



**INSTITUT POLYTECHNIQUE DE BYUMBA (IPB)**

**EDUCATIO – SCIENTIA – MINISTERIA**

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## EDITORIAL

Institut Polytechnique de Byumba (IPB) is involved in research and publication among all lecturers. This is the number 2 of the *Rwanda Journal of Social and Applied Sciences* (RJSAS), the IPB's Scientific Journal which publishes each Semester. It especially focuses on research priorities in various economic, cultural and social sectors, considering the strong linkage between Research and Development.

Under the coordination of the Directorate of Research and Consulting and the Office of the VRAC, this Journal is nourished by five articles from different fields, reflecting the nature of courses offered by IPB and specialization of each author. It aims to produce articles in *agriculture, social sciences, humanities and education*.

One of the missions of Higher Learning Institutions in Rwanda is research. This journal will serve as window where IPB researchers and/or lecturers will exchange with the scientific world their studies and achievements. It is a pillar in strengthening research. Clearly, the number 2 of RJSAS is composed of the following topics:

*Effect of substrates and doses of urea on growth and yield of edible mushroom (Pleurotus ostreatus) in greenhouse* by NDIKUMANA Déo and KANANI Faustin. Mushrooms have high nutritional and medicinal quality food both with respect to the amount of protein or minerals. Although, the food insecurity due to small size of arable land, soil infertility and declining soil arable; the mushroom is crop suitable for Rwanda.

*An investigation of vulnerability among the elderly in Byumba Sector* is the article of MUNYANEZA Néhémie, showing that vulnerable groups are at risk of experiencing negative outcomes because they lack the capability to protect their wellbeing. Essentially, they have greater needs but with fewer resources to address these needs, obligating societies to act on their behalf.

*Restructuring strategies and performance of SMEs in Rwanda* by NIYIBIZI François Xavier. Firms restructure to meet the company's changing objectives. Firms should find their levels and harness the changing environment if they are not to register

failures. Corporate restructuring is necessary and desirable for any dynamic and flexible environment.

*Effet de l'agroforesterie pour la conservation durable des sols agricoles du district de Gicumbi, Rwanda* by HABUMUGISHA Jean de Dieu, RUKANGANTAMBARA Hamudu and SIBO-NKIZEHIKI Jean de Dieu. L'effet de l'agroforesterie dans la conservation des sols a rapporté que ce système régénère et stabilise la fertilité des sols dans un système de production bien adapté aux conditions écologiques et humaine du Rwanda.

*Causes and effects of prostitution in Rwanda: a case study of Muhanga Town in Muhanga District, Rwanda "Period of 2008-2012"* by MUNYANEZA Néhémie. Until the 20th century, the evolution of prostitution was marked by periods of boom followed by measures of prohibition and repression will fail, causing the states to be resigned to a matching tolerance regulation police and health.

Our target is to encourage all IPB lecturers to conduct researches for the benefits of Rwandan community, and consequently for promoting quality Education, according to our motto "*Educatio, Scientia, Ministeria*".

**Father Prof. Dr NYOMBAYIRE Faustin**

## **Effect of substrates and doses of urea on growth and yield of edible mushroom (*Pleurotus ostreatus*) in greenhouse.**

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### **Abstract**

The present study proposed the objective of comparing the effects of four substrates and five doses of urea for the identification of best substrate(s) and optimum dose(s) of urea on growth and yield of edible mushroom (*Pleurotus ostreatus*) species. To achieve this objective, the study took place in Nyagisozi Sector. Two factors were studied; the first was substrates (beans' straw, maize cobs, penissetum and rice straw), the second factor was doses of urea (0, 50, 75, 100 and 120gr) which made a total of 20 treatments and 3 replications in experimental design of "Randomized Complete Block Design". The observed parameters were number of mushroom per tube, cap diameter, stem height and total yield of mushroom measured from August to October 2012 in three times (10, 20 and 30 days after mushroom cultivation). Results showed that the highest mushroom yield was reported on maize cobs' substrate supplemented with 100 gr of urea (with 1993gr) followed by maize cobs' substrate supplemented with 75 gr of urea (with 1833gr), beans substrates without urea (with 1800gr) and substrates of beans' straw supplemented with 120 gr of urea got the lowest yield of 1350gr. The highest cap diameter (18.43cm) and number of mushroom per tube (11.33) were observed also on maize cobs' substrate supplemented with 100gr of urea. However the highest height of stem (9.33cm) was observed on rice substrates supplemented with 75gr of urea. Therefore, according to the performance observed, these findings suggested that the recommended substrates are maize cobs' substrates combined with 100gr of urea and beans' substrates without urea, and could be associated to any other potential yielding substrates for the increase of the production of mushrooms.

**Keywords:** Substrates, Doses of urea, Growth and yield, Edible mushroom, greenhouse.

## 1. Introduction

In Rwanda, the agriculture is confronted with the decline of arable land and soil continual becomes infertility. Rwanda's agriculture sector strategy aims to increase rural incomes, enhances food security and converts agriculture into available sector by shifting from subsistence to market based activities. To avoid mal nutrition in terms of food deficiency and to manage a small soil arable more than usual is becoming major important to use the crops which don't require great extents of the soils and can increase the incomes of households in the country like Rwanda (Nita, 2002).

Mushrooms have high nutritional and medicinal quality food both with respect to the amount of protein or minerals. Although, the food insecurity due to small size of arable land, soil infertility and declining soil arable; the mushroom is crop suitable for Rwanda (Peter, 2003; 2005). They can grow on small surface area, grown with substrates (agricultural or industrial wastes) and produce high yields hence increase livelihoods of Rwandan (Peter, 1991; 2003; 2005).

The widely cultivated species in Rwanda is *Pleurotus oestreatus*. Lateral cap is open and flat, fan shaped. On the contrary, lopsided cap is shallow cap shaped. Spores are elliptical and egg white. There are altogether 50 species in *Pleurotus* which are already known all over the world (Mukafuremu, 2006).

Edible mushrooms are considered as they can help to reduce vulnerability to poverty and strengthen livelihoods through the generation of a fast yielding and nutritious source of food and a reliable source of income. The edible mushrooms have several advantages : high production per small surface area ; healthy food over many other crops, like nutritional value (vitamins, proteins, minerals, fat and carbohydrates) ; the mushrooms have yielded important medicines, like penicillin and other antibiotics from *Penicillium* ; the edible mushroom is bioremediation of the polluted soil or neutralizing acidic runoff water so that the use of mushroom compost (agricultural or industrial wastes) increases pH of the water in soil and heavy metals could

precipitate without clogging the pores of the limestone hence increases soil fertility, as they can grow on poor soils, they are crops suitable for Rwanda (Peter, 2003; 2005).

Mushroom cultivation has now become popular all over the world. From 1985, Technoserve project started boosting edible mushrooms in Rwanda. This contribution was historically based on “*Pleurotus*” cultivation and the spawn production process was also initiated (Zhanxi and Zhanhua, 1999, 2002; Beetz and Kustudia, 2004). In 1997; various supports came from United Nations for Development Programme (UNDP) to assist community for mushroom cultivation and spawn making. These interventions were easily delivered undertaking project-based work cooperatives ([www.mushroomcompany.com](http://www.mushroomcompany.com)). The need of the society in 2003 has driven the Ministry of Agriculture and Animal Resource to develop JUNCAO industry in Rwanda (MINAGRI, 2010). According to the same source, in 2005, Rwanda paid US\$120,000 to buy the JUNCAO technology then started a construction of a Chinese government-aided JUNCAO demonstration center, at a cost of 40 million Yuan. Spawns are now being produced at KABUYE through JUNCAO technology that is implementing in Rwanda (Juncao, 2006).

The researches done on mushroom cultivation used different substrates to identify which is effective in terms of maximum production of mushroom but, until now it is still in very low production in Rwanda (500-1500 gr / tube) comparatively with the mushroom production in the Netherlands (6.1-9.3kg / tube), Finland (30kg/sq.m), Russian federation (65-170kg/sq.m). This may be due to the insufficient nutrients content of some substrates and lack of appropriate species with optimum production in the region (Royse, 2001).

The existing species (*Auricularia* sp. and *Pleurotus florida*) do not produce enough (Peter, 2003, 2005).

To use the appropriate substrates and optimum dose of nutrient is very important to increase such edible mushroom production. Therefore, the present study proposed to evaluate this species (*Pleurotus ostreatus*) in comparison of four substrates and five doses of urea to determine substrates and doses of urea which can be recommended

to get high mushroom production.

## **2. Materials and methods**

### **2.1. Materials**

#### **➤ Greenhouse**

#### **✓ Location:**

The greenhouse used in growing mushrooms (tested in this study) is located in Nyagisozi Sector (Nyanza District-Southern Province-Rwanda) enjoying a tropical climate moderated with soft temperatures of a yearly average being between 18 and 20 °C. Such a climate explains itself by the physical constitution that presents the less high softer hills and valleys by the way of consequence, the early stake and vespérale of the sides, feature of the region of the central tray, eases the times brightened of the thermal balance days settles therefore enters of the days and nights. The sector presents a very damaged relief of which the slopes more or less numerous and strong region of the trays central, says it sector answers to the domination of the country of the hills, these are interrupted of numerous valleys where flow of the streams to water watering sweet potatoes or sorghum according to the seasons.

#### **✓ Design:**

The design was suited to the climatic conditions, topography, soil texture and other factors of the project site. The climatic data required for the erection of this greenhouse model were: monthly temperatures and relative humidity maxima and minima, wind speed and dominant direction, monthly radiation and precipitations.

#### **✓ Measures:**

The width and length of the greenhouse were fixed according to the topography, greenhouse model, crop type and crop system (soil or soil-less media).

✓ **Type of the structure and internal equipment:**

The greenhouse was adapted to the tropical climate and mushroom species tested. The internal equipment of the greenhouse was chosen according to the climatic conditions of Nyagisozi Sector.

✓ **Roof window:**

According to the climate conditions of Nyagisozi Sector, this roof window stayed open or closed because in hot periods, the roof window opening permitted reducing the internal high temperature by releasing of the heat outside; while in cold periods, it was possible to close the window in order to prevent energy loss. Likewise, the roof window permitted also to reduce the humidity excess in rain conditions.

✓ **Curtains:**

The curtains of greenhouse sides were made of plastic rolls that are enrolled to upper direction, opening lateral windows along the greenhouse side. The curtains were opened by manual roll-up.

✓ **Covering:**

The greenhouse was covered by film plastic 180 microns (polyethylene). The polyethylene is the most common film plastic in use. It contains infra red absorbers and reflectors such as IR, UVA, that prevent the loss of wavelength radiation, preventing the loss of energy.

✓ **Microclimate control:**

The microclimate monitoring was by hand. We control temperature, relative humidity, radiation, rainfall and wind.

✓ **Heating:**

It was suitable in lower temperatures, in order to obtain good crop development, high yield and good harvest quality.

✓ **Irrigation system:**

We used simple watering in the greenhouse.

✓ **Climatic requirements:**

Temperatures varied between 18° and 28°C (with annual average temperature: 18-20°C), moisture/humidity varied between 55 and 68% (by watering with direct application of water), air circulated freely through natural ventilation (for good aeration), light passed through the roof window, and pH varied 4 and 7.5 (with an average of 5.5-6.0).

➤ **Other materials**

Materials used for substrates preparation, substrates sterilization, mushroom inoculation, mushroom incubation, mushroom growing and harvesting are mentioned in the table below.

**Table 1: Used materials**

<b>Machines and instrument used in substrates preparation</b>	<b>Materials used for sterilization of substrates</b>	<b>Material and chemicals used for inoculation</b>	<b>Materials for incubations</b>	<b>Materials for mushroom growing and harvesting</b>
1.Lime: Ca(OH) <sub>2</sub> ;	1. Stove of vapor	1.Inoculation box	1.Incubation room	1.Hoe
2.Urea: CO(NH <sub>2</sub> ) <sub>2</sub> ;	2. Metallic boxes	2.Hold	2.Tubes	2.Pick
3.Water: H <sub>2</sub> O;	3. Board to deposit boxes	3.Marker	3.Thermometers	3.Bamboo
4.Scales	4. Sheeting	4.Alcohol	4.Sheeting	4.Plastic
5.Grinding machine	5. Jerrycan	5.Match		5.Shed
6.Mixing machine	6. Firewood	6.Lamp of alcohol		6.Jerrycan
7.Filling machine		7.Smoke producers;		7.Water
8.Plastic for making tubes		8.KMnO <sub>4</sub> ,Formol		8.Paper and marker
9.Shovel for loading		9.Tubes and Spawn		9.Soil
10.Wheel barrow				10.Knife
11.Buckets				11.Balance
12.pH meter and market				

**Source:** Field study

## 2.2. Methods

### ➤ Experimental design

The experimental design was Randomized Complete Block Design (RCBD) with 3 repetitions. Two factors which are substrates and doses of urea were studied. The first factor was the substrates at four levels which are: beans straw, maize cobs, pennisetum and rice straw substrates, the second factor was doses of urea at five levels which are: without urea (0gr), 50gr, 75gr, 100gr and 120gr of urea. In total they were 20 treatments ( $T_1$  = Bean straws substrates without urea “Control test”;  $T_2$  = Maize cob substrate without urea;  $T_3$  = Pennisetum substrates without urea,  $T_4$  = Rice straw substrate without urea,  $T_5$  = Beans straw substrate+50gr of urea,  $T_6$  = Maize cobs substrate+50gr of urea,  $T_7$  = Pennisetum substrate +50gr of urea,  $T_8$  = Rice straw substrate+50gr of urea,  $T_9$  = Beans straw substrate+75gr of urea,  $T_{10}$  = Maize cobs substrate+75gr of urea,  $T_{11}$  = Pennisetum substrate+75gr of urea,  $T_{12}$  = Rice straw substrate+75gr of urea,  $T_{13}$  = Beans straw substrate+100gr of urea,  $T_{14}$  = Maize cobs substrates+ 100gr of urea,  $T_{15}$  = Pennisetum substrate+100gr of urea,  $T_{16}$  = Rice straw substrate +100gr of urea,  $T_{17}$  = Beans straw substrate+120gr of urea,  $T_{18}$  = Maize cobs substrate+120gr of urea,  $T_{19}$  = Pennisetum substrate+120gr of urea,  $T_{20}$  = Rice straw substrate+120gr of urea) totaling 60 experimental units. The plot size for each treatment was 30 cm long and 20cm wide. The spacing between plots were 20 cm and spacing between repetitions = 30cm. The tubes were placed in prepared area then covered over the polyethylene plastic in order to facilitate air conditions suitable for growth of mushroom; the plastic was opened 1-2 times in morning and evening for 30 min. The treatments are then sprayed with small amount of clean water on the surface of tubes covered with a thin soil layer. The yield was harvested carefully to protect the tubes and recorded the yield sum per treatment or tube.

### ➤ Substrate preparation and tubes making

During the research the substrates were prepared in order to make tubes of spawn. The *Pleurotus ostreatus* were grown on these local substrates treated with different dose of urea (50, 75, 100 and 120 gr). The tubes were prepared using different substrates such as: maize cobs; residues of beans straw; residues of pennisetum and residues of rice straw.

A machine for grinding the crop residues (substrates) was used. After their grinding crop residues were mixed and filled in plastic tubes with the machine. The tubes were tightly closed with the ring and cup.

➤ **Tubes' sterilization**

The substrates was filled in plastic tubes and sterilized in 24hours for to avoid the tubes contaminations with the pathogens using the stove which is constructed by the brick. The tubes were arranged on the plank and covered with the sheeting. Three normal barrels are generally used. The two curved structures on the top support the two first barrels. The 3rd is fixed above them and linked up by two taps for temperature regulation purpose. The stove has an arch chamber where the fire gives out much heat and boils the water. Water is boiled at about 96oc. As long as temperature increases within the beneath barrels, hot steam rises from there to the wooden stand located in the sterilization.

➤ **Tubes inoculation**

After sterilization, the tubes cooled down for 48 hours and transferred in inoculation box for the inoculation of tubes. Inoculation means sowing the spawn in substrates in conditions where you have to wait for mycelium propagation period. Bags were transferred in the incubation room to where they day to day needed follow up. The 10 gr of mushroom spawn was sowed in 1kg of each tube of substrate for to remove the contaminated spawns; tubes should be treated gently in the whole process.

➤ **Tubes incubation process**

After inoculation, the tubes were incubated for 30-40 days in condition where to wait for mycelium propagation. The 20 tubes corresponding to the treatments was incubated and marked with T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>6</sub>, T<sub>7</sub>, T<sub>8</sub>, T<sub>9</sub>, T<sub>10</sub>, T<sub>11</sub>, T<sub>12</sub>, T<sub>13</sub>, T<sub>14</sub>, T<sub>15</sub>, T<sub>16</sub>, T<sub>17</sub>, T<sub>18</sub>, T<sub>19</sub>, T<sub>20</sub> in 3 replications.

➤ **Growing and harvesting mushrooms**

After the incubation period, when the tubes was finished filling with the mycelium was transferred in the shed to be grown where the day to day need follow up in different activities such as irrigation, aeration and harvesting. The grown mushrooms

was covered by plastic sachet for avoiding high evaporation, the irrigation in small quantity of water and aeration is necessary at least twice a day (morning and evening) and 10 days after planting we started to harvest using knife.

➤ **Measurements of parameters observed**

✓ **Number of mushroom per tube**

The number of mushrooms developed on each tube (treatment) was counted with simple observation with naked eyes.

✓ **Cap diameter of mushroom at harvesting**

By using the centimeter ruler, at the harvesting time the cap was measured to establish their diameters on 5 mushrooms taken on each treatment.

✓ **Stem height of mushroom at harvesting**

At the harvesting time the height of five mushroom selected was measured using a centimeter ruler on each treatment.

✓ **Total yield of mushroom**

For total yield, whole quantity of all parts of mushrooms were harvested on each treatment and weighed using a precision balance. The mushrooms were harvested on 10, 20 and 30 days after cultivation. The obtained weights were summed and recorded as final reading.

➤ **Data analysis**

MS EXCEL was used for data arrangement, figures and table design. The Analysis of Variance (ANOVA) between different treatments was done using GENSTAT statistical package. The Means comparison was done by Duncan Multiple Range Test (DMRT). At the end, the combination with optimum production will be recommended to be used.

### 3. Results and discussion

#### 3.1. Results

##### ➤ Number of mushroom per tube

The Table 2 below shows the results of analysis of variance (ANOVA) for the number of mushroom per tube.

**Table 2: ANOVA for number of mushroom per tube**

Source of variation	d.f	s.s.	m.s.	v.r.	Fpr
REP	2	7.033	3.517	1.57	
TRT	19	197.733	10.407	4.65	<.001
Residual	38	84.967	2.236		
Total	59	289.733			

l.s.d: 2.472

Source: Data analysis

The analysis of variance showed a higher significant difference between treatment at  $P < 0.001$  (Table 2). The substrates in combination with urea was highly influenced the number of mushroom per tube, the highest number of mushroom per tube (11.33) was recorded in the mushroom treated with maize cobs substrates in combination with 100gr of urea (T14) followed by the mushroom subjected with  $T_1$  (10.00) and  $T_{10}$  (8.00) while the lowest number (4.67) was recorded in the mushroom treated with rice straw substrate and 120gr of urea. The treatment fourteen which is mushroom treated with maize cobs substrates in combination with 100gr of urea showed highly significant difference in comparison with other treatments except treatment one. However, the treatments  $T_2, T_3, T_4, T_6, T_7, T_8, T_9, T_{11}, T_{13}, T_{15}, T_{17}$  and  $T_{20}$  were not significantly different at  $P \leq 0.005$  (Table 3).

**Table 3: Influence of substrates and its combination with different rates of urea on number of mushroom per tube**

Treatment	Number of mushroom per tube
T <sub>1</sub> D0Sbeans straw	10.00ab*
T <sub>2</sub> D0Smaize cobs	5.33cde
T <sub>3</sub> D0Spenisetum	4.67de
T <sub>4</sub> D0Srice straw	5.67cde
T <sub>5</sub> D50Sbeans straw	7.00cd
T <sub>6</sub> D50Smaize cobs	5.00de
T <sub>7</sub> D50Spenisetum	6.00cde
T <sub>8</sub> D50Srice straw	5.00de
T <sub>9</sub> D75Sbeans straw	5.00de
T <sub>10</sub> D75Smaize cobs	8.00bc
T <sub>11</sub> D75Spenisetum	5.67cde
T <sub>12</sub> D75Srice straw	5.00de
T <sub>13</sub> D100Sbeans straw	5.00de
T <sub>14</sub> D100Smaize cobs	11.33a
T <sub>15</sub> D100Spenisetum	6.33cde
T <sub>16</sub> D100Srice straw	7.33cd
T <sub>17</sub> D120Sbeans straw	4.00e
T <sub>18</sub> D120Smaize cobs	6.33bcd
T <sub>19</sub> D120Spenisetum	7.00cd
T <sub>20</sub> D120Srice straw	4.67de

\*Means followed by the same letters are not significantly different according to DMRT at 5%

Source: Data analysis

➤ **Cap diameter of mushroom**

The Table 4 below shows the results of analysis of variance (ANOVA) for cap diameter of mushroom.

**Table 4: ANOVA for cap diameter of mushroom**

Source of variation	d.f	s.s.	m.s.	v.r.	Fpr
REP	2	4.842	2.421	0.74	
TRT	19	252.639	13.297	4.04	<.001
Residual	38	124.944	3.288		
Total	59	382.426			

l.s.d: 2.997

Source: Data analysis

The results of mean comparison (Table 4) showed that influence of substrates and its combination with different rates of urea was significantly different at  $P \leq 0.05$ . The larger cap diameter is recorded in  $T_{14}$  (18.43 cm) which is followed with  $T_{10}$  (17.07 cm),  $T_1$  (16.90 cm),  $T_{18}$  (16.00cm),  $T_5$  (15.67 cm),  $T_9$  (15.20 cm), and  $T_{15}$  (15.13 cm) respectively and is not significant different with them but are significant with other treatments according to DMRT at 5%. The small cap diameter was recorded in  $T_2$  (10.73cm) and it is not significant with  $T_3, T_4, T_6, T_7, T_8, T_{11}, T_{12}, T_{13}, T_{17}$  and  $T_{20}$  (Table 5). The analysis of variance revealed that they are high significant difference between treatments.

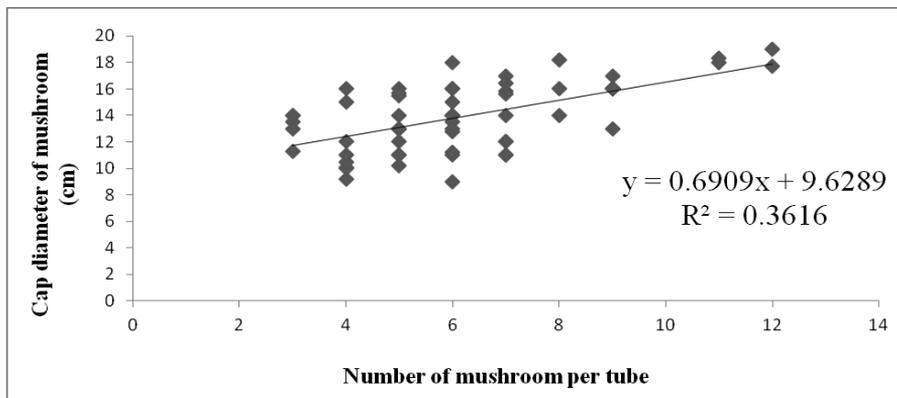
**Table 5: Influence of substrates and combination with urea on cap diameter of mushroom**

Treatment	Cap diameter of mushroom(cm)
T <sub>1</sub>	16.90ab*
T <sub>2</sub>	10.73g
T <sub>3</sub>	11.73efg
T <sub>4</sub>	13.43cdefg
T <sub>5</sub>	15.67abcd
T <sub>6</sub>	12.33defg
T <sub>7</sub>	11.67efg
T <sub>8</sub>	13.33cdefg
T <sub>9</sub>	15.20abcde
T <sub>10</sub>	17.07ab
T <sub>11</sub>	12.77cdefg
T <sub>12</sub>	14.23bcdefg
T <sub>13</sub>	13.20cdefg
T <sub>14</sub>	18.43a
T <sub>15</sub>	15.13abcde
T <sub>16</sub>	13.33cdefg
T <sub>17</sub>	11.43fg
T <sub>18</sub>	16.00abc
T <sub>19</sub>	14.33bcdef
T <sub>20</sub>	12.23defg

\*Means followed by the same letters are not significantly different according to DMRT at 5%

Source: Data analysis

As it is shown in the Figure 1 below, there is a weak positive correlation between the number of mushroom per tube and cap diameter of mushroom ( $R^2=0.36$ ). Although, this means that the higher number of mushroom, the larger cap diameter.



**Figure 1: Relationship between number of mushroom per tube and cap diameter of mushroom**

Source: Data analysis

➤ **Stem height of mushroom**

The Table 6 below shows the results of analysis of variance (ANOVA) for Stem height of mushroom.

**Table 6: ANOVA for stem height of mushroom**

Source of variation	d.f	s.s.	m.s.	v.r.	Fpr
REP	2	17.812	8.906	5.97	
TRT	19	104.817	5.517	3.70	<.001
Residual	38	56.648	1.491		
Total	59	179.277			

l.s.d: 2.018

Source: Data analysis

The mean comparisons of stem height of mushroom (Table 5) showed the influence of substrates and combinations with urea on stem height of mushroom were significantly different in treatments. The exception concerns the treatments subjected

to the bean straws substrates without urea [6.00cm (T<sub>1</sub>)], maize cob substrate without urea [5.833 cm (T<sub>2</sub>)], Pennisetum substrates without urea [5.667 cm (T<sub>3</sub>)], beans straw substrate combined with 50gr of urea [5.667cm (T<sub>5</sub>)], maize cobs substrate combined with 50gr of urea [5.333 cm(T<sub>6</sub>)], rice straw substrate combine with 50gr of urea [5.00cm (T<sub>8</sub>)], maize cobs substrate combined with 75gr of urea [5.867cm (T<sub>10</sub>)], beans straw substrate combined with 100gr of urea [4.667cm (T<sub>13</sub>)], rice straw substrate combined with 100gr of urea [6.000cm (T<sub>16</sub>)], beans straw substrate combined with 120gr of urea [5.100 cm (T<sub>17</sub>)] which are not significant different at  $P \leq 0.05$ . The treatments T<sub>11</sub>, T<sub>14</sub>, T<sub>19</sub>, T<sub>9</sub>, T<sub>18</sub>, T<sub>20</sub> and T<sub>7</sub> are not significant at  $P \leq 0.05$ . The significance was observed in the treatment with rice straw substrate combined with 75gr of urea highly significant in comparison with all others and T<sub>11</sub>, T<sub>14</sub>, T<sub>15</sub> are significant in comparison with other treatments (Table 7).

**Table 7: Influence of substrates and combination with urea on stem height of mushroom**

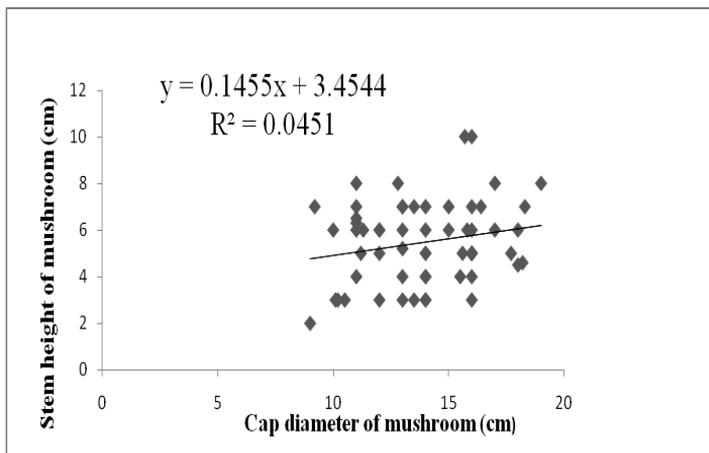
Treatment	Stem height of mushroom(cm)
T <sub>1</sub>	6.000bcd*
T <sub>2</sub>	5.833bcd
T <sub>3</sub>	5.667bcd
T <sub>4</sub>	4.33cd
T <sub>5</sub>	5.667bcd
T <sub>6</sub>	5.333bcd
T <sub>7</sub>	3.667d
T <sub>8</sub>	5.000bcd
T <sub>9</sub>	4.333cd
T <sub>10</sub>	5.867bcd
T <sub>11</sub>	7.000b
T <sub>12</sub>	9.333a
T <sub>13</sub>	4.667bcd
T <sub>14</sub>	7.000b
T <sub>15</sub>	6.667bc
T <sub>16</sub>	6.000bcd

T <sub>17</sub>	5.100bcd
T <sub>18</sub>	4.000d
T <sub>19</sub>	4.500cd
T <sub>20</sub>	3.733d

\*Means followed by the same letters are not significantly different according DMRT at 5%

Source: Data analysis

The relationship between cap diameter and stem height is described in Figure 2. The results showed a very weak positive correlation between cap diameter and stem height ( $R^2=0.0451$ ).



**Figure 2: Relationship between cap diameter of mushroom and stem height of mushroom**

Source: Data analysis

### ➤ Yield

The Table 8 below shows the results of analysis of variance (ANOVA) for yield measured in gr

**Table 8: ANOVA for yield**

Source of variation	d.f	s.s.	m.s.	v.r.	Fpr
REP	2	3523	1762	0.25	
TRT	19	1595240	83960	11.71	<.001
Residual	38	272410	7169		
Total	59	1871173			

l.s.d: 139.

Source: Data analysis

The results of analysis of variance for the yield at harvesting that presented in table 8 showed a high significant difference between treatments ( $P \leq 0.001$ ). However, mean comparison showed that there are homogenous groups between treatments (Table 9). The highest yield of 1993 gr was obtained in the mushroom subjected with maize cobs substrates combined with 100gr of urea ( $T_{14}$ ) which is highly significant in comparison with other treatments. It is followed by  $T_{10}$  (1833 gr),  $T_1$  (1800 gr),  $T_5$  (1767 gr),  $T_9$  (1750 gr) respectively. The lowest yield was recorded in  $T_{17}$ , the mushroom treated with beans straw substrate combined with 120gr of urea (1350 gr), is not significantly different with  $T_{20}$  (1383 gr),  $T_{19}$  (1400 gr),  $T_{18}$  (1450 gr),  $T_7$  (1467 gr),  $T_3$  (1473 gr) and  $T_2$  (1507 gr).

**Table 9: Influence of substrates and combination with urea on yield of mushroom**

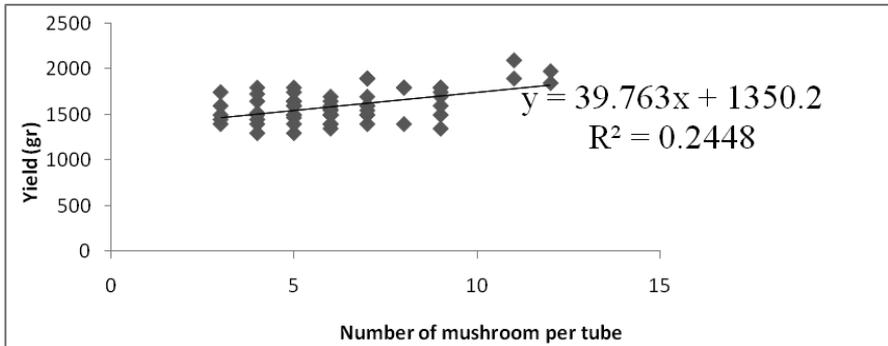
Treatment	Yield (gr)
T <sub>1</sub>	1800bc*
T <sub>2</sub>	1507fghijkl
T <sub>3</sub>	1473ghijkl
T <sub>4</sub>	1517fghijk
T <sub>5</sub>	1767bcd
T <sub>6</sub>	1583fghi
T <sub>7</sub>	1467hijkl
T <sub>8</sub>	1617defgh
T <sub>9</sub>	1750bcde
T <sub>10</sub>	1833b
T <sub>11</sub>	1600efghi
T <sub>12</sub>	1630defg
T <sub>13</sub>	1650cdef
T <sub>14</sub>	1993a
T <sub>15</sub>	1550fghij
T <sub>16</sub>	1667cdef
T <sub>17</sub>	1350l
T <sub>18</sub>	1450ijkl
T <sub>19</sub>	1400jkl
T <sub>20</sub>	1383kl

\*Means followed by the same letters are not significantly different according DMRT at 5%

Source: Data analysis

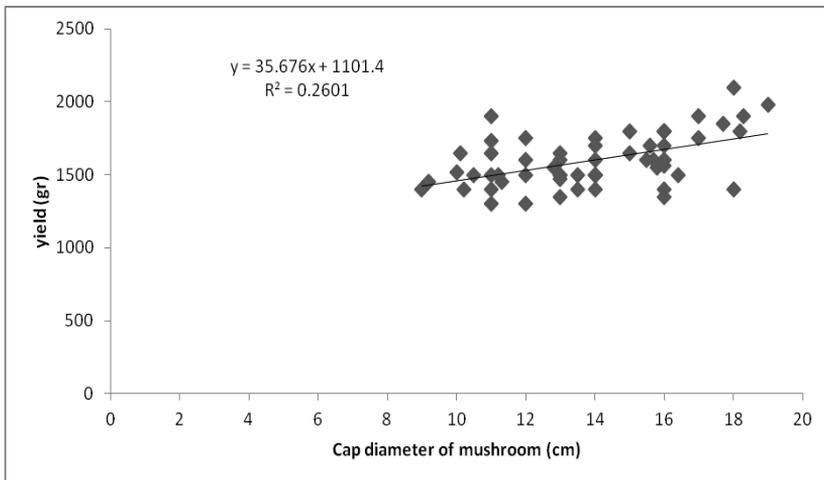
We have also seen that there is a relationship between the yield and the number of mushroom per tube as illustrated in the Figure 3 below. This Figure showed that there is a weak positive linear relationship between the number of mushroom per tube and yield per treatment. That means that, the higher number of mushroom per

tube the higher yield of mushroom.



**Figure 3: Relationship between yield and number of mushroom per tube**  
Source: Data analysis

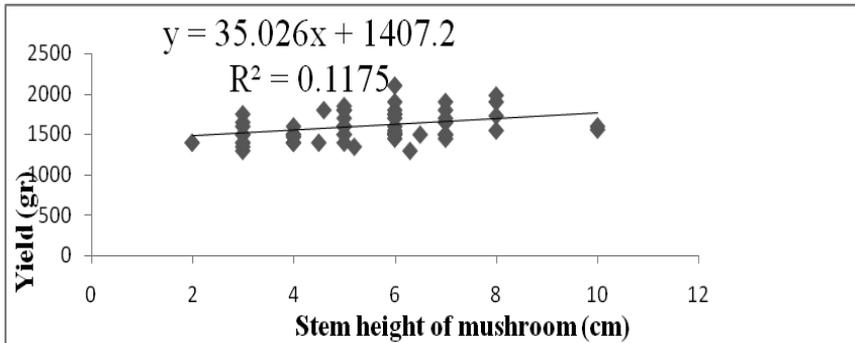
The positive relationship has been observed between cap diameter of mushroom and yield (Figure 4). The figure below indicated that there is weak positive correlation between the cap diameter and yield. This implies that, there is an increase of the yield corresponding to increase in the cap diameter because the determination coefficient ( $R^2=0.2601$ ) illustrates that yield was influenced by cap diameter at 26.01%.



#### Figure 4: Relationship between yield and cap diameter of mushroom

Source: Data analysis

The impact of stem height on yield of mushroom was shown in Figure 5. The correlation between yield and stem height was very weak ( $R^2=0.1175$ ). So, the yield increased with the taller stem height.



#### Figure 5: Relationship between yield and stem height of mushroom

Source: Data analysis

### 3.2. Discussion

This study showed that each treatment (tube of spawn) produced from 1350gr to 1993gr of total mushroom yield. The highest mushroom yield observed with maize cobs substrates supplemented with 100 gr of urea was 1993gr followed by maize cobs substrates supplemented with 80 gr of urea and beans straw substrates without urea respectively with 1883 gr and 1800 gr. These results may be due to the content of maize cobs substrate and the urea quantity (100gr) applied in this treatment where the nitrogen plays an important role on mushroom yield (Peter, 2005).

From results observed for all treatments; the yield and growth parameters differ with different urea quantities applied on different substrates. The dose of 120 gr led to lowest yield on all substrates. These results were due to the excess nitrogen concentration that can influence the growth and yield of mushroom, as Peter (1991, 2003, 2005), in the similar study, demonstrated that the urea affects negatively the yield of mushroom.

The treatment of beans straw substrates without urea had the yield of 1800 gr whereas beans straw substrates supplemented with 120 gr of urea got the lowest mushroom yield (1350 gr). The application of urea on beans substrates is not necessary because the good performance of beans straw substrates was due to their self nitrogen composition. As reported by Rinker (1991) and Rulinda (2009) in similar studies, the nitrogen content is available in beans straws through absorbing capacity of the substrates in atmosphere using their node; means that beans straw substrates are self sufficient in terms of nutrient required by mushroom growth without urea additional. This was also confirmed by the results from Mukafuremu (2006) who found that beans substrates without urea got highest yield of 1646gr/8vole followed by wheat straw and maize straw without urea with 1053gr/7vole.

As revealed by Royse (2001), maize cobs substrates need urea for the best mushroom growth. The same author also reported that, in general, cereals substrates need the some quantity of nitrogen for mushroom growth. Therefore, these statements are in accordance with findings of the study justifying the fact that highest cap diameter (17.50cm) and number of mushroom (10.33) were showed by maize cobs substrates supplemented with 100 gr of urea and highest height of mushroom stem (9.33cm) were showed by rice straw substrates supplemented with 80 gr of urea. These parameters are positively correlated to the mushroom yield. As reported by Lin (2001) in similar study, the same results were also due to substrates composition such as nitrogen content that should be between 1.5 to 2.0 %, color that should be dark brown, pH that should be between 5-6.0; nematodes population that should be free from insects and other undesirable micro-organisms and moisture content that should be between 65-70%. Likewise, mushroom yield starts to decrease, and mushroom production may be affected by the quality of spawn of crop species used (*Pleurotus ostreatus*).

Based on these results of the study maize cobs substrates with 100gr of urea are recommended and beans straw substrates can be recommended without urea.

#### **4. Conclusion**

It was revealed from results of this study that all substrates and doses of urea tested (simple substrates or in combination with doses of urea) significantly produced positive effects on growth and development of mushrooms (*Pleurotus ostreatus*). Emphasis may be put on the highest amount of urea combined with substrates.

Thus, the highest mushroom yield (1993 gr) was reported to maize cobs substrates supplemented with 100 gr of urea, followed by maize cobs substrates treated with 80 gr with 1883gr and beans straw substrates without urea with 1800 gr, while substrates of beans straw supplemented with 120 gr of urea got the lowest mushroom yield (1350 gr).

Likewise, the highest cap diameter (18.43 cm) and number of mushroom per tube (11.33) were also reported on maize cobs substrates supplemented with 100 gr of urea.

Moreover, the interaction between substrates and doses of urea that got the best results was the maize cobs substrates supplemented with 100 gr of urea on total mushroom yield, cap diameter and number of mushrooms per tube, while the best values of mushroom stem height were reported on rice straw substrates treated with 75 gr of urea.

In brief, these findings showed that recommended substrates are maize cobs substrates with 100 gr of urea, but if there is no urea, it can be used beans straw substrates because of their relevant results on substrates without urea.

Furthermore, in accordance with above findings, other crop residues (substrates) and edible mushroom varieties should be tested by future researchers for the optimization of mushroom production.

#### **5. Acknowledgements**

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## **An investigation of vulnerability among the elderly in Byumba Sector MUNYANEZA Néhémie**

### **Institut Polytechnique de Byumba (IPB)**

#### **Abstract**

The studies showed that lives of many elderly people are more frequently negatively affected by the social and economic insecurity that accompany the demographic and developmental process (World Bank, 1994). With greater needs but with fewer resources to address these needs, they are obliged to live by care of the society. However, the lack or limited support by the government and the community coupled with physical deterioration among the elderly and they found themselves in a condition of increasing and varying vulnerability. The purpose of this study was to investigate the nature of vulnerability among the elderly in Byumba Sector with the objectives of finding out forms of vulnerability and its causes among elders of Byumba Sector in Gicumbi District. The study covered the period of 2009-2012. Phenomenological and exploratory approaches helped to collect information from 36 aged 60 and above via in-depth interviews and focus group discussions. Findings showed that aging in Byumba varies according to individual background. Those who experienced a happy early life have much chance to a happy aging, while those who lived in poverty, joblessness, etc. risk to experience a vulnerable aging. Thus in Byumba vulnerability among the aged presents itself into physical, economic and psychosocial forms, having as causes; poverty, landlessness, lack of skills and psychosocial problems etc. The intervention of both government and the community in general was found necessary.

**Keywords: Elderly, aged people, Risk, Vulnerability**

## **1. Introduction**

Vulnerable groups are at risk of experiencing negative outcomes because they lack the capability to protect their wellbeing (Hoogeveen et al, 2004). Essentially, they have greater needs but with fewer resources to address these needs, obligating societies to act on their behalf. Among the groups at risk of social vulnerability, the United Nations (2002) singles out the elderly. By nature, vulnerability is a multidimensional construct. It derives from a number of sources and has varying manifestations, depending on the context. In old age it is described as “the interplay between biological and social threats, individual characteristics and resources, social relationships and wider economic, political and cultural structures (Schroeder and Marianti, 2006).

In traditional Rwandan context, the elderly were the principal source of knowledge and wisdom. At their advanced age, the family which has always been considered as a basic unit of social structure, the core of life, cradle of the future and pillar of happiness was very important for them since it represented a natural framework of life and death with full responsibility to provide all needed services.

It was within the family that old people were cared for by relatives up to their last days as they were considered as sources of wisdom and worthy to be respected. They were cared by their families and especially by their children, as it was in the Rwandans saying that “*Urukwavu rukuze rwonka abana*”. This was the expression in ancient Rwandan society to mean that at old age, elders live by the care of relatives especially by their children. This is because getting older is losing “*gusaza ni ugusahurwa*”, as elderly is much accompanied with physical, mental, social and economic challenges.

Nowadays, old people are of lower social status and with less power than in sub-modern societies; (Ljiljana, 2005) and new generations are no longer attached to elders who seem to be a burden in today’s society; and thus, the new attitude is adopted and “*urukwavu rukuze bararurya*”, to mean that “the old rabbit is eaten”. Many live in poverty, social stigma, depression, etc. Because of their physical

weakness, they are abused and some services are refused to them.

Literature reviewed (Shrestha, 2000; Kaneda, 2006; Harper, 2006; Marcoux, 2001) suggested also that it is a social and moral obligation of governments and the community as a whole to maintain and enhance the quality of life of the elderly. However, due to the complexity of vulnerability, it is necessary to find out the real nature of vulnerability they are suffering from so that interventions may reach their objectives. It was in view of this background that this study was undertaken.

Currently in Rwanda, it is only salaried and contracted employees that are members of the national social security fund (Caisse Sociale du Rwanda) that provides social protection to people living in Rwanda from effects based on lack or reduction of input due to the following reasons: old age, death, disability, occupational hazards, sick leave, maternity leave, treatment, unemployment and provide family basic necessities. The programme may also provide for shelter, nutrition, education, poverty reduction with an intention of social welfare; while people who are not civil servants are not members of this social security fund, yet they are the majority of the population (Kagaba, 2003).

All of these conditions together put the elders in the condition of vulnerability whereby support and protection both by the government and the community in general is revealed necessary.

The main objective of this study was to investigate the nature of vulnerability among the elderly in Byumba Sector with the specific objectives: (1) to explore forms of vulnerability and (2) to find out its causes among the elderly in Byumba Sector.

## **2. Methodology**

This research was cross sectional and qualitative methodology was adopted. The specific survey tools used were: focus group discussions, interviews and observation.

In attempt to understand aging based on the experience of each subject, how each person shows him/herself in relation to his/her conscience as emotions and sensations, the phenomenological approach was used. Purposive sampling was carried out to

select thirty six (36) elderly aged 60 years and above, 23 were females and 13 males for focus group discussions. An interview schedule and focus group guide designed by the researcher were used to conduct the interviews and focus group discussions.

In agreement with selected aged people for focus group discussion, 3 sites were made which elders from the 9 cells could easily attend. One site was at Mucyeri, the other site at Kibali and the last site at Nyamabuye. Every group was composed with 12 elders of sex and varying ages. In-depth individual interviews were carried out to with 8 of them.

To have enough information about the reality of aged people vulnerability, nine (9) other interviews were also held from key informants who have direct or indirect implication in life of these elders. These were three (3) cell leaders, 3 local religious leaders, 2 Byumba hospital nurses and the agent in charge of social affairs of the sector.

For ethical consideration, the researcher asked the permission from the people to be interviewed and the reasons for conducting the interviews were made known to them and their opinions were welcomed and kept and nicknames or codes were used, and therefore participants were ensured that their opinions and all the information provided will be kept confidential.

### **3. Results and discussion**

#### **Results**

The study had the main objective to establish the nature of vulnerability among the aged in Byumba Sector, and specific objectives were to explore the forms of vulnerability and to find out their causes among the elderly in Byumba Sector.

#### **3.1. *Forms of vulnerability among the elderly in Byumba sector***

This section was concerned with forms of vulnerability among the elderly of Byumba Sector. It was led by the first objective of this research which was to explore forms of vulnerability among the elderly in Byumba Sector.

By the focus group discussion and interview, findings revealed that the elderly in Byumba Sector suffer from various forms of vulnerability which cover 3 main aspects: physical, economic and psychosocial vulnerability.

The first form of vulnerability among the aged in Byumba Sector is physical and health vulnerability.

Many of the elders in Byumba Sector suffer from the physical disabilities and chronic illnesses generally due to their age.

**Table1: Characteristics of health status of the informants (N=36)**

Chronic diseases condition	Frequency	Percentage	Frequency per gender	
			Female	Male
Heart diseases	1	(2.8%)	1	0
Loss of hearing	5	(13.9%)	3	2
Loss of sight	3	(8.3%)	2	1
General body pain	13	(36.1%)	9	4
Severe pain in the legs	10	(27.8%)	7	3
Diabetes	4	(11.1%)	1	3
<b>Total</b>	<b>36</b>	<b>(100%)</b>	<b>23</b>	<b>13</b>

*Source: Primary data, 2012*

To the objective about what kind of illnesses did individuals report, the interview enquired about the following six categories of ailments: heart diseases, loss of hearing, loss of sight, general body pain, severe pain in legs and diabetes.

The health problem that affected more the elderly in Byumba was the general body pain (36.1%) and severe pain in legs (27.8%). Loss of hearing (13.9%) occupy the third level, diabetes (11.1%) which are frequent in males (three men against one woman), loss of sight follow with (8.3%) and lastly heart diseases (2.8%).

As for gender differentials, except for heart diseases, both males and females seemed to suffer from similar illnesses. The percentage of males reporting diabetes was substantially higher than of females. On the other hand, fewer males suffer from heart related diseases than females.

Respondents stated that they were characterized by ‘general body pain, physical discomfort; inability to walk long distances because of severe pain in the legs.

The other aspect of vulnerability among the aged people of Byumba was economic vulnerability. The study found that absolute poverty was frequent among Byumba elderly as the majority of them reported that they lived under the poverty datum line of \$1US per day. They faced food insecurity and had to rely on help from relatives.

During our research, it was revealed that some groups of elders were more vulnerable to economic insecurity than others; these included disabled elders, widowed elders, elders living alone, and elders living in remote areas.

Through interview, respondents said that their poverty manifested itself mainly in difficulties and sometimes, the impossibilities of meeting their basic needs, such as shelter, clothing and feeding themselves.

This research revealed also that the rate of widowhood was higher (58.3%) in elderly people of Byumba. However, the frequencies of females (44.4%) were higher than of males (13.9%), which may explain much vulnerability among women than among men. The reality was that it is easier for males to remarry after the death of spouse than for women. The other cause may be found in the effects of war and genocide which took place in Rwanda and many lives especially men.

The rate of elderly people who still live as couples was only 36.6% and the rate of separations was 5.6%.

The above seen characteristics of marital statuses of elderly people in Byumba Sector put them in a state of vulnerability because their age requires companionship.

### **3.2. Causes of vulnerability among the elderly in Byumba sector**

Vulnerability among the aged people of Byumba was attributed to a number of factors and the most important were chronic poverty, childlessness, unemployment, illiteracy, poor health, landlessness, lack of social security systems, gender issue, war and genocide of 1994 and psychosocial disintegration and social abuse.

During focus group discussion, respondents reported that poverty was the important cause of their vulnerability. They said that their main occupation was working in nearby gardens and that the agriculture that they practice cannot help them to gain the money which may help to respond to their basic needs; this is why these elders declared to be in permanent poverty.

Childlessness was also identified as one of the important causes of vulnerability among the elderly in Byumba Sector. In fact, the fact that aged people are physically weak and cannot work anymore to earn a regular income and in most of cases the children who in normal circumstances would care for them have died or abandoned them, they were consequently confronted with serious difficulties of meeting with their basic physiological needs such as shelter, food, clothing, health services etc. The other problem related to childlessness was that they felt loneliness and had none to talk to. When they were sick it was in some cases difficult to get treatment as the community kept not informed and could not intervene.

Among other causes of vulnerability, aged people mentioned also unemployment. In Rwanda, as elsewhere, earnings from employment either formal or informal are the main sources of income for most households and adequate earnings are the main means of avoiding poverty. Thus, unemployment is taken to be lack of involvement in any work, which generates a wage or income at the end of the day. Causes of unemployment among the elderly vary from community to community. Some attributed their unemployment to retirement and retrenchment from the formal sector coupled with lack of savings and assets. Most of them were casual laborers of different services from where they were laid off due to old age. By virtue of their jobs, they never received any retirement package to facilitate the relocation to their ancestral homes. A good number of them also noted that they have failed to get any

other wage-earning jobs due to old age and negative attitudes, which has rendered them chronically poor.

Poor health was also identified as one of the causes of vulnerability among the aged people of Byumba Sector. During Focus Group Discussion at Nyamabuye site, MUKAMANA Martha aged 78 reported: *“we are everyday sick and suffer a lot. We take medicine and we do not recover. Do you know it my son; diseases of old age don’t cure”*. In the same perspective another respondent said: *“because of sickness we can do nothing; it makes us depending upon others who sometimes do not care”*.

This had much implication on life style of elders in Byumba Sector because the majority live by support of good willing people or organizations such as religious institutions and some reached even the level of begging in the streets.

At sixties, those who were used to work for survival and self reliance have no longer strength to do it and they become dependent on others.

Lack of skills was also identified among the causes of chronic poverty among the elderly. This was attributed to their inability to access formal schooling during their early years of life due to different factors including poverty and ignorance of their parents. The female elderly also added the attitudinal factors against girls’ education, which were more widespread and deep rooted during their school-going years. This denied them opportunities through which they could develop competencies that would enhance their survival and livelihoods in adulthood and older stages of life.

This may be justified by the fact that the majority of them couldn’t read and write. It was also remarked that the majority of this portion of population had a very low level of education; just 89% have less than primary level. In fact, the research revealed that 72.2% of aged people of Byumba Sector could neither write nor read and therefore, this reality didn’t permit them to extend the chance of getting information and making them more vulnerable.

According to overall, our respondents showed that being born from a poor family contributes also to economic vulnerability during old age, as some reported that because their parents were very poor, they grew up poor and were chronically poor,

this because they inherited nothing from them.

Some respondents also indicated the lack of social security systems as a major cause of chronic poverty among older persons. Currently, the only social security system in Rwanda for the elderly is the pension scheme for the former public servants, and targets around less than 10% of the elderly. For most of elders of Byumba Sector, a pension was a “dream”, because the majority of them had not the chance to study and to get a job from public service which would help them get the pension after retirement once they have contributed.

This made the elderly prone to chronic poverty and lack of social esteem since whatever little income they earn in the latter years has to cater for their basic needs including health, denying them opportunities for viable income-generating activities at this stage. This also implies that those without any other support and who cannot earn a living are left to providence and hence greater vulnerability to poverty.

The elderly of Byumba Sector informed that the other cause of their vulnerability was the lack of land that could help them maintain activities for their survival. They reported that the fact they don't have land from which they can produce food for feeding themselves and for the market they were vulnerable to poverty and hunger. Thus they couldn't help their families and this made them loose their value in their communities and to be dependant to others.

The other cause of vulnerability among elderly people of Byumba was based on gender inequality. Even though the effort of Government was done to mobilize all the partners to have equal rights on the family properties, some cases were still observed where women didn't have rights to even sell the crop surplus for their own livelihood. This put them in permanent states of poverty particularly during old age when even age robs them of their energies to work on the family farms.

## **Discussion**

Basing ourselves on results from our interview and focus group discussion, it was revealed that aged people in Byumba Sector suffer from different forms of vulnerability: Physical and health vulnerability, economic vulnerability and

psychosocial vulnerability.

The above mentioned vulnerability should be viewed in the line with literature that suggested that as people grow older, they increasingly experience difficulties with self-care and become dependent on others for self-care (Eliopoulos, 2001; Omran, 1971; Prakash, 1999; Crystal et al., 2000; Bloom et al, 2011), and thus, old people are deprived of the basic needs (Keyfitz and Flieger 1990; Sen, 1994; World Bank 1994; Chambers, 1995).

These trends are true for both developed countries and “traditional” societies where changes occur rapidly and older people tend to live alone or with a spouse. In Rwandan community, to discharge themselves from the responsibility to care for elders, younger generations developed a new saying. While in the ancient Rwandan society it was often said that “*urukwavu rukuze rwonka abana*”, to mean that old people are cared for by new generations (here it means their children), it is said today that “*urukwavu rukuze bararurya*” or “the old rabbit is eaten” to mean that new generations are not concerned with that responsibility.

As far as causes behind vulnerability among the aged in Byumba sector were concerned, research identified childlessness, unemployment, lack of social security system for them, landlessness, lack of skills etc.

Previous studies have revealed that ageing as a process of change, comes with many problems and challenges. The process exposes individuals to increasing risk of illness and disability as the body becomes weak and frail. Physical health for many poor people is their single most important asset, bound up with the ability to work, to function independently and to maintain a reasonable standard of living. Good health as an element of human capital is vital for carrying out livelihood strategies. Aged people who have deteriorating health conditions struggle as they cannot engage in any activities.

Evidence from developing countries indicates that when in good health aged people have continued to engage in work while those who have fallen ill end up in poverty when family or household support is insufficient. The inability of aged people in Africa to access health care has been attributed to their low income levels due in part

to the introduction of structural adjustments.

In Byumba Sector, agriculture is an important factor which makes a significant contribution to overall livelihood well-being. With the land, it was revealed that the elderly could get food and other products which should help them feed themselves and gain money. But because they don't have the land they suffer from hunger, poverty, and many of their basic needs are not satisfied. According to DFID (2002), in both urban and rural areas, secure access to land provides the basis for investment in better livelihoods and improved living conditions. Land plays a crucial role in the lives of rural people as it is a key factor in poverty reduction. Though forests, rangelands and wetlands are important resources for the poor, especially in remote areas and in times of hardship, it should be noted that access to land and land rights are frequently the poor's most fundamental livelihood asset. Historically in most areas of the country people rely on the utilization of their land resources to gain a livelihood. Rural economies, including many areas of Byumba Sector are supported by land based activities as small scale farmers and peasants trade their commodities or products on local markets. Clearly old people see land as their most important asset. Rural people have always believed that no other asset contributes to the people's survival. This is echoed by the following in review statement;

Kannan (2004) argues that the high incidence of old age poverty in developing countries is due to the absence of old age social security. In South Africa, says Quigley (2003), the Old Age grant is known to have an important redistributive effect. This grant has been the primary source of income for older persons who would otherwise be living in abject poverty. In the developed countries the combination of strong social security systems and well-developed capital markets has contributed to higher living standards for the elderly (Alejo and Gasparini, 2007).

#### **4. Conclusion**

In this paper, we discussed the nature of vulnerability among the aged people in Byumba Sector with specific objectives to analyse forms and causes of vulnerability.

It was therefore, observed that there is a greater need of intervention to provide care for the elderly. Data analysis revealed that there are groups which are more

vulnerable than others and particularly disabled and old people who live alone. It was also found that women may be more vulnerable than men due to reasons such as lack of productive employment and income, their widowhood status and low education, all of which make them dependent on others and also less empowered so that they are unable to voice their needs and problems.

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**Restructuring strategies and performance of SMEs in Rwanda****NIYIBIZI M. François Xavier,****Department of Management and Development studies, Institut Polytechnique de Byumba (IPB)****Abstract**

Small and medium enterprises (SMEs) are found in existence of any country and Rwanda in particular. SMEs are the backbone of the Rwandan economy; however there is not much theoretical framework on how and why they restructure. Many units are struggling hard to survive, unable to reap the benefits of globalization, and increasing cost of production. Restructuring is used to improve SMEs' operating performance by correcting managerial problems created by ineffective management. Small and Medium Sized Enterprises adopt restructuring as a turnaround strategies in a bid to create value within the enterprise and emphasize more on strategic competitiveness. The study adopted stratified sampling and a sample of 39 respondents was selected among 42 respondents. This article analyzed the effect of the restructuring strategy on the performance of the small and medium sized enterprises, the results showed that there is relationship between restructuring strategies and performance of a SMEs at Pearson correlation coefficient  $r=0.792$  implying that corporate restructuring is likely to affect the performance of SMEs as contended by 79.2% and 20.8% of the respondents confirmed that other factors should be taken into account. Before initiating the restructuring strategy, a feasibility study must be done, otherwise the results become negative, and the restructuring implementation is highly costing. The restructuring strategy when carefully conducted, may lead to the performance of any SME.

**Key words:** restructuring strategy, Small and Medium Enterprise

## **Introduction**

Restructuring is a strategy through which a firm changes its set of business or financial structure (Hitt et al 2005). Worldwide, many firms, financial institutions or organizations, small and medium enterprises fall sometimes into bankruptcy due to the failure in the strategic management system they use. Restructuring is a means by which the corporate office can add substantial value to a business (Dess, et al 2007). Firm use a restructuring strategy because of changes in their external and internal environment.

In the words of Kakuru (2007) corporate restructuring is any change in capital structure, operations or ownership that is outside the ordinary course of business. Firms restructure to meet the company's changing objectives. Firms should find their levels and harness the changing environment if they are not to register failures. Corporate restructuring is necessary and desirable for any dynamic and flexible environment.

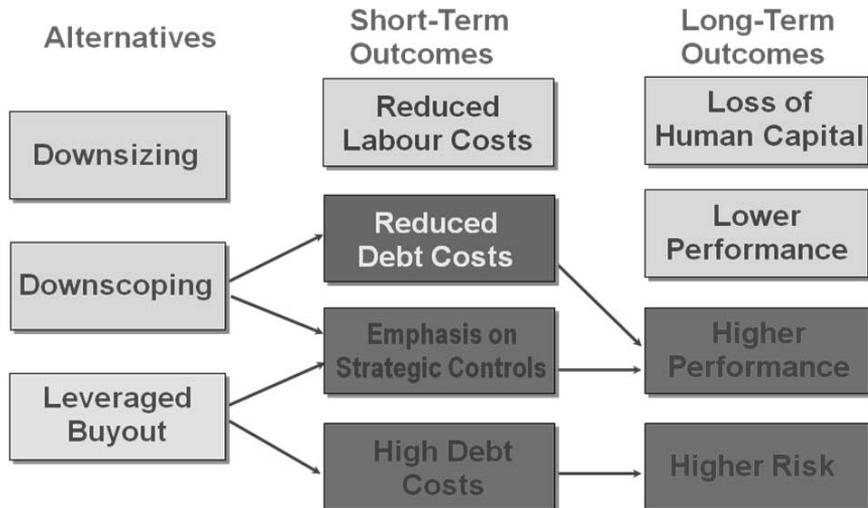
In many SMEs decrease in the return and dramatically increase of expenses are likely to arise; Hence a strategy must be taken in order to address the situation. Economat Diocesain de Byumba (EDB) is one of those which faced that problem of registering some losses or simply it was in the Break Even Point (BEP) situation. Restructuring may be appropriate to position the firm to create more value to the stakeholders, given the environmental changes (Kruse 2002).

Restructuring strategy is a strategic action that an organization might take as it implements a retrenchment or turnaround strategy in its operations. There are a number of ways that an organization can restructure its operations. In many instances, the restructuring involves the organization's strategic managers deciding to refocus on their primary business (es) as it sells off, spins off, liquidates, reengineers, or downsizes. In fact, organizational refocusing has been found to be the most beneficial form of restructuring for an organization. (Rock et al.1990). Restructuring can involve change in the assets, capital structure or management. (Dess et al 2007). Assets restructuring refers to the sale of unproductive assets, or even the whole line of businesses that are peripheral. Capital restructuring involve

changing the debt-equity mix or the mix between different classes of debt or equity. The management restructuring typically involves changes in the composition of top management team, organizational structure or reporting relationships. Tight financial control, rewards based strictly on meeting short-to-medium term performance goals, and reduction in the number of the middle level managers are common steps in management restructuring.

Hitt et al (2005) argued that there are three restructuring strategies that firms use: downsizing, downscoping and leveraged buyouts. Downsizing involves reducing the number of employees and, sometimes in the number of its operating units, but it may or may not change the composition of business in the company's portfolio. Restructuring through downscoping is to reduce the firm's level of diversification often the firm's divests unrelated to achieve these goals. Leveraged buyouts are commonly used as a restructuring strategy to correct for managerial mistakes or because the firm's managers are taking decisions that primarily serve their own interest rather than those of stakeholders (Bergh & Holbein 1997; Markides & Singah 1997). A leveraged buyout (LBO) is a restructuring strategy whereby a part buys all of firms assets in order to make the firm private. Once the transaction is completed, the company's stock is no longer traded publicly. Management buyout (MBOs), employees buyouts (EBOs) and whole firm buyout, in which one company or partnership purchases an entire company instead of a part of it, are the three types of LBOs. Because of managerial incentives, MBOs than EBOs and the whole firm buyout, have been found to lead downscoping an increased strategic focus, and improved performance (Bae & Jo 2002; Seth & Easterwood 1995; Phan & Hill 1995).

As far as restructuring outcomes are concerned (Hitt et al 2005) contend that the short-term and long-term restructuring outcomes may be summarized by the following figure:



**Source:** Hitt, Ireland & Hoskisson (2005) *Strategic management: Competitiveness and Globalization, Concepts (6ed.)*: Thomson Corporation: New York

Although restructuring through downsizing can lead to short term cost reduction, they may be realized at the expenses of long-term success, because of the loss of valuable human resource (and knowledge). Eliminating unrelated business makes it easier for the firm and its top-level managers to refocus on core businesses. The intent of buyout is to improve the efficiency and performance to the point where the firm can be sold successfully within five to eight years. Furthermore, restructuring’s primary goal is gaining or reestablishing effective strategic control of the small and medium sized enterprise

Small scale enterprises have been given an important place in the framework of Rwandan planning since beginning for economic reason. Definition of small scale enterprises in Rwanda has changed over the years. At present, a small scale enterprise is one which has fixed capital investment of 0.5 to 15 millions Rwandan Francs, 0.3 to 12 annual turnover and 4 to 30 employees.

### Small and Medium Enterprises definition

Size of enterprise	Net capital investment (Million RwF)	Annual turnover (Million RwF)	Employees
Micro	Less than 0.5	Less than 0.3	1 to 3
Small	0.5 to 15	0.3 to 12	4 to 30
Medium	15 to 75	12 to 50	31 to 100
Large	More than 75	More than 50	More than 100

**Source:** Ministry of Trade and Industry, Small and Medium Enterprises (SMEs), Development Policy, RDB, June 2010

Khanka (2008), distinguished five types of small-scale industries: (1) Manufacturing industries: industries producing complete article for direct consumption and also processing industries. (2) feeder industries: Industries specializing in certain type of products and servicing, e.g welding, electro-plating, casting etc. (3) Serving industries: covering light, repair, shops, necessary to maintain mechanical equipment. (4) Ancillary to large industries: producing parts and components and rendering services and (5) Mining or quarrying: extracting of valuable minerals or other geological materials from the earth from an orebody, lode, vein, seam, or reef, which forms the mineralized package of economic interest to the miner.

### Materials and methods

The study adopted stratified sampling, using both qualitative and quantitative research centered on restructuring practices. The population was divided into sub-populations such that the elements within each sub-population were homogeneous. Simple random sample were then selected independently from each sub-population.

In this study, the researcher used interview, questionnaires and document analysis as the main tools for collecting data. The selection of these tools was guided by

the nature of data to be collected, the time available as well as by the objectives of the study; secondary data were also collected through documentation from books, brochures or news papers and internet, permanent files, different audited companies' reports and other researchers' findings.

The research population consisted of two (2) managers, (2) chiefs of department, (3) chiefs of units and 35 employees. In total, the research was conducted on 42 employees of EDB the author's case study. The researcher selected a sample of 39 from the whole population size as shown in the following section of Sampling Procedure. The managers provided information related to the way the restructuring strategy is conducted, the problems they face and turnaround strategies used to overcome challenges.

### Sample size

Categories of respondents	Population	Sample	Sample (%)
Managers	2	2	5.1%
Chiefs of Departments	2	2	5.1%
Chiefs of units	3	3	7.7%
Manpowers	35	32	82.1
<b>Total</b>	<b>42</b>	<b>39</b>	100%

**Source:** Primary source (2013)

Data collected from the field were processed, analyzed, and interpreted then transformed into meaningful information for easy understanding. Statistical package was employed to determine the relationship between restructuring strategy and performance of SME. Therefore, data processing involved editing, coding and were also used for easy analysis of data.

### Results

The results were focused mainly on three main parts namely profile of the respondents, the implementation of the restructuring strategy in EDB and the performance of EDB due to the implemented restructuring strategy.

It has been revealed that the overwhelming majority is the manpower 82.1 %; both manager and chief of department were 5.1% each while the chiefs of units (welding, carpentry, and garage) was 7%. This implies that, the high percentage of responses came from the man powers and influenced significantly the researcher's findings. The views of chief of units and managers were also taken into consideration throughout the study.

The distribution of respondents according to their working experience in EDB showed that the employees having the working experience between 10 and 15 years were of the highest percentage 38.4% and 23% for the ones who worked in EDB since between 5 and 10 years and since between 15 and 20 years respectively. For those of fewer than 5 years of working experience, the percentage was of 10.2% while those of between 20 and 25 represent 5.1% and none of them was between 25 and 30.

The views of respondents about the contribution of downsizing strategies to the performance of EDB were sought and the results showed that, the employees' lay-off contributed to the performance of EDB, this was confirmed by 51% of respondents and 48.7% said that downsizing is a strategy with no effect to the performance of EDB. The effect of downsizing can be justified by EDB ability to pay regularly employees' salaries, incentives, taxes and other contributions Rwanda Social Security; the findings revealed that the profit also increases in the previous years due to downsizing activities. The employees' skills and knowledge were effectively used and the control became easy because of employees' reduction in number. However, some work could not be accomplished as planned due to downsizing activities.

The results revealed that the employees transfer and posting affected the performance of Economat Diocesain de Byumba, this was confirmed at the rate of 61.5%, the transfer and posting helped EDB to place the right employee in the right job. Incapacity of the new manager and lack of management training, tendency to remove all what had been initiated by the previous manager these were practices witnessed in EDB as confirmed by 38.5% of the respondents. The supporting reasons for the effect of transfer and posting on performance of EDB were innovations in EDB management where new units of production were initiated, payment of salary on

regular basis salary, debts recovery, etc. Job posting helped EDB both to discover hidden talent of employees and take responsibility for career planning, which makes easier for companies to retain talented workers.

The researcher gathered the information about the contribution of downscoping strategies to the performance of EDB and 64.1% argued that downscoping strategy did not contribute to the performance of EDB. The construction, the maize flour production and scraper manufacturing were removed and replaced by the more productive ones but this have not been empowered before in order to get more profit. The units must be empowered and well managed; they had to be marketed as they could attract customers and be as productive as possible, this was an opinion shared by 35.9% of the respondents. Yet, before removing any unit of production, it's recommended first to renew and reengineer it; afterwards if it remains unproductive it is removed and replaced by a most productive one.

The results showed that employees lay-off contributed to the performance of Economat Diocesain de Byumba, this was confirmed by 43.6% of the respondents, the recruitment of new employees contributed to the performance of EDB at 33.3% while training occupied 23.1%. In the first case of lay-off, the arguments given by the manager and other employees were that the salaries, wages and taxes were reduced and this affected largely the profit. But on the other hand some reasons supporting the necessity of recruitment of new employees and reject the lay-off (downsizing strategy) were given by other respondents (33.3%) saying that in the case of lay-off the remaining employees would not be able to meet all the requirement of the workplace. These respondents contend that, the measure to be taken could be to empower the employees by training, coaching, mentoring and organizing their work; this could be achieved by proper management of human resource management. Before laying-off some employees it could be better to train them in order to increase their productivity and replace the less skilled by the more skilled employees.

It has been revealed that the restructuring strategy through expansion and diversification used by EDB managers in empowering some units of production was for a greater effect on the performance of EDB. Here the frequency of respondents who supported this strategy represents 64.1% and the removal of unproductive units

was supported by 35.9% of the respondents. Adding capacity to the existing product line in a bid to expand existing operations was reported by the respondents as a best strategy of restructuring the units of production rather than introducing other units when the existing ones were not well managed. And in the case it was for a necessity to remove some units, these might be replaced by others which were expected to be more productive. But as argued by the respondents during the questionnaire filling and the interview, the units removed were not replaced by others. For example, the maize or corn flour industry as well as the construction unit and the manufacturing of scrapers and brushes were not replaced by any other unit of production. During his interview to the manager, about the introduction of other units of production that would be more productive, the manager said that they were introducing and empowering the hospitality business as a new entity of production to be implemented in EDB. In this way, all offices were to be transformed in bedding rooms in order to be rent to the customer who would like to be accommodated.

The data about the need for restructuring strategy was collected and the results showed that restructuring was required because of mismanagement encountered this was the views of 51.3% of the respondents. The mismanagement was caused by the poor accounting policy and practices and the mismanagement of human resource. Those who argued that risks could be justified by poor accounting policy and practices were 28.8% of the respondents while 20.5% confirmed that the mismanagement was caused by poor management of human resource.

During the interview with the respondents, the following causes were provided as paramount indicators of the EDB to fall into bankruptcy, namely the borrowing of money to pay monthly salaries, the credits owed to the suppliers, to RRA and RSSB, credits from banks not yet recovered. For that, the restructuring measures such as downsizing and downscoping, the management system, the accounting and the human resource management could be taken into consideration in order to avoid financial distress.

The view of the respondents were sought to determine the relationship between restructuring strategies and performance of RDB:

		Restructuring strategy	Performance of SMEs
Restructuring strategy	Pearson Correlation	1	.792**
	Sig. (2-tailed)	.	.000
Performance of SMEs	N	39	39
	Pearson Correlation	.792**	1
	Sig. (2-tailed)	.000	.
	N	39	39

**Source: Primary data (2013)**

From the table above, results showed that there is relationship between restructuring strategies and performance of EDB at Pearson correlation coefficient  $r=0.792$  implying that restructuring strategies affects performance of SMEs by 79.2% and 20.8% by other factors. The respondents said that, the restructuring strategy when carefully conducted, it leads to the performance of any SME hence EDB in particular. The reasons were that the restructuring strategy increases the productivity that is, the profit of the SME. The professionalism is implemented and the objectives are achieved, the employees are well managed i.e. they are more productive, their salaries and indemnities are regularly paid, the accounting records are daily kept and correctness is insured. The income generating activities are implemented and efficiently managed in order to register the expected profit. The EDB indicators of performance due to the restructuring strategy would be in sum, the customer’s satisfaction, the product quality, the employees’ satisfaction, the resource acquisition, the profitability level, the market position, etc.

**Discussion**

Restructuring strategy can be used to position the firm, to create more value to stakeholders because of changes in both external and internal environment (Kruse, 2002). The respondents (51.3%) argued that restructuring was necessary because of mismanagement caused by the poor accounting policy and practices and the mismanagement of human resource. The basic purpose of restructuring is to enhance the shareholder value (Pandey, 2003). Restructuring was undertaken in order to

avoid the firm to fall into bankruptcy

The study sought to establish whether downsizing contributed to the performance of EDB and the results showed that downsizing contributed to the performance of EDB, downsizing strategy was employed as turnaround strategy for non performing jobs as this confirmed by 51% of the respondents. This embraces the study of Mcknley et al (1995) who estimate that 85% of fortune 1000 firms have used downsizing as a restructuring strategy. Downsizing was used to cut down costs and increase the revenues of the firm. This in line with the airlines downsizing activity which was employed in response to decreases traffic caused by SARS epidemic and the war in Iraq where 1,200 people were laid off in a bid to improve profitability from cost reductions and more efficient operations (Keane, 2003).

Relying to this study 48.7% said that downsizing is a strategy with no effect to the performance of EDB as a big number of employees were laid off. Research has shown that downsizing contributed to the lower returns for both US and Japanese firms, downsizing would have a negative effect on company's ability to achieve strategic competitiveness in the long term (Krishnan & Park, 2002; Lee, 1197). Downsizing does not commonly lead to a higher firm performance (Bergh, 2000).

The study tested whether transfer and posting as per initiated by EDB affected its operating performance and 61.5% of respondents said that transfer and posting contributed significantly to the performance of EDB because with it, employee were placed to the right place and to the right job and this increased the profitability. This also was confirmed by Robert, L. M. & John, J. H.(1997) who argued that, in a transfer, an employee is assigned a job in a different area of the company. Transfer is a mean of increasing job responsibilities as well as compensation. As confirmed by 38.5% of respondents, incapacity of the incoming manager, lack of management training and tendency to remove all what had been initiated and implemented by the previous manager affected negatively the productivity. Maicibi & Nkata (2005) have also witnessed this and argued that transfers do not necessarily increase job responsibilities or compensation. Instead transfers can also be anxiety provoking and many organizations find it difficult to get employees accept them. Job posting systems have the advantage of reinforcing the notion that the organization promotes

from within. This belief not only motivates employees to maintain and improve their performance but also tends to reduce turnover (Gomez-Mejia et al 2001).

The results of this study revealed that downscoping strategy did not contribute to the performance of EDB as confirmed by 64.1%. According to respondents, some units were replaced by more performing plants but their management was poor and they could be empowered enough before they are established. Respondents argued that, before eliminating businesses that are unrelated to the firm's core businesses a feasibility study could be initiated. Dranikoff et al. (2002) argued that Downscoping can be described as a set of actions that causes a firm to strategically refocus on its core businesses. EDB should reengineer its plant and should not eliminate key employees from its core businesses. Hoskisson & Hitt (1990) found that refocusing on its core businesses, the firm can be more managed effectively by the top management team.

From this study 64.1% confirmed that the restructuring strategy through expansion and diversification used in EDB affected its performance, expansion of existing operations contributed to the increase of the revenues and hence the profitability. As noted by the research of Kim & Pantzaris (2001); Lewellen (1971) successful diversification is expected to reduce variability in firm's profitability in that earnings are generated from several different business units.

The results showed that there is relationship between restructuring strategies and performance of EDB at Pearson correlation coefficient  $r=0.792$ . The aim of all organizational restructuring strategies is to change the organization and make it work more effectively, more efficiently, to be more productive and increase profits (Thomas, 2000). Managers now can reduce cost, increase productivity, and enhancing shareholder wealth in their own organization using lessons learned in other organization's restructuring attempts (Bowman et al., 1999).

The respondents confirmed that, the restructuring strategy when carefully conducted, may lead to the performance of EDB but it is supposed to be a journey and not destination.

## Conclusion

It can be concluded that organizational restructuring is a value tool for an organization to use in an attempt to maintain and strengthen its strategic competitiveness. The choice of which strategy to use will vary from a company to another depending on the area the company wants to improve either profitability, performance, or operation. It can be noted that a firm that is simultaneously downscoping and downsizing becomes smaller by reducing the diversity of businesses in its portfolio (Rajand & Forsyth, 2002). Restructuring is a very complicated subject and it is an ongoing process.

This study revealed that downscoping strategy did not contribute to the performance of EDB as confirmed by 64.1%. However the scholars affirm that downscoping generally leads to more positive outcomes in both the short and long-term than does downsizing. The failure of downscoping strategy used by EDB can be attributed to the unwillingness of the firm to carry out feasibility study on the strategies to be used in order to address the issue. The results showed that downsizing activity contributed to the performance of EDB as confirmed by 51% of the respondents. However, 48.7% said that downsizing as a strategy did not contribute to the performance of EDB because it caused a loss of human resource capital.

All in all, it has been revealed that restructuring strategy when effectively employed it can lead to the performance of the firm as confirmed by 79.2% of the respondents. However, it must be undertaken with utmost care to make sure the will of the Small and Medium sized Enterprises are not constrained.

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## **Effet de l'agroforesterie pour la conservation durable des sols agricoles du district de Gicumbi, Rwanda**

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### **Abstract**

The present study is to highlight the effect of agroforestry in the sustainable soil conservation in Gicumbi district, Northern Rwanda. Field surveys on focused 100 people made up of 95 farmers whose 85 answered our different questions; 3 cell executive secretaries, one cell coordinator and one resource person for all cells of this sector were conducted. Opening and closing questionnaire were distributed. The results showed that 93.4% of the respondents are aware of the soil degradation and the role of agroforestry in the soil conservation. They further argue that there is the soil loss in their field and in surrounding regions of Shangasha Sector. However 6.6% of participants deny these assertions. In addition, the results revealed that 63.9% agree the importance of the farmer trainings on family planning and agroforestry production; the establishment of agro forestry cooperatives, and the promotion of the rainwater by storing it in tanks. The agroforestry practice is a sustainable solution for the soil conservation and to meet the needs of farmers in their socio-economic environment.

### **Résumé**

L'objectif de cette étude est de mettre en évidence le rôle de l'agroforesterie dans la conservation durable du sol agricole dans le secteur de Shangasha. Pour aboutir à cet objectif, l'étude a été conduite par le biais d'une enquête auprès d'un échantillon de 100 personnes composé par 95 fermiers dont 85 ont répondu à nos questions, trois secrétaires exécutifs, un coordinateur de cellules et une personne ressource dans toutes cellules composantes du secteur. Un questionnaire individuel, ouvert et ferme a été réalisé au sein de l'échantillon enquêté selon l'âge, le sexe, état

matrimonial et le niveau d'étude, puis l'interview pour le groupe de 6 personnes non instruite de l'échantillon. Le résultat montrait que 93.4 % des interrogés sont conscients de la dégradation du sol et du rôle joué par la pratique de l'agroforesterie dans la conservation du sol. Ils ont déclaré en outre qu'il existe une perte en terre dans leur champs et ailleurs dans le Secteur de Shangasha contre 6.6% qui nient son existence. Les résultats de l'étude, montrent que la formation des fermiers sur le planning familial et la production agroforesterie, création des coopératives agro forestières, valorisation des eaux de pluie par le stockage dans des citernes représentent en totalité 63.9 % des répondant. L'agroforesterie est une solution durable pour la conservation des sols et d'accroître leur productivité

## **1. Introduction.**

Méthodes de lutte contre l'érosion, les systèmes et outils d'aide à la prise de décision sont nécessaires pour protéger nos ressources du sol pour les générations futures et de réduire les coûts économiques de l'érosion des sols (MINAGRI, 2005). L'érosion des sols continue d'être la principale menace à la viabilité à long terme de l'agriculture rwandaise sans oublier celle de Shangasha. L'érosion a abaissé de la fertilité des sols, par la perte des matières organiques et d'autres éléments nutritifs dans les sédiments emportés au cours des dernières années dans le secteur de Shangasha due de l'absence de la couverture végétale et du relief accidenté.

Les facteurs du milieu physique sont naturellement fragiles: 60% des terres cultivées sont situées en montagne sur des pentes très fortes (de 20 à 80%) et le régime des pluies souvent violentes favorise le ruissellement (MINAGRI, 2005)

De plus, la démographie élevée accentue la pression foncière. Le secteur de Shangasha compte 16335 habitants avec une activité, traditionnellement agricoles, qui représente toujours l'un des moteurs de son économie (MINALOC, 2003). Ainsi la mise en culture de plus en plus rapprochée diminue les temps de jachère, provoque le surpâturage et favorise la dégradation des sols (Bazivamo, 2003).

En effet, la lutte contre l'érosion dans cette région du secteur de Shangasha, district

de Gicumbi et dans tout le pays entier daté depuis longtemps, voire même avant le début de l'époque coloniale belge dans les années 1937, et après jusqu'en nos jours, sous l'assistance des institutions étatiques ou privées (Anonyme, 2002). De ce fait, développer de nouvelles, efficace et économique de la lutte contre l'érosion technologies, y compris les stratégies d'utiliser des arbres, système d'agroforesterie doit se trouver à être efficace et durable dans des région montagneuses à contrôler l'érosion sur les pentes raides tout en fournissant également la matière organique; favorisant la rétention des éléments nutritifs; l'infiltration et rétention de l'eau dans le sol; L'enracinement des cultures; Le recyclage des éléments lessives dans le sol; la concentration, la sauvegarde et enrichissement des éléments nutritifs (Brils, 1994). L'agroforesterie, systèmes d'utilisation des terres où l'on fait pousser des arbres ou arbustes en association avec des cultures, des pâturages ou bétail, dans un arrangement spatial ou temporel ou les deux, et dans lesquels il ya à la fois des interaction écologiques et économiques (Encyclopédie Canadienne, 2006).

Selon König (1992), dans son étude sur l'effet de l'agroforesterie dans la conservation des sols a rapporté que ce système régénère et stabilise la fertilité des sols dans un système de production bien adapté aux conditions écologiques et humaine de la région.

Roose et Ngayizigiye (1996) ont rapporté que l'intégration des arbres et surtout des haies de *Calliandra calothyrsus*, permet une réduction de l'érosion et des pertes en matières organique et éléments nutritifs à un niveau tolérable 1-3 %, des résultats comparables ont été obtenus comme suit : 120 à 250 t/ha/an sous cultures non protégées, 1 à 2 t/ha/an sur parcelles protégées (MINAGRI, 2005).

En général, Le système d'agroforesterie a été vulgarisé au Rwanda presque dans toutes du pays pour améliorer la fertilités des sols et lutte contre l'érosion, cependant promouvoir le système d'agroforesterie accompagnés par des mesures socioéconomiques qui s'adressent aux systèmes de gestion des terres à risques et avec le développement durable du territoire a été ignoré. Maintenant, des grave problèmes de dégradation des sols peuvent se poser s'il s'agit d'une dégradation des sols liés au système de labourage dans cette zone d'érosion. Si l'érosion est souvent une externalité de l'agriculture sur un sol nu alors, l'absence de couvert favorise

l'agression par la pluie et le vent (Tassin et al. 1995).

L'objectif de cette étude est de mettre en évidence la conscience des agriculteurs sur l'effet de l'agroforesterie dans la lutte contre l'érosion et la gestion de la fertilité du sol

## **2. Matériels et méthodes**

### **Zone d'étude**

Le Secteur de Shangasha est l'un des secteurs du District de Gicumbi, Province du Nord, limité au Nord par le secteur de Rushaki, à l'Ouest et Sud par le secteur Bwisige, à l'Est par le secteur de Byumba. Sa superficie est de 32,85km avec une population estimée à 16.335 habitants.

L'altitude varie entre 2000 et 3500 m au sommet du plateau. Le relief est très accidenté, avec des pentes raides. Les vallées sont profondes et étroites. Le secteur jouit d'un climat tempéré de type équatorial avec une température moyenne annuelle comprise entre 19° et 22°C. La pluviométrie moyenne dépasse les 1.200 mm par an. Les pluies sont abondantes mais irrégulières, parfois improvisées pendant la saison sèche. On observe souvent des glissements de terrains importants pendant la grande saison pluvieuse. Le sol est érodé, sableux-argileux avec un système mixte d'agroforesterie.

### **Méthodologie**

#### **Techniques**

#### **L'échantillonnage**

Dans le processus de recherche, il n'est pas possible de faire des mesures ou des observations sur l'ensemble des objets ou des personnes concernées par le sujet. Il convient d'en extraire un échantillon.

D'après AKTOUF O. (1992, p. 73), le mot «échantillon » vient du mot français « escandillon » qui veut dire « échelle pour mesurer ».

Il s'agit d'un groupe représentatif qui doit représenter en miniature, l'ensemble plus vaste concerné par le problème de la recherche.

Pour DE LANDSHEERE, G. (1982, p. 119) cité par MUKASE, (2006, p. 33), « échantillonner » « *c'est choisir un nombre limité d'individus, d'objets ou d'événements dont l'observation permet de tirer des conclusions (inférences) applicables à la population entière (univers) à l'intérieur de laquelle le choix a été fait* ».

Pour notre travail, l'univers était de 16335 populations –fermiers repartis en 5 Cellules administratives. Comme nous ne pouvions pas enquêter tout le monde, faute des moyens tant financiers que temporels. C'est pour cette raison que nous avons recouru à l'échantillonnage, où nous avons choisi un groupe représentatif.

Pour y arriver, nous avons suivi la formule de détermination d'échantillon d'Alain BOUCHARD. Lorsqu'une population mère finie est inférieure à 1.000.000 individus, on fait correspondre un échantillon de 96 individus étant donné une marge d'erreurs de 10%.

$$n = \frac{No}{1 + \frac{No}{N}}$$

Avec  $n$  = Taille de l'échantillon

$No$  = Taille de l'échantillon pour un

$N$  = Taille de la population

Alors

La taille de l'échantillon corrigé est de 95.

A cet échantillon, s'ajoutent également 5 autorités des cellules administratives du Secteur Shangasha ainsi que les dirigeants des coopératives, ce qui fait un échantillon

total de 100 individus.

L'observation directe

Durant nos passages lors de l'enquête, cette technique a consisté à observer les pratiques agro forestières pratiquées, les comportements des fermiers face à l'agroforesterie: Ceux ayant ou n'ayant pas pratiqué l'agroforesterie au sein des exploitations et de poser d'autres questions sur les points intéressants de l'étude.

### **Le questionnaire**

Pour collecter des informations concernant l'impact de l'agroforesterie dans la conservation durable des sols dans le secteur de Shangasha, nous avons formulé le questionnaire à distribuer dans 6 cellules administratives du secteur de Shangasha, dans le district de Gicumbi de la Province du Nord. Nous avons élaboré 2 types de questionnaires. Il y avait d'abord le questionnaire à adresser à l'administration de la cellule et les dirigeants des coopératives. Ici, les questions devaient être répondues par le secrétaire exécutif, le conseiller ou autre ayant des attributions au niveau de la cellule ou encore l'un des dirigeants des coopératives agricoles.

Ensuite, nous avons formulé le questionnaire à adresser à 95 fermiers pris comme échantillon dans les 5 cellules administratives. Le questionnaire a porté sur les thèmes suivants:

- Les conditions sociologiques et de travail
- Conditions socio-économiques.
- Agriculture en général et l'agroforesterie en particulier

Le questionnaire renfermait des questions à la fois fermées et ouvertes. La plupart des questions étaient de type oui ou non, où une petite justification était quelquefois exigée pour que l'enquêté éclaircisse son avis. Les questions à choix multiples étaient également formulées en vue de faciliter la tâche de dépouillement. Cependant, les questionnaires distribués n'ont pas été tous retournés. Certains n'ont pas reçu de réponses et d'autres n'ont pas été récupérés. Heureusement, le nombre de ceux qui

ont été répondus et récupérés dépasse de loin ceux qui sont perdus et approche de celui du questionnaire distribué.

### **Analyses statistiques des données**

Les données collectées ont fait l'objet d'un dépouillement manuel et ont été saisie et analysées à l'aide du tableur Excel 2003.

### **3. Résultats et Discussion**

Caractéristiques de l'identification de notre échantillon enquêté sur le sol et l'agroforesterie dans la conservation du sol

Information concernant l'identification notre échantillon enquêté sur le rôle de l'agroforesterie dans la conservation du sol est représenté dans le tableau 1 ci - bas. Notre échantillon enquêté portant sur 100 personnes cibles, les fermiers et autorités locales à qui nous avons distribué le questionnaire relatif au sol et à l'agroforesterie. L'échantillon regroupe la première catégorie de « fermiers » prise au hasard comprenant 95 personnes. Seulement 86, soit 90.5% ont répondu à notre questionnaire puis les 3 Secrétaires Exécutifs et les Coordinateurs des Cellules ainsi qu'une autre personne chargée de l'agriculture, soit 100%, ont répondu à notre questionnaire.

L'enquête s'est orienté aussi selon l'âge sur ces cent personnes ciblées et se situe entre 21 et 61 ans et plus. La majorité de personnes enquêtées sont des adultes d'âge compris entre 31 à 40 ans soit (44%), suivi de celles entre 21 à 30 ans (23,1%). Un pourcentage moyen de 15,4% de nos enquêtés sont âgés de 41 à 50 ans et pourcentage de 12,1% est âgé de 51 à 60 ans et un petit nombre des interrogés sont âgés de plus de 60 ans, soit 5,5%. Egalement, l'enquête s'est établie selon le sexe. La grande majorité des personnes enquêtées sont du sexe féminin qui représente 53,8%, tandis que le sexe masculin représente 46,2%. L'effectif des répondants masculins est inférieur à celui du sexe féminin. Puis, l'enquête s'est effectuée selon la situation matrimoniale, des personnes ayant les statuts de célibataire, mariées, veufs/veuves et divorcés/séparé (e)s.

Les résultats issus de cette étude tableau1, montrent que la composante de l'échantillon est dominée par les fermiers 90,5%, le sexe féminin domine et représente 53,8%, les mariées et des personnes veufs /veuves avec des proportions respectives de 48.4% et 30,8%.

81,3% des enquêtées ont un niveau primaire, une image type de la communauté rurale de la société rwandaise qui est beaucoup plus concernée par le sujet de pouvoir accroître leur niveau de vie. La société rwandaise, dans son ensemble, est majoritairement composée par les femmes. Au Rwanda, les femmes contribuent beaucoup dans les différents secteurs du développement dont l'agriculture.

N.B.: Sur 100 questionnaires élaborés, 91(\*) ont été répondus et retournés, soit 91%. Par contre 9 questionnaires soit 9% n'ont pas été récupérés par suite de perte ou autres causes éventuelles.

**Tableau 1. Caractéristiques de l'identification de notre échantillon enquêté sur le rôle de l'agroforesterie dans la conservation du sol**

Variable	Valeurs ou proportions		
	Questionnaires distribués	Réponses recrues	%
<b>Fermiers</b>	<b>95</b>	<b>86</b>	<b>90,5</b>
<b>Secrétaires executives</b>	<b>3</b>	<b>3</b>	<b>100</b>
<b>Coordinataires des cellules</b>	<b>1</b>	<b>1</b>	<b>100</b>
<b>Personnes ressources</b>	<b>1</b>	<b>1</b>	<b>100</b>
<b>Total</b>	<b>100</b>	<b>91*</b>	<b>100</b>

Selon l'âge	Echantillon	%
De 21 a 30 ans	21	23,1
De 31 à 40	40	44
De 41 à 50	14	15,5
51 à 60 ans	11	12,1

61 ans et plus	5	5,5
Total	91*	100

Sexe	Echantillon	%
Masculin	42	46,2
Féminin	49	53,8
Total	91*	100

Etat matrimonial	Echantillon	%
Célibataire	14	15,4
Mariés	44	48,4
Divorcés(e) séparé(e)	5	5,5
Veufs/veuves	28	30,8
Total	91*	100

Niveau d'études	échantillon	%
Aucun niveau d'étude	6	6,6
primaire	74	81,3
Secondaire	8	8,8
Supérieure	3	3,3
Total	91*	100

**Source:** Analyse des données 2010

La majorité de nos répondants sont des personnes mariées et des personnes veufs / veuves avec des proportions respectives de 48,4% et 30,8%. Les célibataires (15,4%) et divorcées ou séparées (5,5%).

Finalement, la répartition des répondants a été faite selon leur niveau d'études. Le tableau 1 montre que 81,3% des enquêtées ont un niveau primaire, 8,8% des enquêtées ont un niveau secondaire, 6,6% n'ont aucun niveau d'étude et que 3,3% des enquêtées ont un niveau supérieur.

La perte en terre et la pratique de l'agroforesterie dans le secteur de Shangasha.

### Existence de la perte en terre dans le secteur de Shangasha

En vue de savoir si les répondants de Shangasha sont conscients du problème de perte en terre dans leur champs, nous avons posé une question y relative. Les résultats des réponses sont représentés dans le tableau 2 ci-dessous.

**Tableau 2 : Avis des enquêtés sur l'existence de la perte en terre dans leur champs**

Existante de la perte en terre dans leur champs et ailleurs.	Fréquence	%
Oui	85	93,4
Non	6	6,6
Total	91*	100

**Source:** Analyse des données 2010

Le tableau 2 révèlent que la majorité de nos répondants, soit 93,4% déclarent qu'il existe une perte en terre dans leurs champs et ailleurs dans le Secteur de Shangasha contre 6,6% qui nient son existence. Ceux qui déclarent qu'il n'y a pas de perte en terre sont ceux qui ont les champs bien entretenues et ou même ceux qui ont les champs se trouvant dans les endroits plats ou bien encore ceux qui ne savent pas comment interpréter les effets de l'érosion.

L'agroforesterie face au problème de perte en terre dans le secteur de Shangasha.

Les résultats de réponse à cette question sont présentés dans le tableau 4 ci-bas montrent que la majorité de nos enquêtés, soit 41,8%, affirment qu'ils font des terrasses progressives associées à l'agroforesterie tandis que , 28,6% pratiquent l'agroforesterie seule sous forme des haies vives, des cultures en couverture ou en jachère etc.; 9,9% disent qu'ils utilisent des terrasses radicales associées à l'agroforesterie ainsi que des méthodes combinées parmi lesquelles l'agroforesterie; 5,5% utilisent des fossés de lutte anti-érosives (LAE) seuls ; 4,4% disent qu'ils utilisent des terrasses radicales, un petit nombre de nos répondants, soit 2,2%, déclarent qu'ils ne font rien pour la lutte anti érosives.

**Tableau 3: Avis des répondants sur les mécanismes pris par les fermiers pour la réduction de la perte en terre**

Mécanismes pour la réduction de la perte en terre	Fréquence	%
Ne font rien	2	2.2
Construction des terrasses radicales seules	4	4.4
Construction des terrasses radicales associées à l'agroforesterie	7	7.7
Construction des terrasses progressives seules	0	0
Construction des terrasses progressives associées à l'agroforesterie	38	41.8
Agroforesterie seule (haies vives, etc.)	26	28.6
Création des fossés de lutte anti érosives	5	5.5
Méthodes combinées (terrasses radicales & progressives, fossés de lutte anti-érosives et agroforesterie)	9	9.9
Total	91*	100

**Source:** Analyse des données 2010

Si on analyse bien, presque toutes les méthodes de LAE sont accompagnées par le système agro forestier, ce qui la qualifie d'importance capitale dans l'entretien et le maintien de la fertilité des sols.

Le rôle de la pratique agro forestière dans le secteur Shangasha

A la question de savoir les pratiques agroforestières dont les enquêtés utilisent, le tableau 5 donnent des réponses.

**Tableau 4: Avis des répondants sur la pratique agro forestière utilisée**

Pratique agro forestière utilisée	Fréquence	%
N'utilise aucune pratique agro forestière	1	1.1
Pratiques de rotation	3	3.3
Pratiques spatiales mixtes	16	17.6
Pratiques zonales	26	28.6
Pratique des ligneux sur structures antiérosives	38	41.8
Brise-vent et rideaux abris	6	6.6
Pratiques sylvopastorales	1	1.1
Total	91*	100

**Source:** Analyse des données 2010

Le tableau 5 montre que 41,8% des fermiers enquêtés confirme que le reboisement peut rendre productif le terrain occupé, aider à stabiliser les talus et fossés, sur bandes enherbées et en terrasses.

28,6% des fermiers enquêtés confirment qu'une grande production de biomasse des haies vives, de même que la fixation d'azote, et une importante restitution d'éléments nutritifs sont dues à l'agroforesterie.

Les causes probables du manque de pratique de l'agroforesterie dans le secteur Shangasha

Le tableau 5, montre que, 30,8% des enquêtés disent que l'éloignement des sources d'eau pour arrosage et le manque d'espaces appropriées pour la création des pépinières constituent des causes probables de l'insuffisance des plants agro forestiers dans le Secteur de Shangasha ; 15,4% des enquêtés déclarent l'ignorance des fermiers en matières de l'installation et la conduite des pépinières comme cause probable de l'insuffisance des plants agro forestiers ; 11% des enquêtés déclarent que

L'insuffisance des semences agro forestiers est la cause probable de l'insuffisances des plants agro forestiers; 7,7% des enquêtés déclarent le manque de moyens financiers comme étant aussi comme cause probable de l'insuffisance des plants agro forestiers; 4,4% des enquêtés déclarent la démographie galopante comme l'un des causes probables de l'insuffisance des plants agro forestiers.

**Tableau 5: Avis des enquêtés sur les causes probables de l'insuffisance des plantules agro forestières**

Causes probables de l'insuffisance des plantules agro forestières	Fréquence	%
Carence des sources d'eau pour arrosage	28	30,8
Manque d'espaces appropriés pour la création des pépinières.	28	30,8
Ignorance dans la conduite des pépinières.	14	15,4
Manque de semences agro forestières	10	11
Manque de moyens financiers	7	7,7
Démographie galopante	4	4,4
Total	91*	100

**Source:** Analyse des données 2010

Sur l'insuffisance des sources d'eau, les résultats de notre enquête ont révélé que la majorité des personnes enquêtées font plus de 2 km pour une durée de plus d'une heure pour arriver à la source d'eau. Les personnes qui habitent les sommets des collines sont les plus concernés par ce problème. Une personne interviewée lors de notre enquête nous a répondu en ces termes: « Sur ce sommet où j'habite, il n'y a aucune source d'eau. Ma femme et mes enfants font plus de deux heures de marche pour arriver à la source qui n'est même pas aménagé, situé à 4 km d'ici ».

La conséquence de l'agroforesterie dans la conservation durable des sols

L'agroforesterie a des nombreuses conséquences non seulement sur les sols Rwandais mais aussi et surtout sur les sols du Secteur Shangasha.

**Tableau 6: Avis des enquêtés sur le rôle de l'agroforesterie dans la conservation durable des sols dans le Secteur de Shangasha**

Le rôle de l'agroforesterie sur la conservation durable des sols (effets positifs)	Fréquence	%
Augmentation des apports de matière organique et d'éléments nutritifs au sol.	37	43,5
Réduction des pertes de sol, provoquant ainsi un meilleur recyclage de la matière organique et des éléments nutritifs.	22	25,9
Amélioration des conditions physiques et chimique du sol.	16	18,8
Influence sur les processus et les conditions biologiques du sol.	10	11,8
Total	85 **	100

**Source:** Analyse des données 2010

\*\* : 85 sont eux parmi 91 enquêtés qui ont répondu que l'agroforesterie joue un rôle dans la conservation durable du sol. Comme il ressort du tableau 6, 43,5% de nos enquêtés ont affirmé que l'agroforesterie intervient dans l'augmentation des apports de matière organique et d'éléments nutritifs au sol; 25,9% de nos enquêtés l'ont saluée en tant qu'intervenant dans la réduction des pertes de sol, provoquant ainsi un meilleur recyclage de la matière organique et des éléments nutritifs; 18,8% de nos enquêtés affirment que l'agroforesterie intervient dans l'amélioration des conditions physiques et chimique du sol; 11,8% de nos enquêtés ont répondu qu'elle a une influence sur les processus et les conditions biologiques du sol. L'agroforesterie offre un certain potentiel antiérosif. Puisque le principal effet défavorable de l'érosion est la perte de matière organique et d'éléments nutritifs, le potentiel de contrôle de l'érosion constitue un moyen important de maintien de la fertilité du sol.

**Tableau 7: Avis des enquêtés sur les conséquences de l'agroforesterie sur la vie de la population**

Conséquences de l'agroforesterie sur la vie de la population	Fréquence	%
Accroissement de production (rendement de culture)	17	20
Augmentation de la traite une fois utilisée comme fourrage	11	12,9

Production des tuteurs	15	17,6
Production des bois de chauffage	15	17,6
Epuration de certains gaz à effet de serre	2	2,4
Brise vent pour la protection des cultures et des maisons.	16	18,4
Sert pour la délimitation des parcelles appartenant à différents fermiers	9	10,6
Total	85 **	100

**Source:** Analyse des données 2010

Comme il ressort du tableau 7, 20% de nos enquêtés ont affirmé l'accroissement du rendement de cultures par l'agroforesterie du fait que le sol est bien maintenu et par conséquent la fertilité est augmentée ; 18,4% des enquêtés certifient que les arbres agro forestiers sont utilisés pour protection de leur cultures et maisons ; 17,6% de nos enquêtés ont affirmé avoir reçu des tuteurs et des bois de chauffage via l'agroforesterie; 12,9% de nos enquêtes ont affirmé que l'agroforesterie intervient dans l'augmentation de production élevée du lait lorsqu'ils ont fait nourrir leurs vaches des quantités exigées des feuilles de *Calliandra sp*, *Leucaena sp*, etc; 10,6% ont répondu que les plants agro forestiers servent de limitation des parcelles appartenant à différents fermiers; 2,4% affirment que l'agroforesterie intervient dans l'épuration de certains gaz à effet de serre.

A coté de ces conséquences positives ci haut fournies, d'autres qualifiées comme étant négatives peuvent être observées lorsque l'agroforesterie n'est pas bien faite. Telles que déclarés par certains fermiers du secteur de Shangasha eux- mêmes, en évoquant la compétition soit en éléments nutritifs, en lumière solaire et/ou en eau entre cultures et plants agro forestiers. L'abri des rongeurs, des insectes et des oiseaux pouvant endommager les cultures y associées.

Stratégie pour atténuer la perte en terre dans le secteur de Shangasha par l'agroforesterie

Malgré les conséquences dues à une perte en terre cultivable, le tableau 8 montre les propositions données par nos répondants.

**Tableau 8: Stratégies proposées pour faire face à la perte en terre à Shangasha à l'aide de l'agroforesterie**

Stratégies proposées pour faire face à la perte en terre à Shangasha à l'aide de l'agroforesterie	Fréquence	%
Collecter des eaux de pluie par le stockage dans des citernes	21	23,1
Création des coopératives agro forestières	21	23,1
Habitat regroupé	3	3,3
Encourager l'investissement dans l'agroforesterie	6	6,6
Formation des fermiers en matière de "planning familial" et de l'agroforesterie	21	23,1
Extension et réhabilitation des pépinières existantes.	7	7,7
Sensibilisation des pratiques agro forestières	6	6,6
Formation des comités de gestion de l'environnement en matière de l'agroforesterie	3	3,3
Création de la régie associative agro forestière	3	3,3
Total	91*	100

**Source:** Analyse des données 2010

Le tableau 8 fait ressortir que 23,1% des répondants proposent la formation poussée des fermiers en matière de "planning familial" et l'agroforesterie et la valorisation des eaux de pluie par stockage dans des citernes qui seront utilisées pour l'arrosage pendant la sécheresse et la création des coopératives agro forestières comme la stratégie pour faire face à la perte en terre; 7,7% des répondants proposent l'extension et la réhabilitation des pépinières existantes comme stratégie; 6,6% proposent la sensibilisation des pratiques agro forestières et la recherche de beaucoup d'intervenants dans ce domaine comme stratégie; 3,3% des enquêtés proposent la création des régies associatives agro forestière, l'habitat regroupé et formation des comités de gestion et de l'environnement comme stratégies.

#### 4. Conclusion

Ce travail met en évidence des opinions des correspondants relatifs à la conservation du sol agricole à travers la pratique d'agro forestière bien adaptée aux conditions physiques et socio -économiques de secteur Shangasha représenté

une stratégie efficace pour la conservation des sols contre l'érosion. Ceci implique que l'adoption de l'agroforesterie peut donc être considéré comme un outil de développement durable en district Gicumbi. De plus, peut être de bonnes raisons pour le gouvernement et ONGs de soutenir les agriculteurs dans l'adoption de l'agroforesterie. L'agroforesterie, surtout l'intégration des légumineuses dans le système de production vivrière permettront à la fois d'améliorer la fertilité du sol, d'accroître productivité agricole et de répondre aux besoins des agriculteurs dans leur environnement socio-économique comme le besoin en bois et autres dans le Secteur de Shangasha.

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## **Causes and effects of prostitution in Rwanda, a case study of Muhanga Town in Muhanga District “2008-2012”**

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### **Abstract**

This research was conducted in Muhanga Town, Muhanga District, in Southern Province of Rwanda. The general objective of this study was to analyze the sociological phenomenon of prostitution in Muhanga Town by identifying its causes and effects. Findings revealed that causes of prostitution are poverty and despair (67.6% of respondents), war and 1994 genocide (13.2%), social conflicts (11.8%) and search for facility (7.4%). Regarding the consequences of prostitution, respondents mentioned the spread of HIV/AIDS and other STDs (50% of respondents), family life destruction (14.7%), depravity of morals (13.2%), uncertain future for prostitutes (11.8%) and insecurity (10.3%).

**Key words: Prostitution, causes, effects**

### **Introduction**

Prostitution exists in the world since long time ago (Haecht, 1973). Some authors claim that it has existed since men were upon the earth (Philippon, 2005).

According to the same author, until the 20th century, the evolution of prostitution was marked by periods of boom followed by measures of prohibition and repression will fail, causing the states to be resigned to a matching tolerance regulation police and health.

In some ancient societies prostitution was linked to the notion of hospitality: the cleaning women are offered to people passing through. We encounter this custom in Chaldea, India, Egypt and the East. Soon the family or clan found an interest in this practice. In some countries, girls were as a dowry in anticipation of marriage. According to A. Kagame, such hospitality existed in traditional Rwanda but not very often (Kagame, 1954).

In addition to this hospitality soon appeared prostitution by organized religious priests of certain deities. To the extent made by these forms of prostitution, aware also of the source of profits they represented the rulers of ancient Asia organized legal prostitution in creating state institutions for both to protect public order and to provide fiscal resources (Philippon, 2005).

The Law of Moses, however, prohibits prostitution in the daughters of Israel but tolerates it for the foreign women. The regulation is also seen in Greece. Then arises the prostitution business. It is the same in Rome where are created the “red light districts” of prostitutes but where a prostitute could not get out exercising outside for fear of being beaten to death (Haecht, 1973).

Researches (Melissa Farley, 2010; Marion Pajumets, 2004; Donna M. Hughes et al, 1999) revealed that prostitution is a social problem and has many consequences especially on women because they lose their humanity and qualities that define them as individuals.

In Rwanda, many people are afraid to say that prostitution exists in our community while at night, especially on weekends, pubs, bars, hotels, streets are lined with these little old ladies “waiting for a plane” (*bateze indege*). It’s not only those places that facilitate the exercise of the oldest profession but there are also houses of prostitution. Even male prostitution began to gain ground in Rwanda. The police got rid of the prostitutes every night in the streets to limit the damage they can cause for the security, because they attack passers by asking them if they want to do sex with them. They are even responsible for some incidents when fighting them for example one of them misappropriate a customer from another. Abuse by their customers who refuse to pay after the pass or beat them is also a source of disorder.

Genocide and its consequences have worsened the situation. It left behind many orphans and widows who must fend for their livelihood. There are some who manage to self sufficient and others who, because of their economic, social and moral vulnerability are forced to resort to this less honorable practice.

Previous studies (Donna M. Hughes and Claire M. Roche, 1999; Jacobson, Jodi

L,1992; McKeganey and Barnard M,1992) revealed that prostitution has a lot of consequences on social life of prostitutions, children and the entire social environment, thus strong measures must be adopted to manage this phenomenon (Haecht, 1973).

Conducted in Muhanga District this research intended to find out causes and consequences of prostitution on both prostitutes and their social environment.

## **Methodology**

This research was conducted on a sample of 68 individuals chosen from a population of 233 prostitutes in Muhanga Town within a time boundary of 5 years, from 2009 to 2013. This period was chosen because it was characterized by strong explosion prostitutes in Muhanga Town. Both qualitative and quantitative information were collected and techniques such as documentation, observation, interview and questionnaire were used. Moreover, statistical, historical and analytical method helped us through this research.

## **Results**

This section starts by identifying respondents and continues with presentation of causes that lead them to prostitution and related consequences.

### **3.1. Identification of respondents**

Respondents are identified by age, education, marital status, occupation and place of residence.

#### **3.1.1. Age and educational level of respondents**

Age and level of education were considered in analysis of prostitution as shown by the table below:

**Table 1: Identification of respondents by age**

Age	Frequency	Percentage
13-19	29	42.6
20-29	35	51.5
30 and over	4	5.9
<b>TOTAL</b>	<b>68</b>	<b>100</b>

**Source: Primary data 2012**

From the above table 42.6% of respondents are prostitutes aged 13-19 years, 51.5% are 20 to 29 years and 5.9% are aged 30 and over. The observation shows that the second age group (20-29) contains more prostitutes (51.5%). Through interview, respondents revealed that the reason is that most prostitutes are girls who are in the age where they need body lotion and good clothes, hence due to poverty within their families they decide to join prostitution. In addition, girls of this age are in town to be used as household but once returned, they do not want to return to the village and are recruited by older practitioners.

**Table 2: Identification of respondents by level of education**

Educational level	Frequency	Percentage
Illiterate	28	41.2
Primary	38	55.9
Secondary	2	2.9
<b>TOTAL</b>	<b>68</b>	<b>100</b>

**Source: Primary data 2012**

From this table, we observe that, depending on the educational background, 41.2% of respondents have never been to school, 55.9% did only primary school, and 2.9% secondary level. This information reveals that the more girls are uneducated, the more they are attracted in prostitution.

### 3.1.2. Marital status and place of residence of respondents

Marital status and place of residence have also been taken in account to analyze the context of prostitutes in Muhanga District as mentioned in table below:

**Table 3: Identification of respondents by marital status and place of residence**

<b>Matrimonial status</b>	<b>Frequency</b>	<b>Percentage</b>
Singles	41	60.3
Free union	21	30.9
Widows	5	7.4
Divorced	1	1.5
<b>TOTAL</b>	<b>68</b>	<b>100</b>

**Source: Primary data 2012**

As stated in the above table, considering marital status, 60.3% of respondents are single without children, 30.9% have children but never had a husband, 7.4% are widows and 1.5% divorced. Singles prostitute easily because they are free of family responsibilities. Class made of singles is very represented. The reason that was advanced here was that it is very easy to them to practice prostitution more than married who are tied by the marriage law or controlled by partners.

Those who are freely united are the ones who chose to live together without any legal engagement and this cannot prevent prostitution. Divorced people and widows are also represented. Widows are no longer accompanied by any husband and have most of times a lot of financial problems that they cannot be able to solve being alone. Some of them choose to prostitute themselves in order to find means to meet their basic needs. It seems to be the same for divorced people. This in accordance with what observed Jacobson (1992), saying that in Africa and Asia studies carried out by the World Bank and a number of international research organizations have found that divorced or separated women comprise the great majority of prostitutes or “semi” prostitutes.

**Table 4: Identification of respondents by place of residence**

<b>Place of residence</b>	<b>Frequency</b>	<b>Percentage</b>
Rent	30	44.12
Town surroundings	19	27.94
Own	13	19.12
Family	6	8.82
<b>Total</b>	<b>68</b>	<b>100.00</b>

**Source: Primary data 2012**

According to place of residence, 27.94% of prostitutes in our study live in the surrounding areas of Muhanga Town, engaged during the day and return in the evening; 8.8% live in their families; 44.12% rent low level houses that can be small room they share most often two. Yet they know to organize so that each can make his pass without disturbing the other. Note that 19.1% live in their own homes.

We can observe that most of respondents live in house they rent monthly. They reported that they are not able to find their own houses because of lack of means. There is also a great number of prostitutes who come from town surroundings and after sex working they return home. So they do not need to rent a house reserved for their work but they come in town only for pass and sometimes their relatives do not know that they are prostitutes. It is also important to notice that there are some of them who cannot meet their basic needs even if they live in their own houses. There are still some girls and women who exercise prostitution living in their own families. Most of times, their families do not know about this.

**3.1.3. Occupation of respondents**

Occupation of respondents has been mentioned with the intention to analyze the relationship between occupation (income) and prostitution as it is shown in the table below:

**Table 5: Identification of respondents by occupation**

<b>Profession</b>	<b>Frequency</b>	<b>Pourcentage</b>
Jobless	40	58.8
Housemaids	13	19.1
Restaurants	4	5.9
Bars	5	7.4
Little commerce	3	4.4
Studies	3	4.4
<b>TOTAL</b>	<b>68</b>	<b>100</b>

**Source: Primary data 2012**

It is noteworthy just that, according to the type of income activity, 58.8% of them have no other recognized employment; 19.1% are housemaids, 5.9% are employed in restaurants, 7.4% in bars; 4.4% are engaged in little trade and 4% are students. As we can observe on this table, most of respondents have no other recognized job which can occupy them during the day. Respondents informed that when it is day, they waste time walking in the town or staying at home. The nights, they prow on roads or the town searching for clients or choose to seat or stand in front of their houses (generally besides roads) waiting for clients (bateze indege).

During this research, it was revealed that there is a great number of housemaids who exercise prostitution when their employers are at work. Those girls do sex work during day but some of them jump over compounds during nights for this. Those who are employed in restaurants and bars are very exposed to prostitution because they are asked for sexual intercourses by a lot of clients. If they do not take protective measures, they fall easily in this practice. There are also some prostitutes who choose to search money by opening little commerce (selling tomatoes, avocados, vegetables, fruits, beer, tea, ...) to deceive public opinion about their own identity.

### **3.2. Causes and effects of prostitution in Muhanga Town**

Within this section we are going to present causes and effects of prostitution in Muhanga district.

### 3.2.1. Causes of prostitution

The causes of prostitution are numerous according to the results of our investigations:

**Table 6: Causes of prostitution**

Causes of prostitution	Frequency	Pourcentage
Poverty and despair	46	67.6
War and genocide	9	13.2
Family conflicts	8	11.8
Search for facility	5	7.4
<b>TOTAL</b>	<b>68</b>	<b>100</b>

**Source: Primary data 2012**

As we note throughout in above table, 67.6% of our target population were prostitutes by misery and despair due to unhappiness related to poverty that appear within families and lack of employment , 13.2% have been prostitutes because of war and genocide, 11.8% because of family conflicts and 7.4% because of the facility search.

#### Poverty and despair

The majority of our respondents claim to have been led so far by family poverty or destitution entirely caused by multiple reasons. Some argue that the family did not have sufficient resources to feed the children of the house, one of the informant declared: “Iwacu mu rugo turi abana icumi kandi papa nta bushobozi afite bwo kudutunga. Abavandimwe banjye birirwa bahingira baturage. Nabonye ibyo byose mpitamo kwiyizira kuyashakira mu bagabo” which can be translated “*At home we are ten children and my father doesn't have enough land to feed us all. My brothers would be used in the fields of Mayaga. Seeing that I could not get there I came to seek money through prostitution*” (our translation).

Other reasons that accompany poverty in promoting prostitution in Muhanga Sector are war and genocide and family problems.

## **War and Genocide**

Among our respondents, 13.2% said that they have lost their parents during the war and 1994 genocide perpetrated against Tutsi. Thus due to losing their parents who used to provide them with food, family control and care, some young girls decided to join prostitution.

This case concerns girls from families of two sides, genocide survivors and genocide perpetrators.

## **Family Problems**

For 11.8% of total surveyed prostitutes, the separation of parents, disagreements and incessant fights between their parents led some girls to flee the family home to seek asylum where they could not hear any noise. Some women were forced into prostitution after the divorce with their former spouses. A former prostitute of foreign origin reflects her life: “Naje mu buraya kuko nta kundi nari kubigenza uretse kwigurisha. Nagombaga kwita ku mfubyi nari nasigiwe n’umugabo wanjye kandi umuryango we ntacyo wifuzaga kumarira” which can be translated “*I joined immediately prostitution because I had no other alternative than being sex worker. I had to cater for the orphans since my husband’s family was not concerned about my well-being*” [our translation].

## **Search for facility**

Some girls or women involve themselves in prostitution because they find it the easy way to earn life. This category represents 7.4% of those surveyed. Respondents reported that many women are involved in their client after he had paid them to drink and that some use their bodies only to earn money.

### **3.2.2. Effects of prostitution**

These consequences are numerous and affect not only the prostitutes but also the society. We asked whether prostitutes or other informants: government, religious authorities and the population.

**Table 10: Effects of prostitution**

Consequences	Frequency	Pourcentage
Propagation of HIV/AIDS and STDs	34	50.0
Depravity of morals	9	13.2
Family life destruction	10	14.7
Insecurity	7	10.3
Uncertain future for prostitutes	8	11.8
<b>TOTAL</b>	<b>68</b>	<b>100</b>

**Source: Primary data 2012**

According to this table, 50% of respondents themselves reported that prostitution propagates HIV/AIDS and STDs; for 13.2% of respondents, prostitution contributes to depravity of morals; 14.7% of respondents mentioned family life destruction; for 10.3% of respondents, prostitution causes insecurity while 11.8% of respondents mentioned uncertain future for prostitutes.

### **Propagation of STD and AIDS**

The STDs enter the body through the unprotected sex. When we asked them if they were aware of the risks their work exposes them, the attitudes differ. Although they feel this threat, the conviction that prostitution is their only source of income and shelter against problems of everyday life, they do not give up.

What is worse is that many of them do not dare screening and determine their status. These are the confessions of a prostitute: “sinabasha kujya kwipimisha kuko naba niteshereza umutwe ubusa. Ibyo byagakwiye kubanza gukorwa n’abakiriya bacu ariko mbona nta n’ubwoba bibateye. Bavuga ko iyo bakoresheje agakingirizo bataryoherwa n’imibonano. Natwe rero tugaporofita tukabaca menshi n’ubwo tuba tuzi ko urupfu rurekereje kandi ko n’abakiriya bahandurira” which can be translated “*I cannot be tested because it would only be to discourage me. But even before we raise awareness about screening, should start by our customers aware of the benefits*

*of condom use as many of them have no worries. They say that if they used it, they do not taste their charm. And we make them pay more knowing that it is easy to catch your death without ignoring also that our client might be contaminated*“(our translation).

### **Depravity of morals**

Prostitutes reported that they care about anything. What matters to them is searching for money and thus, morality is not their business. Those who suffer the most are the children of prostitutes because their education may suffer as long as their parents do not have time to take care of them. In this respect, one of the prostitutes told us that it is important first to find them to eat before thinking about their education.

### **Insecurity**

Some criminals can seek refuge among prostitutes. They know very well that the other places are closely monitored by the police. Security is also threatening prostitutes in that way they are despised by the world in general.

During our research, prostitutes informed that they are often subject to all kinds of rape and complain anywhere. Their clients often take them as toys with which they must seek pleasure by all means. The prostitute so alienates her dignity as a human person, even losing it at a certain level by becoming a commodity like any other.

The very fact of being called prostitute shocks many of them. One of them told us: *“You know how it is shocking to hear everyone you pass by saying here a prostitute who goes there! It’s really horrible to be called prostitute*“(our translation). Their fate does not please them at all. According to their confidences, each of them would have a husband to her and a home. Contempt even comes to non-payment by the partners who leave without pay and even manage to beat them up to tear their clothes.

Non-use of condoms by their customers often causes unwanted pregnancies which make them available in sometimes. They also rounded up by the police who put them in prison. Thus even “feel outside normal society concerned in the sense that they are afraid to return home once they encounter serious difficulties in life in which they hoped to find only ease and freedom.”

### **Uncertain future for prostitutes**

Regarding the future of prostitutes, they know very well that it is totally uncertain. Their job does not allow saving, very concerned about STDs. But this is not the case for any prostitute who like this told us: *“AIDS and even those STDs do not frighten me! How a juicy girl like me can be reached by such diseases? I cannot even go and get tested because if I was HIV positive I should despair for nothing. Is there a person who will not die?”* (Our translation). In this regard, prostitutes say they have no fear of STDs when they still feel fit and do not wish to be tested for not despair unnecessarily. This fact risks of infecting many customers these unprotected sex and casualties increase. Costs for health care will also be on the rise because there will be more patients to treat and care.

### **Destruction of family life**

Married men who frequent prostitutes are most often heavy overspending to meet these new partners: gifts, rent or even buying houses for prostitutes, outlets in hotels and other entertainment venues to prove they love them. This greatly ruins the family savings. This creates misunderstandings among couples. This generally leads to divorce if not repented. A prostitute we met in a nightclub told us that sometimes clients pay her 5000RWF for only two passes in addition to other 5000RWF for the rental of the room.

### **Discussion**

The first objective of this research was to find out causes of prostitution in Muhanga Sector. Findings revealed that the primary factor that leads girls and women to prostitute themselves in that Sector is poverty (67.6%), supported by other factors like war and genocide (13.2%), family conflicts 11.8% and because of search of facility (7.4%).

Different researches (Fanny Busutil, 2011); (Donna M. Hughes, 2004); (Kwesi Atta Sakyi, 2013); (Marion Pajumets, 2014), proved that in many societies, poverty is the main cause of prostitution, this because prostitution and sex trafficking are based on a balance between the supply of available victims and the demand for victims to

provide the sex acts. Victims are recruited from marginalized, poor, and vulnerable populations. Women who are making a more or less free choice to be in prostitution do so out of immediate necessity – debt, unemployment, and poverty. They consider resorting to prostitution as a temporary means of making money, and assume as soon as a debt is paid or a certain sum of money is earned for poverty-stricken families, they will go home (Donna M. Hughes, 2004).

Still because of poverty, some parents sell their children to pimps because their low salary does not allow them to meet the needs of their family. Poverty also becomes a cause of abandonment. This rejection forces children to leave their family environment to become street children. Vulnerable and in need of money, they are the main targets of operators who promise them work and remuneration. In Kenya, for example, a sexual encounter with a young girl under the age of 16 can cost around twenty euros. But the price can reach sixty euros depending on the situation. Fanny Busuttil (2011).

*For Marion Pajumets (2004) as often this problem is connected to responsibilities towards other people, they may also prostitute in order to earn enough money to help pay school fees of their younger sibling back home, or to send remittances to their aged parents or help renovate the living quarters of their parents. To conclude on causes of prostitution, Kwesi Atta Sakyi,( 2013) observes that unemployment, poverty, illiteracy, peer pressure, greed, sexual pleasure and lack of high morals are the causes of prostitution anywhere in the world.*

On the other side, this research revealed that prostitution has different consequences including propagation of HIV/AIDS and STDs (50%); depravity of morals (13.2%); family life destruction (14.7%); uncertain future for prostitutes (11.8%) and insecurity (10.3%).

According to Donna M. Hughes and Claire M. Roche, (1999), Jacobson, Jodi L (1992), McKeganey N, Barnard M.(1992) the sex of prostitution is physically harmful to women in prostitution. STDs (including HIV/AIDS, chlamydia, gonorrhoea, herpes, human papilloma virus, and syphilis) are alarmingly high among women in prostitution.

As far as the issue of insecurity is concerned, health consequences to women from prostitution are the same injuries and infections suffered by women who are subjected to other forms of violence against women. The physical health consequences include: injury (bruises, broken bones, black eyes, concussions). The similar study conducted in Minneapolis/St.Paul in 1994 with 68 women who had been prostituted for at least six months found that half the women had been physically assaulted by their purchasers, and a third of these experienced purchaser assaults at least several times a year. 23% of those assaulted were beaten severely enough to have suffered broken bones. Two experienced violence so vicious that they were beaten into a coma. Furthermore, 90% of the women in this study had experienced violence in their personal relationships resulting in miscarriage, stabbing, loss of consciousness, and head injuries (Parriott, 1994).

## **Conclusion**

Through this research, it is well revealed that prostitution exists in Rwanda as well as elsewhere. In Muhanga town, findings showed that the important factor that leads young girls and women to prostitute themselves is poverty and despair (67.6%), without forgetting other factors like war and genocide (13.2%), family conflicts 11.8% and search of facility (7.4%). This study discovered that this old profession doesn't go alone. It is also important to notice that it has consequences such as propagation of HIV/AIDS and STDs (50%); depravity of morals (13.2%); family life destruction (14.7%); uncertain future for prostitutes (11.8%) and insecurity (10.3%) which requests a special attention to local government, NGOs and the community in general. Further researches are therefore recommended to find out what can be done to handle with this problem.

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## HOW TO PUBLISH IN RWANDA JOURNAL OF SOCIAL AND APPLIED SCIENCES:

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The title should be concise and informative. Choose as few words as possible to describe the contents of the paper adequately.

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List the authors on the title page by full names whenever possible. List authors' affiliations and addresses below each name, including the full postal address and country name.

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Please clearly indicate who will handle all stages of refereeing, publication, and post-publication, if that person is not the first author. Ensure that person's telephone and fax numbers (with country and area code) are provided, in addition to e-mail and complete postal addresses.

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Following the abstract, about 3 to 10 **key words** that will provide indexing references should be listed.

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Authors should use the solidus presentation (mg/ml). Standard abbreviations (such as ATP and DNA) need not be defined.

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**Materials and methods** should be complete enough to allow experiments to be reproduced. However, only truly new procedures should be described in detail; previously published procedures should be cited, and important modifications of published procedures should be mentioned briefly. Capitalize trade names and include the manufacturer's name and address. Subheadings should be used. Methods in general use need not be described in detail. The methodology employed in the work should be described in sufficient detail.

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This section should explore the significance of the results of the work, do not repeat them.

The **Acknowledgments** of people, grants, funds, etc should be brief. Place acknowledgments, including information on grants received, before the references in a separate section, and not as a footnote on the title page.

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**Reference to a book:**

Strunk Jr., W., White, E.B., 1979. *The Elements of Style*, third ed. Macmillan, New York, 384 pp.

**Reference to a chapter in an edited book:**

Schoorel, A.F.; van der Vossen, H.A.M. (2000). *Camellia sinensis* (L.) Kuntze. In van der Vossen, H.A.M. & Wessel, M. (eds), *Plant Resources of South-East Asia* No. 16. Stimulants. Backhuys Publishers, Leiden, the Netherlands. Pp.55-63.

**Reference to a thesis or dissertation:**

Amory, J.Y., 1996. Permian sedimentation and tectonics of southern Mongolia. M.S. thesis, Stanford University, 183 pp.

**Reference to a paper in a conference proceeding:**

Ishibuchi, H., Nozaki, K., Tanaka, H., 2001. Fuzzy data mining: effect of fuzzy discretization, in: Proc. 1st IEEE International Conference on Data Mining, San Jose, CA, 241-248.

**Reference for a paper in press:**

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