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Editorial

According to Dr Alfred Nuwagaba a Lecturer at Kigali Independent University ULK, the Higher Education Funding in Rwanda uses a costs sharing approach but it has faced the challenge of using financial means testing (FMT) to identify potential beneficiaries. Nevertheless, FMT might be unfair and in some cases financial assistance wasn't given to those that deserve due to some malfunction within the system what led to a failed higher education system and would hamper the economic development of the country with a negative impact on the quality of the graduates and the sector as a whole. The researcher suggests the government of Rwanda to look at policy change to make the costs sharing approach more appropriate for the sector that would involve streamlining systems like choice of beneficiaries, loans disbursements and corrections.

Food sustainability is an effective solution to food price pikes. Prof. Dr. Eng. Francis Dominicus NZABUHERAHEZA, a Senior Lecturer and Senior Researcher at Kigali Independent University ULK has carried out a study on the status of local edible plants prevalence and preservation in northern province, Rwanda. The researcher points out that edible plants could be promoted and economically transformed at industrial level in order to add value and create job in rural area for sustainable development of the region. The researcher also comes up with another solution for food security in his study "Entomophagy for Food Security: a Case of Edible *Ruspolia Nitidula*" read through and get to know how brown and green grasshoppers are edible insect as a huge source of nutrients for human diet for proteins (about 35.50 % and 35.60%) and for fats (about 15.50 % and 15.20 %) respectively.

As MUGISHO Ndabuli Théophile, a Lecturer at Kigali Independent University suggests that violence is widespread throughout the world and Rwanda is no exception. In 1994, it experienced the genocide as the outcome of a negative face of education hence the imperative need for peace education in Rwanda. To bridge the gap education can change positively people's mindsets as it propagates necessary skills and knowledge to a wide cross section of the population, uprooting the culture of violence and promoting that of peace.

We sincerely address our heartfelt thanks to the contributor-researchers and readers both internal and external for their collaboration.

Dr SEKIBIBI Ezechiel

Rector of Kigali Independent University ULK

**EVALUATION OF HIGHER EDUCATION COSTS SHARING
FUNDING MODEL IN RWANDA; CASE STUDY; HIGHER
EDUCATION STUDENTS LOANS DEPARTMENT
(HESLD-REB)**

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Abstract

Higher education funding in Rwanda uses a costs sharing approach. This has been analyzed to ascertain its suitability for Rwanda. It was found out in this research that costs sharing approach is a good model in Rwanda but it has faced the challenge of using financial means testing (FMT) to identify potential beneficiaries. There FMT is viewed by most respondents as unfair and that in some cases; financial assistance has not been given to those that deserve due to corruption in the system. It was also found out that a failed higher education system would impact on the economic development of the country and also if the higher education sector is underfunded, this will impact on the quality of the graduates and the sector as a whole. The government of Rwanda would need to look at policy change to make the costs sharing approach more appropriate for the sector and this would involve streamlining systems like choice of beneficiaries, loans disbursements and corrections. The government would need to open up and allow individual higher learning institutions to look for financial resources that will complement the financial commitments from government. The study carried out was a qualitative study.

Key words

Costs sharing, Financial means testing (FMT), Higher education funding model, and public private partnership (PPP).

1. INTRODUCTION

This chapter explains the aims of the research detailing the background of the study problem, the main research question analyzing current higher education funding model of cost sharing. This is an issue that the government of Rwanda is slowly phasing out of funding higher education and hence the above options have been proposed (MINEDUC, 2012). The evolution of the higher education system has been discussed stretching from 1994-2012. This includes the statistics on student enrolment and higher learning institutions. Statistics show that in 1994, there was only one University in the country, with a total student enrolment of 3,261 students, and this has grown overtime to 73,674 students for current year 2011/2012 spread in 31 higher learning institutions in Rwanda (MINEDUC, 2012). This chapter finally gives an explanation of the motivations to do this study that intends to analyze the Higher Education system in Rwanda since 2009 until present days.

This study scope is chosen because it is when higher education funding started reducing considerably and thus a need to find ways of generating funding for higher education in Rwanda. The Higher education budget in 2008 amounted to USD 42,737,627.42 and this reduced to 43.1 percent in 2009, and then increased by 60 percent in 2010, then reduced by 6 percent in 2011 and it went up by 9.5 percent in 2012 (MINICOFIN, 2012). The problem here is that the increment in funding in 2011 may not be considered realistic since student numbers have gone up to 73,674 as per table 1 below. The Higher education funding in Rwanda since 1963 to 1994 was fully done by the government of Rwanda, and at the time there was only one state university called National University of Rwanda. The country was only having a few students accessing higher education and this was not so much of a funding budget burden to the state. There was only 3,261 students in the

academic year 1994/1995 and this has since increased to 73,674 students in 2011/2012 (MINEDUC, 2012). This increment in student numbers justifies the need for increased student funding which has unfortunately been going down overtime (Semugaza, 2005 and MINEDUC, 2012). Higher education sector in Rwanda has since independence grown with a total of 31 higher learning institutions of which 17 are public owned and 14 are privately owned (NCHE, 2011). Funding of higher education in Rwanda has gone through a transformation from full government funding to costs sharing between government and the students, use of public private partnership arrangements, use of student loans from financial institutions, internally generated incomes by higher learning institutions and tuition fee charges (MINEDUC, 2012). The researcher has evaluated all these options in this study to ascertain their feasibility and sustainability and their effects on quality of service delivery at higher learning institutions in Rwanda.

2. LITERATURE REVIEW

This chapter offers a review of the numerous sources that supports or does not support the study topic as previous published work on higher education funding. The analysis of their findings is done and from that, study gaps are identified and these will shape and support the main research question and sub-research questions of this study. On completion of the literature review, it would be clear how the research study would help in dealing with the gaps that would have been identified. Higher education funding in Rwanda is a real challenge as the government ponders its withdrawer completely from funding recurrent budget of higher learning institutions, and provision of tuition fees and leaving allowances to students (HESLD, 2012). Rwanda is faced with a

challenge of its unit cost in that comparatively, both a private and public sponsored students may be doing the same course but paying different tuition fees. For instance for a science course, a private student would pay \$526 and a public sponsored student is paying \$2,192 and there has been questions surrounding such disparities. The government of Rwanda is beginning to think that, it would be cheaper if higher education is made private where students have to take financial responsibilities for their University studies. They could get financial help from government in form of loans, where the student would have to pay back to the government 100 percent of the loan plus an interest of 8 percent per annum (HESLD, 2012).

Loans recovery from students has not been good in Rwanda and this could be attributed to poverty levels and lack of employment for some students. Another theory could be that employers may not be deducting agreed loan repayments from salaries of loan beneficiaries from Higher Education Student Loans Department. The loans distributed by HESLD are USD 115,261,894 and the loans recovered are just about USD 1,754,385. This rate of loans recovery is so low and it could lead to costs sharing approach unattainable in the long run for the country since there will be no revolving funds to sustain it (HESLD, 2012). The researcher however feels that there is a contradiction on policy of achieving a robust higher education in the country and yet it is gradually having its resources allocation going down. It is a good policy to have free universal basic education in Rwanda, but this may not be good enough in developing its economy since the country will need to have them trained further in higher education institutions. The government of Rwanda ought to continue supporting higher education through the cost sharing approach introduced in 2008 as a way to achieve its vision 2020 of producing enough manpower for the economy (MINEDUC, 2011).

According to Hayman (2007), adequate higher education funding is vital for a country's economic growth, as poor funding for higher education would impact its potential for growth since it would have shortage of educated manpower. It is good to appreciate that having basic education is crucial as it raises literacy rates in a country. This allows for successful students to proceed to polytechnics to study practical courses that are vital for job creation and this is a step in the right direction. The government however does not have enough financial resources to cater for construction of good physical and social infrastructure for students learning.

Rwanda uses a cost sharing approach for funding its higher education. This approach apportions financial responsibilities to both the students and the government. This approach needs the corporation of provincial, district and other local leaders who help to determine potential beneficiaries of government assistance. Currently, HESLD (2012) asserts that there has been challenges since poor assessments are done by the local leaders. This leads to poor decisions being made in facilitation of students. This system could be improved with strengthening of the assessment mechanism for the potential beneficiaries. Teferra and Altbach (2004) argue that cost sharing is inevitable if the higher education funding is to be realistic, for instance in Tanzania, the policy provides for cost sharing between the government and the students, under this arrangement the government has to deal with financing direct costs of higher learning institutions and then costs in form of leaving allowances should be met by students with the help of their families. At the moment, HESLD (2012) estimates that disbursements are higher when compared to recovery as so far since the introduction of costs sharing in higher education funding in 2008, about RWF 65 billion has been disbursed and only about RWF1 billion has been recovered. This

puts question mark on the success of this students financing approach in Rwanda.

The education sector in Rwanda has a big budget vote from government; it should be at ministry of education level to allocate a big part of it to higher education provided there is good political will (MINEDUC, 2011). Political influence is deemed to have a role in funding of higher education. For instance, McLendon et al. (2009) talks about higher education funding in the US that tends to have a lot of support from politicians and if this is linked to the situation in Rwanda, for the country to transform its economy through producing quality graduates, there are needs of political support in allocation of state funding to the higher education sector and generally the study explores this assumption. The findings by McLendon et al. (2009) indicate that states in the US with powerful politicians lobby for good funding allocations to their states from the central government and the individual states themselves to ensure that a good percentage of their budget is allocated to higher education.

3. JUSTIFICATION OF THE STUDY

Reduction of budget ceilings for higher education subsector from 35,989,686,941 RWF in 2009/10 to 35,789,218,713 RWF in 2010/11 is already a manifestation of drop in funding (MINICOFIN, 2011). Reductions in funding have led to the scrapping off students' maintenance allowances and memoir fees have brought some challenges to higher learning institutions for instance students failing to do their memoirs on time, institutions failing to meet their financial obligations. Due to these challenges, the government of Rwanda has to find alternative ways to fund higher education and perform a costs and benefits analysis on them before they can be adopted by higher learning institutions.

4. STATEMENT OF THE PROBLEM

Government funding of higher education in Rwanda has been reducing by 25 percent every year, starting from financial year 2010/2011 (MINICOFIN, 2011). There seems to be challenges with costs sharing approach especially emanating from the use of financial means testing (FMT). The researcher has to analyze this approach as a higher education funding model in Rwanda.

5. OBJECTIVES

1. To analyze the current higher education funding model of costs sharing.
2. To assess the rating of costs sharing model by both students and the HESLD staff.
3. To analyze the link between a well functioning higher education system and its effect on economic development.

6. RESEARCH QUESTIONS

1. Is the government of Rwanda current and other higher education funding methods suitable for this sector?
2. Does the rating of costs sharing approach affect government policy on funding higher education in Rwanda?
3. Does reduced higher education funding affect the economic development of Rwanda?

7. RESEARCH METHODOLOGY

Research methodology is about designing ways systematically on how research questions can be solved or how the researcher intends to do his research. Alternatively, it could also be called the work plan; procedures to be followed by the researcher in conducting her research study (Rajasekar et al., 2006). It is crucial that the researcher understands and presents clearly the techniques to be used during the research study and how the collected data is to be analyzed so as to provide answers to the outlined research questions. Appropriate data must be collected using the right methods depending on the study method. This research has adopted a qualitative research method and data that has been used is both primary and secondary data. The qualitative approach was adopted because of its ability to help the researcher to form a holistic and narrative understanding of the problems associated with higher education funding models in Rwanda. This approach is quite appropriate when collecting data from population that require use of instruments like document reviews, observations and interviews employed in this research as supported by McMillan and Schumacher (1993).

Quite a number of secondary sources (MINEDUC higher education action plans, 2011 and MINICOFIN higher education budget estimates, 2010) have supported this study. The analysis of information from secondary sources has helped to supplement primary data collected from the field. The study outcomes are coming up with a research report that gives analysis about the current higher education funding model in Rwanda. The researcher has adopted a qualitative research study methodology because it allows working without specific boundaries and hence inclusion of new concepts, innovation in the study and ability to find reliable answers to the research question and it allows for realistic findings as argued by Toloie-Eshlaghy et al., (2011).

The study data sample of 45 respondents has been chosen purposively for HESLD staff and randomly for students such that, reliable information could be got from the respondents. This sample was divided into two subsamples. The first subsample focused on 15 employees from HESLD and the second subsample on 30 students that have benefited from HESLD financing for their higher education. It is argued by Marshal (1996) that small samples are appropriate for qualitative research studies and what should matter should be the quality of the chosen sample and the richness of the information obtained from them. Russell and Gregory (2003) also argue that small samples could be adopted in a qualitative study provided that the research questions can be fully answered and provocative issues could be generated and call for further research and again the researcher should have to exercise adequate judgment in identifying the study sample.

7.1. RESEARCH DESIGN

There are quite a number of instruments that have been used for qualitative research (Westbrook, 1994) they include use of surveys, observations, case studies and others like interviews. The researcher opted to use surveys and specifically using questionnaires and interviews to collected data. This approach was chosen because of its ability to facilitate use of interviews, questionnaires and this coupled with one to one conversations with the respondents allowed for good research findings on the analysis of collected data. Westbrook (1994) argues that using qualitative research methodology allows for structured and unstructured interviews and this helps the researcher to get required information for the study easily from the respondents and during data analysis. It was possible to make replicable and valid inferences obtained from the data to its context during this research study.

7.2. DATA COLLECTION INSTRUMENTS AND DESIGN

Data for this study was collected from both primary and secondary sources. As regards secondary sources, the research reviewed budget documents from HESLD, disbursements and loans recovery documents, and Rwanda higher education policy documents (MINEDUC, 2011). This was done through observation by reading and analyzing the contents therein those documents. Primary data for this study was collected from HESLD using questionnaires and group interviews.

7.3. QUESTIONNAIRES AND THEIR DESIGN

The design of the questionnaires for this study was composed of both open and closed ended questions. The questionnaire design was based on literature from secondary sources of information especially from ministries of education and finance published documents (MINEDUC, 2012 and MINICOFIN, 2012). The information that was particularly useful was that on higher education financing and the models used. The closed ended questions took the form of multiple choice questions based on the likert scale of 1-5. This likert scale helped to understand the feelings, attitudes and opinions of the respondents on the subject matter (Brown, 2000).

7.4. INTERVIEWS AND THEIR DESIGN

The targeted study population at HESLD was its two departments of loans disbursement and recovery. HESLD has only two departments. They were all considered for this study. This was because the loans disbursement department is responsible identifying and for giving out the funds to the student beneficiaries

and the loans recovery department is responsible for collection of the loans disbursed to students during their study.

7.5. OBSERVATION AND DESIGN

This instrument was used by the researcher to observe higher education financing trends, which has been turbulent under the 2009-2011 period considered for this study. It was done through documentary reviews from the ministries of education, finance and economic planning. There was no particular design for this research instrument.

7.6. PILOT STUDY

Pilot study helps the researcher to refine the research instruments especially the questionnaire and this helps the researcher to have increased chance of finding reliable data for the study problem (Woken, n.d). A pilot study was done to help the researcher in refining the research questions on the questionnaires with the respondents through phone conversations with the director of HESLD and one on one meeting with two departments at higher education student's loan department head offices. This pilot study was aimed at scheduling the study survey as a collaborative approach and this helped boost up the response rate. Through the pilot study, the ten selected respondents from the two departments of loans disbursement and recovery found the questions in the questionnaires to be appropriate and they were all adopted and acceptable for the study.

7.7 DATA ANALYSIS

As regards the analysis of collected data, this has been done using Excel and Ms Word as they have features well enough for analyzing the collected data and more so it is easy to come up with information that can be graphically presented for illustration

purpose and understanding of the end users of the project report. The process involved editing the raw data to remove errors and ambiguities, the data has been classified into groups depending on the questions asked and answers obtained, and tabulation of data has been done to help explain the findings from the research. Since this is a qualitative study, there has been a content analysis of the information obtained from the survey as codes were assigned to different questions and responses from the survey based on the themes and from this, a study analysis is made to make some recommendations on the study findings. The data collected from the survey using questionnaires, group interviews has also been analyzed using SPSS to find frequencies. This helped to explain the findings logically.

7.8. VALIDITY AND RELIABILITY OF RESEARCH RESULTS

The study questions were fully answered since the survey method, which employed use of questionnaires, group interviews, and observation used to collect data was reliable. Johnston (1997) argues that as long as the study findings can be generalized to different circumstances and wider groups, this becomes a good test for the validity of study findings. The findings from this study can be generalized to different wider groups and the trustworthiness of the source of information increases the validity of the study results. Triangulation is also a vital test on reliability of study findings (Mathison, 1998) as different methods are used in collecting data and analyzing it. The researcher has used questionnaires, interviews, observation and review of past literature about higher education in Rwanda as the use of such various techniques increases reliability of the study findings.

The questionnaires, interviews, and observations were done appropriately by the researcher to ensure research was well done. The study gaps identified in the literature that shaped the research questions for this study have to be narrowed since

the findings from this study have come up with some answers and the way forward. Patton (2001) argues that reliability and validity of a study are paramount as the audience needs to be convinced of the research findings and the argument here is that the researcher has to trust his sources of information for the qualitative study. The source of information for this study is trusted and hence the results are reliable. There cannot be reliability if the information is not valid; there is some argument that validity of information in qualitative research is not crucial (Creswell & Miller, 2000). However, there needs to be some ways on how research findings should be measured and checked out for its correctness depending on the rigor that was involved in the study. This qualitative study approach involved rigor, quality procedures that ensures the findings are valid and reliable and can be depended on for further research in the area.

8. RESULTS AND DISCUSSION

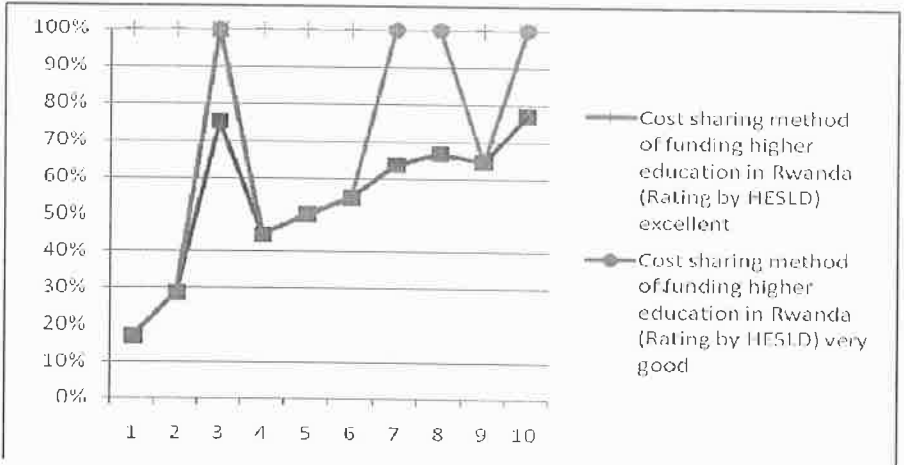
This chapter gives details about the research findings from this study. The study is about the evaluation of the current HE financing model in Rwanda. It is vital to have a good higher education system in Rwanda if the country is to achieve economic development that is sustainable (MINEDUC, 2011). Rwanda aspires to achieve an educated middle class of entrepreneurs who are knowledgeable and equipped with business skills needed for making investments in the country as laid down by MINICOFIN (2012).

8.1 COST SHARING HIGHER EDUCATION FUNDING MODEL IN RWANDA

This is the current higher education funding model used in Rwanda HESLD (2012). This method is viewed by respondents as one where the parent and the state both make financial contribution for a student pursuing her/his studies at Rwandan higher learning institutions. Findings from the study showed that Rwanda uses a costs sharing approach to fund its higher education system since 2008. From the 67 percent response rate, 60 percent of them rated it as excellent, 20 as a very good system, 10 percent rated it as good and 10 percent also rated it as poor. No respondent rated as fair as per figure 1 below. This means that, whereas it may be a good funding policy, its method of implementation is not good. It may also seem to suggest that, the model receives different support from the respondents and one would think that the respondents were rating it on how fair or unfair it is as a policy instead of just giving it weight based on Likert scale rating. The majority rated it as excellent giving reasons like; it is a government policy and therefore, it should be adopted and thus make a parent and state both responsible for funding higher education in the country. This finding compares well with those of Adeniyi and Taiwo (2011) on costs sharing in Nigeria where this method has been used for quite a long time. Whereas the findings from the rating of current higher education model by respondents showed excellent support, there is a need to look at affordability by parents and students. This approach could be excellent for countries that have attained some good level of economic development and parents have enough savings, which they can use to support their children at higher learning institutions in Rwanda. The FMT approach used in selecting beneficiaries of funding support from government should be reviewed and strengthened to ensure support goes to those that

deserve it. This may also help to close the gap between the rich and the poor and in the long run, this may bring about balanced regional economic development. As regards the FMT, the government could think of employing a neutral private firm that could do the assessment of all applicants for financial support from the government, one would think that this is fairer than just using politicians at districts who may not do well in this regard.

FIGURE 1. GRAPHICAL ILLUSTRATION OF RESPONSES FROM HESLD



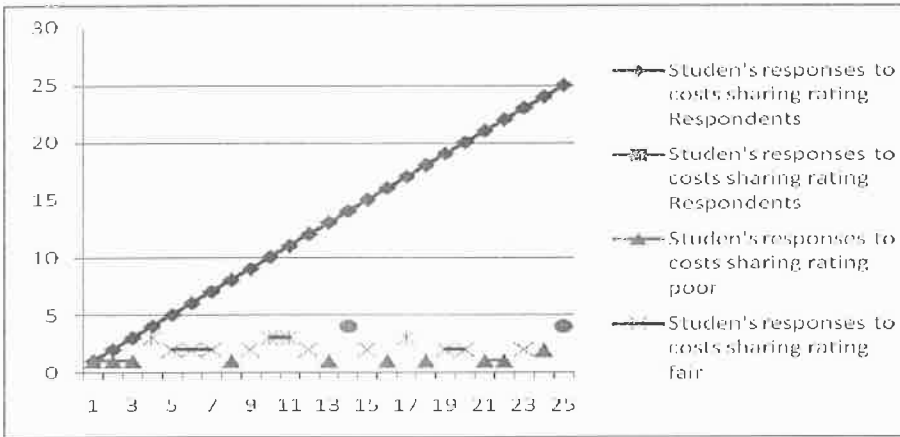
Source: Author.

8.2. RATING OF COSTS SHARING MODEL OF FUNDING HIGHER EDUCATION IN RWANDA BY STUDENTS

The student respondents almost gave the opposite rating of the current higher education funding model of costs sharing whereby, 83 percent response rate was received from student respondents to the questionnaire, 40 percent respondents rated it as poor, 36 percent gave it a fair rating, 16 percent rated it as good, and 8 percent rated it as very good as shown in figure 2

below. The arguments advanced by students for this poor rating is attributed to unfairness in the evaluation process which uses the FMT (financial means testing). This makes some eligible students to miss out due miss evaluation by some corrupt government officials. The students in their responses are not sure whether or not the errors in the evaluation process are innocent or intentional. The other reason for not giving costs sharing a good rating is that people in Rwanda are poor and they may not be able to meet their financial obligations or contribution to their higher education funding since they may not be employed as this makes the situation economically worse (MINEDUC, 2011 and MINICOFIN, 2011).

FIGURER 2: GRAPHICAL REPRESENTATION OF STUDENT RESPONSES



Source: Author

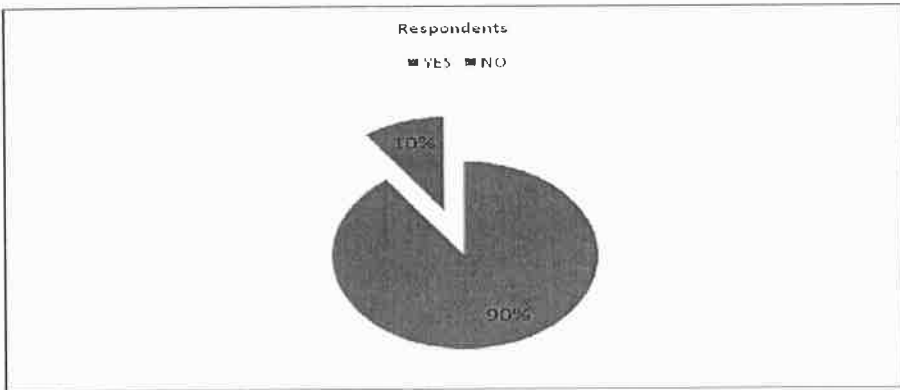
When one looks at a similar study in Tanzania by Teferra and Altbach (2004), it was argued that costs sharing can only be possible if the parents are economically empowered and this compares appropriately with situation in Rwanda where this

policy might not receive a lot of support from students since they are fully aware on their poor economic positions, which makes them run to seek for government support on their study leaving allowances and memoir fees.

8.3. SUPPORT FOR COST SHARING RESEARCH FINDINGS

Respondents were asked in the questionnaire on whether or not they support the current cost sharing model of funding higher education in Rwanda. The responses from HESLD staff showed this pattern; 90 percent respondents answered NO, and 10 percent answered YES as shown in figure 3 below. The reasons advanced for NO is that Rwandan students are not able to financially support their studies, and that students should instead get full tuition and leaving expenses loans which they can pay when they get employment on completion of their studies. The YES response came with a reason that a student must somehow also take some financial responsibility as this would make them more serious and responsible student with their studies. The entire 25 or 100 percent student respondents do not support costs sharing and the argument advanced by students is that it expensive on them and it is not fair as indicated in figure 2 above. They feel the government should take full responsibility for funding higher education in the country as a way providing a social service to its citizens.

FIGURE 3: GRAPHICAL REPRESENTATION OF STUDENT SUPPORT LEVEL OF COSTS SHARING



Source: Author

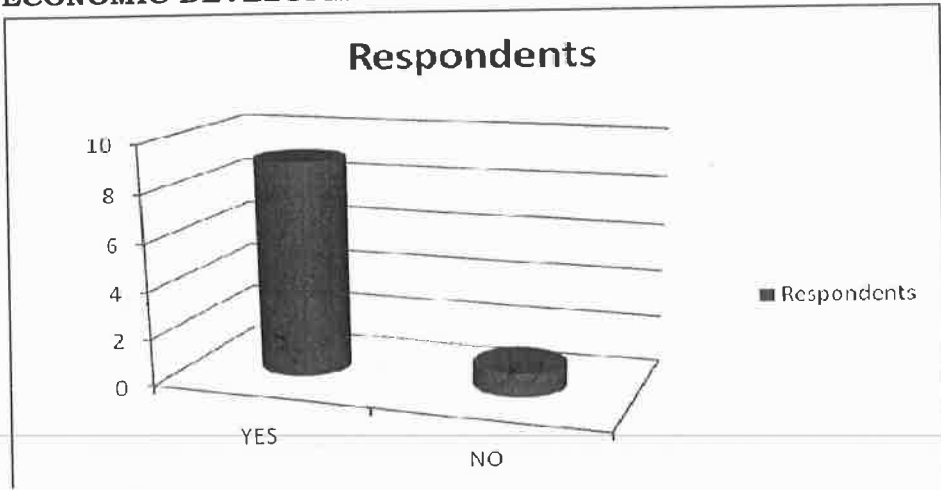
However when one looks at these responses, it keeps one wondering whether or not the policy on higher education funding adopted by government is fair to its beneficiaries and according to MINEDUC (2012) costs sharing is the way to go and it is the policy that was eventually adopted by government in 2008, but it has come with challenges especially with application of FMT and high poverty levels in the country. The major issue with student respondents is that the country is poor and does not adequately make students and parents able to meet their contribution for students to be able to attain their higher education degrees. Barr (2004) argues that it is crucial for students and parents to contribute to their higher education financing as nothing comes cheap in this sector. Students should not hide under the veil of arguing that it is expensive. In any case, it is the state that pays all the funds and the student pays only upon getting employment and really it is a small percentage that is deducted from the salary of the beneficiary and this is done for a reasonable period time that will not financially hurt them (HESLD, 2012).

8.4. HIGHER EDUCATION FUNDING AND ECONOMIC DEVELOPMENT OF RWANDA

8.4.1. HESLD RESPONSES

The study findings from questionnaires reveal that 90 percent of respondents agree that once you reduce higher education funding, this will have an impact on the economic development of the country. Those that do not agree are 10 percent respondents and their argument is that, they do not understand how higher education funding is linked to economic development as indicated in figure 4 below. Those that agree that economic development can be hampered by a poorly funded higher education have advanced these reasons. The country will lack well educated workforce to help build the country. Also, the earning capacity of poorly educated workforce may not be good and this will deny the economy some taxes essential for her development. For a country to develop, it should have a well functioning higher education sector according to Ranger (2004). It is an educated workforce that help to drive an economy, therefore, Rwanda has to provide funding for this sub sector such that, it will be able to have required manpower in all the key and no key areas in an economy.

FIGURE 4: HESLD RESPONSES ON HE FUNDING AND ECONOMIC DEVELOPMENT OF RWANDA



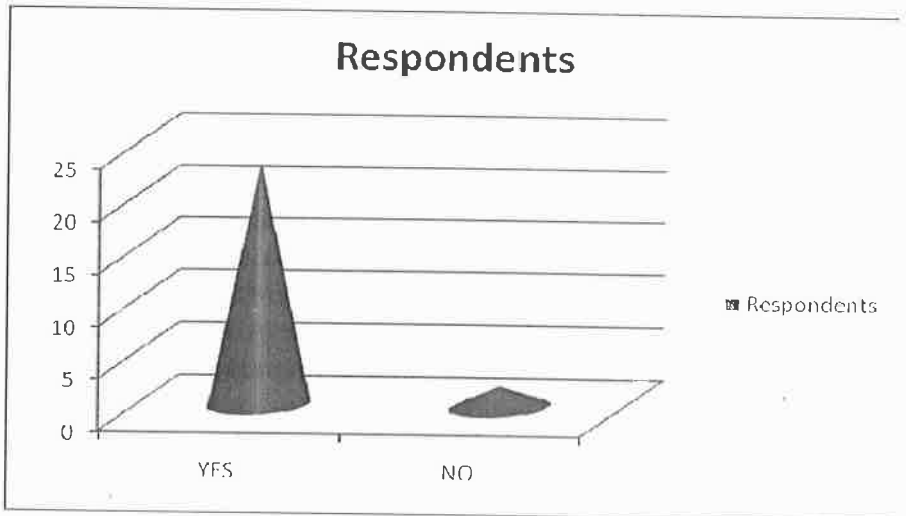
Source: Author

8.5. STUDENT RESPONSES ON HE FUNDING AND ECONOMIC DEVELOPMENT OF RWANDA

The analysis of the information and data obtained from students shows that 92 percent of respondents believe that a good education in an economy is paramount for its economic development and 8 percent think that there is no relationship between them as indicated in figure 5 below. The emphasis of the government should be to provide quality of education to produce quality graduates that will work in service and non service sectors of Rwanda and this is what will enhance development as was argued by Ssempebwa (2011) that higher learning institutions should strive to produce well qualified graduates and this may not be achieved with inadequate funding of the sub sector.

Costs sharing higher education financing model in Rwanda lacks the support of the majority of students and other stakeholders. The government could explore the option of funding its higher education using public private partnership (PPP) and internally generated resources by individual institution. The government of Rwanda should not use student bank loans to fund higher education in Rwanda because it lacks enough support. It is clear from this research that social economic transformation of the country depends on the vibrant its higher education sector. Given the flows in the current higher education funding model of costs sharing in Rwanda especially stemming from FMT and the associated high poverty level, this method has become inappropriate and the government should consider adoption of PPP and encourage HLLs to generate its financial resources.

FIGURE 5: STUDENT RESPONSES ON HE FUNDING AND ECONOMIC DEVELOPMENT OF RWANDA



Source: Author

8.6. RECOMMENDATION AND SUGGESTIONS

This study has analyzed the costs sharing approach of funding higher education in Rwanda. This is the current funding model used in Rwanda since its adoption in 2008 (HESLD, 2012). The current higher education funding model of costs sharing should be maintained since it is clear from the findings that once the FMT is done right and fairly, then the model is excellent. This model has worked well in Uganda and Tanzania and with the right approach, it would work also well for Rwanda since one would also argue that all these countries almost have the same economic realities as also argued and supported by Teferra and Altbach (2004).

Higher learning institutions should be allowed to charge tuition fees to students and the policy on this should be very clear Adeniyi and Taiwo (2011). The point should be that such fees should be regulated by the responsible government such that they are affordable by parents and students. Government higher learning institutions in Rwanda charge tuition fees to privately sponsored students. This has proven a success in generating funds, which they use to fund university activities (MINEDUC, 2011).

1.7 CONCLUSIONS

The study was about analyzing the current (costs sharing) higher education funding model in Rwanda so as to understand its suitability for the country. This kind of analysis would influence a policy change on how the government of Rwanda can best use the suited models to fund its higher education sector. Rwanda stands a high chance to attain economic development if it develops and adequately funds the Higher education sector. Higher education funding methods in Rwanda have been changing since 1963 when funding was solely the responsibility of the state and currently

the model used by the government of Rwanda is based on the costs sharing method (MINEDUC, 2012). There is also need to understand why the cost sharing has met a lot of challenges in Rwanda.

8.8. SCOPE FOR FURTHER RESEARCH

The FMT testing appraisal method should be studied further to ascertain on how best it can be done. This is a precursor to success of costs sharing model of funding higher education in Rwanda.

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STATUS OF LOCAL EDIBLE PLANTS PREVALENCE AND PRESERVATION IN NORTHERN PROVINCE OF RWANDA: A CASE STUDY OF FOOD SUSTAINABILITY AT MUSANZE LOCAL MARKET

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ABSTRACT

The main objective of this study was to carry out a survey on the status of local edible plants predominance and preservation and establish ipso facto the processing methods used for food security assurance in Musanze District of the Northern Province of Rwanda. In order to know the status of relative frequency, level of utilization and processing of indigenous consumable plants in Musanze Region of Rwanda, a baseline survey was carried out using a participatory method of data collection. Twenty Respondents of Musanze local market named the freshly consumed plants as indigenous as well as exotic origins that were locally harvested, sold at local market and used for food security and sustainable development in their households.

The food types generally fell into five broad categories, namely; vegetables, fruits, roots/tubers, pulses and cereals. Irish potatoes, beans, maize, sweet potatoes, cassava, taro, cabbage, carrots, peppers, cauliflowers, tomatoes, carrots, tree-tomatoes, passion-fruits or *Passiflora edulis*/maracouja, papaya, pumpkins, amaranths, avocado, gooseberries, sorghum, wheat, finger millet,, soybeans, peanuts were the most commonly used edible food plants found at Musanze Market. Edible plants foods processing is limited to traditional methods and only a few fresh edible plants are processed and preserved by small scale processing industries.

The results of the study showed that among vegetables sold at Musanze market, cabbage and cauliflower are predominant, legumes like beans and peas are highly available, cereals such as maize/corn and rice are more sold, fruits like tomatoes, bananas and passion fruits are most prevalent while edible roots and tubers like Irish potatoes, carrots, and sweet potatoes were found most frequent.

It can be concluded that a post-harvest technology is needed for better preservation of the fresh edible plants. Thus, edible plants could be promoted and economically transformed at industrial level in order to add value and create job in rural area for sustainable development of the region.

Key words: Cereals, edible plants, fruits, legumes, roots, tubers, and vegetables.

1. INTRODUCTION

Edible vegetable like cabbage and cauliflowers widely cultivated are good source of beta-carotene, vitamin C, lactose and fibers for human health improvement (Redenbaugh, *et al.*, 1992). Cabbage is prepared in many ways such as salads, pickling and mixing with beans for eating (Delahaut and Newenhouse, 1997).

Pulses or kidney beans are known edible legume considered as source of plant proteins. These leguminous crops are harvested for their dry grains and green leaves for human and animal consumption. Some pulses seeds are used as oleaginous crops mainly for oil extraction (e.g. soybeans and peanuts oils), as well as those used exclusively for sowing purposes (such as clover and alfalfa). Leguminous crops (beans and peas) harvested green for food, such as snap peas, snow peas, and fresh green beans. All these fresh green pods are classified as vegetable crops (Kaplan, 2008).

Beans are one of the longest-cultivated plants. Most of the kinds commonly eaten fresh or dried, those of the genus *Phaseolus* widely cultivated in Rwanda. Common beans species (more than 40.000 new varieties worldwide produced for regular consumption as source of proteins and energy) are mainly hybrids of *Phaseolus vulgaris*, *Phaseolus lunatus*, *Phaseolus acutifolius*, *Phaseolus coccineus* and *Phaseolus polyanthus* grown in different countries of the World (Strube and OveDragsted, 1999).

Soybeans oil and proteins content account for about 60% of dry soybeans by weight (protein at 40% and oil at 20%). The remainder consists of 35% carbohydrate and about 5% ash. Soybean cultivars comprise approximately 8% seed coat or hull, 90% cotyledons and 2% hypocotyl axis or germ. Most soy protein is a relatively heat-stable storage protein. This heat stability

enables soy food products requiring high temperature cooking, such as tofu, soy milk and textured vegetable protein (soy flour) to be made (Uwaegbute and Obatolu, 1998).

The principal soluble carbohydrates of mature soybeans are the disaccharide sucrose (range 2.5–8.2%), the trisaccharide raffinose (0.1–1.0%) composed of one sucrose molecule connected to one molecule of galactose, and the tetrasaccharide stachyose (1.4 to 4.1%) composed of one sucrose connected to two molecules of galactose. While the oligosaccharides raffinose and stachyose protect the viability of the soybean seed from desiccation (see above section on physical characteristics) they are not digestible sugars, so contribute to flatulence and abdominal discomfort in humans and other monogastric animals, comparable to the disaccharide trehalose. Undigested oligosaccharides are broken down in the intestine by native microbes, producing gases such as carbon dioxide, hydrogen, and methane (Watson, and Andrew, 1983).

Since soluble soy carbohydrates are found in the whey and are broken down during fermentation, soy concentrate, soy protein isolates, tofu, soy sauce, and sprouted soybeans are without flatus activity. On the other hand, there may be some beneficial effects to ingesting oligosaccharides such as raffinose and stachyose, namely, encouraging indigenous bifidobacteria in the colon against putrefactive bacteria. Raw soybeans, including the immature green form, are toxic to humans, swine, chickens, and in fact, all monogastric animals (Strube and OveDragsted, 1999).

The peanut (*Arachis hypogaea*) is a major food crop species of regional importance; some of the other species are cultivated for food to a small extent in Africa. Other species such as *A. pinto* are cultivated worldwide as forage and soil conditioner plants, with the leaves providing high-protein feed for grazing livestock

and a nitrogen source in agroforestry and permaculture systems (Watson, and Andrew, 1983).

Maize spread to the rest of the world because of its ability to grow in diverse climates. Sugar-rich varieties called sweet corn are usually grown for human consumption, while field corn varieties are used for animal feed and as chemical feedstocks. Maize is the most widely grown grain crop in the Africa (Gundlach, *et al.*, 2009).

Maize meal is made into a thick porridge in many cultures: from the polenta of Italy, the *angu* of Brazil, the *mămăligă* of Romania, to cornmeal mush in the U.S. (and hominy grits in the South) or the food called mealie pap in South Africa and *sadza*, *nshima* and *ugali* in other parts of Africa. Maize meal is also used, as a replacement for wheat flour, to make cornbread and other baked products. Masa (cornmeal treated with limewater) is the main ingredient for tortillas, atole and many other dishes of Central American food (FAO, 1988).

Some species of sorghum can contain levels of hydrogen cyanide, hordenine and nitrates lethal to grazing animals in the early stages of the plant's growth. When stressed by drought or heat, plants can also contain toxic levels of cyanide and/or nitrates at later stages in growth (Gundlach, *et al.*, 2009).

Wheat is planted to a limited extent as a forage crop for livestock, and its straw can be used as a construction material for roofing thatch. The whole grain can be milled to leave just the endosperm for white flour. The by-products of this are bran and germ. The whole grain is a concentrated source of vitamins, minerals, and protein, while the refined grain is mostly starch (<http://w.w.w.books.google.com/books>, retrieved on 28th December 2012).

Roots and tubers such as yam are living organisms. When stored, they continue to respire. The respiration process results in the oxidation of the starch (a polymer of glucose) contained in the cells of the tuber, which converts it into water, carbon dioxide and heat energy. During this transformation of the starch the dry matter of the tuber is reduced (Oboh and Oladunmoye, 2007).

In spite of the fact that indigenous/traditional edible food plants have always ensured food security at the household level, the process of collecting them from the lands, their production, consumption and postharvest technology are now at embryonic state. This gap can be attributed to limited available knowledge in applied sciences and postharvest technology of the local population for assuring food security and sustainable development. Note that the majority of farmers are only interested in the cultivation and commercialization of fresh crops from which they can generate income, and because no one has cultivated indigenous food plants with the intention of adding value and preservation for any disaster prevention. Although the archaic or antiquated methods of utilization, especially food preparation, varied from one household to another, boiling, steaming and frying were very common and cross-cutting almost all the households. The principal mode of food preservation cited by households, especially for seeds, was sun drying, roasting, salting and crushing. Thus it is time for transferring the biotechnology applied to agro-food industry and post-harvest technology disseminating among local farmers and cooperatives for food security assurance and regional sustainable development (<http://www.fao.org/es/faodef/faodefe.htm>, retrieved on 27th December 1994). In general, edible domesticated legumes, cereals, roots, tubers, vegetables and fruits are used in a wide variety of foods processing and even preservation at industrial level. This study will help stakeholders of applied sciences to target the areas of entrepreneurship and investment for sustainable development of the region.

2. MAIN OBJECTIVE

The main objective was to evaluate the status of predominance/relative frequency and preservation of edible plants in the region of Musanze District located in the Northern Province of Rwanda.

3. METHODOLOGY

Concerning study area, the survey on the predominance and preservation of edible plants was carried out in the beginning of the year 2013 in the Musanze District of the Northern Province of Rwanda.

Data were collected from randomly chosen 20 farmers and retailers of the foresaid district who were dealing with edible plants production and retailing at local Musanze market. In this case, Semi-structured questionnaires were administered in the local language (Kinyarwanda) in order to acquire the sought knowledge on the following on the predominance and processing status of edible plants in the region of Musanze.

The main indigenous/traditional and exotic comestible plants were centered on available sold comestible plants such as legumes or pulses, cereals, roots and tubers, vegetables and fruits seasonally harvested and found at Musanze local Market. The techniques of preparation and preservation were also considered and the results from our investigations were processed and hereby presented using *Excel software* for prevalence determination in percent.

4. RESULTS PRESENTATION, INTERPRETATION AND DISCUSSION

4.1. Results Presentation and Interpretation

After a survey conducted among farmers in the beginning of January 2013, the predominance of different edible plants found in the town of Ruhengeri was determined. The repertory of leaf vegetables widely sold at Musanze market is given in the following Table 1:

Table 1: Main Vegetable Edible plants sold at Musanze “Foods” Market

S/N	Vernacular Name	French Name	English Name	Predominance in %
1	Amashu	Choux	Cabbage	40
2	Shufuleri	Choux-fleurs	Cauliflower	14
3	Dodo na Epinari	Amaranthes/ Epinards	Amaranthus	10
4	Isombe	Feuilles de manioc	Cassava leaves	8
5	Ibitunguru	Oignons	Onion	8
6	Tungurusumu	Aile	Garlic	6
7	Puwavuro n’Urusenda	Poivrons et piment	Capsicum spp.	4
8	Timu	Thym	Thym	4
9	Celeri	Celeries	Celeries	4
10	Ibisusa	Feuilles de courge	Pumpkin leaves	2

Considering the frequency/predominance of above edible vegetables, it would be better to presented them in the following

Figure no 1:

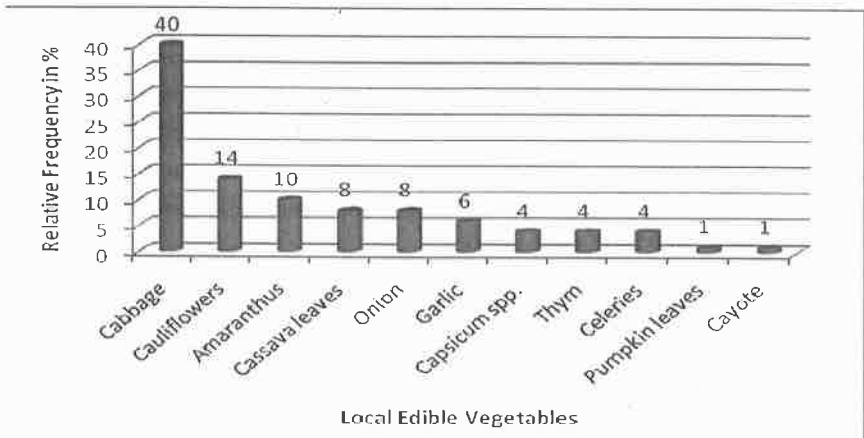


Figure 1: Predominance of Local Edible Vegetables in Musanze District (in January 2013)

This figure 1 shows the high predominance/high relative frequency of cabbage at about 40% of leaf vegetables found in Musanze District of the Northern Province of Rwanda. This region is fertile and prosperous with volcanic soil, use of NPK and DAP (chemical fertilisers), application of organic fertiliser (animal dung mixed with compost) and frequent rain season found near national park of volcanoes. Green, white and red cabbages and cauliflowers should be processed for better preservation, long shelf-life and food security assurance in Rwanda. All these above 10 leaf vegetables (see the repertory of the Figure 1) have de facto different vitamins and minerals and even fiber for better persitalitism of the intestinal tractus. So, cabbage is especially a good source of beta-carotene, vitamin C and fiber. It is a cruciferous vegetable, and once fermented as sauerkraut containing lactic acid bacteria

(called probiotics in applied biotechnology to vegetable foods), it is then known to reduce the risk of some cancers, especially those in the colorectal group. This is possibly due to the glucosinolates found in cole crops belonging to *Brassicaceae* family, which serve as metabolic detoxicants, or due to the sulphoraphane content, also responsible for metabolic anti-carcinogenic activities. Purple cabbage also contains anthocyanins, which in other vegetables have been proven to have anti-carcinogenic properties. Along with other cole crops, cabbage is a source of indole-3-carbinol, a chemical that boosts DNA repair in cells and appears to block the growth of cancer cells. Research suggests that boiling these vegetables reduces their anti-carcinogenic properties (<http://www.plantea.com/carrots.htm>, retrieved on 26th December 2012).

It would be better to add value to these fresh leaf vegetables for better conservation and hunger reduction among Rwandan people. The region of Musanze has different predominant edible legumes considered as source of plant proteins and vegetable oils (see Figure 2):

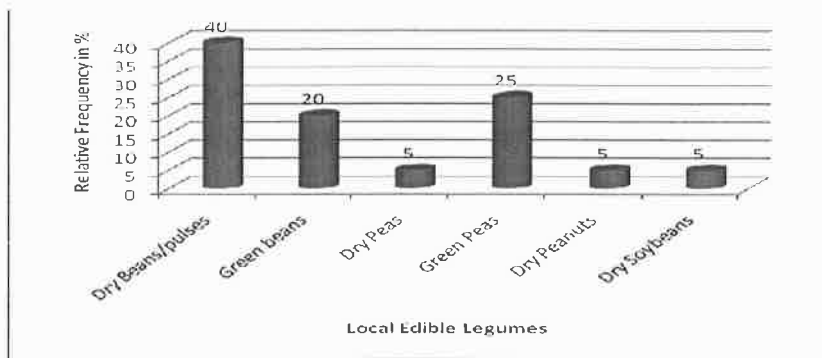


Figure 2: Predominance of Edible Legumes sold at local Market of Musanze in January 2013

This Figure 2 indicates the predominance or relative frequency of beans as *Phaseolus vulgaris* (*Fabaceae*) at 40% of legumes widely sold in the region of Musanze District. Beans are used as seeds and vegetables (umushogoro) for human and animal feeding. Beans and peas are a good source of proteins and minerals. The preservation of green/fresh (ibitonore, imiteja n'urunyogwe) and dry beans and peas (*Pisum sativum* belonging also to *Fabaceae* Family) started at INES-Ruhengeri as post-harvest technology assay for adding value and enhancing the shelf-life in order to fight against hunger and malnutrition among local people.

Soybeans (*Glycine max* as *Fabaceae* rich in free cholesterol vegetable oil: about 20% should be promoted in our Country), peanuts, lentils, and fava beans are coming from other districts of Rwanda. Nutritious flours as rich source of plant proteins, vegetable oils, fermented cheese called tofu and condensed fats named peanuts butter can be obtained from soybeans and peanuts (*Arachis hypogaea* also *Fabaceae*) for health benefits and income generation and poverty reduction in the region. Besides these common legumes, Musanze District has also different edible cereals found at local market, which are presented in Figure 3:

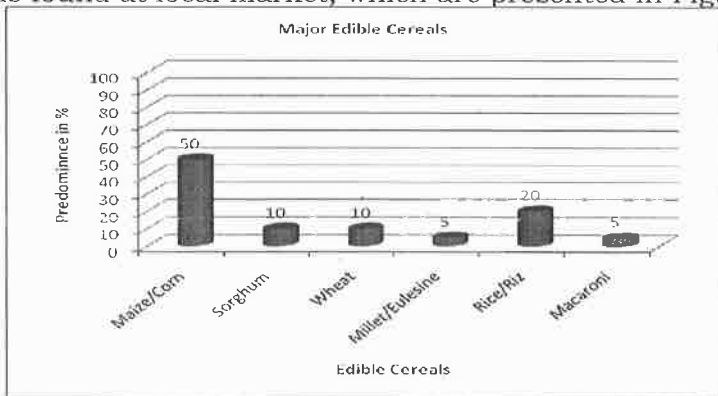
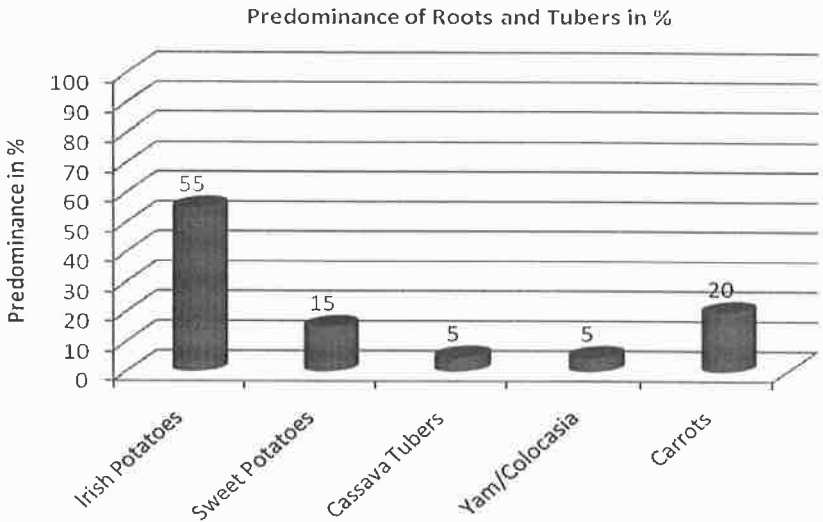


Figure 3: Major Edible Cereals Found at Musanze Market in January 2013

The Figure 3 shows that Zea mays belonging to Poaceae Family are widely cultivated and sold at Musanze Market. Now farmers state to intensify also the indigenous sorghum as source of traditional beer called Ikgigage known as source of vitamins B-complex and minerals needed for human health improvement and warm traditional wedding ceremonies. The modern processing of beer from sorghum and maize is at embryonic state, only local brewery known as BRALIRWA tried to use white sorghum in lager beer production in Gisenyi industry of Rubavu District of Rwanda. Once de facto promoted, the local wheat (*Triticum spp.* as *Poaceae*) and indigenous millet (*Eulesine coracana* or African finger millet belonging also to *Poaceae* Family) will be also used in beer processing for food security and health benefits of our population. All these above germinated cereals are a good source of malt/maltose, vitamins B-complex, and minerals for human health improvement and income generation (Barceloux, 2009).

Other sources of starch and minerals are roots and tubers widely sold in the region of Musanze District. These roots and tubers are Irish potatoes (*Solanum tuberosum* as *Solanaceae*), sweet potatoes (*Ipomea batatas* belonging to *Convolvulaceae* Family), cassava or yuca/manioc (*Manihot esculenta* as *Euphorbiaceae*), yam/igname or ibikoro (*Dioscora spp.* belonging to *Dioscoraceae* family), taro/amateke (*Colocasia esculenta* as *Araceae*), and carrots (*Daucus carota* belonging to *Apiaceae* family) are known to be a best source of starch or fermented flour for dough making in the District of Musanze (see figure 4). The cooked dough is accompanied with meat sauce or fishes for malnutrition combating in several households of Rwanda. The modern conservation methods are at infancy state up to date. Bread trials were already done from these roots and tubers by laureats from the Department of Biotechnologies at INES.



Available Edible Roots and Tubers at Musanze Market in January 2013

Figure 4: Edible Roots and Tubers Sold at Musanze Market in January 2012

This Figure 4 shows that the Irish potatoes are widely cultivated and sold at Musanze market while the forgotten sweet potatoes are now promoted by few sectors of Musanze District. However, roots and tubers are good source of flours for cooked dough (umutsima/ ubugari) which is well appreciated by almost Rwandans loving fried and boiled potatoes, chips/French frites and roasted foods during entertainment and wedding ceremonies. Other sugars used in applied biotechnology are extracted in different fruits cultivated and sold at local market as indicated in Figure 5:

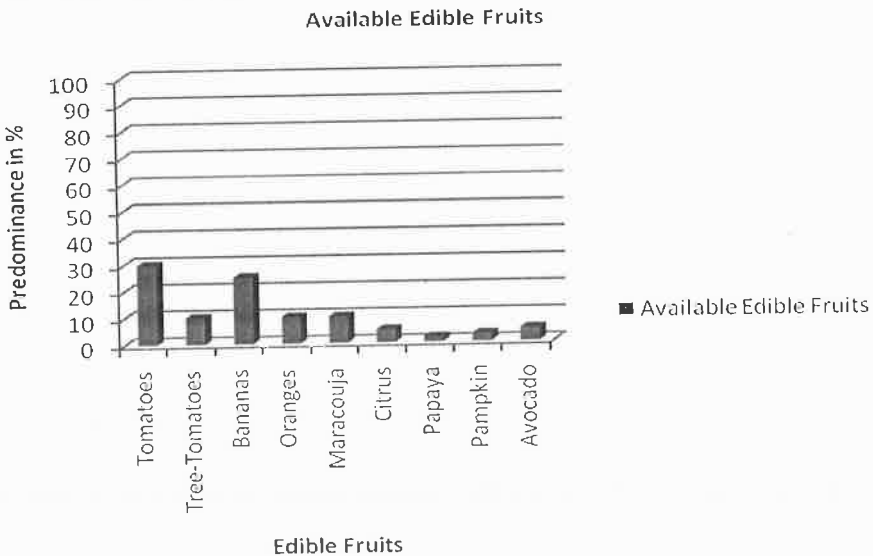


Figure 5: Major Available Edible Fruits Sold at Musanze Market in January 2013

This Figure 5 indicates that tomatoes and bananas are predominantly sold at Musanze market while tree tomatoes, oranges, maracouja, and avocado are also promoted and found in the region of Musanze. The attempt to produce different wines was carried out by laureates of the Department of Biotechnologies at INES-Ruhengeri. Promoted tropical fruits such as banana plantain, passion fruits, mango, papaya, berries, jackfruit, pomegranate, cherimoya, citron, mandarin, lemon, lime, bergamot, watermelon, agrumes, and tree tomatoes are a good source of anti-oxidants needed for health benefits and adding value to extracted juices for food security and sustainable development of our Country.

4.2. Results Discussion

Some kinds of raw beans, especially red and kidney beans, contain a harmful toxin (lectin phytohaemagglutinin) that must be removed by cooking. A recommended method is to boil the beans for at least ten minutes; undercooked beans may be more toxic than raw beans. According to FAO (1988), cooking beans in a slow cooker, because of the lower temperatures often used, may not destroy toxins even though the beans do not smell or taste 'bad (though this should not be a problem if the food reaches boiling temperature and stays there for some time).

As applied biotechnology method, fermentation is used in some parts of Africa to improve the nutritional value of beans by removing toxins. Inexpensive fermentation improves the nutritional impact of flour from dry beans and improves digestibility, according to research co-authored by Emire Shimelis, from the Food Engineering Program at Addis Ababa University. Beans are a major source of dietary proteins and carbohydrates in Rwanda, Burundi, RD of Congo, Kenya, Malawi, Tanzania, Uganda and Zambia (Uwaegbute *et al.*, 1998).

According to Kaplan, and Lawrence (2008), Comestible legumes: kidney beans (*Phaseolus vulgaris*), soybeans (*Pisum sativum*), lentils (*Lentil culinaris*), peanuts, cowpea, and pigeon-pea called *Cajanus cajan*, constitute a good source of proteins, carbohydrates, fibers, oil, iron and folate. These pulses or legumes are cultivated or intermingled together with maize and squashes in Rwanda for better fixation and exchange of nitrogen in nodules and soil. Beans would provide much-needed nitrogen for the corn and pumpkins/squashes. For human consumption, soybeans must be cooked with "wet" heat to destroy the trypsin inhibitors (serine protease inhibitors).

Especially green peas (*Pisum sativum*) are eaten as innovative luxury without any preservation. While dry soybeans seeds are roasted and ground for aromatic flour production. These edible should be available year-around and make nutrients more bio-available for all seasons and all people. Roasted and ground mature peas and maize seeds are well appreciated by consumers (http://www.grainlegumes.com/default.asp?id_biblio=52; retrieved on 26th December 2012).

Nowadays, predominant beans and maize seeds are greatly harvested and consumed freshly in Musanze area. All cereals are boiled or milled for porridge and traditional beer production. Few small scale production units extract juices from different fruits. Cabbage and carrots are some times rotten without adequate processing methods application. Roots and tubers are freshly eaten or only used for flours production. There is a risk of aflatoxines development in these non well packaged during rain seasons.

Carrots as roots can be eaten in a variety of ways but carrots leaves are not used for local dishes. Vegetables and fruits are less preserved in the region. The Food and Agriculture Organization of the United Nations (FAO -1994) reports that cabbages are prepared in many different ways for eating, although pickling, in dishes such as sauerkraut, is the most popular. Cabbage is a good source of beta-carotene, vitamin C and fiber, but cabbage when contaminated is sometimes a source of food borne illness in humans (Delahaut and Newenhouse, 1997).

Concerning storage of fresh fruits, for example tomatoes that are not yet ripe are optimally stored at room temperature uncovered, out of direct sunlight, until ripe. In this environment, they have a shelf life of three to four days. Now genetically modified tomatoes can be stored about one week without any deterioration or spoilage.

When ripe, they should be used in one to two days. Tomatoes should only be refrigerated when well ripened, but this will affect flavor. Leaves, stems, and green unripe fruit of the tomato plant contain small amounts of the toxic alkaloid tomatine. They also contain solanine, a toxic alkaloid found in potato leaves and other plants in the nightshade family. So, processing activities and applied biotechnology of tomatoes are necessary for safe food distribution. All organs of pumpkin are eaten especially leaves, gourd, flowers and leaves. Roasted pumpkin seeds constitute a best snack foods and medicines. According to Yoshinari *et al.*, (2009), pumpkin seeds can produce oil for healing purpose. Preliminary research indicates that phytochemicals found in pumpkin may favorably affect positively insulin and glucose levels in laboratory diabetes models (Brat, *et al.*; 2006).

Fruits and vegetables constitute a good source of incomes and nutrients (Zidorn, *et al.*; 2005). Different fruits, berries, avocado, garlic, onions and other herbal condiments are also used as traditional medicines in Musanze District. Several edible plants in extinction were collected in INES Botanic Garden for biodiversity conservation and environment protection purpose. Roots and tubers are a good source of starch for calories generation in human body (Oboh and Oladunmoye, 2007). In Musanze, predominant roots and tubers are potatoes carrots and cassava.

Few production units extract juices from fruits. Avocado fruits are a good source of oil used in cosmetics after extraction with an appropriate solvent (Wolstenholme and Whiley, 1999). It would be better to promote and intensify the edible fruits for large scale industries implementation in rural areas of the Musanze District. Up to date, the only used methods of preservation of few edible plants are sun drying, roasting, frying and grinding. Thus, local people need applied biotechnology to agro-food industries for food security and sustainable development of the region.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The region of Musanze is prosperous paradise with volcanic fertile soil that produces diversified fresh delicious comestible plants as source of essential nutrients needed for human health improvement, hunger eradication and malnutrition combating. But, from the study, it was found that the status of edible plants production, processing and preservation is yet at embryonic level, since almost harvested plants are freshly sold and consumed without any application of modern biotechnology and adding value for accessible food quality and quantity, and permanent food security for all seasons. The immediate action to be taken is to promote the agriculture and post-harvest technology for better preservation of fresh edible plants.

In this regard, vegetables, legumes, roots, tubers, fruits and cereals should be promoted and intensified for overproduction, stocking, processing and preservation at industrial level for adding value, export, income generation, food security assurance, job creation in rural areas, vocational entrepreneurship of cooperatives, applied sciences education of youth, poverty reduction, human health improvement, welfare of the rural population and sustainable development of our Country.

5.2. Recommendations

Like cabbage, legumes or pulses should be industrially processed for flatulence (gases/imisuzi or by-products produced from oligosaccharides called raffinose and stachyose digested by bacteria found in large intestine of beans consumers) reduction. For biotechnology applied to agro-food industry, Some species of useful mold (or mould = moisissure) produce alpha-galactosidase, an anti-oligosaccharide enzyme, which humans can take to

facilitate digestion of oligosaccharides in the small intestine in order to avoid the foresaid flatulence-causing gases. So, enzymes from harmless bacteria (lactic acid bacteria such as *Leuconostoc mesenteroides*, *Streptococcus lactic*, and *Lactobacillus lactis*) and molds (e.g. *Aspergillus niger* and *Aspergillus oryzae*) should be used for health benefits.

One effective strategy is to soak beans in alkaline (baking soda) water overnight before rinsing thoroughly. Sometimes vinegar is added, but only after the beans are cooked as vinegar interferes with the beans' softening.

Fermented beans will usually not produce most of the intestinal problems that unfermented beans will, since yeast/levure (e.g. *Saccharomyces cerevisiae*, *Saccharomyces carlesbergensis* and *Saccharomyces pombe*) can consume the offending sugars. It would be better to exploit rationally the leaves from edible plants such beans, soybeans, peanuts, potatoes, carrots and comestible fruits trees and shrubs for more nutrients extraction and preservation as it has been well explored by our ancestors. Proposed solutions for food security are land use consolidation, organic manure application and land tenure, protection of fertile soil located near volcanoes, settlement management, crop protection and use of appropriate post-harvest technology for adding value to fresh products. In these fresh plants we will find also hidden active chemical principles that help the population to solve the crucial problem of HIV/AIDS inflectional disaster.

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ENTOMOPHAGY FOR FOOD SECURITY: A CASE OF EDIBLE RUSPOLIA NITIDULA IN MUSANZE DISTRICT OF RWANDA

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Abstract

A chemical composition of brown and green grasshoppers as edible insect called *Ruspolia nitidula* belonging to Orthoptera family was carried out in order to assess the nutritional values of comestible parts of these scarce delicious and periodic insects curiously collected by children in Rwanda. These wonderful insects are surprisingly flying during night and taking short rest where there is a shining light. In our study, brown and green grasshoppers were collected and prepared for chemical composition analysis. The findings indicated that brown and green grasshoppers have respectively for proteins about 35.50 % and 35.60% of for fats about 15.50 % and 15.20 %, which can be consumed for fighting hunger and malnutrition in developing countries. Despite this, they are a huge source of nutrients for human diet; these insects can be also a source a pest for some crops. A further study on grasshoppers' eco-system and their keeping methods are therefore needed for their multiplication in tropical countries like Rwanda.

Key words: Edible insect, Entomophagy, Food security, Grasshopper, and *Ruspolia nitidula*.

1. Introduction

Grasshopper is a comestible insect scientifically called *Ruspolia nitidula* and a common name attributed to winged orthopteran insects with hind legs adapted for jumping. These insects include the longhorned grasshoppers, pygmy grasshoppers, and shorthorned grasshoppers, or locusts. They subsist on vegetation and are distributed worldwide wherever vegetation grows. Insects are a good source of nutrients (Banjo, Lawl and Songonuga, 2005).

Grasshoppers are 3 to 13 cm (1 to 5 in) long when fully grown. They develop by gradual metamorphosis: The nymph is initially wingless and gradually comes to resemble the adult as it grows through progressive molts. Only the adults can fly. Some species undergo seasonal color changes, being green at some times and red or brown at others. Grasshoppers are closely related to crickets, and male grasshoppers make chirping or stridulating noises similar to those produced by crickets. Females of several species also make sounds. Unlike true crickets and longhorned grasshoppers, shorthorned grasshoppers chirp by rubbing their hind legs or forewings against other parts of their bodies. The eardrums of shorthorned grasshoppers are clear, circular areas located on the abdomen at a point just behind the junction of the hind legs with the body. The hearing organs of longhorned grasshoppers and crickets are located on the forelegs.

Entomophagy is the insect-eating act adopted by animal being including human consumption of insects. Normally, an insectivore is a small insect-eating mainly nocturnal terrestrial or fossorial mammals. Any organism/creature that feeds mainly on insects is called entomophage or insectivore.

Humans have consumed insects for thousands of years – in some cases as emergency food, in other cases as a staple, and in still other cases as delicacies. In modern times, consumption of insects has declined in many societies, and has often been shunned as old-fashioned, dirty, or unhealthy. Yet, among various cultures scattered throughout the world, insects remain a vital and preferred food and an essential source of protein, fat, minerals and vitamins. For some members of the rapidly growing upper and middle classes of urban society, insects are “nostalgia food,” reminding them of earlier, simpler days in the rural countryside (Banjo, Lawl and Songonuga, 2005).

Worldwide, over 1,400 insect species are reportedly eaten as human food. Most are harvested from natural forests. Although, while insects account for the greatest amount of biodiversity in forests, they are the least studied of all fauna. Surprisingly little is known, for example, about the life cycles, population dynamics, and management potential of many edible forest insects. Similarly, little is known of the impacts that over-harvesting of forest insects might have on forest vegetation, other forest fauna and the ecosystems themselves (Chavunduka, 1975).

Among forest managers, there is little knowledge or appreciation of the potential for managing and harvesting insects sustainably. There is almost no knowledge or experience in manipulating forest vegetation or harvest practices to increase, maximize, or sustain insect populations. Indeed, as many insects cause massive damage and mortality to valuable commercial trees, virtually all insects are considered undesirable pests by many forest managers. What knowledge does exist in these respects is often held by traditional forest dwellers and forest-dependent people (Dufour, 1987).

This study attempts to address these issues and discuss strategies to promote edible forest insects for enhancing human nutrition and further insects' preservation.

Nowadays, African diets consist of a vast variety of wild foods, among which are edible insects. Edible insects are traditionally important foods in Africa, Asia, Australia and Latin America. Food insects may be used for medicinal or food purposes (Dufour, 1987).

In Rwanda, the most commonly consumed insects are grasshoppers and bees' larva, While in Uganda, termites (*Macrotermes Spp.*), ants (*Macrotermes bellicosus*) and grasshoppers (*Ruspolia nitidula*), consumed among many cultures. Insects seasonally consumed in Rwanda are shown in the Figure 1:

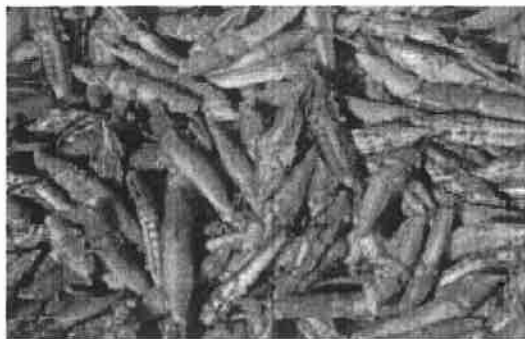


Figure 1: Brown and Green Grasshoppers Found in Rwanda

Grasshoppers are supplementary food items and also provide significant nutritional and economic benefits to rural communities. They are important sources of protein and fat to rural and urban dwellers. These insects form an important part of cultural diets. However, Africa is confronted with high levels of malnutrition as a result of shortages in proteins especially animal protein (Dufour,

1987). This paper deals with nutritional values of grasshoppers used in human diet.

2. Main Objective

To assess the chemical composition of consumed seasonal grasshoppers (*Ruspolia nitidula*) in Rwanda.

3. Materials and Methods

a. Materials

Two Plastic boxes of collected grasshoppers, Analytical balance, Oven, Ash Muffle, Apparatus for Proteins and Fats Analysis.

b. Methods

Data on raw materials, preparation method, and consumption culture were collected in Cyuve sector of Musanze District in Rwanda during last year 2011. Major parameters were: water content, dry matter, proteins, fats, carbohydrates, and ash. Oven was used for moisture and dry matter content determination. Ash was determined using a muffle furnace. Kjeldahl method was used for proteins content. Soxhlet apparatus was used for lipids/fats extraction, and carbohydrates were determined using a spectrophotometer. These nutritional values were determined using standard analytical and biochemical procedures set by AOAC. Data analysis was done using Excel and Analysis of Variance (ANOVA).

4. Results and Discussion

4.1 Results Presentation and Interpretation

In this study we started with the anatomy of a grasshopper belonging to Orthoptera as indicated in Figure 2:

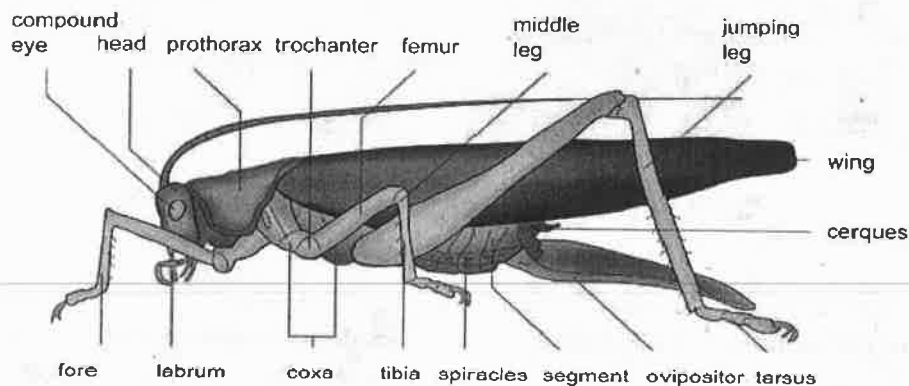


Figure 2: Anatomy of a Grasshopper used in Culinary Dishes

Orthoptera means straight wings; ortho = straight, ptera = wings. These insects often have a pair of elongated and thickened forewings and a membranous hind pair. The main parts of a grasshopper used in culinary dishes are head, thorax, and abdomen that are a huge source of proteins and fats. These parts are normally fried in vegetable oil for further consumption by the whole family as an opportunistic food. These insects are seasonal and highly perishable. Villagers have come to believe that the insects such as grasshoppers are of interest and can be utilized a day or two after collection. It is important to find a system of grasshoppers keeping, multiplication and preservation. This study seeks to show that the insects can be processed by conventional cooking methods (frying in Vegetable oil after salting for a longer shelf life at the household level (Figure 3):



Figure 3: Fried and Salted Grasshoppers in Vegetable Oil for Food Security

Scientifically speaking, this human nutrition is called an entomophagy, insect-eating family or insectivore household. These dishes are delicious and nutritious for our body. So the insect-eating system should be adopted for human life improvement and food security.

In this study, it was found that food insects can supply a huge energy and proteins for human body after consumption. Insect is a source of proteins for better metabolism of human body. Grasshopper chemical composition is presented in the following Table 1:

Table 1: Chemical Composition of Brown and Green Grasshoppers Found in Rwanda

Insect Name	Insect Nutritive Values per 100 grams (Mean Values with SD)					
	Water	Dry Matter	Proteins(g)	Fats (g)	Carbohydrates (g)	Ash (g)
Brown Grasshopper	44.20±0.34	55.80±1.37	35.50±0.67	15.50±0.67	4.00±1.36	0.80±0.67
Green Grasshopper	44.49±1.36	55.51±0.67	35.60±1.34	15.20±.68	3.90±1.34	0.81±0.66

This Table 1 shows that food insects were an expensive source of proteins, i.e. about 35.50 % for brown grasshopper and 35.60% for green grasshopper. Grasshopper is also a wonderful source of lipids (about 15.5%) needed for human health improvement. These results were significant with $P \leq 0.5$. These findings show that grasshoppers should be used in human diet as source of proteins, fats and carbohydrates.

4.2 Results Discussion

This study revealed that some of the insects which are pests also have high nutritional qualities. Protein content of insects has been also studied by other scientists (Banjo *et al.*, 2005). The result of dry matter determination (about 55.8%) of grasshoppers from this study is similar to that obtained by Chavunduka (1975). The dry matter, moisture, nitrogen free extract and ash content level obtained generally agree with those reported by other author investigating different insects from several parts of the world (Dufour, 1987). Same differences may be due to variations in the dietary habits of the insects or as a result of different ecotypes. Differences may also be due to the age of the insects. The results of this study confirm the fact that insects are indeed a good source of protein and other nutrients. The consumption of non-toxic insects therefore, should be encouraged. Insects are traditional foods in most cultures, playing an important role in human nutrition and have much nutrient to offer. They can be reared for their high nutritional qualities and sold to the populace that regards them as delicacies. Edible insects constitute an important part of the daily diet of a large proportion of the population in Africa. Grasshoppers are a good source of proteins and similar results were found by Chavunduka in 1975. Lipids content (about 15.2 - 15,5%) in grasshoppers can supply a good amount of calories to human body, this was confirmed by other researchers (Banjo *et*

al., 2005). According to Dufour (1987), generally insects provide high quality of proteins, lipids and supplements (minerals and vitamins) even when dried, fried or roasted. Some of them sought after species, especially those with high nutritional value content, ought to be cultivated with modern techniques to increase their commercial values and availability (Banjo *et al.*, 2005). Thus, the edible insects should be deeply studied for poverty alleviation and food security in order to achieve the Rwanda vision 2020 and the MDG goals.

5. Conclusions and Recommendations

Grasshoppers (belonging to Orthoptera Family) are an important source of proteins and fats for human consumption for fighting hunger and sporadic malnutrition in developing Countries. Organoleptic tests and in particular palate tests done in the laboratory yielded excellent appreciation of insects consumption.

As proposal, this entomophagy should be inclusive in habitual culinary dishes prepared and offered to customers in Rwandan Hotels and Restaurants. However, these scarce, annual, and expensive insects are collected periodically without any preservation. The high costs are normally due to the unmet supply against demand.

In this regard, it is therefore important to study their ecology and consider them for large scale cultivation as food items for the brighter future of Rwandan People. Insects processing and preservation will improve the entomophagy and the human life of local people by reducing the poverty and malnutrition in developing Countries.

Note that other species of insects (e.g. bees, termites) and their larva found in Africa such as Lepidoptera, Coleoptera, Hymenoptera, and Isoptera should be also studies for human consumption purpose.

In fact, the capturing, processing, transporting, and marketing of edible insects can provide interesting income and livelihood opportunities for an undetermined number of people living around the Volcanic chain of the Northern Province of Rwanda, especially in Musanze District during nocturne activities of insects collection under special electrical light.

Traditionally, these activities were all locally based and largely under-recognized. However, more sophisticated and wide-reaching marketing and commercialization of edible forest insects should be more advanced preservation method in Musanze and Burera Districts, including attractive packaging and advertising. Some advocates believe that creating a wider market for food insects could provide an economic incentive for conserving insect habitat as biodiversity conservation.

Recently, MINEDUC award has been offered in May 2012 to Prof. Dr. Eng. Francis Dominicus Nzabuheraheza (PhD) for biodiversity conservation relative to on-going prosperous botanic garden project implementation at INES-Ruhengeri for job creation, recreation, education, drugs from medicinal plants, income generation and poverty reduction purpose in the region. We expect a positive achievement of the eco-system establishment goals in Musanze District located near Volcanoes.

Meanwhile, to further promote ipso facto forest insects as human food, six major areas need to be proposed:

- ✓ Geographic information gaps;
- ✓ Improved insect identification;
- ✓ Better understanding of the ecological roles of edible forest insects;
- ✓ Assessment of the potential for rearing insects for food and other purposes;

- ✓ Post-harvest handling of insects and improved processing and storage; and
- ✓ Economic and marketing data and information.

Considering, above observations, we would like recommend to stakeholders from RDB, REMA, RAB, and RBS to promote entomophagy and forest insects keeping by biodiversity conservation and plants species in extinction taxonomy, protection and multiplication using tissue culture methods.

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EVALUATING PEACE EDUCATION IN RWANDAN PRIMARY SCHOOLS: a case study of public primary schools in Gasabo district.

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Abstract

This paper portrays the findings of survey conducted on evaluating peace education as a component of basic education in Rwanda. Precisely, the study focused on Gasabo district public primary schools. It was conduct between February and June 2013. This said, the background data show the imperative need for peace education in Rwanda, a country that has experienced terrible genocide in 1994 against the Tutsi. Two questions guided the research. The contribution of this paper is in its endeavour to describe the extent Rwanda has gone in applying peace education and gives suggestions on what should be done to achieve the successful establishment of a culture of peace among Rwandans.

Acronyms

COFAPRI: The Congolese Females Action for Promoting Rights and Development

GPPS: Gasabo Public Primary Schools

UN: The United Nations

HIV/AIDS: Human Immune Virus/ Acquired Immune Deficiency Syndrome

UNESCO: the United Nations Educational, Scientific and Cultural Organization

1. Introduction

Violence is widespread throughout the world and Rwanda is no exception. The genocide against the Tutsi was the outcome of a failed education system. Indeed the entire elite and the grassroots fully participated in it. This evidences that violence was deeply embedded in the entire Rwandan society.

The UN objective for the establishment of a culture of peace through education is provoking among people all over the world the appreciation of the role of peace education in promoting the culture of peace. This exciting development in peace education is hence both a way of life and a process that supports knowledge about various precepts and manifestations of peace and violence as well as peacemaking. Believing in the power of education, the Rwandan government has sought the establishment of peace education programme in different schools and institutions. Education can change positively people's mindsets; it propagates necessary skills and knowledge to a wide cross section of the population. Actually, this avoids the culture of violence and promotes that of peace.

In this context, Gasabo public primary schools (GPPS) have implemented a programme that is close to peace education. The curriculum aims to reach the intellectual and moral changes of pupils. The schools do not teach peace education as a separate subject but they have inserted it in their programme. For better achievement, participatory methods should be used to transfer peaceful skills to pupils.

The aim of this study is to assess if GPPS schools follow closely the principles of peace education. The study was guided by the following questions:

- a. To what extent does the peace education subject in GPPS cover key aspects of peace curriculum?
- b. How often are pupils implicated in educational activities that convey the principles of peace education and how regularly do teachers involve learners in practical activities that help gain peacemaking skills?

2. School description

In different countries, peace education in schools is described and interpreted in various contexts for facing different violence specific to the regions and to the period (Harris and Morrison 2003:30). In this vein, Gasabo Public Primary Schools (GPPS) are located in the country that lived the horrendous genocide against Tutsis in 1994. This genocide caused a lot of atrocities and hurt among the people. Accordingly, the GPPS are equally concerned with the aftermaths of the genocide and to Aladejana (2005:17), the other conflicts that occur at school should not be neglected. Peace programme teaching in Gasabo public primary schools is valuable to promote the culture of peace and nonviolence among students via new knowledge, attitudes and skills that shun the culture of violence.

The scope of this study is primary school education, with particular attention to Gasabo public schools. This study was carried out from February 1 to June 5, 2013. The researcher conducted this study with key informants from these schools. These schools are involved in teaching peace education based on the outcomes of the 1994 advent of genocide.

3. Methods for data collection

The researcher conducted this survey at six GPPS. He used interview with twenty five respondents, males and females. These include the administrators, teachers, parents and pupils. The respondents were not randomly chosen as the researcher knew the straight collaboration that exists between school leaders, parents and the pupils. The researcher also used a documentary method in order to collect secondary data on peace education and violence in the above mentioned schools. Besides, he had to interpret the data the respondents provided with the aim to get patterns of meanings. Finally, he used the interview checklist and content analysis to study data.

4. The programme components

4.1. Curriculum

Schools are institutions that society can formally, intentionally and extensively use to achieve peace task. Such mission attains through a curriculum. The latter requires that teachers transmit skills and knowledge via an active pedagogy. To Bar-Tal (2002:1), peace education programme in schools equips children with competences and alternative ways to eschew violence.

The courses that are taught convey the culture of peace and nonviolence to pupils and they include citizenship, human rights and freedom, civic values, formation of common identity, social cohesion, environment, gender and peace.

Similarly, GPPS objectives endorse peace learning through their curriculum. In this curriculum, if civics and non divisive history courses are taught via pupils centred approaches, they can foster the sense of peaceful community, which is not the case in the public primary schools of Gasabo district of Rwanda.

The curriculum of GPPS includes environment issues. In fact, there is a straight link between peace, security and the environment. As for the latter, the pupils of GPPS learn about their home and school environments, erosion, biodiversity protection and species extinction, global warming and the dangerous effects of pollution. In fact, Carl and Swartz (1996:4) admit that studying environment develops a holistic thinking about how natural and human systems interrelate, develops strong personal convictions and provides dynamic experiences in order to protect and conserve the natural resources. Botha and Kristen (1993:24) believe environment education is linked with disarmament education for protecting the ecosystem. This proves the necessity of promoting a concept of peace based upon ecological security and sustainability for protecting humans and nourishing them by natural process (Harris 1988:14). Accordingly, Gasabo public primary teachers should train their pupils to protect the ecosystem by insisting on environmental conservation and preservation of natural resources.

In addition, the curriculum covers areas like HIV/AIDS in order to get a holistic outlook of peace learning. Indeed, there is need to harmonise the school peace education programme with those of traditional subjects within the school system. According to Carl and Swartz (1996:22), this would eschew contradictions arising from value incompatibility between the different contents and particularly with methods used that are implemented.

However, there are no preconceived lesson plans, materials or teacher training to aid them executing the school peace curriculum. Furthermore, peace education is among the subjects that are not tested in examinations, which makes both teachers and students focus less on it.

What is puzzling is that there is 'no explicit conflict resolution or peace building curriculum in Rwandan schools' (Bizimana 2001:76). Due to this, Gasabo public primary schools have integrated these subjects into their general programme. Such incorporation equips pupils with knowledge about peace and nonviolence in conflict management in order to build their future (Houghton and John 2007: 78). Essentially, personal and interpersonal behaviour change moves pupils to act in a less violent way. Peace education inoculates pupils against the evils of violence. Congruent with Harris and Morrison (2003:10), peace learning edifies learners with the skills that are useful for muddling through their contentions in a peaceful way and it also persuades them to act peacefully when they affront conflict. To this point, Harris (1996: 38) concludes that the effectiveness of peace education builds upon promoting the culture of peace and nonviolence both at school and at home.

4.2. Peace education methods

As for methods, peace education requires specific methods and strategies as to achieve nonviolence. Students' centred methods favour cooperation and group work rather than individualistic competitive learning in order to promote peace at school (Hutchison 1996:76). Thus, matching the means and the ends makes peace education peaceful, friendly and dialogical (Reardon 1988:64).

The way principles of peace learning takes place moves the schools toward joint learning process and decisions making, which involves parents, teachers and students for exploring school conflicts. Such collegial involvement gives power to peace

education programme at school since it emphasises participative methods of teaching and learning. Reardon (1988:71) states that critical thinking, possession of information and interactions between students support peace and urge teachers to create peaceful classrooms.

Peace education requires specific methods and strategies to achieve nonviolence. Active methods oppose traditional teaching. They involve students in learning issues of conflicts and violence, skills, behaviours and 'dispositions from the classroom climate, which is established by the way a teacher structures the lesson' (Harris 1990:255).

Actually, peace pedagogy directly addresses the passivity of traditional education. Aladejana (2005:18) underscores that peace education values oppose traditional teaching by highlighting participative methods. This means that such pedagogy builds on dialogue, cooperation, critical thinking, self esteem and democracy for positive achievement. In fact, this contributes to the knowledge, skills and attitudes essential for democratic students and citizens in the future.

Conversely, traditional education promotes passivity toward violence and considers the teacher as the unique possessor of the truth. Accordingly, it fosters student's passivity because teachers dominate classroom interaction and use force to control students (Sinclair and Avery 2000:47). This must be avoided since it considers students as ignorant and it does not help to address division among students and dictatorship at school (Harris 1990:256).

4.3. Conflicts and violence management in schools

Conflicts and violence are predictable in schools. They have multiple effects on all the school community and this also applies to the public primary schools of Gasabo district. Page (1991:5) underscores that school violence diminishes dialogue at school and particularly among students, which can be extended outside the school. In the future, this may cause dislocation of the school community and the society in general. It may also cause the exclusion of some students and staff, hatred and brutality, vindictive behaviour and retaliation that may culminate into fight and injure (Page 1991:12). Violence can cause physical and psychological trauma as the student who has been brutalised several times may be hurt or handicapped, which may force him to abandon school (Deutsch 1991:8).

As we have seen in previous points, conflicts are natural and inevitable but culture of violence is learned. So, it can be destroyed by the ways learned in peace education. To Deutsch (1991:12), violence is not intrinsic part of human nature; it is a learned behaviour and can be dealt with peaceful means and peaceful ways for resolving conflicts and preventing violence. In public primary schools of Gasabo, like in any community, conflict is unavoidable and sometimes it culminates into use of force. The way contention is managed determines the relationships among the conflicting parties; this also depends on the social position of the other party (Salomon 1999:14). In addition, it reduces the number of the students who use violence at school.

The way conflicts and violence are handled in schools is very meaningful for the school peace. Alger (1996:270) ascertains that this may happen because some students have learned that the best way to settle conflicts is not to involve in dialogue but

rather fight. Such students believe to be respected at school; they are feared because of their brutality (Maxwell and Maxwell 2004:128). Learning conflict resolution is a way of dealing with the root causes of conflicts that are instilled in the psyches of the students by teaching them to be open, sharing and cooperative (Harris and Morrison 1993:62).

The schools support students who understand conflicts dynamics in order to empower them with communication skills to manage nonviolently relationships at school. Salomon (1999:17) highlights the insistence that is laid on interpersonal relations and systems in which the disputants are helped by a third party to resolve their differences. This transforms violent values, attitudes and behaviours into peaceful ones. Smit (2005:9) confirms that the school empowers its students with skills of dialogue, tolerance and consensus building as to eschew the use of force. This because violence produces more violence and it is destructive whereas the force of dialogue is constructive (Davies 2005:49). Similarly, the power of religion about nonviolence is not neglected. Since different religions are allowed and are active in these schools of Gasabo district, this helps to teach the students about nonviolence, love and forgiveness.

Mediation is another way that can be used to resolve disputes. However, Isenhart and Spangle (2000:72) supports that teachers and administrators involve in students conflict resolution but in an impartial way. In fact, the third party to a conflict must be fair and have no stake in order to reaching fair solution (Evan et al 1999:67). This is a way of overcoming the authoritarian beliefs that dominate some students or teachers' minds. Rigid thinking can be avoided if the schools dismantle the coercive structures and exploitation via its regulations (Haavelsrud 1983:134). If discipline is well implemented, it helps set up democratic participation and

the empowerment of students to fully contribute to the school management of conflicts.

Furthermore, Smit (2005:7) ascertains that the school has to support strongly the free flow of information among its staff members. Basically, this procedure aims to expand transparency and accountability in school decision making by pressing on understanding, tolerance and solidarity among all students and thereby celebrate cultural diversity (Kaman and Harris 2000:83).

Nonetheless, arbitration intervenes in case school mediation has failed. Congruent with Köylü (2004:9), the third party will take a binding resolution about the issues in accordance with the law. In addition, Brem and Nevo (2002:6) hope that arbitration can help resolve conflicts; but sometimes it reaches win-lose solutions. This process has a negative side because later on it may culminate into retaliation. However, Gervais (2004:11) notes that if the offender begs for forgiveness to the offended, this may reduce the tension between the disputants and hence, contention cannot fuel. Based on the writings of Brown (2000:12) and Gervais (2004:54), thinking in this way means that the students have acquired the effectiveness of peaceful methods of dealing with conflicts and violence at school. Indeed, each member of the school community has much to contribute to and gain from the promotion of the culture of peace (Fien and Hutton 1987:332). Therefore, a positive management of conflicts in schools aims to settle the culture of peace by providing positive peace and security to the whole school and its partners (Salomon 1999:17).

5. Evaluating peace education principles in Gasabo district public primary schools.

This section is going to assess how closely the GPPS conform to peace education principles. As we have already stated, the GPPS curriculum does not address directly peace education but does so via some courses that are included in their curriculum. In this vein, the schools develop some values as to educate pupils and attitudes to enable the pupils to become peaceful individuals (Haavelsrud 1999:133). Thanks to participatory methods, this moves these schools toward the culture of peace. Peaceful relations must exist at all levels in a school because they build particular knowledge and skills with strong implications for pupils, teachers and administrators, even beyond school. Davies (2005:43) supports that those principles are fundamental to teaching and learning in the area of peace education.

5.1. Results

Table 1: The coverage of peace education programme content in Gasabo public primary schools.

	Area of peace education	Number of peace topics in GPPS (62)	
		Frequency	%
1	Respect of all human rights	3	5%
2	Culture, religion and peace via education	2	3%
3	Democratic participation	1	2%
4	Participatory communication and the free flow of information and knowledge	2	3%
5	Environment and population	2	3%
6	Gender equality	3	5%
7	International and regional peace and security	1	2%
8	Unity and tolerance	3	5%
9	Understanding and solidarity	1	2%
	Total	18	30%

Source: Data from the field, 2013

In reading through the table above, we find that only 18 topics, i.e roughly 30% of the 62 in the entire GPPS curriculum focus on peace education.

Table 2: Frequency of pupils involvement in themes that demonstrate values and principles in peace learning (Sample of 25).

	Themes	Very often	Often	Rarely	Never
1	Nonviolence	20 (80%)	2(8%)	2(8%)	1(4%)
2	Citizenship and nationhood	6(24%)	12(48%)	4(16%)	3(12%)
3	Dignity	9(36%)	3(12%)	11(44%)	2(8%)
4	Justice and security	10(40%)	3(12%)	5(20%)	7(28%)
5	Forgiveness	13 (52%)	6(24%)	3(12%)	3(12%)
6	Respect and solidarity	14 (56%)	5(20%)	5(20%)	1(4%)
7	Democracy and responsibility	8 (32%)	8(32%)	7(28%)	2(8%)

Source: Data from the field, 2013

Through the table above, we discover that only the scores for ‘very often’ for numbers 1, 5 and 6 achieved 50%. Actually, this means that pupils are not often implicated in educational themes and activities that express values and principles in peace learning.

Table 3: Teachers involving pupils in peace making themes and activities for skills acquisition (sample of 25).

	Themes	Very Often	Often	rarely	never
1	Engage pupils in dialogue to discuss school problems	2(8%)	4(16%)	9(36%)	10(40%)
2	Set up whole class discussion on social issues	2(8%)	4(16%)	11(44%)	8(32%)

3	Encourage pupils to dialogue with others for conflict resolution	1(4%)	7(28%)	8(32%)	9(36%)
4	Make pupils appreciate the value of dialogue in conflict management	1(4%)	8(32%)	14(56%)	2(8%)
5	Involve pupils in conflict mediation	3(12%)	4(16%)	9(36%)	9(36%)
6	Engage learners in team work and cooperation	2(8%)	6(24%)	10(40%)	7(28%)
7	Express tolerance in class management	5(20%)	10(40%)	6(24%)	4(16%)
8	Make pupils respect the rights of one another	3(12%)	6(24%)	11(44%)	5(20%)
9	Establish democratic principles in pupils classroom management	2(8%)	3(12%)	7(28%)	13(52%)
10	Pupils follow their individual turns in classroom activities	6(24%)	4(16%)	7(28%)	8(32%)
11	Discourage violence in classroom	8(32%)	2(8%)	6(24%)	7(28%)
12	Involve learners to be concerned with mate's difficulties	1(4%)	3(12%)	7(28%)	14(56%)

Source: Data from the field, 2013.

The table above shows that all the themes are below 50%. Exception is made for items 4, 9 and 12, but in a negative way; that is under the column 'rarely or never'. This indicates that teaching methods do not give enough opportunity to pupils to involve in peace making skills acquisition.

5.2. Discussion of findings

The present study was limited to the public primary schools of Gasabo district, Kigali Rwanda. The reason for this was that peace learning appeared to be the first subject to overtly address peace issues in the public schools of this district.

The findings reveal that GPPS peace education curriculum contains some topics that deal with peace education. However, the themes that deal with peace education are not well implemented. This is to say that peace education must cut across subject boundaries and educational practices including administration, guidance counselling and others (Fien and Hutton 1987:329).

In fact, peace education is not just about adding topics or themes to the curriculum. According to the Congolese Females Action for Promoting Rights and Development, peace education is a strong tool as it is a learning process whose aim is mind transformation through the acquisition of appropriate skills, values and attitudes (COFAPRI 2012). This way can empower GPPS pupils in order to seek and maintain peace at school and in their daily activities. Moreover, this has an implication of making peace education go beyond subject matter issues to include all aspects of learning that touch on the behaviour of every pupil (Brown 2000:2) and (Wichert 1989:26).

Among all the courses that are taught in these schools, only history, civic education and ethics deal with peace education. The essential thing should be to insert and teach every subject with peace education orientation. In this regard, Smit (2005:11) states that teachers in all levels of schooling undoubtedly constitute a vital link in the web of building a culture of peace and nonviolence for the pupils around the world.

Actually, nonviolence and a holistic peace education framework need to be integrated into curriculum areas in terms of content

like knowledge and texts; in the context of participatory and cooperative methods (Sinclair and Avery 2000:41). The reason for this is that classroom management skills can endorse nonviolence principles and practices to conflict management.

The realities in GPPS are that pupils are not involved in activities that demonstrate values and principles in peace education. Besides, they are not even frequently engaged in peace making skills acquisition activities. Therefore, there is lack of information about specific practices in GPPS classrooms prior to 1994 events. However, teachers tend to teach the way they were taught, which is a factor that lies at the heart of the conservative nature of formal education (Köylü 2004:52).

This openly leads to lack of critical thinking, pupils' discussions and collaborative learning as well as suggestions that there may be hidden programme that divides pupils along ethnic lines. This moves the teaching system to be teacher focused, didactic lesson and lack of checking for comprehension (Gervais 2004:261). Actually, this indicates a lacuna in the implementation of peace education in GPPS's process toward educating for peace.

During the post interview discussion, most of the respondents told us that they have not enough time to engage the pupils in peace oriented activities, even in extracurricular activities. What is true in these schools is that 'practically these topics are taught like any other topics in the programme' (Botha and Kristen 1993:79). Notwithstanding, peace education is not exactly like other school subjects since it is more about the affective than the cognitive domain of educational objectives (Maxwell and Maxwell 2004:34). For that reason, Kaman and Harris (2000:91) and Bar-Tal (2002:26) suggest the use of experiential learning as the mode of instruction.

We believe that the pupils can acquire knowledge by doing or by engaging in appropriate actions. In fact, Bar-Tal (2002:33) maintains that 'students need to live under the conditions described in peace education in order to internalise its objectives'. The essential thing is to provide GPPS pupils with peace infused skills and activity based lessons that 'together build the attitudes, values and behaviours of constructive living within community (Alger 19961: 265).

Based on the above arguments, the GPPS teachers should create appropriate situations for pupils to learn the peace principles as well as the strategies for peace. Congruent with (Harris 1988:75), these strategies comprise peacekeeping, peacemaking and peace building. It is only through the practice of these peace strategies that GPPS pupils can internalise the objectives, values and principles in peace education. In fact, principals and administrators can easily contribute to the achievement of this. They can make decisions regarding instruction and appropriate school direction in consultation with other staff members and students. Indeed, GPPS can model pupils' behaviour with reference to the principles that must be fostered.

The above was supported by a respondent who said that 'you can change the curriculum but this will give nothing if the approach does not change'. Accordingly, the curriculum and the system are represented in the classroom by the teacher. Teachers are filters through which school programmes are actualized and policies interpreted (Brem and Nevo 2002:4).

Courage can enable GPPS teachers use every opportunity in the instructional process in order to develop in the learners a culture of peace and nonviolence. Such spirit leads to the establishment of a school where pupils work together to resolve conflicts, respect their human dignity and also lead to social development because there is a link between peace and development (Davies 2005:53).

6. Conclusion and suggestions for improvement

Findings of this study have shown that peace education is yet to be effectively implemented in GPPS. The conclusions of this study also mean that 'teachers should be aware of, not only with the concept of peace education but also with its pedagogical strategies' (Deutsch 1991:267).

In peace education process, the teacher's role is the most crucial than anyone else's. Accordingly, the fundamental problem is that a good number of the teachers do not understand the peace education concept or its objectives, principles and strategies. This buttresses the need for adequate teacher preparation in this area of study. This certifies that GPPS teachers can effectively help their pupils build up and accordingly gain the ability to grow peaceful. In this regard, the following recommendations are made:

- Permanent peace trainings (seminars and workshops) should be organised for the teachers of GPPS. This would enable them acquire the pedagogical expertise for implementing peace education principles in their respective schools.
- The curriculum should implement active pedagogy that allows GPPS's pupils to develop their critical thinking, sense of action and openness of mind, interaction between students, participation, etc. Principles and strategies of peace education in GPPS should be integrated into basic methodology courses.
- Peace education topics should be added to all subjects on GPPS programme.
- The schools should use books for peace education programme to give teachers and pupils peace education reference.

- At home, parents should contribute to strengthening peace principles. They can undertake to be watching movies about peace heroes more often than war heroes.
- GPPS administrators and the whole school community should continue to use every opportunity to denounce violence and project peace.
- The GPPS administration should institute peace merit award to be given to deserving pupils and other staff members. The schools should devote a day to award any member of the school who merits honorific medal.

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