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Report of Farmer Innovation contest in Mali: Koulikoro, Ségou and Sikasso regions

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Table of Contents

Executive Summary:

Smallholder farmers engage in production activities under varied agro-ecological conditions thus blanket recommendations are not always appropriate meaning context specific solutions in form of farmer led innovations are sometimes required. These innovations often remain invisible or 'beyond the radar' of research scientists. In order to scout for these innovations and also encourage farmers to innovate, a farmer innovation contest was conducted in Koulikoro, Ségou and Sikasso regions by IER PARI scientists with financial support from ZEF through FARA. The contest involved scoping visit, sensitization and training of scouters, publicity via electronic and print media, submission of innovation applications, prescreening of applications, evaluations, validation and awarding of prizes. Scoping involved a reconnaissance visit to the regions to collect key regional information. This visit also helped to identify the best media for publicizing contest information. Sensitization and training sessions for extension staff in the three regions were thereafter held where farmer innovations concept was introduced and explanations on how to fill the contest application forms given. This was followed by radio announcement jingles in ORTM at prime hours in both local and French languages. Application forms were filled and submitted to the *cercle* level extension officers and forwarded to the regional offices. An evaluation panel was constituted comprising of extension offices, researchers and PROFEIS Mali network staff. The submitted applications were screened and five innovations selected per gender category per region and validation field visits made to the innovators fields where new scoring was done and three winners per category determined. The selected innovations comprised 40% mechanization innovations, 35 % crop protection, 15% livestock value chain innovations and 10% tree crops. Among these 10 winners were then awarded with prizes. In conclusion, the contest demonstrated that farmers have innovations that can be improved and promoted for impact and the winning and non-winning farmers' innovations deemed useful to other farmers can be disseminated and up-scaled within and to other regions.

1. Introduction

The Forum for Agricultural Research in Africa (FARA), in partnership with the Centre for Development Research (ZEF) of the University of Bonn and under the German Federal Government initiative 'One World No Hunger' is implementing the "Programme of Accompanying Research for Agricultural Innovations (PARI)". PARI is taking cognisance of the successes of research and innovation initiatives in African agriculture and in consideration of the concept of integrated agricultural research for development (IAR4D) promoted by FARA, to build an independent accompanying research programme to support the scaling of agricultural innovations in Africa and thereby contribute to the development of the African agriculture sector. The PARI project is implemented alongside the green Innovation Centres (GIC) led by GIZ within the One World No-Hunger initiative.

PARI is being implemented in 12 countries in Africa (Benin, Burkina-Faso, Cameroon, Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Togo, Tunisia, and Zambia). PARI also partners with the AGRODEP team facilitated by IFPRI for series of modeling activities.

To ensure a good basis and that the PARI project is effectively taken forward, three studies were proposed in 2015 to review and assess the extent and level of national and international investments on agricultural innovations in Africa. In 2016, each country has been given the opportunity to design and conduct the studies they deemed relevant for their national agricultural development policies, and for the attainment of the goals of PARI project. Bottom-up Innovation contests have also been organized in four Eastern and Southern African countries (Ethiopia, Kenya, Malawi, and Zambia). The contests have been implemented at the country level by FARA in collaboration with country partners. The farmer innovation contest is organized in 2017 in two countries: Cameroun and Mali.

Despite the potential for agriculture to alleviate rural poverty, adoption of introduced agricultural innovations is still low across the country. The big question is why most of agricultural innovations coming from research and extension have not taken root in Mali? There are two hypotheses: the first one is that researchers and development agents do not understand farmers and therefore are unable to develop innovations in line with farmers' needs; the second is that

researchers and development agents do not involve farmers in the identification of the needs and the design of the innovations.

Several studies found that innovation is essential for agricultural development (Hayami and Ruttan, 1985; World Bank, 2011). Farmers were considered only as innovation adopters, but with the changing environment many of them become innovators (Reij and Waters-Bayer, 2001). Because of this, in recent years there has been a concerted effort to promote farmer innovations. This is because farmers innovate;

- To address the challenges they frequently face;
- To complement the highly promoted externally-driven innovations in addressing the increasing challenges conflicting agriculture;
- To develop local innovations that are context specific since their production is under varied agro-ecological conditions which render blanket recommendations inappropriate for all conditions.;

Since farmers' innovation processes are claimed to be relatively cheaper, easily accessible, and locally appropriate (Reij *et al.,* 2009; Waters-Bayer and Bayer, 2009), their adoption would be faster if they are available. Farmer innovations include; creating an entirely new (and better) way of doing things; modifying or adding value to common practice; modifying external technologies or adapting them to local conditions. Any practice along the food chain (crops, livestock and fish values chains production, processing, transportation, handling, storage, marketing) that is done differently from commonly known or traditional practice and is developed primarily by a farmer or group of farmers themselves (without direct support from extension, development agents or formal research) qualifies as a farmer innovation and this can be technical, organizational or institutional.

The Program of Accompanying Research for Agricultural Innovations (PARI) in its effort to identifying high-potential bottom-up farmer innovations instituted farmer innovation contests in 12 African countries including Mali because innovators often lack incentives to share their newly developed practices. To realize the contest several activities were carried out by IER-FARA team in the three selected regions. These activities included training sessions of extension agents and scouters; monitoring of scouters; filled applications collection and their prescreening; evaluation

of filled innovation application forms; selection of better innovations and winner awarding. The farmer innovation contest is a procedure in which farmers compete for prizes and share their independently developed innovations. The awarding of prizes to the winners serves as an incentive to overcome innovation secrecy and has been found to be a good instrument in scouting local innovations (Tambo and Wunscher, 2014). It is also a way to encourage farmers to be more innovative and/or continue innovating.

The remainder of the study is organized as follows. Section two presents the methodology followed for choosing the contest area (regions). Section three shows the results and discussions step by step. Section four presents the description winning innovations and in section five conclusions are drawn and some further implications are noted.

2. Methodology

The farmer innovation contest in Mali was spearheaded by the IER-PARI team, in collaboration with the FARA team and Regional Directorates of Agriculture, Livestock and Fisheries in the three regions where the contest was implemented. The contest started with a meeting between the PARI team in Mali and the staff from FARA in Bamako. During the meeting, the team from FARA introduced the concept of the farmer innovation contest and the details on what this entailed were discussed and agreed upon. The PARI team in Mali and the staff from FARA undertook visits to the regions of Koulikoro, Ségou and Sikasso (see map bellow), to discuss the agreed upon understanding and roadmap with regional Agriculture, Livestock and Fisheries officers. The famer innovation contest was open to male farmers (>35 years), female farmers (>35 years), youth (18-35 years) and groups working in the food value chain in the three regions. By contesting and eventually obtaining prizes (awards), it was expected that the innovative farmers could share information on the innovation. Adoption of these innovations by other farmers could then contribute to improved food security and livelihoods thereby leading to agricultural development and economic growth of Mali.

2.1 Choice of contest study area

In Mali, the farmer innovation contest was carried out in Koulikoro, Ségou and Sikasso regions. In each of the regions three *cercles* were selected based on innovation potentials, proximity and intensity of agricultural production. The three regions were purposively preselected out of five

where the Green Innovation Centre (GIZ) activities are concentrated and the importance of their contribution to the food basket in Mali; this because of security reasons and fund limitations.

2.2 Introductory visits to the Regions

For the first step towards implementing the farmer innovation contest, a PARI team from IER headquarters and FARA visited the agricultural offices of each of the three selected regions to sensitize them. During the visits the team met senior staff from the Regional Directorates of Agriculture, Livestock and Fisheries, including the Regional Directors, regional Chief Officers of extension and various department officers within the region Agriculture technical services. The discussions focused on the proposed innovation contest, its objectives and the perceived benefits of the contest to the farmers and to agricultural production in general. The PARI team also outlined the step by step approach to be used to select the farmer innovators and the role that the field extension officers were expected to play as well as the timelines. In each region, a contact person was appointed to be the lead person for all activities pertaining to the farmer innovation contest as well as act as the link between the Regional Directorates of Agriculture, Livestock and Fisheries and the research team. In addition, he/she was expected to compile a list of the number of extension staff in each of the three *cercle*s within the selected region.

The best possible mechanisms through which farmers could get information about the farmers' innovation contest were also identified. These included; through extension officers, local radio stations, text messages, churches and mosques. Others were; farmer organizations such as Farmer Unions (AOPP), Regional Chambers of Agriculture, cooperatives and value chain platforms. During the visits, background information about the three regions was collected such as the number of *cercle*s and communes in each region. This was in order to have an idea of the number of staff likely to attend the training that was to be subsequently organized.

The most appropriate radio stations for each of the three regions were also identified and visited. The details of the announcements that were to be made were agreed upon and the cost implications determined. Visits were also made to the Green Innovation Center staff within GIZ-Bamako, ADAF-GALLE (PROFEIS) and the National Directorate of Agriculture for discussions with officers.

2.3. Training Extension officers

One day trainings were organized and conducted in each of the three regions where one extension officer from each commune in each of the cercles was trained in addition to the officers from the region headquarters representing the various departments within the Regional Agriculture, Livestock and Fisheries services. The trainings were conducted by FARA and the PARI team in Mali. In Ségou region, 40 extension officers and staff from the regional offices attended the training whereas in Koulikoro region, 45 extension officers and staff from the regional offices attended. In Sikasso, 40 extension officers and regional officers were trained. The training included introduction to farmer innovations; criteria to identify a farmer innovation; examples of farmer innovations; about the farmer innovation contest; who is eligible to apply; the roles of the scouters and rewards. Participants were then taken through the application forms and details on how to apply including the timelines. The extension officers were given six weeks to scout for the innovations. The contest was open to male (>35 years), female (>35years) and youth (18-35 years) farmers and groups working in the agricultural food value chain in the three regions.

2.4. Scouting for the innovations

Soon after the training the extension officers embarked on scouting for innovations in their various areas of mandate in the subsequent six weeks. To ensure that as many farmers as possible knew about the contest, information on the farmer innovation contest was announced on the Mali Radio and Television Channel (ORTM) which is regional and national radio station in the three regions. The announcements were made in *Bamanakan* (a local language) and in French. The script (announcements) used were prepared and edited by the PARI team in liaison with the radio stations. The announcements included information on where the innovators could obtain more information and collect the application forms. The announcements were broadcasted for about 30 days within the application period and ended one week before the deadline for application. In each region two mobile numbers were provided for farmers to call and inquire about the contest. Many farmers called in and were given full information as well as referred to their extension officers where they could pick the forms.

By the end of the scouting period the number of questionnaires filled was very few and an extension period of 3 weeks has been given to scouters from each region for contacting more farmers. From this last round in total 45 applications were received from Ségou region, 42 from

Sikasso region and 3 from Koulikoro region. Assigned staff from IER went round and collected the filled application forms from the region offices. Due to the shortage of time, the forms were not screened to ascertain whether the application was an innovation or not. The evaluation team thus started by screening the innovations before they did the evaluation as discussed below.

2.5. Screening and evaluation of the applications

2.5.1. Formation of the evaluation committee

Staff from IER-PARI team collected filled applications from each of the target regions. A first screening of the applications consisted of verifying if the applications were fully filled, with legible hand writings and if the innovation mentioned was really a farmer innovation.

Once in Bamako a committee was formed with six members: two members from IER-PARI team (one livestock specialist and one socioeconomist), one representative of Ségou regional directorate of agriculture, one representative from Sikasso regional directorate of agriculture, one representative of National forestry and fisheries office and one representative of ADAF-GALLE ONG (from PROFEIS project). Dr. Augustin Kouevi from FARA did backstopping of the committee.

2.5.2. Development of criteria for marking and ranking

To ensure a smooth marking and ranking of the innovations, the evaluation team discussed and agreed upon five criteria and assigned weights to each criterion as shown in Table 1 below. The originality of the innovation was given the highest weight followed by the relevance of the innovation. The lowest weight was on environmental friendliness.

Table 1: Criteria for ranking farmer innovations and their weights

Criteria	**Weight**
Originality	0.3
Relevance	0.25
Technical viability	0.15
Environmental friendliness	0.10

Financial accessibility and Economic viability	0.20
Total	**1**

2.5.3. Prescreening of innovations

The applications were initially prescreened by the evaluation team to ascertain those that were innovations and could enter the contest and those that were common practice and were not innovations. From the 45 applications in Ségou region 11 qualified as farmer innovations while in Sikasso region, out of 42 applications 8 were found to be farmer innovations. In Koulikoro, all of the 3 applications qualified as farmer innovations. The application forms for those that were identified to be innovations were separated into three categories; men, women and youth (18 to 35 years old) as shown in Table 2.

Table 2: Summary of distribution of selected innovators by region and gender

Region	***Male***	***Female***	***Youth***	***Total***
Koulikoro	1	0	2	**3**
Ségou	8	1	2	**11**
Sikasso	5	0	1	**6**
Total	**14**	**1**	**5**	**20**

2.5.4. First level of evaluation

After prescreening, farmers' applications, the evaluation team members divided themselves into three sub-groups of two each. Each sub-group went through each of the applications that qualified as innovations and scored them independently against the five criteria that were developed prior to the starting of the evaluation. The same criteria were used across the three regions. The criteria were weighted so as to add up to one as shown in Table 1.

Each application was evaluated and given a score against each of the five criteria. The scores ranged from 1 to 5 where 1 was the lowest score and 5 was the highest score. The procedure followed was that members of each sub-group discussed among themselves until they agreed on

a common score for each criterion and each application form. The scores were then weighted for each criterion and summed for each application giving a weighted sum as shown in the equation 1 below:

$$WS_f = \sum_{i=1}^{5} score\ (f_i) * (w_i) \quad (1)$$

Where

WS_f = Weighted sum for farmer f

i = Criteria for scoring (1, 2, …, 5)

$score\ (f_i)$ = Score for farmer f on criterion i

(w_i) = Weight for criterion i

An average of the weighted sum for the three sub groups was calculated and the average weighted sum was used to rank the applications from first to last. The highest average weighted sum was ranked number 1 and the lowest average weighted score was ranked last. This was done separately for three categories of farmers (men, women, and youth). Those who ranked from number 1 to 5 in each gender category moved on to the second stage.

2.6. Field verification, validation of selected innovations and final ranking

The team of evaluators conducted field visits to verify and validate the innovations that had been ranked between 1 and 5 in each of the three categories. Farmers were visited in their farms to ascertain that they were the actual innovators and that the innovation actually exists and works. The validation exercise also involved interviewing the farmers, their neighbors or adopters, and extension agents or scouters on the reported innovation. In addition to this, the team got the opportunity to see the innovations, where feasible. All the preselected farmers in each region were visited by the evaluation team after making prior appointments with the farmers via their mobile phones. After discussing with the innovators and where possible observing and getting a demonstration of the innovation by the innovators, the team looked at innovativeness/originality, authorship, functionality, and utility for farmers. The scores here were 0 or 1 for each criterion. And 0 for any criterion can fail the application.

2.7. Final ranking

To obtain the final ranking of the innovations the selection committee visited the selected innovators in each region for all categories. After verification and discussion with the winner and others, the team decides whether the innovation is valid or not. For each category the team ranked the valid innovations. The first three highest ranking innovators in each gender category in each of the three regions were picked as the best.

3. Results and discussions

At the end of the evaluation exercise there were three winners in each of the gender categories in each region. Out of the 10 winning innovations, the highest innovations related to mechanization (60%) while 20% related to crop protection and 20% to poultry. A summary of the winners and winning innovations is shown below.

3.1. Winning Innovations

Tables 3, 4 and 5 bellow present winners and winning innovations per category.

Table 3: Winners of the innovation contest in Koulikoro region

Name of farmer	Name of innovation	Rank
Female category	0	
Male Category		
Siaka Diarra	Senelafia (transforming a tricycle into mototractor)	1
Youth category	0	

Table 4: Winners of the innovation contest in Ségou region

Name of farmer	Name of innovation	Rank
Female category		
Kadiatou Wonogo	Utilisation of Balanites Aegyptiaca bark to combat sorghum antrax	1
Male Category		
Abdoulaye Bouaré	Minimotocultor	1
Bakary dit Bina Diakité	Souflet de forge	2
Bakary Daou	Technic to raise chicken and guineafowl chiks	3
Youth category		
Moussa Traoré	Modifying big format rice parboiler to a medium format	1

Table 5: Winners of the innovation contest in Sikasso region

Name of farmer	Name of innovation	Rank
Female category		
Male Category	0	
Oumar Kone	Danikéla Nafatiama (multipurpose seeder)	1
Foussey Samaké	Bagadji horon (biopesticide)	2
Djibril Coulibaly	Technic to make local chicken to reproduce faster and with many chicks	3
Youth category		
Arouna Koïta	Making more effective air pump	1

3.2. Award of winners (best innovators)

After completing the evaluation exercise and knowing the best innovators in each category and in each region, a ceremony will be organized to award prizes to the winners. All the innovators who submitted applications will be awarded certificates of participation. The prizes will be awarded as follows:

1st 2nd and 3rd prizes for best male innovators per region

1st 2nd and 3rd prizes for best female innovators per region

1st 2nd and 3rd prizes for best youth innovators per region

The proposed prizes are as follow:

1st Prize = Equivalent of 800 000 CFA (1600 USD)

2nd Prize = Equivalent of 650 000 CFA (1150 USD)

3rd Prize = Equivalent of 500 000 CFA (1000 USD)

3.3. Details on award per winner

Name of farmer	Name of innovation	Awards
Siaka Diarra	Senelafia	Tricycle, with administrative documents and essential spare parts
Oumar Koné	Multipurpose seeder	Tricycle, with administrative documents and essential spare parts
Kadiatou Wonogo	Combating sorghum anthrax by using Balanites Aegyptiaca barks	Tricycle, with administrative documents and essential spare parts
Abdoulaye Bouaré	Minimotorcultor	Electric Genrator
Moussa Traoré	Rice parboiler	Melter and
Arouna Koïta	Air pump	Tricycle, with administrative documents and essential spare parts
Djibril Coulibaly	Raising chicken	Motorcyle
Fousseyni Samaké	Biopesticide	Motorcycle
Bakary Daou	Raising guineafowl chicks	Motorcycle
Bakary dit Bina Diakité	Fire setter	Motorcycle

Challenges

Several challenges have been encountered during the period of scouting because extension agents in the different regions were not used to organize farmers' innovation contest. First they were claiming fuel fees before they go to the field, while during the training session this issue had been deeply discussed. Secondly, in spite of their attendance to the training sessions, many of the extension officers reported on common practices applications instead of farmer innovations. Thirdly, many farmers calling for information about the contest thought that they only needed to register and wait to contest on a due day, meaning that the radio announcements was either not well formulated and well communicated by the radio announcers, or not well understood by radio listeners.

The time frame agreed on for the contest coincided with the rainy season whereby farmers were very busy with their farming activities, and had little windows for talks. Many of the extension officers were young with poor field experiences and agriculture and innovation background, and little motivation for the identification of farmer innovations in the field.

Since evaluations took place at the end of farming season, several of the innovations could not be verified on the field. Therefore, the timeframe for the innovation contest should be country specific, and even covers a whole year.

Prices of equipments and materials have changed during the course of the year, we had to add extra money to purchase first awards.

4. Description of winning innovations

4.1.Danikela nafatiama (multipurpose seeder)

Innovator: Oumar Koné – Best male innovator, Sikasso Region

This is an innovation that addresses the lack of animal drafting power, man power, time consuming and high cost of labor during sawing and fertilizer application periods for different crops; which leads to the on respect of the cropping calendar. As a result, the non-respect of the calendar concludes at low productivity and production.

The innovation was intended to alleviate the high labor demand and protect weak drafted animals during the crop sawing and fertilizer application periods for respecting the agricultural calendar. With the innovation farmers could plant more land area at time and thus avoid conflicting resources allocation during the rainy season.

The innovation: The multipurpose seeder can saw rice, millet, sorghum, peanuts, cowpea and maize. It also can apply fertilizer. The seeder can saw several rows (9) of plants at once. The distance between plants on the same row and distance between rows are tuned up depending of the crop to plant. Example the cylinder for each row has holes that can be closed or opened regarding the crop; if one wants to plant rice the other holes are closed and only the rice one is opened. The seeder is pulled by a tractor and can plant 4 ha a day, while drafted animals can plant only 1 ha a day and about 10 persons to plant 1 ha a day. Fertilizer can be applied at same time of sawing saving time and resources. In this way, farmers can plant larger areas of crops at

time and benefit from early rainfall for crop growth. Consequently, there is reduction in area losses through respect of crop calendar. The farmer is also able to plant for others making more cash during the period.

It took a full year to the innovator to implement the seeder; he designed the machine on paper and gave it to fabricant. They went through several tests before coming with the prototype. The main problem with the machine is the cost. Currently many farmers hire the seeder for a day or more in the area.

The following photographs represent the seeder and the farmers who designed it.

The benefit of the innovation

Despite the high cost of the equipment, it can save time because of doing several activities at a time (sowing, fertilizing and seed covering). Farmers could increase their cultivated land area and respect the crop calendar and produce more crops and improve their food security. This type of equipment can create employment in the rural area for maintenance and sale of spare parts. It helps also fixed the youth who try to escape harsh work in the villages. The equipment helps to avoid using of weak draft animals.

4.2.Minimotorcultor

Innovator: Abdoulaye Bouare – Best male innovator – Ségou Region

Minimotorcultor is an innovation that aims to alleviate poor smallholder farmers' equipment burden in the rice and millet production zone. The genesis of innovation was a concern over the lack of appropriate machinery and the weakness of drafted animals at the beginning of the rainy

season. Rice and millet are major food crops produced by farmers in the zone and farmers possess large fields.

The innovation: The minimotorcultor is a motorbike adapted for plougthing and weeding which are hard and time consuming for farmers in the zone. The innovator used an old motorbike and adapted hoes on it. Since many of the farmers possess motorbike, the operation is not a constraint for them. The innovator found during the experimentation of the machine, that the engine is not very powerfull for deep plougthing; but there is an engine adaptable to the machine on the local market.

Benefits of Innovation: The machine is less expensive than drafted animals (2 bullocks) and can be used for many years if maintained correctly. Farmers could increase their cultivated land area and respect the crop calendar, therefore produce more. By adopting this type machinery employment can be created in the rural area for maintenance and sale of spare parts. It helps also fixed the youth who run to big cities to escape harsh work in the villages. The following photographs can tell more.

4.3.**Senelafia**

Innovator: Siaka Diarra– Best male innovator – Koulikoro Region

The genesis of the innovation was concern over the mortality of drafted bullocks and the lack of machine to plougth crop fields during the rainy season. The innovator could not grow maize on a borrowed 5 ha of land because he lost the bullocks he paid and the other farmers were not able to plougth his land timely. By observing the type of works done with tricycles, he imagined if he could use it for agriculture purposes. He started designing and implementing the idea in mind for alleviating the plougthing and weeding burden.

The innovation: The "Senelafia" is constructed using materials from diverse sources: frame of a tricycle; iron to make the wheels and hoes; etc. He went through several trials to come up with this prototype which is not completely functional. The machine has the capacity to plougth more than 2 ha days while the drafted animals do ½ ha a day. The machine can be used to transport crop after harvest if it is coupled with a wagon. All the materials and spare part needed to build the machine are available on the local market. The machine is relatively cheep, compared to others from abroad and easy to maintain. Once the machine operates perfectly, the owner can service for other farmers and make money. The following pictures may tell more the innovation.

Benefits of Innovation: The machine can reduce time and cost of plougthing and help farmers accomplish other activities such as transport. With the machine farmers can execute in time cropping activities and respect seasonal calendar or crop calendar. The risk of animal mortality or theft or weakness faced by farmers during the cropping season is avoided with the machine. The innovator can work with the research program on equipments to fine tune small problems in the functioning of the machine and make it perform well. As a result, the farmer can increase production and productivity of crops.

4.4.Air pump

Innovator: Arouna Koïta– Best youth innovator – Sikasso Region

The genesis of the innovation is concern over the long waiting period of tractorists or truck drivers when they face a flat tire. The innovation helps filling with air all tires in a short time without using expensive tools or moving long distances. Crop transporters and farmers owning tractors will have service at place and at relatively low cost without any fear of losing their load or losing time to accomplish some work.

The innovation: Due to lack of electricity or generators in most of villages in Mali, truck drivers or tractorists have to travel long distances to repair tires in case of flat tire. The innovator built an air pump by modifying the cylinder and the arm for pumping. Less effort is used to operate the pump, even a child can operate it. The cylinder is made by a polyethylene pipe, its' length and width are set up by the innovator through several trials. The pump has the same characteristics of the other regular pumps thus the cylinder and the arm are larger compared to the former ones. In addition, because of the longer of the arm, the pump can be operated by young people to fill any king of tire. The following photographs show the pump.

Benefits of Innovation: The benefits include increased income from the service offer to diverse machines (tractors, trucks, charts, bikes, etc.). Reduced waiting time to get tires fixed during work periods and job creation in rural area. The pump is easy to transport to other places for servicing. The innovator is able to provide services for many clients in a fewer time meaning he makes more money compared to others.

4.5.Rice Par-boiler

Innovator: Moussa Traoré-Best youth innovator Ségou Region

The genesis of the innovation is concern over how to reduce large rice par-boiler and make smaller one that can be handled by women. The former rice par-boiler was built to contain 150 kg of paddy and women have to be in group to use it. For individual use, the container should be smaller (to contain about 80 kg or less of paddy rice). Women had problems with the bigger

container in terms of handling and capacity to fill it for par-boiling. The following photographs show the par-boiler.

The innovation: The innovation is in recalibrating the container and to ease the handling. For that, dimensions of the container have been changed to fit users' needs and can be easily manipulated to avoid hand burns (the container is very hot when used to par-boil rice). Also the innovator adds small wheels and a stick to pull it. This makes women to provide less effort for operating the par-boiler and without burning their hands. The recalibrated container is easy to handle because the volume to fill it is not excessive for a woman. Many women in the par-boiling business are purchasing the recalibrated container. The following photographs show the diverse containers.

Benefits of the innovation: The benefits of the innovation include reduced cost of functioning. The new par-boiler requires less energy and can be taken from place to place for servicing while the former one was too large to be transported. The recalibrated container fits one person needs while for the former they have be in group. The materials required for building the new par-boiler are available on local market, making the cost affordable to users. Many projects are purchasing the par-boiler for women organizations in localities.

4.6.Use bark of «Balinites Aegyptiaca » to combat sorghum anthrax
Innovator: Kadidiatou Ouonogo Best-female innovator in Ségou region

The innovation concerns over anthrax attacks on sorghum fields causing losses of crop production and productivity in the area. Many farmers were using chemicals to treat their fields, but continued to face the same anthrax attack the next season. Anthrax causes heavy crop losses to farmers implying food insecurity and income reduction. Also many of them don't know how to use the chemicals to combat anthrax, making them exposed to health problems and environment degradation.

The innovation: it is built on observation. In the past populations from the region were using "Balanites Aegyptiaca" bark to wash their clothes. This means that it has some toxin. It consists of getting some barks of Balanites Aegyptiaca dried or not and put it in jug of water for a while (5 hours or more); collect the water in which the barks were and wash the sorghum seed with it. Then dry the seed under the sun for hours, and plant it the next day. Other farmers said they adopted the innovation. The following photographs sow how to use the innovation.

Benefits of the innovation: the innovation is simple, easy to replicate and is costless compared to chemicals. The innovation is fully bio and healthy and environmentally sound. The quantity of bark to use depends on quantity of seed; the volume of water is estimated to less than 5 cubic meter. A child can run to the bush and cut the barks. The whole activity of treating the seed will not cost 1000 CFA.

Testimonies from other farmers indicate the effectiveness of the innovation; two ladies and a man confirmed they used the innovation and they have not noticed any anthrax attack in their fields.

4.7.Bagadji Horon (Biopesticide)

Innovator: Fousseyni Samaké - Second best-male innovator in the Sikasso region

The innovation concerns attacks of pests on cotton, maize and sorghum destroying yearly production and reducing productivity. Chemicals are very expensive for poor smallholder farmers, dangerous for human health and environmental damaging. The alternative is to have a bio pesticide accessible to farmers. Since bio is promoted for different crops by NGOs in the zone, many farmers want to benefit from the higher price of bio products. As a champion farmer, the innovator combines several extracts of plant to make a product which doesn't kill insects but prevent plants to be attacked. The following photographs depict how he makes the bio pesticide.

The innovation: All extracts of plant used to make the bio pesticide are repulsive. He combines "Cobbi" oil, extract of Neen seed oil, tobacco, potassium, chili pepper and soap. The final product is spread using the regular sprayer as can be seen on the above photograph. The product doesn't kill insects but prevent plants to host them; also many diseases are bored by insects and treating fields with the product save crops against insects and diseases. All elements needed for the preparation of the product are available locally. The final product is easy to make and dosage depends on crop and the severity of the attack.

Benefits of the innovation: The innovation is very cheep, the diverse elements constituting the final product are accessible without any cash expense. The product doesn't destroy the environment and doesn't have any side effect after using it. The innovator is training farmers to make and apply the final product on different crops. Using pesticide bio allows farmers to sell their cotton or legume at higher price.

4.8.Soufflet de forge

Innovator: Bakary dit Bina Diakité - Second best-male innovator in the Ségou region

The innovation concerns making fire at anytime and anywhere for being able to repair or to construct agricultural related equipments. Making fire is a big burden in some places in the farming areas of the Ségou region; burning charcoal requires availability of wood which is scarce. So, the charcoal in hand should be used very accurately. Therefore, carpenters or blacksmiths operating in village levels face huge difficulties for servicing clients out off their shops. It takes them enormous time to set fire and start work. The innovation allows in 5 minutes to set big fire without using important quantity of charcoal.

The innovation: The innovator assembles old motor bike battery, an old convertor, an electric cable, a used can and charcoal. The electric cable plays the role of energy transporter to function the machine. Once the machine runs fire is produced and charcoal starts burning. The innovation is easy to transport and easy to operate.

Benefits of the innovation: the innovation is cheep and easy to replicate. The materials used to make the innovation are available locally and sometime costless. The innovation is light easy to transport. Le cost of building the innovation is estimated at 7500 CFA, about $15. The innovator uses the materials for servicing other farmers. The following photographs tell more about the innovation.


BROOKLYN
BREWERY

4.9.Raising guinea fowl chicks

The innovator: Bakary Daou, Best third male innovator in Ségou region

The innovation concerns the high mortality rate of guinea fowl chicks. About 90% of the guinea fowl chicks were dying due to attacks of worms. In poultry, guinea fowl generates more cash than chicken because of its' quick multiplication and the taste of the flesh. Guinea fowl is also used in many rituals making it more expensive than others such as chicken, ducks, etc.

The innovation: The innovator by noticing high mortality of the guinea fowl chicks, he tried to understand why. By searching he found worms in the digestive tube of the chicks. To combat the worms he uses ash from cereal straw, put it in jug, poured water on it and collect the liquid. The

liquid is used in chicks' drinking water. To the liquid he adds sometimes grains of fonio. Fonio is cereal that looks like grass and wild guinea fowl up take grass grains in the bush for feed. Currently by giving the chicks the filtered liquid from combining ash, fonio grains and water, 90% of them survive. The innovation is easy to apply and doesn't require any cash expense. The following picture shows the innovator in his poultry farm.

Benefits of the innovation: with the innovation the farmer was able to raise large number of guinea fowl and make money by selling each head at 3500 CFA, $7 on average. The innovator was able to renew and extend his farm. Other farmers were coming to him to ask how he found solution for the high mortality rate of the guinea fowl chicks.

4.10. Raising chicken

The innovator: Djibril Coulibaly best third male innovator in the Sikasso region.

The innovation concerns raising large number of chicken using local feed. The innovator used to travel in cities during the off-season for temporarily works. He noticed that the cash he brings is entirely used in at most two months. He then decided to stay doing a sustainable business. Many people raise chicken, but their herds are small and poorly fed. The question was how to raise large number of chicken with small revenues.

The innovation: The innovator started with 3 hens and 1 rooster. The 3 hens started laying eggs; at hatching he kept 1 hen with all the chicks and frees the two others. By giving extra feed to the hens they started laying eggs again in a smaller time. In one month time he ends up having the number he would have in 6 months' time. He was able to increase the number of sales and the number of chicken for each sale. For example he sells at least 60 chicken in a month at 2500 CFA, $5 each. He is able to make the same amount of money in a month as that he gets during all the time he stays in cities for the off-season.

Benefits of the innovation: The innovation is easy to apply if there is space and this available in rural areas. The extra feed the innovator gives to the chicken is locally available. Currently with increasing urbanization the demand of chicken rises on markets. The cost during a month is estimated at 15 000 CFA, $30 while benefits are estimated at $300 on average. The innovator was able to buy a TV set, a motorbike and he raises sheep and cattle. His home is built in cement while his brothers live in mud houses and don't have the equipments and animals he owns. The following photograph shows the chicken farm.

4.11. The awarding ceremony

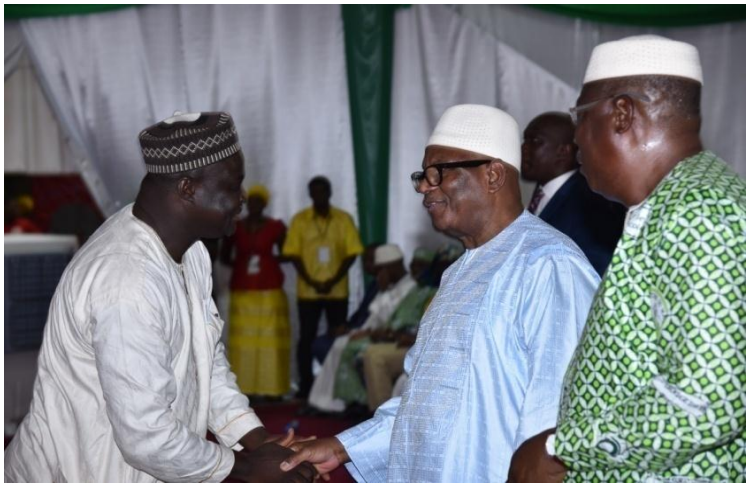
To awards to winners, the IER-FARA team targeted the "SIAGRI" which is an event gathering farmers and their organizations from national and international horizons. Farm enterprises, suppliers, agro-dealers, food processors and traders have also attended the event. The event had taken place from the 5th to the 13th of May 2018. Three winners were symbolically presented to get their certificate from the FARA representative, the Prime Minister and the President of Mali (see photos in appendix 2). The other winners got their award from the President of Agricultural Chambers of Mali.

Name and location of the awardees

Name of the Awardee	Region	Village
Oumar Koné	Sikasso	Diambala (Bougouni)
Fousseyni Samaké	Sikasso	Flola (Bougouni)
Djibril Coulibaly	Sikasso	Sirakélé (Koutiala)
Arouna Koïta	Sikasso	Peguéna (Koutiala)
Abdoulaye Bouaré	Ségou	Markala
Bakary dit Boua Diakité	Ségou	Dougabougoukoroni
Bakary Daou	Ségou	Kénouala (Bla)
Kadidiatou Wonogo	Ségou	Cinzana Gare
Moussa Traoré	Ségou	San
Siaka Diarra	Koulikoro	Farabana

Dr Fatunbi Oluwole from FARA giving a certificate to the lady winner from Cinzana

Dr Fatunbi Oluwole greeting the president of Mali with the president of Mali farmers



The President of Mali giving a certificate to the best male innovator from Sikasso in presence of the president of Mali farmers

The Prime Minister of Mali giving certificate to the second best male innovator from Sikasso, in presence of the Minister of Agriculture

Innovative Farmers receiving their awards from the President of Mali Farmers


KINGO


KINGO

5. Conclusions and implications

The awarding of prizes to the winners serves as an incentive to overcome innovation secrecy and is a good instrument in scouting local innovations (Tambo and Wunscher, 2014). In addition, it makes it possible for farmers to share their innovations some of which are very useful to other farmers. Farmers can also have innovations that can be improved for even better benefits. For impact, there is need to promote and scale up these innovations once proven.

Many farmers have not understood the innovation contest, how it is organized and how to participate. This explains le reduced number of participation in the different regions covered by the contest in Mali. Several of the extension agents were not engaged enough to disseminate the circumstances of the contest and were also confused about farmers' innovation although they participated to training where they get exposed to all the materials defining the concept. Radio broadcasting in French and local language was done at a period where farmers are most occupied with fields works, therefore less time to listen to radio.

Some of the innovations even if not awarded are found researchable, joint research in collaboration with the innovators should be designed and implemented. Similarly both winning and non-winning farmers' innovations deemed useful to other farmers should be disseminated and up-scaled within and to other regions.

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Appendix 1: Selected innovations by region and gender

Sikasso Male

Name of farmer	Name of Innovation
Souleymane Berthe	Tabanogon
Souleymane Coulibaly	Fabrication de moulin
Djibril Coulibaly	Technique d'élévage de poussins
Chaka Goïta	Technique de greffage de mangues
Fousseyni Samaké	Bagadji Horon (biopesticide)
Oumar Koné	Danikela Nafatiaman

Sikasso youth

Name of farmer	Name of Innovation
Arouna Koïta	Fabrique de pompe à air

Sikasso female

Name of farmer	Name of Innovation
Madame Coulibaly	Charrue en bois

Ségou Male

Name of Farmer	Name of Innovation
Mama Nassiré	Lutte contre les plastiques consommés par les animaux
Bakary dit Bina Diakité	Souflet mécanique de forge
Abdoulaye Bouaré	Minimotoculteur
Ba Koniba Diarra	Technique de lute contre le striga avec le sel
Tidiani Traoré	Conservation du vouandzou avec woulounitoulo
Malick Keïta	Protection du sorgho et du mil contre le charbon
Daou Bakary	Technique d'élévage de pintadeaux
Kassoun Tangara	Utilisation de wouloudjoloko dans la conservation du niébé et du vouandzou

Ségou Female

Name of farmer	Name of Innovation
Kadiatou Ouonogo	Utilisation d'ecorse de zeguéne dans la lutte contre le charbon du sorgho

Ségou youth

Name of farmer	Name of Innovation
Moussa Traoré	Modification de l'étuveuse à grand format
Zanké Diarra	Traitement de légumineuses et pastèques à base de plante

Male Koulikoro

Name of farmer	Name of Innovation
Siaka Diarra	Sene lafia

Youth Koulikoro

Name of farmer	Name of Innovation
Abraham Z Diarra	Amorsage de ruche d'abeille
Abraham Z Diarra	Technique de lute contre les feux de brousse