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Analysis of externalities and possibility of internalization case of market gardeners in the Lubumbashi area

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Abstract: The development of the city of Lubumbashi in DR Congo is closely linked to mining and copper processing. They are currently experiencing a revival of impressive activities throughout Katanga. However, the state of soil contamination in this city and its mining hinterland no longer allow for long-term agricultural production. In a general way, this work consists in analyzing the externalities and to see the possibility of internalisation of market gardeners in the aforementioned city. In a specific way, this work consists in evaluating the socio-demographic aspects, to identify the economic parameters of this activity; evaluate the externalities between Chemaf (mining company) and market gardeners. To achieve this, a survey was conducted among 80 market gardeners. 50 of whom practiced in the vicinity of Chemaf and 30 practicing market gardening away from this company. After stripping the data were entered in Excel and the statistical processing performed by mini tab 16. The TUKEY test was used to compare the different averages of the observed parameters. After this analysis, profit, profitability and yield have been found to be evolving at a loss in the site near Chemaf, which is not the case in the site located far from Chemaf. And so the mining company has a negative externality in the surrounding site.
Keywords: mining, gardening, externality and internalization

Introduction

The World Commission on Environment and Development warns of the danger of global changes brought about by uncontrolled human activity [6]. Thus, the number of these changes is accompanied by deadly dangers [7]. Therefore, the development of human activity modifies the environment, and these modifications directly threaten human activity [2]. And [1], adds that, from the beginning, the work on urban land rent shows that human economic activity creates the essential of its own environment. According to [18], changes in the price of land (differential land rents for location, intensive rents due to investment) directly capture the "value of the environment", ensuring a regulation of the allocation of space, in terms of the very absence of an urban planning regulator. In this context, mining development can generate more revenues for the State and be at the origin of the important economic growth, but it will be an economic development without true "development" which benefits the population in the broad sense [16]. Indeed, companies, which are one of the links in the chain of human activity, must thus incorporate new environmental protection criteria into their operation [5]. [10]. States in the same sense that Africa Centro-Austral was the seat of a very old mining activity. The beginning of

industrial copper production in Katanga also coincides with the onset of atmospheric pollution, ore mining industries are numerous and the population density is constantly increasing. Unfortunately, in various hydro-metallurgical plants and foundries, the extraction of copper and cobalt was accompanied by releases of by-products rich in zinc, lead, arsenic, cadmium or sulfur compounds. In fact, these discharges have a harmful impact on the environment, air, water and soil [2]. Some cases of pollution of the environment by industrial activities have been decried by the local population's even if, companies reject all these accusations [20]. The bottom line of the question is that, even if agreement is reached on the environmental consequences of a particular accumulation regime, what would the cost imply for the implementation of the corresponding modes of regulation? However, externalities are among the main reasons that push the government to intervene in the economic and environmental sphere [4]. This is the term used when indirect effects affect consumption and production opportunities, but the price of the good consumed or produced does not take it into account. Indeed, this state of affairs demonstrates the current situation of the Lubumbashi mining area where we are currently seeing a flourishing of the development studies of the city intimately linked to mining and processing of copper ores. These are experiencing an impressive upsurge of activity throughout the upper Katanga. Mineral extraction industries are numerous and the density of the population is increasing more and more [9]. Indeed, this work aims to assess the negative impact of mining activities near market gardening sites, facing the emergence of the industrial sector and the development of market gardening in the city. To achieve this, the following specific objectives are pursued: assessing the socio-demographic characteristics of market gardeners, analyzing economic parameters, assessing the externalities between Chemaf and the surrounding market gardeners, analyzing the possibility of internalization, identifying the constraints , clear the prospects of market gardeners.

Environment, Materials and methods

Environment

Lubumbashi, also known as the Copper Capital, is the capital of Upper Katanga Province, located in the southeastern DR Congo at 11 ° 40 'S, 27 ° 29' South and between 1200 and 1300 m of altitude. It is the second largest city in the Democratic Republic of Congo after the capital Kinshasa, also known by the presence of several mineral deposits, and also by its intense economic activities. With a population of approximately two million inhabitants [17], the city of Lubumbashi belongs to the climate type CW6 according to the Koppen classification. Its rainfall pattern is characterized by a rainy season (November to March), a dry season (May to September) and two months of transition (April and October). [19]

Study area and sampling

The study was conducted in December 2018 – February 2019 in the city of Lubumbashi precisely in the different municipalities where the mining sites are located. A survey and structured interview were made on a sample of 80 vegetable growers, 50 of them engaged in agricultural activities in Kampemba town, Kabetcha site near the mining company, and 30 as witnesses in Lubumbashi town site tingi tingi. This last is far away from the mining companies. From the random sampling method, implemented with different producers. To arrive at the analysis of the externalities experienced by the producer of the Kabetcha site, this method consisted of the collection of data at the production site level in market gardeners and other relevant information which allowed us to have reliable information.

Fig. 1. Kabetcha site, Tshamilemba district, Kampemba / Lubumbashi

Collected data and statistical analyzes

The main data collected during the survey can be summarized as follows: The socio-demographic situation (age, sex, level of education, marital status), the economic parameters linked to the agricultural exploitation of sites (profit, profitability, yield, labor, area planted and the fertilizer used), Externalities (level of appreciation of the presence of the company in the polluted site, point of view consequence of the mining activities in the polluted site, product affected by pollution), the possibility of internalization (measure taken for the promotion of agriculture in the polluted site, protection of the environment in the site polluted by the company), the constraints (the reasons of use of the small surface areas , the reasons for the decline in yield), the prospect of the future (market gardeners' thinking about performance behavior and the absence of a mining industry) The data collected o They are manually tabulated and entered into an Excel 2013 database and then analyzed using the Mini Tab version 16 statistical analysis software. Descriptive statistics such as mean, frequency, and standard deviation, and quantitative statistics were used to identify trends in the various variables mentioned above.

Results

Board. Variation of socio-demographic variables of market gardeners

site	**age**	**sex**		
		H	**F**	
Kabetcha	41,54±15	40%	60%	
Tingi tingi	33,5±7	0	100%	
	married	**Divorced**	**widow**	**single person**
Kabetcha	60%	18%	2%	20
Tingi Tingi	23%	6%	0	70%
	university	**secondary**	**primary education**	**illiterate**
Kabetcha	1%	8%	54%	36%
Tingi tingi	0	13%	73%	13%

Sources: Our investigations

· **Age of the maraichers**

The average age of the maraichers between the sites varies 44,54±15 and 33,5±7. The comparison of the average ages showed that there is a significant difference in age ($p<0,05$) according to the sites. The oldest maraichers are in the site of Kabetcha.

· **The distribution of sexes of the maraichers**

The average of sex of the maraichers between the two sites varied. The comparison of the averages of sex by the test of Tukey, announces a significant difference between the sites. It is noticed that there is more female sex with 70% as a whole of the sites and 30% of the male sexes of the maraichers.

· **Distribution of the maraichers depending on the marital status**

The variation of the marital status of maraicher varied between the two sites, and one notices more person in charge (groom) in the site of Kabetcha that that for Tingi tingi.

· **The distribution levels of studies of the maraichers**

The average of level of study of maraicher varied and calculated in term of percentage, between the two sites whose remarks have a higher level of study of maraichers in the site of Kabetcha than that of Tingi tingi.

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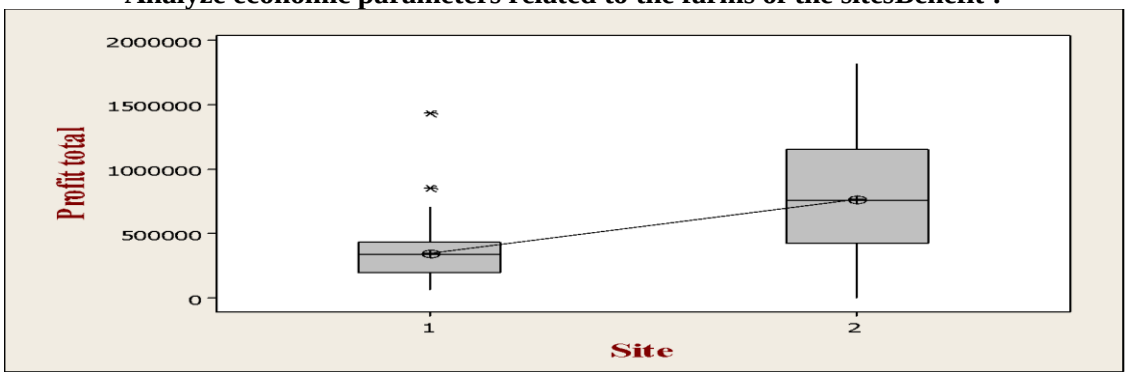
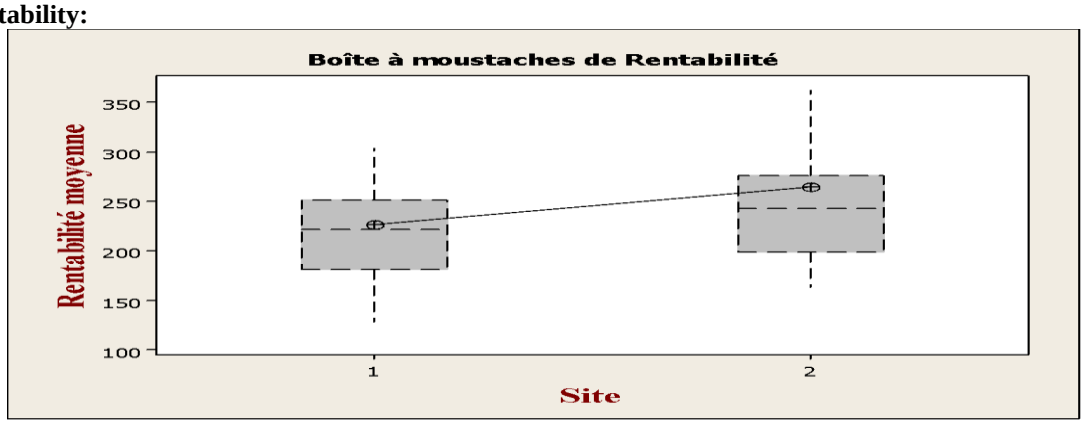
Analyze economic parameters related to the farms of the sitesBenefit :



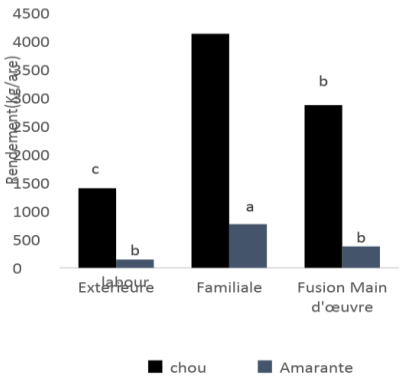
The profit of the maraichers varied between the two sites, the comparison of the benefit shows a significant difference in profit (p<0,05) according to the sites respective and the tendency of profit reveals that the site of Tingi Tingi (2) generates more profit with an average **853500±456382 FC** and Kabetcha (1) **347388±228218 FC**

Profitability:

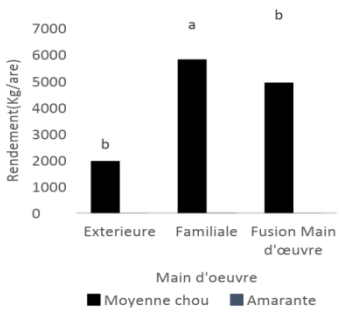


Profitability between the two sites shows that the products have like averages 227,4±70% in Kabetsha and 264±128% with Tingi Tingi. But the tendency shows between the sites, that Tingi Tingi has a high profitability compared to that of Kabetsha with a difference in profitability being equivalent to 27%, and the comparison between the two sites shows that there is not a significant difference (p>0.10). Profitability is similar to Kabetsha (1) as in Tingi Tingi (2).

Workforce:



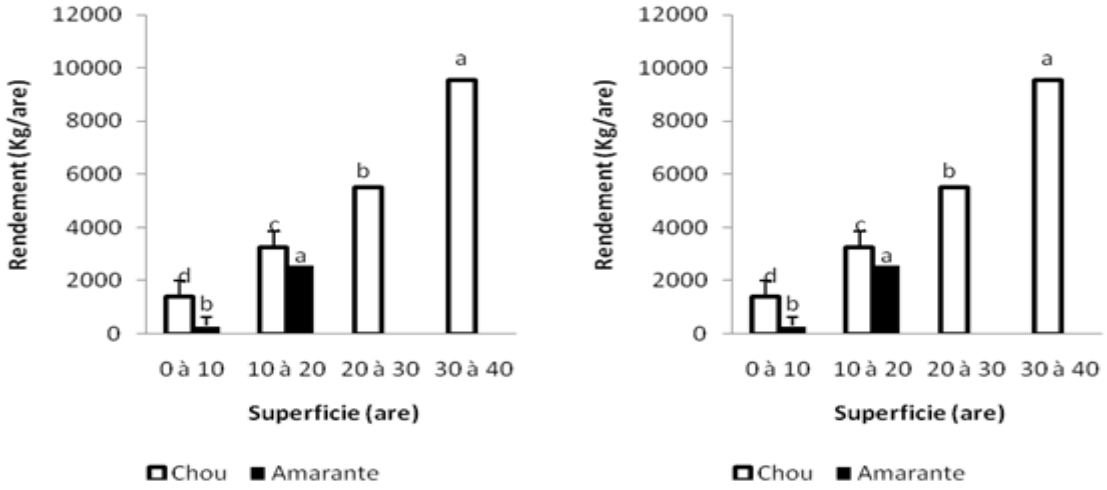
Site of kabetcha



site of Tingi tingi

The result shows that a significant difference (p <0.05) between the two sites and the trend reveals that the quality of the workforce is a function of crop yields. It is noted that the family workforce produces more output between the two sites followed by other outside help

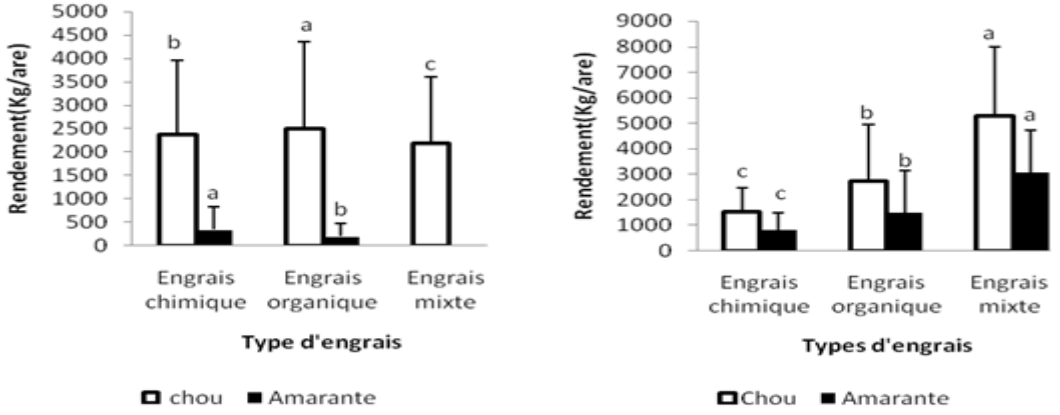
EmblavedSurfaces



Site of kabetcha site of Tingi tingi

Cabbage and amaranth yields varied by area regardless of site. The comparison of yield averages showed a clear influence of area (p <0.05) on both speculations. The best yields have been obtained over large areas of cultivation, and there are yield gains on Tingi tingi for both speculations, compared to the Kabetsha site. For areas between 30 to 40 ares, cabbage yields were 9528 kg at Kabetsha and 12412 kg at Tingitingi; for amaranth, the yields were 2575 kg at Kabetsha and 4727.7 kg at the Tingitingi site, for an area of between 10 and 20 ares.

Types of fertilizer



Site of kabetcha site of Tingi tingi

The figure below shows that yields varied with fertilizer types. This variation is greater in the Tingitingi site than in the Kabetsha site. The best yield of cabbage is achieved by adding organic fertilizer to Kabetsha, while in Tingitingi, mixed fertilizer justifies the good yields of cabbage and amaranth. As for the amaranth of Kabetsha, the good results are obtained thanks to the contribution of chemical fertilizer. The difference in average yields is significant between the two sites (P <0.05) 5300 kg of cabbage and 3061 kg of amaranth in the Tingitingi site against 2185 kg of cabbage

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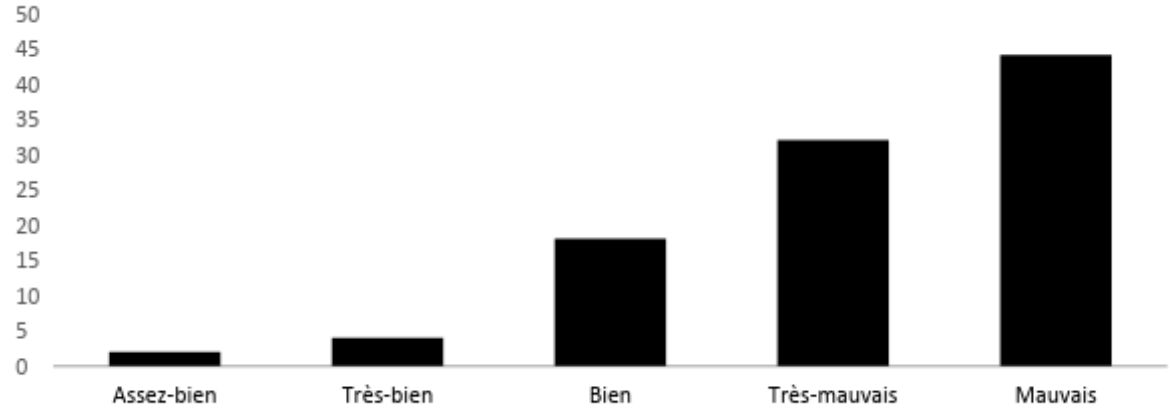
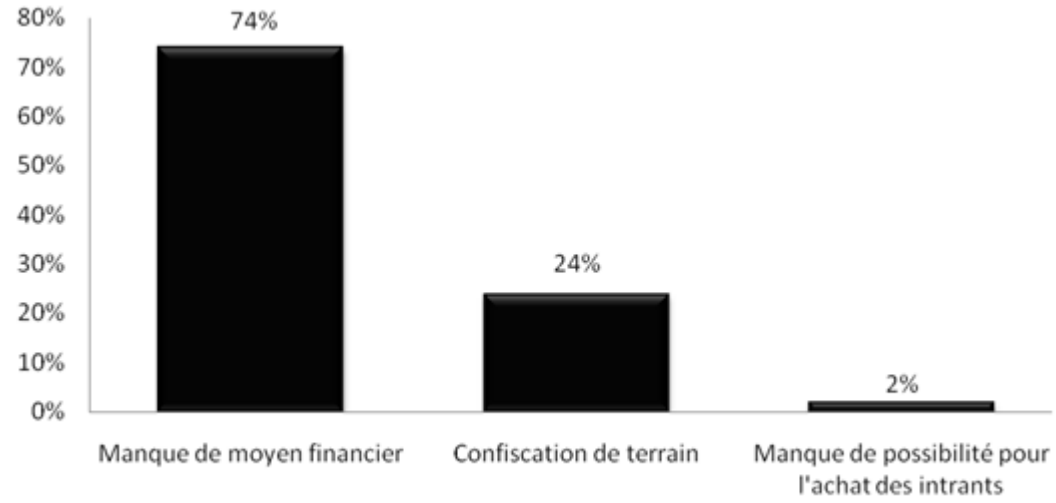
Evaluation of the externalities [1]

Level of appreciation of mining industry in the Kabetsha site



The evaluation of externality among market gardeners operating in these environments have negatively assessed the presence of this mining industry: 44% presented a "bad" rating, 32% presented a "very bad" rating. The presence of this industry was presented by a minority of respondents, 18% rated "good", 4% rated "very good" 2% rated "fairly well".

Contraints evaluation[2]

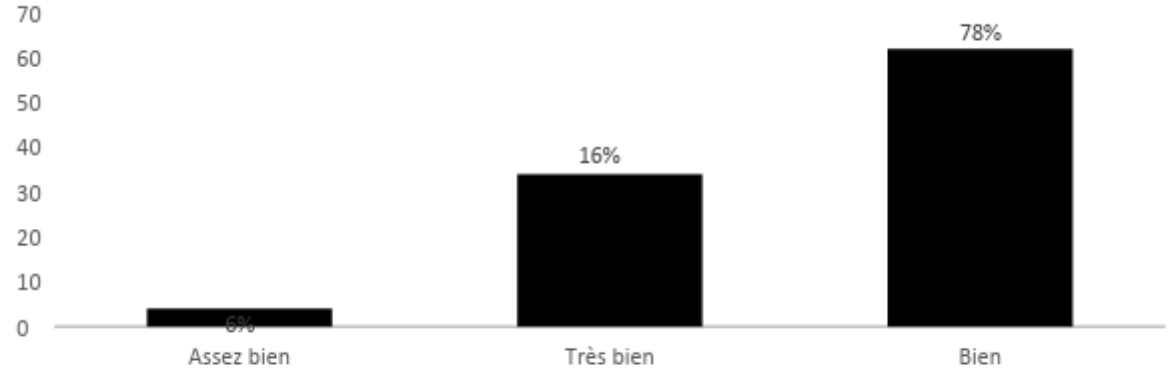


The market gardeners of the Kabetsha site have difficulty in expanding the areas of cultivation, the difficulties experienced, 74% of respondents approve a lack of financial means, 24% responds to the confiscation of land without being compensated and difficult to sell, 2 % by the lack of opportunity for the purchase of agricultural inputs.

[1] Assez bien : Rather well, bien : well, tres mauvais : very bad
tres bien : very well, mauvais : bad
[2] Manque de financement : miss financing:
Confiscation de terrain : Confiscation of ground:
Manque de possibilité d'achat des intrants : Miss purchasing possibility of the intrants:

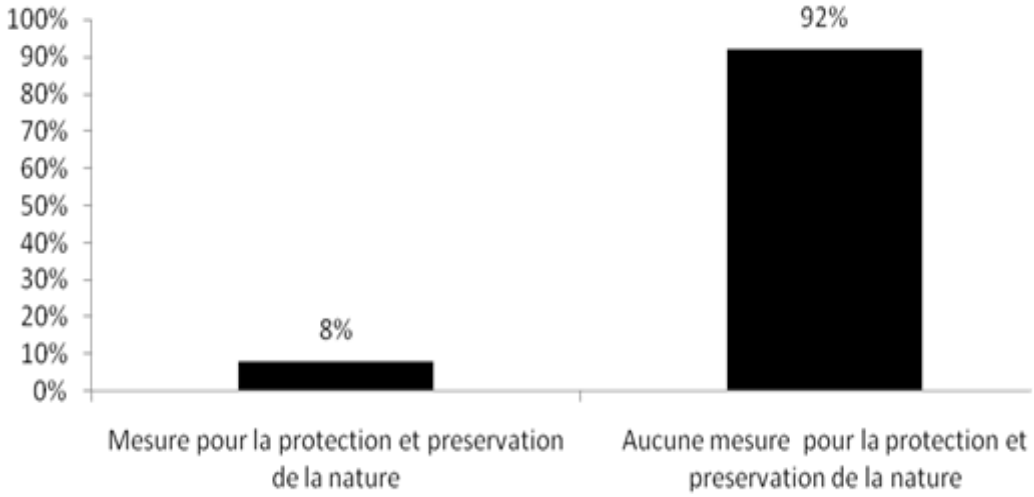
Evaluation of internalization possibilities

Measures taken by the mining industry for the promotion of agriculture



For the promotion of agriculture, the majority of farmers in the Kabetsha site said the lack of measures by the mining industry to develop agriculture so 78% of respondents said only that, the company is not totally concerned with agriculture; 16% of respondents said they received seed with a very good score followed by 6% of respondents received the fertilizer with a fairly good score

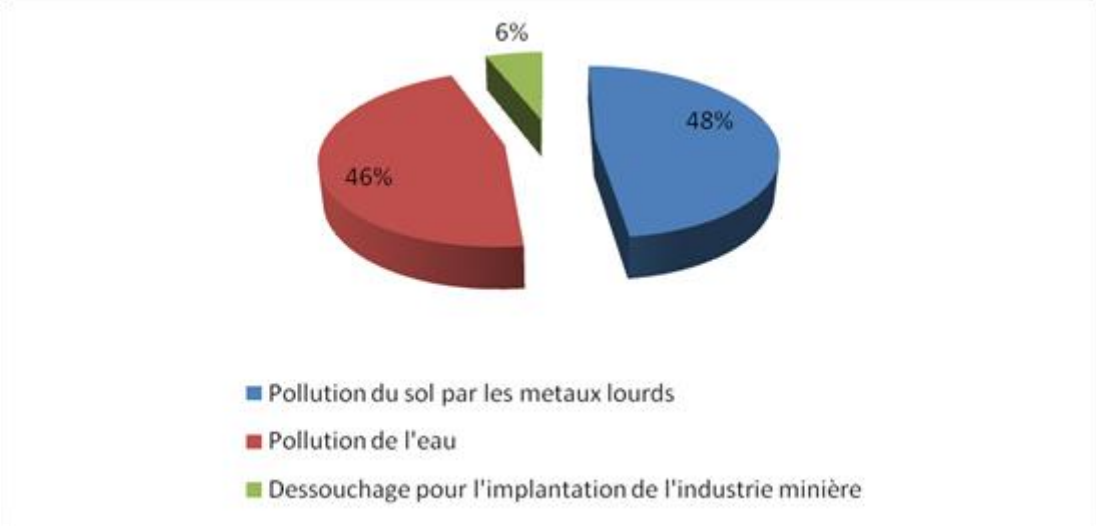
Protection and preservation of the environment



The protection and preservation of the environment, most market gardeners of Kabetcha site, presume no measure of preservation and protection of the environment, and the trend shows that 92% of respondents say, and 8% who prejudge a possible reforestation project.

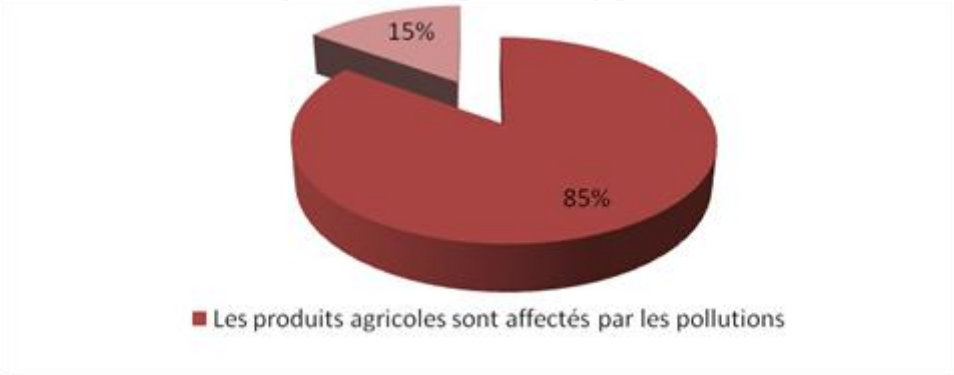
Assessment of the consequences of mining activities

Decrease in returns



The results reveal that, the decrease of the yield in the site is a function of the pollution, nearly 48% the decrease conditioned by the pollution of heavy metals, 46% the pollution of the water supplying the irrigation of market gardening and 6% heavy work of stain removal.

Assignment of the products by pollution[3]



A very high frequency of 85% of agricultural products are affected by the pollution of the mining industry against 15% estimated unaffected, resulting in a poor rating of the installation of the plant in the market garden site in Kabetcha.

Discussions

Economic parameters related to the farm of the sites

After the analysis of the variance, the profit and profitability are higher in the control site than in the close site of the company. The yield of market garden crops varied according to the area planted, the type of fertilizer used and the labor force employed. In general, the yields increase with the cultivated area regardless of the market gardening site, so that the important productions are obtained over large areas. However, compared to the control site, Kabetsha is experiencing decreases in production of cabbages and amaranths respectively of 2884 kg and 2152.7 kg. For both crops the areas between 30 to 40 ares (cabbage) and 10 to 20 ares (amaranth). Although production is a function of the cost of production, which includes labor and for weeding and harvesting, the results obtained in this work associate these parameters with the area. It has been reported that yields per hectare can be very high on small, non-mechanized, very well managed farms, because seedling and

[3] Produit agricole effecté par la pollution : Agricultural produce effecté by pollution

planting density can be optimized [11]. The combination of mineral and organic fertilizers justified high yields in the control site. Since the combination of organic and inorganic inspires several expectations in market gardening, these results seem logical and consistent with the literature. Thus, [12] certifies that the combination of organic and mineral fertilizers creates the ideal environmental conditions for cultivation, as organic fertilizers improve soil properties while mineral fertilizers provide plants with the necessary nutrients. If the soil is rich in nutrients, the plants grow well and give high yields. If the soil is poor in one of the elements, plant growth is limited and yields are reduced [9]. On the other hand, the best yields in Kabetsha are obtained thanks to the use of organic fertilizer in the cultivation of cabbage. This suggests that the soils of this site are sufficiently rich in inorganic fraction for plant nutrition, despite presumed high levels of heavy metals. The fertilizer user manual highlights the role of organic fertilizers. According to [13] certifies that organic fertilizers are valuable, not only because they bring to the plants nutrients but also because they have a favorable effect on the state of the soil in general. As for the quality of labor employed, the use of family members for market gardening has generated significant returns, compared to the external labor force and the merger of these two. It seems reasonable to us that the use of family labor is beneficial, as long as it is rarely quantified in the total cost of market gardening, depending on the context of this study. [5] Reveals that social economy enterprises are considered as groups of associates around a common project. In order to minimize costs and maximize efficiency, the inhabitants of Kabetsha and Tingitingi neighborhood organize themselves into families to form a livelihood to satisfy their families in the case of our study. Authors such as [6] [15] and [14] have looked at the notions of sustainable livelihoods (MED). They report that people need a series to have to achieve positive livelihood outcomes. Reports published by international organizations indicate that the MED approach requires the mobilization of a certain number of complex tangible and intangible assets as previously identified.

Evaluation of the externalities and possibilities of internalisation

Of all the market gardeners surveyed, the fall in yields would be linked for 48% following the pollution of the soil by heavy metals, 46% correlated with water pollution. The allocation of market gardening products was mentioned by 85% of market gardeners to justify the decline in yields they suffer. [3] reveals that these claims seem justified in the analysis of the soils of this district, as reported and published in November 2011, the author deplores the pollution of water, soil and edible plants related to the exploitation copper and cobalt by the companies Chemaf and Ruashi Mining in Tshiamilemba and Kabetsha in the city of Lubumbashi. The NGO is concerned for the health of more than six thousand inhabitants of these two neighborhoods exposed daily to this pollution. This report indicates that, after analyzes in a Belgian laboratory, samples of well water, soil and edible plants taken in these two districts, concentrations of lead, cadmium and zinc much higher than normal. Indeed, the metal trace elements known as "heavy metals", are toxic high content also for plants that for the environment consequent. [11] indicate that the presence of vegetable crops near industrial facilities often leads to examining environmental pollutant levels in pollutants accumulated in vegetables consumed by the population. In fact, because of their massive and / or repeated use and their persistence in the environment, the accumulation of metallic trace elements (ETM) can lead to the contamination of ecosystems and thus present risks for living organisms [8] . Analysis of internalization possibilities related to the negative impacts of the mining industry, 78% of market gardeners said that the interventions of the mining company located in the Kabetsha neighborhood do not fall within the agricultural field. In relation to the protection and preservation of nature, 92% of market gardeners declared the absence of measures relating to it. In the community sector, 20% of farmers reported incidentally the construction and rehabilitation of a health center. These situations are rather deplorable for such a large company.

Conclusion

By way of conclusion, this study shows that the mining company Chemaf has a negative externality in the surrounding market garden site. It is therefore important that the company considers a measure of internalisation to market gardeners and that politico-administrative authorities play arbitration roles.

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