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# Microfinance services for smallholder farmers: an assessment from rice farmers' expectations in Central Benin

Smith A. R. Dossou , Augustin K. N. Aoudji, Albertine M. Houessou and Rodrigue S. Kaki

\* Correspondence: [smithdossou@yahoo.fr](mailto:smithdossou@yahoo.fr)

School of Economics,  
Socio-Anthropology and  
Communication for Rural  
Development, Faculty of  
Agricultural Sciences, University of  
Abomey-Calavi, Benin, 03, BP 2819  
Cotonou, Bénin

## Abstract

This study analyzed the adequacy between credit supply and the expectations of rice farmers in Central Benin to define policies for improved agricultural-oriented financial services. A survey was conducted in October 2016 among 120 rice farmers randomly selected from six rice-farming villages. Data collected through structured and semi-structured interviews included the financial services offered by Microfinance Institutions, socio-demographic characteristics of rice farmers, their expectations and perception. Multivariate analysis combining hierarchical ascending cluster analysis and principal component analysis (PCA) was used to define the distinct groups of rice farmers according to their credit expectations. The unmet expectations of rice farmers for a credit scheme that suits their needs were identified based on the gaps between their expectations and perception. There were three rice farmers' clusters with distinct characteristics based on their expectations. These farmers were not satisfied with all the attributes of the current credit scheme. Pending the effectiveness of the agricultural bank, the approaches such as the inventory credit system are useful in facilitating credit access to smallholder farmers. It is also essential to combine credit supply with financial education and technical support in a system such as contract farming.

**Keywords:** Credit access, Rice farming, Expectations, Perception, Benin

## Background

In Sub-Saharan Africa, the agricultural sector plays a key role in tackling poverty and promoting food security (Sheahan and Barrett 2014; Affognon et al. 2015). In Benin, it contributes 23% on average to gross domestic product (PNUD 2015) and employs about 47% of the country's active population (INSAE 2016).

Supplying farmers with adequate inputs could foster agricultural development (Shah et al. 2008). Several studies have demonstrated that credits have a beneficial effect on farm productivity and on the cash-flows of farmers' households (Rajagopalan 2000; Arif 2001; Dawar 2003; ONU 2005). Financing constraints in the agricultural sector, therefore, limit the productive capacity of poor farmers (Shah et al. 2008). This impedes the

modernization of agriculture by decreasing the use of technological innovations (Adégbola et al. 2009; Tarchiani et al. 2017).

In the context of increasing demand for agricultural financing in developing countries, including Benin, commercial banks show a limited interest in financing this sector (Kodjo et al. 2003). Microfinance has, therefore, become the main supplier of agricultural finance (Wampfler and Lapenu 2002; Morvant-Roux et al. 2010). However, most microfinance institutions only fund agricultural activities with lower risk, such as agricultural trade, or agri-food processing. As a result, microfinance is less able of meeting most farmers' financing needs (Moses and Zangue 2017). This supports the need to develop microfinance schemes tailored to the farmers' needs in order to effectively strengthen their investment capacity and optimal management decisions. Documenting the specific requirements of farmers could assist the government and other stakeholders in agricultural funding in developing adequate policies to satisfy these requirements.

This study seeks to analyze the adequacy between credit supply and the expectations of rice farmers in Central Benin, in order to identify policies for improved agricultural-oriented financial services. Indeed, rice has progressively become a fundamental food in both rural and urban areas of Benin and contributes to food security (Konnon et al. 2014). However, the domestic supply does not fulfill the growing demand. This increased demand is reflected in massive imports, accounting for more than 60% of total consumption in 2013 (FAO 2015). In order to guarantee food self-sufficiency for rice, with the prospect of serving sub-regional and regional markets, it is essential to set up financing schemes tailored to the requirements of rice farmers.

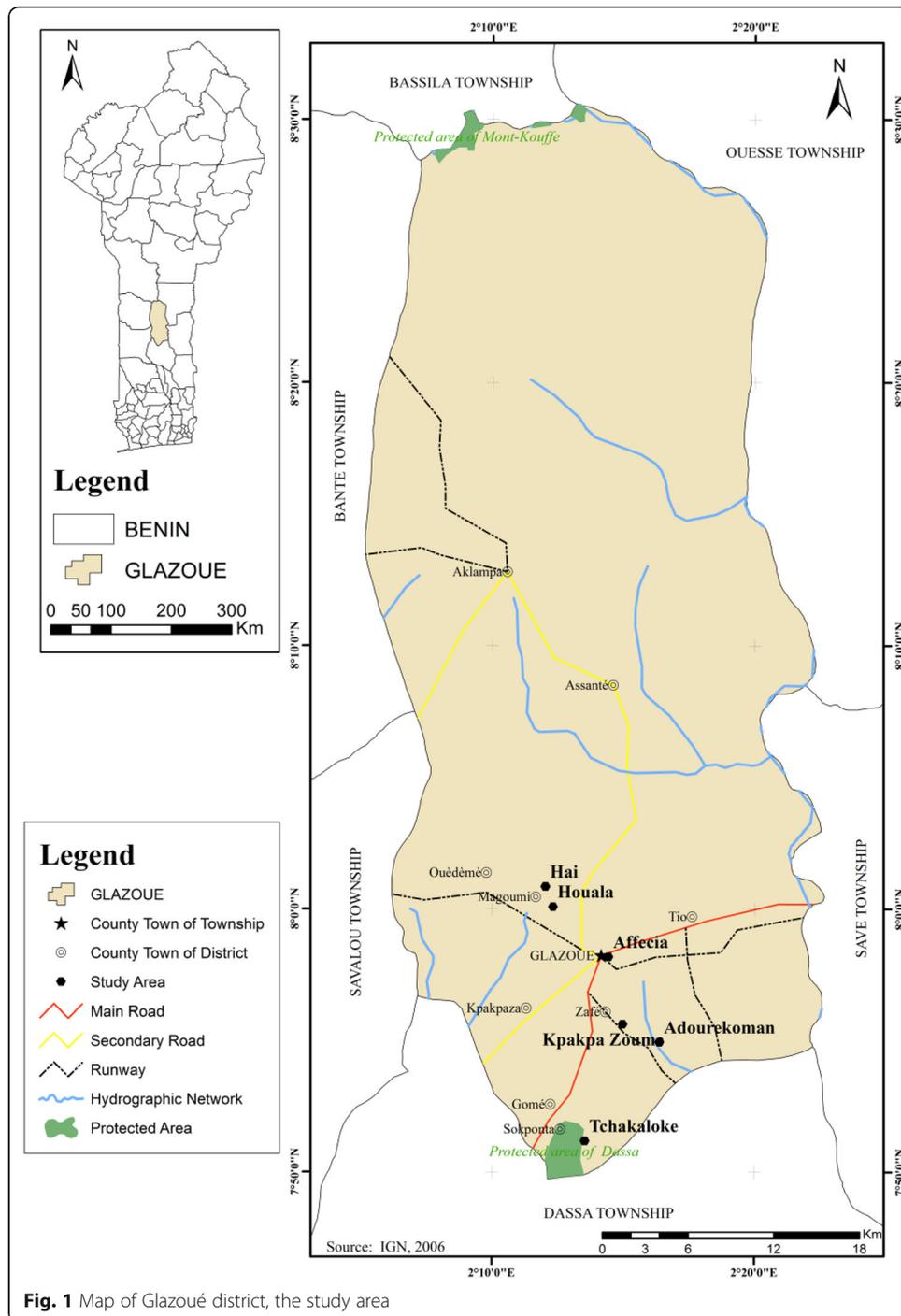
The present study was built on an integrated framework combining the characteristics of rice farmers and their farms, the financial services offered (Kumar et al. 2012), the categorization of rice farmers according to their expectations (Aoudji et al. 2014), and the expectancy disconfirmation paradigm (Oliver 1980; Taylor 1997). It was hypothesized that rice farmers are unsatisfied with the current credit supply. Although this study was conducted in Central Benin, its practical interest was to provide policymakers in Sub-Saharan Africa with useful information for identifying the attributes of adequate agricultural credit from the microfinance institutions.

This paper is organized as follows. In the next section, the research methodology is presented. "Results" appear in section 3, and the discussion of those results is done in the "Discussion" section. The main conclusions and related policy recommendations are summarized in the "Conclusion" section.

## **Methods**

### **Data collection**

A survey was conducted in October 2016 in the district of Glazoué, a major rice production area (Allagbe and Biao 2013) located in Central Benin (Fig. 1). The survey was based on semi-structured and structured interviews. The semi-structured interviews were conducted among the heads of microfinance institutions established in the study area. The interview focused on the services offered in general, the lowest and the ceiling amounts, the interest rate, the required guarantee, the duration, and the repayment terms. The structured interviews were conducted among 120 rice farmers



**Fig. 1** Map of Glazoué district, the study area

randomly selected in six villages. This sample was selected from 500 rice farmers identified in the district of Glazoué, which represents 24% of the total population. The questionnaire focused on rice farmers' socio-demographic characteristics, their expectations, and perception of the credit system.

A list of nine micro-credit attributes for agriculture was established for the assessment of expectations and perception of the credit scheme: affordable interest rate, flexibility of guarantee, geographical proximity of microfinance institutions, consideration

of the farming calendar for the grace period, obtaining the amount requested, flexibility in the requirements of identity documents, credit granting to individuals, exemption from processing and other fees, timely processing of credit applications. These attributes were defined with rice farmers during an exploratory survey. Regarding the expectations, rice farmers were asked to value the importance of the attributes when applying for credit, by using a 7-point Likert scale, ranging from 1 (not at all important attribute) to 7 (very important attribute) (Kelley and Turley 2001; Ragaert et al. 2004). To assess rice farmers' perception of the credit scheme, the same attributes were used in the form of statements. Rice farmers were to tell their level of agreement on each attribute, by using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) (Bryhni et al. 2002).

#### **Data processing and analysis**

Data processing and statistical analysis included the characterization of the financial services, the identification of unsatisfied rice farmers' expectations for the credit scheme, and the categorization of rice farmers based on their expectations.

##### ***Characterization of financial services***

The list of institutions offering financial services in the study region was established. The characterization of these institutions was done through a description of their services, the lowest and the ceiling amounts, the interest rate, the required guarantee, the duration, and the repayment terms.

##### ***Identification of unsatisfied rice farmers' expectations for the credit scheme***

The average score of each attribute of expectations was calculated. An attribute is important to rice farmers when its average score equals at least 4 (the middle of the Likert scale used) (Kelley and Turley 2001). According to the expectancy disconfirmation framework (Oliver 1980; Taylor 1997), expectations of rice farmers are met for an attribute if the mean score of perception is consistently superior to that of expectations. This condition was checked for each important attribute previously identified by performing the Wilcoxon test.

##### ***Categorization of rice farmers based on their expectations***

The rice farmer clusters were defined based on multivariate analyses. Hierarchical ascending cluster analysis was performed based on Ward's method, with the Euclidean distance as similarity index between the observations. The classificatory variables included the attributes of micro-credit for agriculture. Principal component analysis (PCA) was then performed to complement the hierarchical ascending cluster analysis (Glèlè-Kakaï and Kokodé 2004). The identified rice farmers' clusters were profiled based on the socio-demographic characteristics.

## **Results**

### **Socio-demographic characteristics of the sample**

The rice farmers surveyed were predominantly men, with about one-quarter of women in the sample (Table 1). Their age ranged between 25 and 75 years old. A quarter of

**Table 1** Socio-demographic characteristics of rice farmers

Variable	Value
<b>Gender (%)</b>	
Female	29.2
Male	70.8
<b>Age (years)</b>	
Minimum	25
First quartile	34
Second quartile	40
Third quartile	47
Maximum	75
<b>Marital status (%)</b>	
Married	64.2
Single	25.8
Divorced	8.3
Widowed	1.7
<b>Education (%)</b>	
None	52.5
Primary level	32.5
Secondary level	14.2
University level	0.8
<b>Household size (number of individuals)</b>	
Minimum	1
First quartile	3
Second quartile	5
Third quartile	6
Maximum	11
<b>Surface area of rice producing (ha)</b>	
Minimum	0.5
Mean	1.49
Maximum	5
Standard deviation	0.97
<b>Total farm size (ha)</b>	
Minimum	1.5
Mean	7.98
Maximum	37
Standard deviation	5.95

them was under 34 years old, and half of them were over 47 years old (Table 1). About two-thirds of them were married. Singles represented one-quarter of the sample. The proportions of divorced and widowed were low, with a total of 10% (Table 1). More than half of the rice farmers surveyed did not attend school. About a third of them had primary school level; one-seventh had reached secondary school level and less than 1% had an advanced level (Table 1). Household size ranged between 1 and 11 people. Based on the quartiles, half of the households had 5 people, and one-quarter of them had more than 6 persons (Table 1). All of them were mainly engaged in agriculture.

The acreage of rice lands varied between 0.5 and 5 ha, while the total farm size ranged between 1.5 and 37 ha among the farmers surveyed (Table 1).

#### Characterization of financial services

In the study region, the microfinance sector included two main categories of service providers: savings and credit institutions (five) and Non-Governmental Organizations with a micro-credit component (two). The functioning of four of the savings and credit institutions (80%) depended mainly on the members' deposits. In addition to the members' deposits, traditional banks, government, and external aid funded only one institution. Through funding from external partners, the Non-Governmental Organizations provided credits to individuals.

Only the Non-Governmental Organizations (100%) and two savings and credit institutions (40%) offered their services to farmers in the form of short-term credits. The amounts of credit granted varied between XOF 10,000 (USD 17.24) and 5,000,000 (USD 8618.08), with a repayment term of 1 to 18 months. Concerning the rules for granting credit, nominal interest rates ranged between 1 and 2% per month, with a requirement including financial (15% to 20% of prior savings) and material guarantees, as well as joint surety. The proportion of credits granted to agricultural activities in a year by these institutions varied on average between 5 and 20%.

#### Rice farmers' expectations on the credit scheme

All nine attributes were important to rice farmers (Table 2). The comparison between perception and expectations scores showed that rice farmers were unsatisfied with all the attributes of the credit scheme (Table 2). Efforts are required to meet rice farmers' expectations in terms of agricultural financial services supply. The most important discrepancies between perception and expectations were recorded for the following attributes: timely processing of credit applications, geographic proximity of microfinance institution, and affordable interest rate. Particular attention must be paid to these attributes.

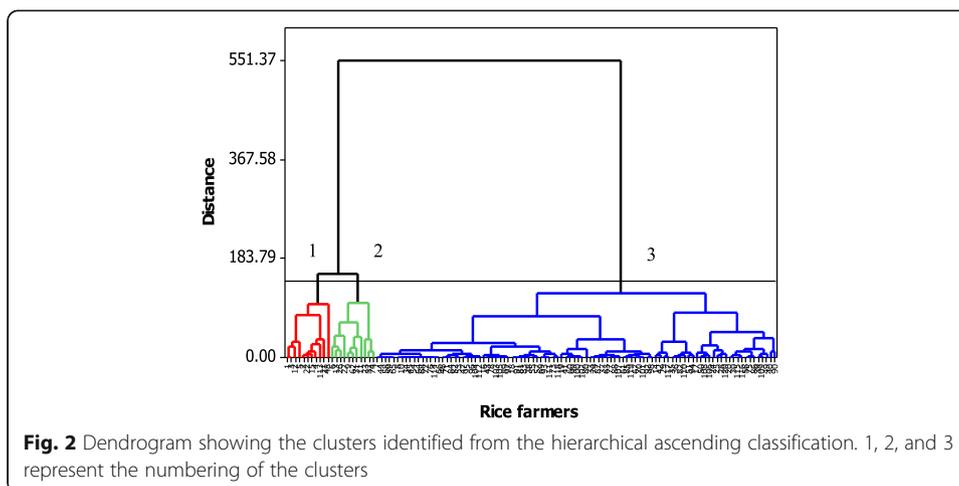
#### Categorization of rice farmers based on their expectations

Three rice farmers' clusters were identified based on their expectations (Fig. 2).

**Table 2** Results of Wilcoxon test on the difference between the mean scores of perception and expectations

Attributes	Expectation	Perception
Affordable interest rate	6.74	3.75*
Flexibility of guarantee	6.34	3.39*
Geographical proximity of microfinance institution	6.58	3.31*
Consideration of the farming calendar for the grace period	6.48	3.85*
Obtaining the amount requested	6.38	3.92*
Flexibility in the requirements of identity documents	5.98	1.39*
Credit granting to individuals	6.29	3.84*
Exemption from processing fees and other fees	6.32	1.05*
Timely processing of credit applications	6.64	3.32*

\*Significant differences ( $p < 0.01$ ).



Those clusters were interpreted thanks to the principal components analysis (PCA). Based on the eigenvalues analysis of the correlation matrix (Table 3), the first three components could be used to interpret adequately the PCA results. Those components explained about 65% of the variability. The first principal component (PC1) explained most of the variation (39%), the second principal component (PC2) explained 15%, and the third (PC3) explained 11%. The correlations between the principal components (PC) and the original variables (Table 4) showed that the PC1 was negatively correlated with consideration of the farming calendar for the grace period, obtaining the amount requested, exemption from processing and other fees, and timely processing of credit applications. The PC2 was negatively correlated with affordable interest rate and flexibility of guarantee. Concerning the PC3, it was negatively correlated with the geographical proximity of microfinance institution and positively correlated with flexibility in the requirements of identity documents and credit granting to individuals.

The factorial plans of the first three principal components (Figs. 3 and 4) are interpreted below, based on the correlations between principal components (PC) and original variables (Table 4). Cluster 1 (9.16% of the respondents) is composed of rice farmers who were looking for more affordable interest rates, flexibility in terms of guarantees, and proximity of microfinance institutions to their residential area. The second cluster (9.17% of respondents) is composed of rice farmers who were primarily looking for the proximity of microfinance institutions to their residential area. Finally, rice farmers in cluster 3 (81.67% of respondents) valued the flexibility in the requirements of identity documents and the preference for individual credits (optional membership of a farmers organization). This cluster is also concerned with the following attributes: a grace period for the repayment suited to rice farming, obtaining the amount requested, no processing and other fees, and timely processing of credit applications.

The  $\chi^2$  test showed significant differences in the frequency distribution between clusters for sex ( $\chi^2 = 20.83$ ,  $p = 0.003$ ), age ( $\chi^2 = 56.26$ ,  $p = 0.042$ ) and level of education ( $\chi^2 = 27.24$ ,  $p = 0.024$ ) (Table 5). The proportion of women in cluster 2 was comparable to the overall situation of the sample. This proportion was higher in cluster 1 and lower

**Table 3** Eigen analysis of the correlation matrix

Parameters	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Eigenvalue	3.5220	1.3195	1.0001	0.9039	0.6456	0.5057	0.4473	0.3773	0.2785
Proportion	0.391	0.147	0.111	0.100	0.072	0.056	0.050	0.042	0.031
Cumulative	0.391	0.538	0.649	0.750	0.821	0.877	0.927	0.969	1.000

PC Principal component

in cluster 3. Rice farmers under 30 years old were overwhelmingly represented in cluster 1, while rice farmers aged 31 to 45 predominated in clusters 2 and 3 (Table 5). Concerning the level of education, cluster 2 included nearly a quarter of rice farmers who had reached the university level, unlike clusters 1 and 3 (Table 5). Marital status did not vary across clusters. Rice farmers were married in the majority (Table 5). Regarding household size, no consistent differences were found across clusters (Table 5). As for the total acreage of land used by the rice farmers, clusters 1 and 3 were similar, with the majority of rice farmers using less than 5 ha of land. Among the majority of respondents and regardless of the cluster, rice cultivation occupied between 10 and 50% of the total acreage (Table 5).

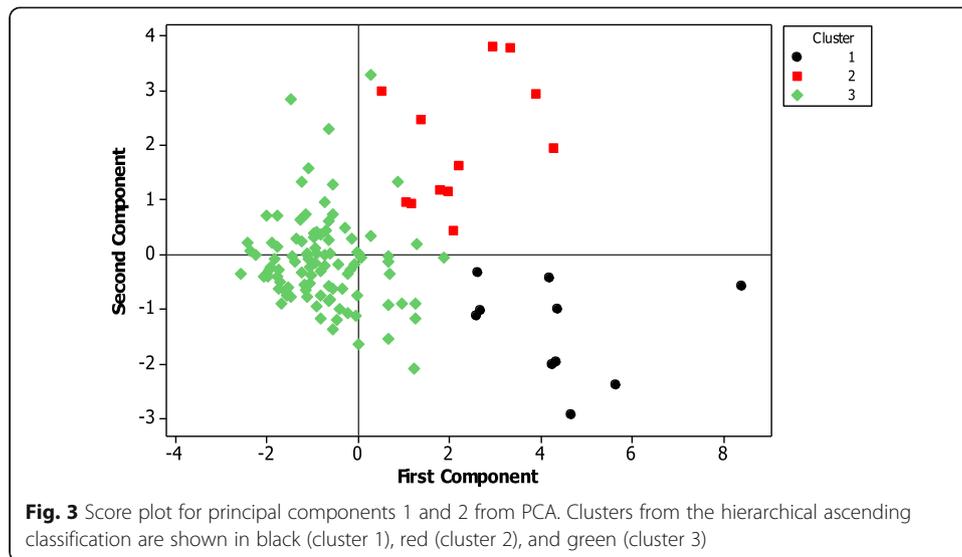
## Discussion

### Characterization of financial services

The access of rice farmers to financial services in the study region was low. This reflects the general national trend. Only 5% of farmers in Benin had access to formal credit (Allogni et al. 2010). In addition, the supply of financial services is mainly focused on short-term credit. Rice farmers are therefore unable to use this credit for their investments—a limitation for rice production development. This situation could stem from the fact that financing agricultural activities is generally costly, riskier, and less profitable for microfinance institutions (Chalmers 2005). Furthermore, most of these institutions depend on external funding, mainly from donors (Hunguana et al. 2012), limiting their capacity to finance farmers. Efforts are needed to ensure the effectiveness of financial service to farmers. The effective integration of an insurance component would improve the supply of financial services for agricultural activities, including rice production. Previous studies suggested that an insurance component should be incorporated into the schemes for commercial agricultural credit to increase the credit flow

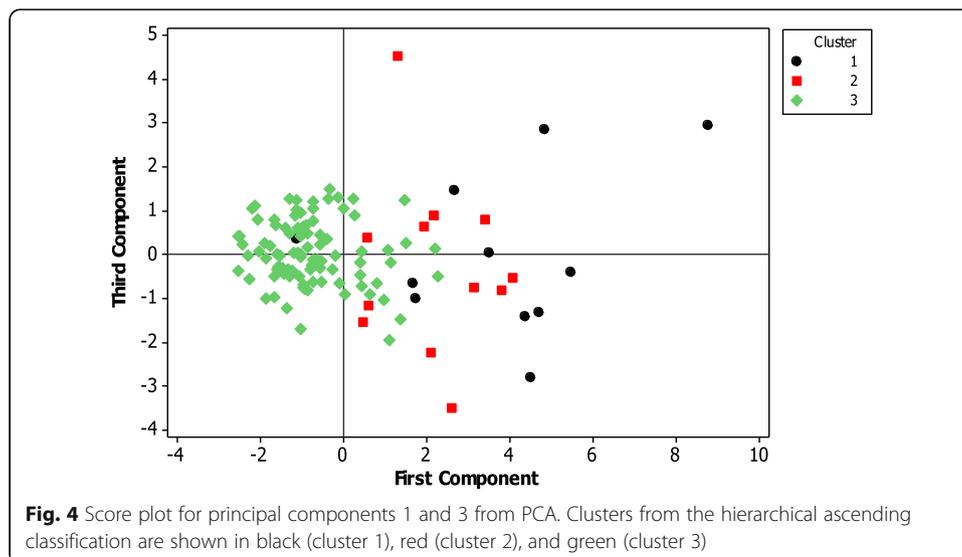
**Table 4** Correlation between principal components (PC) and original variables

Variables	PC1	PC2	PC3
Affordable interest rate	−0.170	−0.643	−0.285
Flexibility of guarantee	−0.270	−0.602	−0.131
Geographical proximity of microfinance institution	−0.272	0.178	−0.537
Consideration of the farming calendar for the grace period	−0.372	0.307	−0.181
Obtaining the amount requested	−0.396	0.093	−0.302
Flexibility in the requirements of identity documents	−0.376	−0.130	0.423
Credit granting to individuals	−0.338	0.050	0.460
Exemption from processing fees and other fees	−0.378	0.023	0.314
Timely processing of credit applications	−0.362	0.263	−0.016



to the agricultural sector (Collier and Skees 2012; Polycarp and Odufote 2012; Collier et al. 2013). Many agricultural risks, including those relating to weather and markets, will be addressed by the insurance. Incorporating insurance has also the advantages of simplifying administrative arrangements for the financial service providers, reducing their lending risks. However, it could present some drawbacks for farmers who have other less costly ways of managing their risks. In this case, the insurance will simply increase the credit cost without adding proportionate benefits, making the credit less attractive.

Moreover, the government of the Republic of Benin is already committed to the establishment of an agricultural bank capable of meeting farmers' needs. However, it is important to innovate in credit supply and include a technical and management support (financial education) package to reduce the failure risks.



**Table 5** Socio-demographic characteristics of rice farmers across the clusters

Socio-demographic characteristics	Clusters		
	Cluster 1	Cluster 2	Cluster 3
<b>Gender (%) **</b>			
Male	56	74.8	83.33
Female	44	25.2	16.66
<b>Age (%)*</b>			
≤30	40	11.11	10.93
31–45	36	55.55	57.81
≥46	24	33.34	31.26
<b>Education (%)*</b>			
None	39.5	38.88	57.81
Primary level	31.33	5.55	34.37
Secondary level	23.5	33.33	7.81
University level	5.67	22.22	0
<b>Marital status (%)</b>			
Married	70	75	62.24
Single	30	16.66	26.53
Divorced	0	8.33	9.18
Widowed	0	0	2.04
<b>Household size (%)</b>			
≤2	30	8.33	23.46
3–5	30	25	43.87
≥6	40	66.66	28.66
<b>Farm size (%)*</b>			
≤5 ha	43.5	27.77	40.63
5–10 ha	40	55.55	34.37
>10 ha	16.5	16.66	24.99
<b>Share of the acreage of rice land in the farm size (%)</b>			
≤10%	8.33	8.33	14.46
10–50%	75	82	80.72
≥51%	17	9.77	4.82

\*Variable showing a significant difference in the frequency distribution between clusters ( $p < 0.05$ )

\*\*Variable showing a significant difference in the frequency distribution between clusters ( $p < 0.01$ )

### Satisfaction of rice farmers' expectations towards credit supply

As hypothesized, the rice farmers were unsatisfied with all attributes expected from the credit scheme. The dissatisfaction of rice farmers with the attribute “affordable interest rate” is not surprising. Previous studies pointed out the high-interest rate charged by microfinance institutions in rural and urban areas (ADB 2016; Hong and Hanson 2016). Furthermore, the interest rates charged by the microfinance institutions are high compared with market lending rates (between 9 and 15% per year)<sup>1</sup>. This stems from the fact that it is essentially the interest on the credits granted that allows the microfinance institutions to cover the various costs incurred (Kariuki and Ngahu 2016),

<sup>1</sup><http://www.izf.net/ancien/entreprise/num-4611>

including borrowing from traditional banks. The reduction of costs incurred could be a solution to affordable interest rates. The future agricultural bank of Benin could make financial resources available to microfinance institutions on better terms. This would have cost implications but also a potentially high return on investment (improvement of productivity and income of farmers). The exemption from processing fees and other fees is related to the credit cost.

With regard to the attribute “flexibility of guarantee”, apart from the joint surety for farmers organizations, the terms of the microfinance institutions were relatively restrictive. These findings are consistent with those of Razakharivelo (2013), which revealed that more than a quarter of the women beneficiaries were not satisfied with the guarantees requested by the microfinance institutions in Madagascar. Despite the necessity for the microfinance institutions to keep rigorous about the issue of guarantee, they could consider other types of guarantees, such as the inventory credit system. Regarding the attribute “flexibility in the requirements of identity documents”, the government should continue the ongoing efforts to provide each citizen with civil status documents. In the meantime, microfinance institutions may use witnesses who have valid civil status documents.

Regarding the issue of proximity, so far, most farmers are forced to travel long distances before accessing a microfinance institution, leading to extra expenses. The proximity of financial services is a key element for improved access to agricultural finance (Dhakal 2013). This proximity should improve with the increase of the solvent demand that would lead microfinance institutions to bring their agencies closer to optimize their activities. The introduction of credit reference bureaus is therefore an important policy issue for improved access to agricultural finance.

Rice producing and marketing activities last approximately 6 to 8 months, while credit repayment follows a monthly basis after a grace period of 1 to 3 months for the majority of microfinance institutions. These conditions do not allow rice farmers to harvest and market their products before starting repayment. Flexible repayment schemes adjusted to the financial flows of agricultural activities could make lending programs more accessible to farmers (Christen and Pearce 2005; Koumassa 2007). This includes the implementation of a monitoring mechanism and the education to finance management allowing the efficient use of credit. In this light, contract farming could be explored (Prowse 2012).

Although the credits are not supposed to cover all the financing needs of rice farmers, the amounts received are low to meet the annual rice production financing needs. Indeed, the average amount of credit granted to rice farmers surveyed by the microfinance institutions was XOF 232,633 (USD 400.97) per hectare; while the total cost for rice production per hectare in the study area was XOF 381,664 (USD 657.84) (Yabi 2013). This weakness in the volume of credits stems from the risk minimization strategies and the unavailability of the resources at the microfinance institutions (Kodjo et al. 2003; Niyongabo 2008; Sossou 2015). Generally, the undersupply of credit is due to information problems (adverse selection and moral hazard) leading to equilibrium credit rationing as discussed in the model of Stiglitz and Weiss (1981). Credit rationing is a frequent practice in financial markets. The future agricultural bank, as indicated above, could play a key role in the refinancing of microfinance institutions to improve farmers’ financing mechanisms.

The rice farmers mentioned their preference for individual credits. According to their perception, credits obtained through a farmers' organization are often used in the social sphere because of their non-discrete nature. To reduce the risks associated with the low repayment rate, microfinance institutions usually give credit either to solidarity groups of farmers who cannot provide material guarantees or individually to farmers with a little more collateral. Several studies demonstrated the benefits of joint surety for micro-credit beneficiaries and for microfinance institutions (Paxton 1996; Honlonkou 2002; Mauk 2013; Noglo and Androuais 2013). Rice farmers should be made aware of the performance of the Solidarity Credit Group.

Rice farmers' dissatisfaction about the attribute "timely processing of credit applications" stems from the long procedure in microfinance institutions, linked to the complexity of the compilation of the dossier (Pasha and Negese 2014). According to the rice farmers, a delay in the release of the credits affects the farming calendar, with many consequences: drop in yield, change in the destination of credit, and difficulties in the repayment of the credit. It could be useful in this context to sensitize farmers to request credit far in advance. Assistance in preparing the application could be also helpful.

#### **Categorization of rice farmers based on their expectations**

Three clusters of rice farmers were identified based on their expectations of a credit scheme suited to their activities. These clusters presented a variety of socio-demographic characteristics. Cluster 1 was composed of rice farmers who were relatively younger compared with the other clusters (2 and 3). They had a higher level of education compared with cluster 3. These young rice farmers (cluster 1) had less financial and material resources to meet the requirements of microfinance institutions in terms of guarantees. This explains their desire for a more affordable interest rate, flexible modalities of guarantee, and proximity of microfinance institutions, unlike rice farmers in cluster 3. This could also explain the concentration of women in this cluster. Rice farmers in cluster 2 had a high level of education compared with the other groups. This category of farmers (cluster 2) was more interested in the physical accessibility of the credit supply. The effect of borrower-lender distance results in a physical cost that farmers, in our case, need to bear to contract with microfinance institutions (Pedrosa and Do 2011). There is the direct transaction cost—transportation cost to obtain financial services from microfinance institutions—that farmers support. This is a barrier to accessing credit in rural areas.

Women were poorly represented in clusters 2 and 3. This low proportion of women could stem from the difficulties related to rice farming and the limited access of these stakeholders to certain inputs, namely land. In Africa including Benin, women have limited access to land and other productive resources (World Bank 2011; Thiessen 2016). In the study area, women were more involved in growing legumes (soybeans and groundnuts) and especially in post-harvest activities (processing, marketing).

In general, the major lowlands development programs are not financed by the rice farmers themselves but are carried out under various programs and projects. However, improved rice farmers' access to adequate credit could allow them—in all those clusters—to grow more rice acreage, in order to increase their productivity, as well as their

household cash-flow (Sulemana and Dinye 2016; Lawanson 2016). Conversely, households may demand credit, while their current income is high due to the expectations of future income, which will guarantee their repayment (Chen and Chiivakul 2008).

## Conclusion

The present study analyzed the adequacy between credit supply and the expectations of rice farmers in Glazoué (Central Benin). Savings and short-term credits were the financial services offered by the microfinance institutions located in the study region. The average amount of credit obtained by the farmers surveyed was XOF 232,633 (USD 400.97) per hectare and the maximum duration for the repayment was 18 months. The monthly interest rates ranged from 1 to 2%, with a guarantee required.

Based on their expectations for agricultural credit, rice farmers were divided into three clusters. The socio-demographic characteristics of the clusters were different. On the whole, rice farmers were not satisfied with the current credit supply. This result reflects the inadequacy between the current supply of microfinance institutions and the needs of rice farmers. Various alternatives have been discussed to develop a micro-credit service that is more adapted to the needs and expectations of farmers without compromising the viability of microfinance institutions. The forthcoming creation of an agricultural bank in Benin could contribute to lift restrictions on access to finance, by building on microfinance institutions that are already trying to support farmers. Among other things, the provision of financial resources—at affordable conditions—to microfinance institutions will allow them to consider reducing interest rates. To reduce the risk of credit defaults, credit supply needs to be innovative by including a package of technical support and management (financial education). All this could be done through a contract farming system. In addition, the promotion of other types of accessible guarantees such as the inventory credit system would improve access to finance for rice farmers. There is a need to sensitize rice farmers on the benefits of Solidarity Credit Groups, and the submission of credit applications far in advance of the agricultural calendar, to anticipate the time required for the dossiers processing. Finally, the government must continue its ongoing efforts to provide each citizen with civil status documents as a cross-cutting measure.

## Abbreviations

PCA: Principal component analysis; PC: Principal component

## Acknowledgements

Not applicable for that section.

## Authors' contributions

SARD designed the methodology of the study and performed the data analysis and interpretation. AKNA organized the data collection, institutional support, and provided useful policy insights to the research. AMH carried out the introduction and conclusion sections. RSK developed the questionnaire and carried out the data collection. All authors participated in the writing and revision of the manuscript. All authors read and approved the final manuscript.

## Authors' information

Not applicable for that section.

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## Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Competing interests**

The authors declare that they have no competing interests.

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