economie Rurale (IER) and Association Malienne d'Eveil au Developpement Durable (ONG AMEDD). Each of these organisations has its own focus and data generated are shared with the others. Also, data generated during the first phase are available to all project partners. Our research will use these data in addition to data that will be generated for its own purpose. A second Phd research is being doing in the project framework on crop-livestock systems. When possible we will collect some data together and share them mutually.<br><br>Data management plan will follow guidelines of Plan Production Systems (PPS). All numerical data will be stored and monitored in a file named "PhD documents" from my Personal Computer and backup copy of these data will be made monthly in an external hard drive.  Surveys data will also be saved and monitored in the PPS online data management (http://phd.pps.wur.nl/).<br><br>Eventually, the project may collaborate and exchange data with other projects being implemented in southern Mali (e.g. Africa RISING project). Elsewhere, interns (e.g. master students) may be involved in data collection on the behalf of the project's activities; they will be requested to keep data generated confidentially. |