Impact of brick production and proposal for restoration after exploitation in the rural commune of Ampangabe and Ambohitrimanjaka, District of Ambohidratrimo

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ABSTRACT

Bricks have been an ancient building material since 3000 BC. This is due to factors such as its structure, thermal and acoustic insulation, durability, comfort and environmental friendliness. The brickworks survey was carried out in the commune of Ambohitrimanjaka, covering 96 households in 25 fokontany. This study shows that brick production brings in significant income for many families, contributing both to improving their standard of living and reducing unemployment. The brickworks are an asset for the commune of Ambohitrimanjaka, as bricks not only improve the village's infrastructure and give it a special aesthetic appeal, but also contribute to its socio-environmental development. It is important to improve the quality of bricks and their compliance with building and environmental standards.

Keyword : *brick, build, thermal, durability, environmental*

INTRODUCTION

Fired bricks have been used by man since around 3000 AD. (Lynch, 1994). The manufacture of fired bricks has continued to evolve, and today's products combine the functions of structure, thermal and acoustic insulation, filling, durability against weathering, comfort, resistance to fire and respect for the environment. These are the key factors that have favoured the use of fired bricks for millennia. Brick is a rectangular parallelepiped of raw, sun-dried or kiln-fired clay used as a building material. (Pascal, 2009-2010). It is a building material, made of clay, of the artisanal type (Millot, 1964). It was introduced to Madagascar around 1837 by Jean Laborde. In colonial times, bricks were made in the abandoned rice fields of Betsimitatatra. Then, brickmakers even exploited the beds of the Ikopa river. (Ramilisoa, 1995). Today, many brickworks are located around the capital, due to the presence of clay in these areas. Brickmaking takes place seasonally, between May and November. In the Commune of Ambohitrimanjaka, brickmaking is an alternative source of income for farmers. The marketing of bricks varies from one brickmaker to another, such as sale at the place of manufacture, sale to order and sale through intermediaries. (RANDRIA, 2022). Faced with this, the theme of the article is brickmaking, a source of income and local development. But the question arises : does brickmaking contribute to local income and development? The hypotheses: the socio-economic life of the farmers is based on the place of the artisanal

brickworks in their lives, and local development is generated by the spatial organization of the area. This study aims to valorize the production of fired bricks to achieve local development.

Specifically, this study aims to : Verify whether brick production generates sufficient income for farmers. Identify the impact of production on local development. The expected results are that brick production will be valorized on the one hand, and development will be achieved on the other.

MATERIALS AND METHODS

1.1. Study area

The rural commune of Ambohitrimanjaka is located 12km west of the capital, taking the RN 58 A dike road first, then turning left at the crossroads called Art Malagasy after the road is almost asphalted. The surface area is 21.765 km^2 of which the inhabited area is 10.08km^2 , the uncultivated area is 0.65km2 and other occupations are 11.35km^2 . The total population is 46,274, with a density of 2,126 inhabitants/km^2 and 11,568 households. It is subdivided into 25 fokontany Anosimanjaka, Ambatomainty, Ambatolampy avaratra, Ambatolampy antsimo, Ampanomahitsy, Farahindra, Beloha, Fiakarana ,Fmpahibe, Mahitsy avaratra, Lehilava ,Mahitsy firaisana ,Antsahafohy ,Antsahamarina ,Miadana ,Antanetibe, Andranomahitsy ,Ikopakely ,Namorana Ambohimananjo, Ampiriaka ,Andringitana and Ambodivona. The climate in this area is tropical and semi-arid, with two seasons. Summer lasts 6 months, from November to April, and winter lasts 6 months, from April to October. These two main seasons are separated by a short, barely perceptible spring: September-October. The temperature in winter is 10°-20° and in summer 20°-30°. During the rainy season, which lasts 92 days, precipitation is ≤1,100mm. The soil type in this area is ferralitic likely to generate laterite, more or less degraded. Along the rivers, Baiboho (BB) and Tanimbary (TB), a fertile soil with a high kaolite (clay) content, dominate this area, making it ideal for brick and tile making.

1.2. Collecting data

According to (Jouve, 1986) the operational study established farm typologies. A typology of brick factories in the Ambohitrimanjaka commune was drawn up following Jouve's study.

The Démarche survey was based on households in the study area, i.e. 96 households spread across the twenty-five (25) Fokontany. The questionnaires are grouped into nine variables. ISAN'NY MPONINA (ISP); MPANAO ASA TANANA (MAT); SIKOTRA (SIK); LANDY (LD); TANY (TY); VATO (VT); VY(Vi); RARY (RR); BIRIKY(BRK) and MPANEFY (MNF).

1.3. Data processing

The data were processed using the following software: Excel; XL-STAT. Two analyses were used in this study: hierarchical ascending classification (HAC), aimed at dividing individuals into homogeneous classes, and principal component analysis (PCA), performed on the variables with the highest correlations.

RESULTS

1. Classification by fokontany according to activities

Hierarchical ascending classification is a tool for dividing the study area into classes. Here, the commune of Ambohitrimanjaka is subdivided into twenty-five Fokontany, grouped into three classes "C1; C2 and C3". More

specifically, in the "Fokontany Anosimanjaka" (classified in C3), the source of income is based on fired brick production. On the other hand, classes C2 and C1 are varied. (Figure 1)

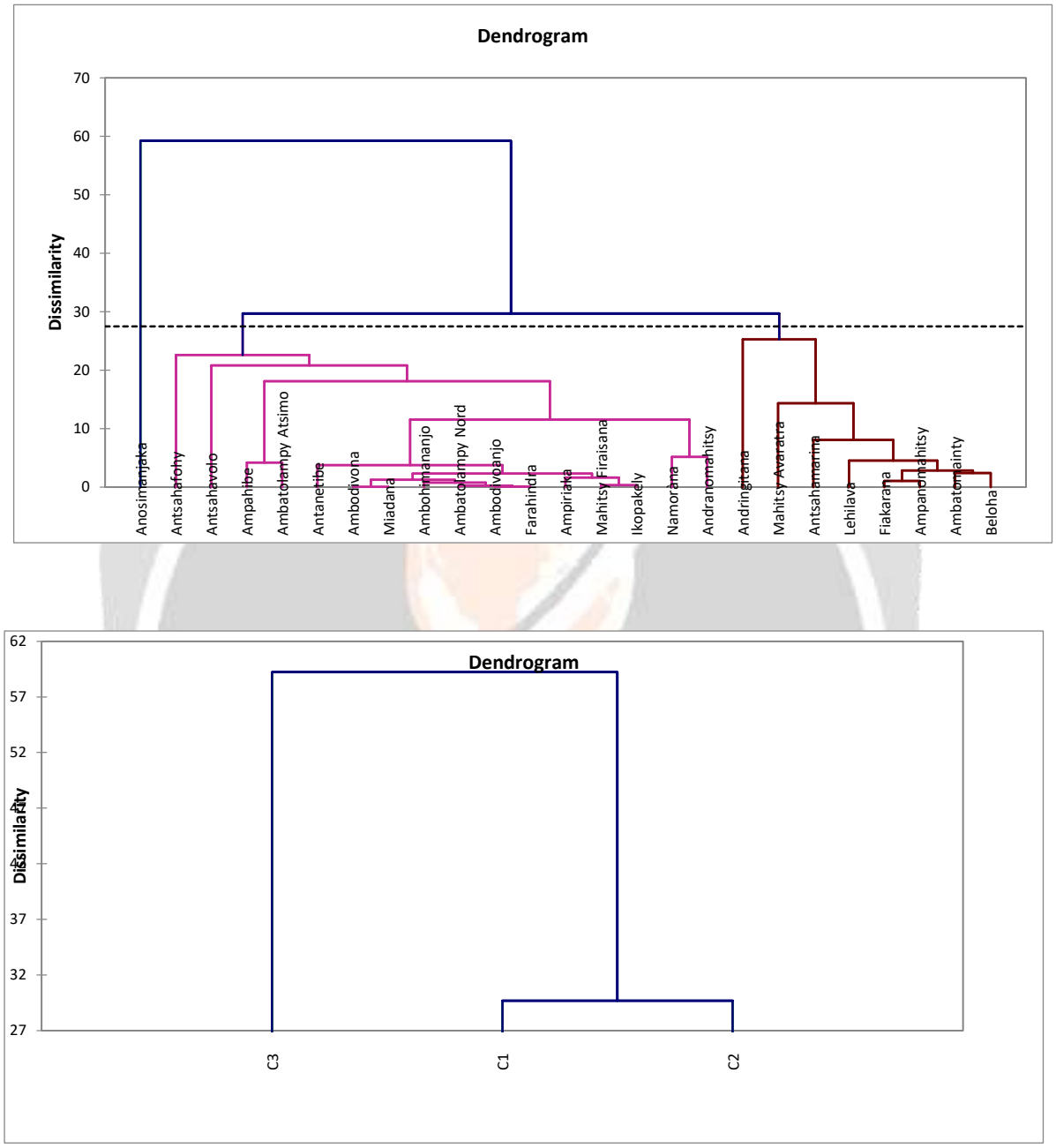


Figure 1.Classification of farmers' activities by fonkontany

2. The place of artisanal brickmaking in the socio-economic life of farmers

Anosimanjaka's main source of income is handmade bricks.

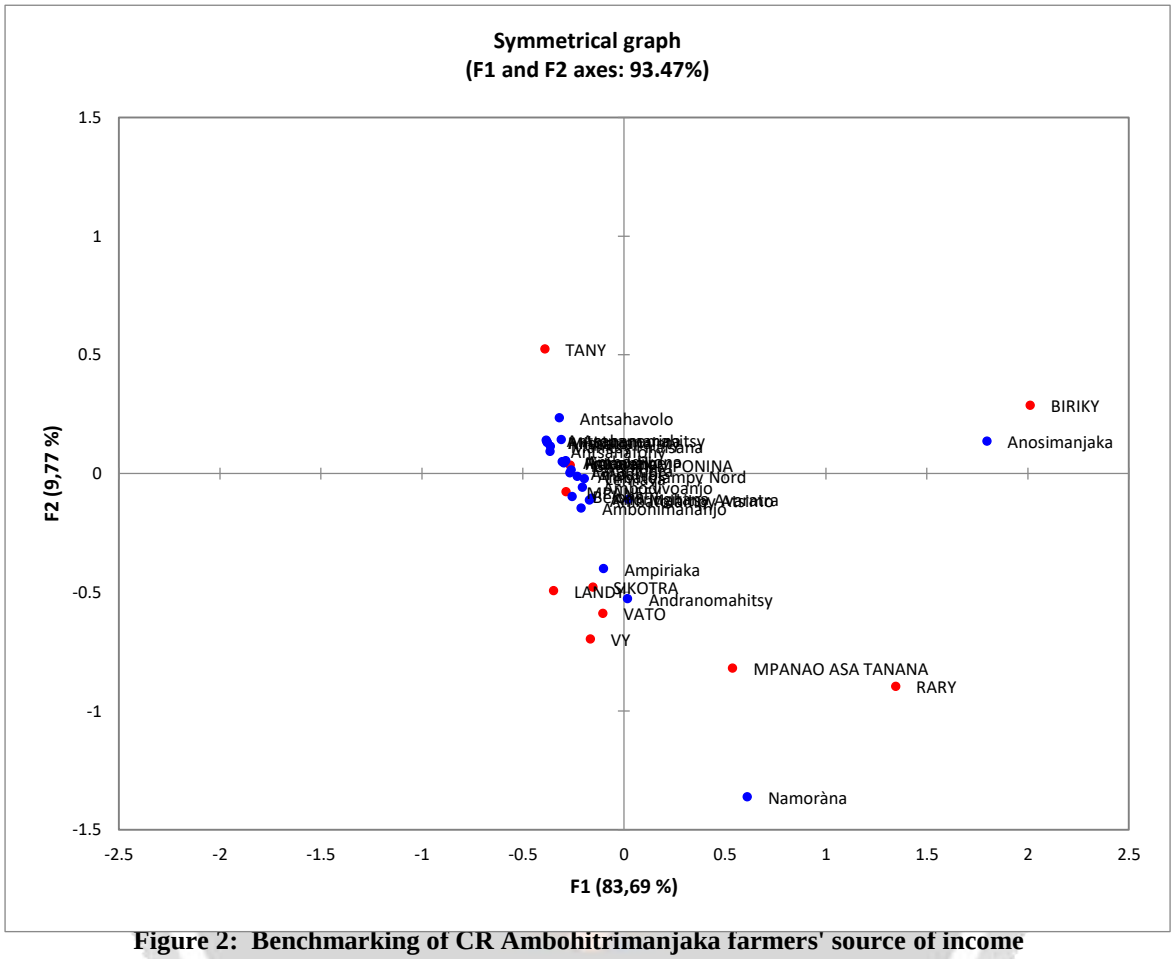
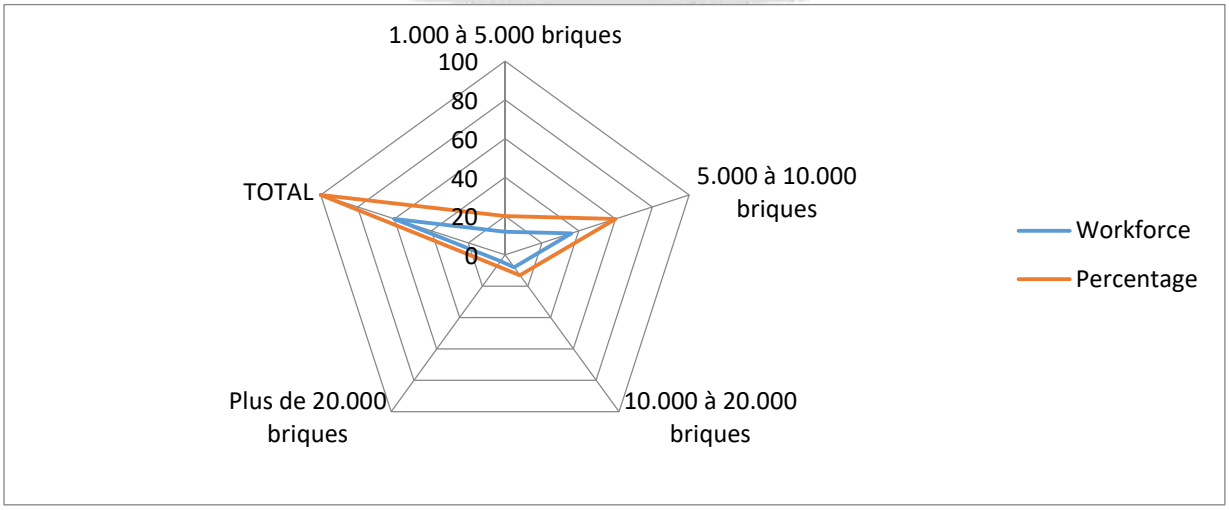


Figure 2: Benchmarking of CR Ambohitrimanjaka farmers' source of income

2.1. The number of bricks produced each month in the brickworks

According to the local survey, 60% of operators produce between 5,000 and 10,000 bricks a month, while 20% produce between 10,000 and 20,000 bricks a month. Only .7% of operators produce more than 20,000 bricks monthly. The quantity of bricks to be produced by brickmakers depends on the size of the kiln and the fuels used. (Figure 3)



2.2. Marketing bricks

Of the 60 brickmakers surveyed, 30 (50%) inform their direct and indirect customers as soon as storage is finished. 18 or 30% of them transport the bricks produced to the storage area and wait for customers to arrive. 12 or 20% of brickmakers market their brickworks to prove the quality of the bricks produced, another way of marketing bricks after production. (Figure 4)

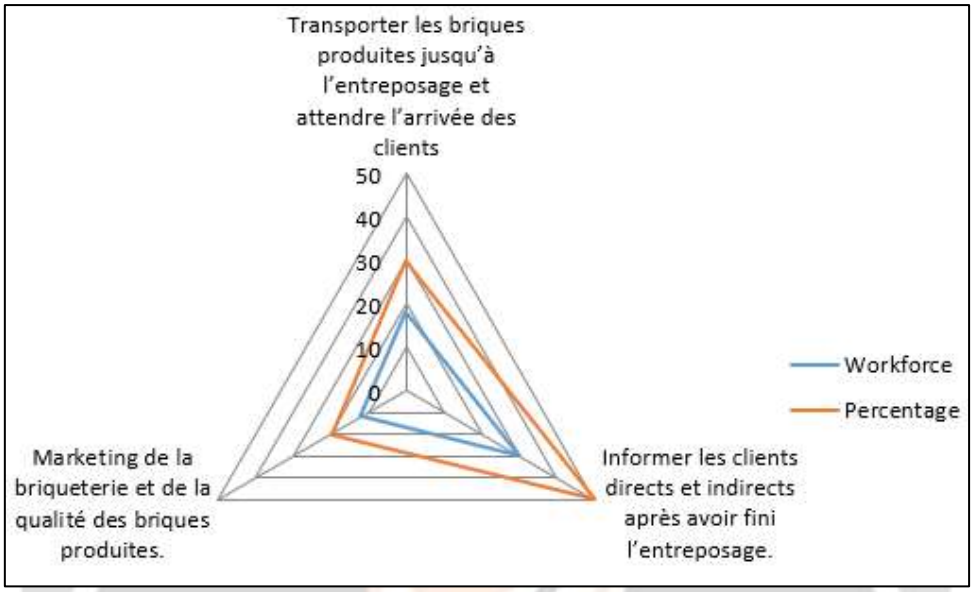


Fig 4 : Brick marketing

2.3. Determining the source of income of the most important farmers

Principal Comparant Analysis (PCA) is an access analysis of the correlation matrix between the most important individual variables. Here, brick production and Rary are highly correlated, as the Pearson values for brick are 0.78 and Rary is 0.80, different from 0 at significance level alpha=0.05. Next, the Kaiser-Meyer-Olkin (KMO) test is used to verify the linear effect of correlations. Its value ranges from 0 to 1, indicating a null effect of partial correlations, which is equivalent to saying that latent factors explain all correlations. The value of the KMO is 0.5, so the fit of the correlations between the variabilities is average. (Table 1)

Table 1 : Pearson correlation matrix and Measure of sampling precision

Variables	ISAN'NY MPONINA	MPANAO ASA TANANA	SIKOTRA	LANDY	TANY	VATO	VY	RARY	BIRIKY	MPANEFY	**KMO**
ISAN'NY MPONINA	**1,00**	-0,06	0,02	0,10	-0,04	-0,06	0,16	-0,15	0,00	0,25	
MPANAO ASA TANANA		**1,00**	0,23	-0,07	-0,11	0,03	0,07	**0,80**	**0,79**	0,19	
SIKOTRA			**1,00**	-0,09	-0,02	-0,20	**0,53**	-0,09	-0,02	0,16	
LANDY				**1,00**	-0,09	0,29	0,14	-0,02	-0,07	-0,16	
TANY					**1,00**	-0,16	-0,11	-0,15	-0,07	0,13	

VATO						**1,00**	-0,12	0,07	0,03	0,17	0 ,5
VY							**1,00**	-0,04	-0,09	0,01	
RARY								**1,00**	**0,94**	-0,20	
BIRIKY									**1,00**	-0,07	
MPANEFY										**1,00**	

Values in bold are different from 0 at significance level alpha=0.05

2.4. Confirmation of the reliability of the brickworks: a source of revenue

Reliability refers to the internal consistency of fired brick production. Before applying measuring instruments, they must first be tested Cronbach's alpha coefficients. Here, Cronbach's alpha coefficients of F1 is 0.94 to the exclusion is built by the perception of control on the F2 0.69. So, according to the Cronback result, we can say that the article theme is confirmed. Values in bold for each variable correspond to the factor for which the cosine squared is greatest (Table 2).

Table 2 : Reliability of analysis test

AXIS	ISAN'NY MPONINA	MPANAO ASA TANANA	SIKOTRA	LANDY	TANY	VATO	VY	RARY	BIRIKY	MPANEFY	Alpha de Cronbach
Axis 1	-0,09	**0,86**	0,03	-0,05	-0,12	0,06	-0,04	**0,99**	**0,93**	-0,07	0,94
Axis 2	-0,2	-0,29	-0,63	0,1	-0,01	0,15	-0,65	0,14	0,04	-0,61	0,69
Axis 3	-0,08	-0,09	**0,27**	0,14	-0,12	-0,28	**0,52**	0,07	-0,04	-0,79	0,4
Axis 4	0,1	-0,01	-0,1	**0,52**	-0,25	**0,58**	0,24	0,04	-0,05	**0,05**	0,03

2.5. Saturation after rotation

Comparing the results of normal PCA with PCA with VARIMAX rotation looks for a simple structure : the axes are rotated so as to increase the number of strong and weak saturations on the factors

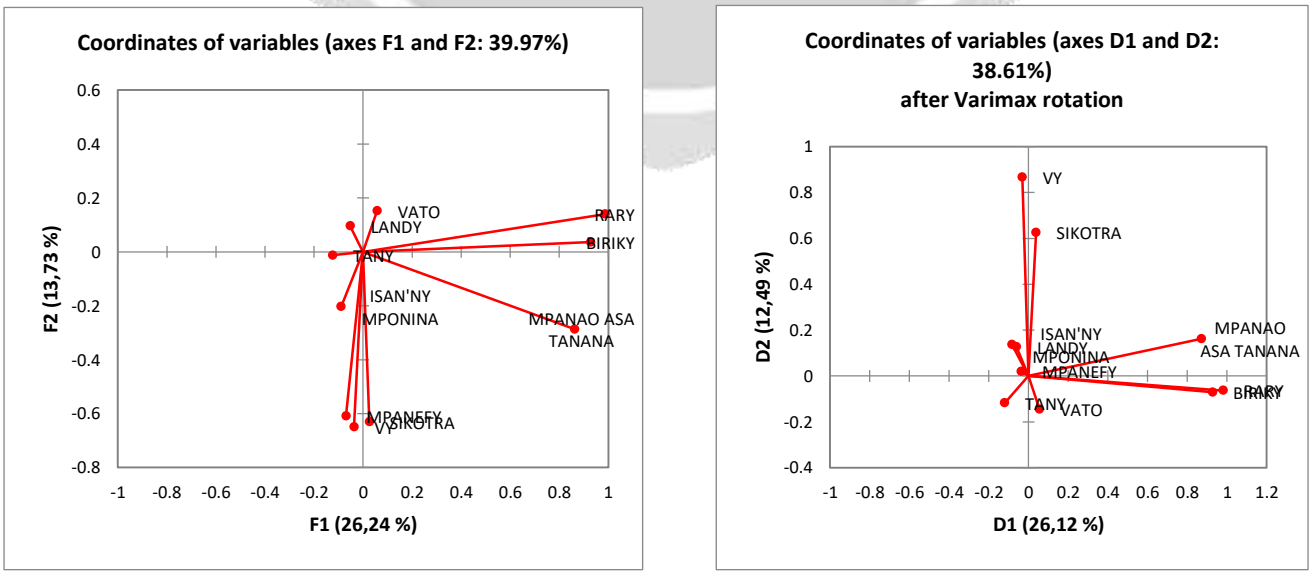


Fig 5 : Normal saturation and saturation after rotation

2.6. Bricks as a source of income in the Ambohijanaka commune

Three types of positive impact of the local brickworks. The responses are generally socio-economic. 45% of the responses obtained are dominated by the source of income and activity, while 33% and 22% development and fame (figure 5).

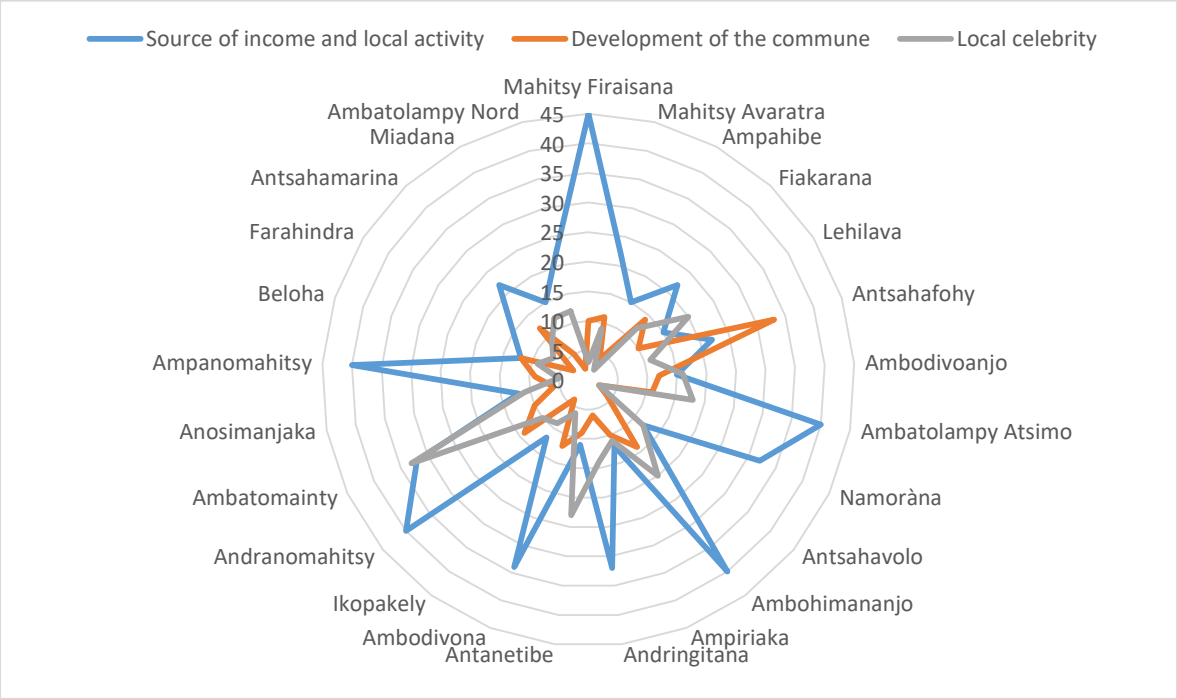


Fig 6 : Contribution of brickworks to income

3. Characteristics of development in the Amohitrimanjaka commune

An analysis of the commune's socio-economic situation has identified a number of potential areas for local development. Ambohitrimanjaka's development policies focus on social, environmental, economic and governance issues (Figures 2 to 4).

3.1. Social and environmental aspects

In socio-environmental terms, they reflect the determination of peasant women to impose objectives of democratization and preservation of the local ecosystem. Unlike the Firaisana, Belo,miadana, Mahitsy avaratra, ambodiavoanjo Andringitana and Antanetibe fonkontany, the Ampiriaka, Antsahafohy, Farahindra and Ampanomahitsy fonkontany attach great importance to this socio-environmental policy. The development focus is on the farmers in the fokontany. Mutual aid between social and environmental aspects prioritizes access to water and sanitation, teaching and education, as well as youth development, health, road infrastructure and housing and urban planning.

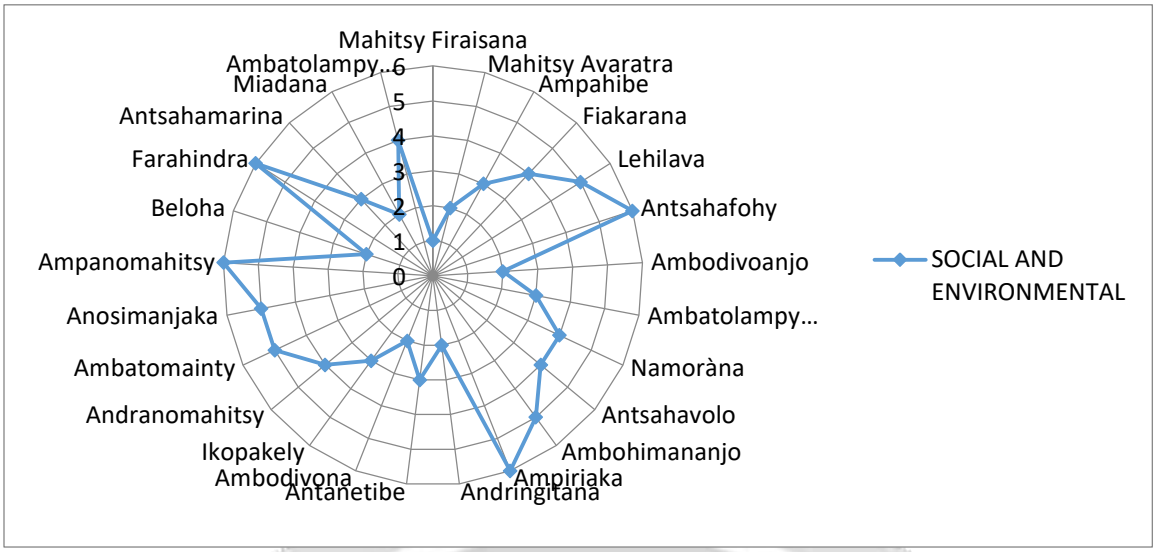


Figure 7 : Benchmarking socio-environmental development

3.2. Economic aspect

The development policy based on economic profitability has been used by the various successive Mayors of Ambohitrimanjaka. The Ikopakely, Ambodivoanjo, Antsahavolo and Beloha fokontany are the ones that favor an economy based on agriculture, livestock, fish farming, handicrafts, tourism, trade and commercial services. The mobilization of farmers' organizations has led to sustainable development through processing and production for the urban market, rather than for the regions. It has developed more rapidly with increasing state intervention in new areas, such as education, health and the economy.

As a result of decentralization policies, local authority administrations have grown substantially, while national administrations have seen their growth significantly limited.

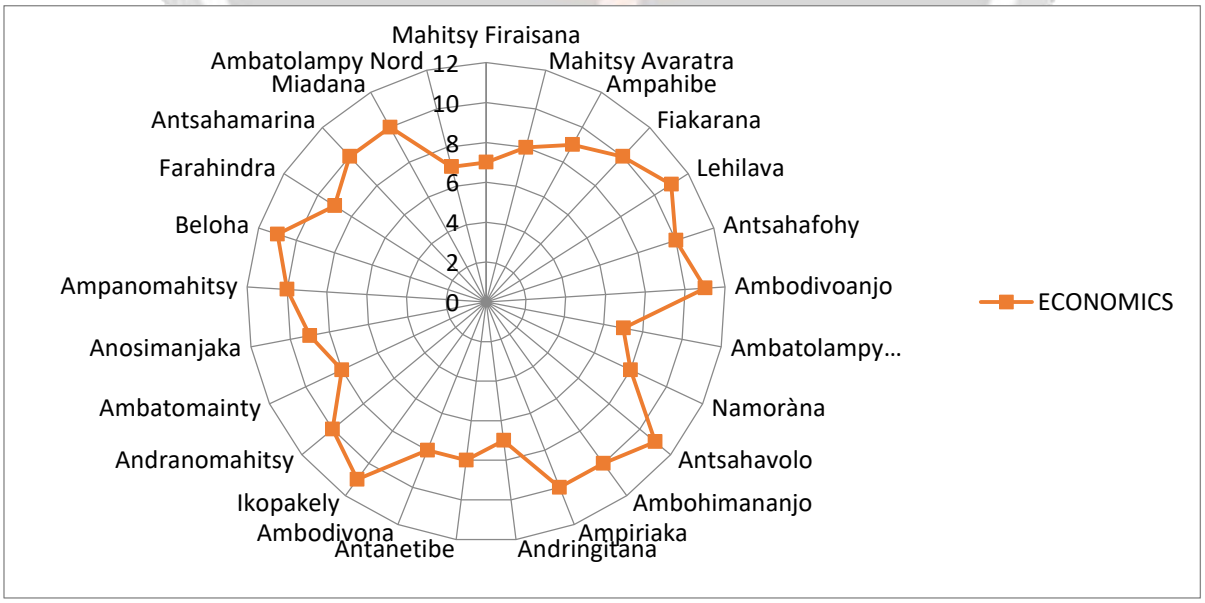


Fig 8 : Economic development benchmarking

3.3. Governance section

It is currently being challenged by other concepts, such as the notion of governance, which better covers contemporary forms of transformation in the logic of government. Most often, governance refers to the collective regulation that develops on the basis of relations between public and private players. The governance component of the Ambohitrimanjaka commune is based on finance, local administration and security. This component was implemented by the Ampahibe, Miadana, Farahindra, Ampanomahintsy, Andranomahitsy, Ampiriaka, Ambatolampy and Antsahafohy fokontany; while it was not applied at all in the days of the Namoràna, fiakarana, Mahitsy avaratra, Ambatomainty, antanetibe and andringitana fokontany.

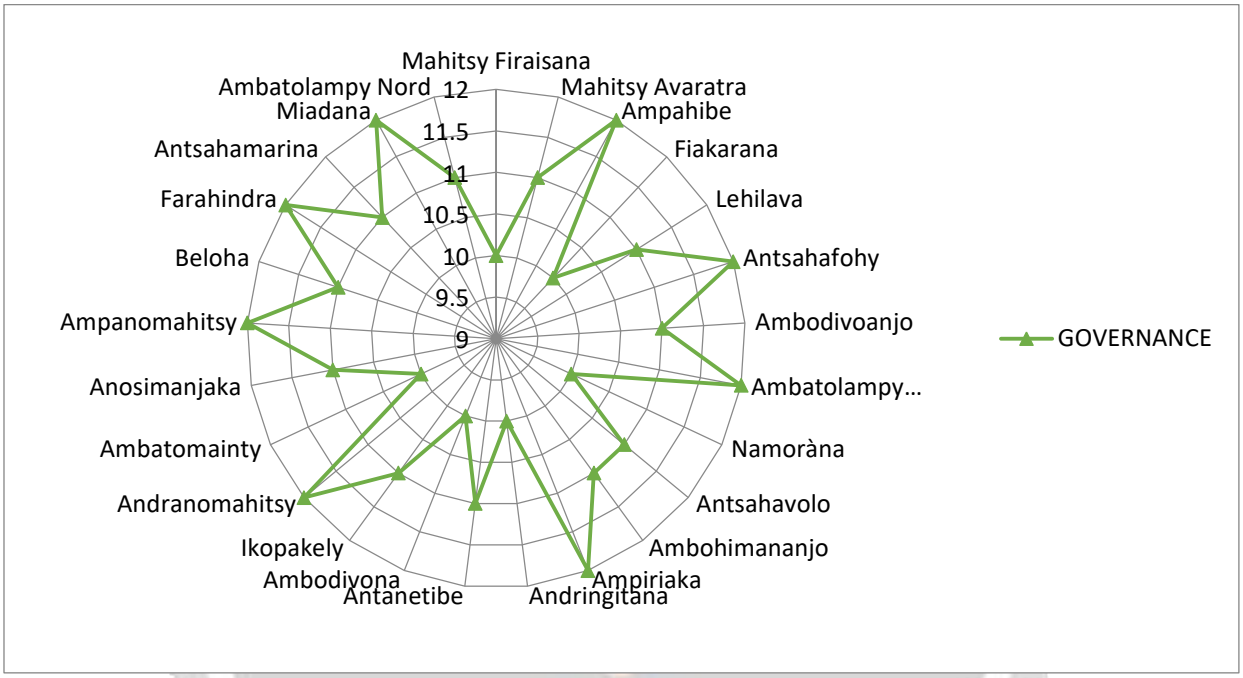


Fig 9 : Benchmarking governance development

DISCUSSIONS

In practice, clays are classified according to their plasticity (fat or lean), color (red, greenish, colored) and firing behavior (sandstone or refractory). These properties depend essentially on the chemical and mineralogical composition of the clays used. The influence and behavior of these two parameters during firing are described in research by (Kommann, 2009)The quality of the resulting brick products is not necessarily the same, as cited by (Acme-Brick Alviset and Kornmann, Lourenço and V asconcelos, & Mathy, 2009). The economic importance of clays is considerable, since, in addition to the production of bricks and tiles, they are used in a wide range of industries : ceramics (pottery, porcelain, etc.), cement, chemicals (insecticides, fertilizers, etc.) and medicines. Ambohitrimanjaka bricks are made on site, i.e. in the quarry. At present, however, some manufacturers tend to transport their raw materials close to the road and the village to make and fire them. The Ambohitrimanjaka brickworks are a source of income for most of the fonkontany, particularly class 3, but also a source of local activity (Figure 1 and Figure 2). The trade is already an activity for the local population. According to surveys and observations, brickmaking can lead to other activities. Brick production is undoubtedly a profitable activity for the local population. Indeed, some families can improve their standard of living. It also reduces

unemployment. In this case, the trade deserves to be encouraged. Interest in bricks is not limited to the family level, but is spreading to the communal level. It has become a main activity of considerable economic importance. The majority of responses obtained, in the positive sense, revolve around the purely economic benefits, because for each trade, the objective is to earn money.(Figure 4). In addition, the income resource in the commune does not remain on brick production alone, but is complementary with Rary, so brick farming and Rary are almost correlated. (Table 1).

From a development point of view, the brickworks contributes to the Commune's development through the considerable amount of bricks it receives. Most of the bricks manufactured are consumed by customers from other communes. Artisanal brickmaking in this area is of great socio-economic importance. It provides an opportunity for brickmakers to improve their standard of living. The development of the study area respects the preservation of the environment. The sustainable development of the commune depends on the process of change through which the exploitation of natural resources such as land. The preservation of the environment and the protection of future generations are considered essential conditions for development placed at the service of the people of Ambohitrimanjaka. (Figure 6)

The quality of the bricks produced means a long service life for the infrastructure. As for the rebate on the brickworks, it's not yet available. But it will be the source of a considerable sum of money to be paid to the commune. This sum will improve the local economy.(Figure 7).

As far as governance is concerned, it also sometimes has a normative tone. Indeed, by insisting on the necessary dissociation between collective regulation and the activities of the State, it has been used to maintain the idea of a withdrawal of the State in favor of actors (public or private) drawing their legitimacy from expertise rather than by virtue of any political legitimacy. (Figure 8).

CONCLUSION

In this article, the commune of Ambohitrimanjaka is renowned for its clay bricks. Bricks are produced by extracting the clay on site, planning the molding of the bricks, building the kilns and firing the bricks in the kilns, but this production requires large quantities of wood for firing, as the kiln has to remain lit for three long days. After firing, the bricks are taken out of the kilns, stored and then laid out on the market for sale. The quality of these bricks depends on the origin of the clays and the way they are made. The Ambohitrimanjaka brickworks contributes to the commune's income and development by providing work for young people and reducing the number of unemployed. It facilitates construction and gives the village an aesthetic appearance. All in all, it's an asset that helps improve society's standard of living.

Brickmaking promotes economic growth through socio-economic and environmental development . The manufacture of fired bricks has made it possible to determine the optimum mixes and conditions for the manufacture of fired bricks. Reproducibility and evaluation of properties based on construction standards and environmental legislation will also have to be carried out.

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