ISSN 2243-7045

TRAVESÍA

REFEREED MULTIDISCIPLINARY JOURNAL OF ROMBLON STATE UNIVERSITY

Volume I No. 01 • 2011

ISSN 2243-7045

TRAVESÍA

REFEREED MULTIDISCIPLINARY JOURNAL OF ROMBLON STATE UNIVERSITY
Odiongan, Romblon, Philippines
Volume I No. 01 • 2011

TRAVESÍA, the official publication of the Research, Extension and Production Center of Romblon State University, is a refereed multidisciplinary journal that publishes reports of original research in agriculture and fishery, science and technology, business, education, arts and sciences, R&D management and other relevant fields of study. It also publishes notes and reviews on relevant and timely topics. One issue a year may be published but supplements may be released anytime as necessary. For submission and subscription, refer to the *Guide to Authors* section.

Message

FROM THE UNIVERSITY PRESIDENT

Our journey as a university has begun.

First of all, let me thank the people from the Research Department for making possible the publication of this multidisciplinary journal which is aptly named after a hard-to-cross strait in the island, travesía.

The choice of the 'name' is commendable as this mirrors our struggles in promoting research culture in the University. In the past, we had contained comments about our poor research programs and we took these with a positive heart. I believe that nothing happens in a vision without equipping our people. In 2008, we launched series of research capability building activities which led us to the formulation of our Research Agenda. We anchored all our research efforts to this roadmap and we gradually hit our marks.

I have been very supportive of sending our faculty to research fora, conventions and conferences here and abroad relevant to their professional organizations because I know that exposure to these activities will help them develop confidence that will broaden their concepts and perspectives about research and development. It did not take too long until our researchers won recognition and awards for their scholarly works. These are big boost to our young University.

And today, we take a step higher by publishing a refereed journal. I am expressing my gratitude to our referees from other SUCs and government line agencies for generously sharing with us their expertise and assisting us in scrutinizing the manuscripts included in this issue.

May this publication be a valuable resource of knowledge and ideas for integration in our academic instruction. I challenge all faculty of this University to conduct researches and submit them for the next issue of Travesía. Anyway according to one Nobel laureate, research is nothing but 'to see what everybody else has seen, and to think what nobody else has thought.'

DR. JETER S. SESPEÑE

Foreword

Travesía, according to our forebears, is the expanse of the sea between Tablas and Mindoro that is the hardest to traverse because of gigantic waves and turbulent winds. It is the portion shunned by most navigators.

On its maiden issue, Travesía takes us to the trail that gave birth to a new research culture in the University characterized by dynamism, collaboration, quality and usability.

It took about three years before the academic community has finally internalized the culture of research; that it is one of the mandated functions of the University; that it is the defining factor of a faculty's expertise; and that it is the generator of new knowledge and technology.

In the pages of Travesía are some chronicles that captured the research culture that was: passive and lethargic; a condition that challenged the leadership of the research unit. Just like crossing a travesía, breaking a time-honored culture required a foresight, faith, courage and determination. Introducing change was never easy. But how did we make it? The paper about 'Strategies in Promoting Research Culture in SUCs' is a must read to mark the series of techniques employed in reorienting the mind-set of the faculty about research and development.

Today, our efforts are paying off because we have earned the respect of other academic institutions in the region and beyond. Our research proposals have been getting millions from funding agencies. Our faculty researchers have been winning awards for their scholarly works, a proof that we are already leveling up with our contemporaries.

However, there is much yet to be done to strengthen, nurture and sustain the new culture of research in the University. It is my fervent wish that every faculty would dare to cross his or her own travesía and savor the sense of fulfillment that comes by, following a successful cruise through it.

Keep on traversing. Nobody knows, that maybe somewhere, something amazing is waiting to be known.

DR. MERIAN C. MANI
Vice President for Research,
Extension and Production

Table of Contents

R&D MANAGEMENT ARTICLES

Research Papers

Comprehensive Analysis of the Poverty Situation in the Philippines: Basis for a Sustainable Local Poverty Reduction Program Model[1]

Merian C. Mani[2], Jeter S. Sespeñe[3], Julio R.T. Chavez[4], Borromeo B. Motin[5] and Edgardo F. Fadallan[6]

ABSTRACT

Poverty is a social concern dealt by various national, international organizations, and Local Government Units in search of workable solutions. Yet, it remains to be an unsolved issue; hence, a comprehensive analysis of the poverty situation in the Central Philippines was conducted. The study was conducted in the MIMAROPA Region which is a cluster of island provinces in Southern Tagalog that consistently belongs to the club of 40 poorest provinces in the Philippines. Ten poor municipalities, two from each province, were studied in order to analyze the poverty situation in the region. Combination of qualitative and quantitative methods was employed and key informant interviews and Focus Group Discussions were used in gathering data that were subsequently complemented with various service statistics of the five provinces. Results show that the poor municipalities in these provinces were facing almost common issues that directly affect the poverty situation in the region. Causes and immediate effects were interrelated. The unresolved poverty situation in the locality may be attributed to the weak political will of the LGU in implementing a sustainable poverty reduction program, piecemeal programs of various sectors, and none compliance with the public consultation required to package the SLPRP. Likewise, the top down approach of management was not advantageous. Thus, a convergence web approach was proposed in developing a Sustainable Local Poverty Reduction Program model to address the identified problems. The project gave birth to the In Vitro- In Vivo Development frameworks which is the novelty of the study.

Key words: *Convergence Web Approach, Community In Vitro and In Vivo Development Framework, SLRP Model, MIMAROPA Region*

[1]Awarded Best Publishable Paper in Education and Culture during the International Conference for Higher Education Researches, University of Northern Philippines, Vigan, Ilocos Sur on April 28 to May 1, 2010. A Grant-in-Aid Study from the Commission on Higher Education-UPLB-Zonal Research Center. Best Poster, CHED-UPLB-ZRC Symposium 2011

[2] Ed.D.; Vice President for Research, Extension and Production, RSU

[3] PhD in Commerce; University President, Romblon State University

[4] Director for Publication, RSU

[5] PhD in Philippine Studies; Director for Extension, RSU

[6] MS Horticulture; Director for Special Projects, RSU

INTRODUCTION

Poverty is defined as a state of want in relation to a social standard and is usually associated with lack of income (Balisacan, 2001). In the Philippines, poverty and inequality are recurrent issues worsened by global financial crisis resulting in food and fuel shortage and commodity price hike. It is aggravated by the prevalent graft and corruption, patronage politics and the dole out mentality among poor communities that has worsened through the years. Poverty in the country exists in various faces: lack of employment opportunities, lack of funds for livelihood projects, the increasing number of out-of-school youths, frequency of theft, and the increasing gap between the rich and the poor.

The main causes of poverty in the country were explained in the 2009 study of the Asian Development Bank. Among these were low to moderate economic growth; low growth elasticity of poverty reduction; weakness in employment generation and the quality of jobs generated; failure to fully develop the agricultural sector; high inflation during crisis periods; high levels of population growth; high and persistent levels of inequality and recurrent shocks and exposure to risks, such as: economic crises, conflicts, natural disasters and environmental poverty. These causes were already apparent in an investigation conducted by Balisacan in 2001. Results of that study pointed to the following as the possible causes of poverty in the Philippines: inability to obtain adequate return from one's labor services; inequality of the distribution of wealth and access to resources; low labor productivity; unresponsiveness of government to the needs of the poor that are often reinforced by people's low expectations; the complexity of the processes that make poverty self-reproducing as the poor unwittingly participate in their immiserization (manipulation by vested interest).

A study conducted by Lam attempting to describe who the poor are, revealed that the poor live in rural areas (70%, 2000); have no adequate access to housing; derive income mainly from entrepreneurial activities (35.3%, 1998) such as retail trade, construction and transport sectors; are less educated and more malnourished than non-poor due to inadequate access to public service, including clean water, electricity, education, health and sanitation services; are more economically active than the rest of the population with a higher labor participation rate; and coming from bigger families than average ones.

In the island cluster of MIMAROPA, the acronym for Mindoro, Marinduque, Romblon and Palawan, poverty is of utmost concern since these island provinces belong to the club of 40 poorest provinces in the

Philippines. Poverty incidence is highly denoted by their relative rankings: Oriental Mindoro, 8th; Palawan, 12th; Occidental Mindoro, 13th; Romblon, 20th; and Marinduque, 27th (NCSB, 2005).

For decades, addressing poverty has been the flagship program of the government through its various agencies particularly the Department of Social Welfare and Development (DSWD) and the Department of Agriculture (DA). In fact, the Philippine government is in full support of the millennium development goals of the United Nations Organization, and one of which is to eradicate extreme poverty by 2015 (UNDP, 2008). However, the last four administrations had launched noteworthy government programs on poverty reduction: Aquino spearheaded the "Tulong sa Tao Program", Ramos was for the banner program "Comprehensive and Integrated Delivery of Social Services (CIDDS)" , Estrada focused on "Lingap sa Mahirap Program", and Arroyo for "Kapit-Bisig Laban sa Kahirapan (KALAHI)" literally translated as " Linking Arms Against Poverty". During the third year of Arroyo's administration, the government positioned the 4P's which is the Condition Cash Transfer (CCT) program aimed at addressing poverty and supporting improved health and education outcomes of poor children and pregnant women.

Unfortunately, poverty remains a major issue of concern in the country despite these initiatives. Contrary to reports of economic growth, poverty alleviation programs have had still limited impact on poverty reduction in the country. For the past four decades, the number of households living below the poverty line has declined very slowly and unevenly, much slower than other neighboring countries in Asia (NEDA). Poverty is indeed a serious issue and something must be done about it; however, interventions cannot just start from nowhere but from the grassroots. Essential in coming up with a relevant and responsive poverty alleviation program is the conduct of a comprehensive study and analysis of the poverty situation in a certain locality to ensure that the development programs to be launched are congruent to the needs of the people and the community, hence this study.

METHODOLOGY

Research Methods Used

The study employed a combination of qualitative and quantitative methods of research to comprehensively analyze the poverty situation in selected municipalities in the region. The different components of the problem were described based on the data gathering experiences that

happened in the first municipality, in which a model, anchored on a TQM-based framework grounded in the PDSA cycle was developed in order to come up with valid and reliable data. This was named *Community In Vitro and In Vivo Development Framework*.

Getting into an 'unfamiliar' territory required intensive planning and plans of which were translated into doable intents and were studied in terms of their workability. Deficiencies were acted upon and planning was improved the second time the researchers conducted the surveys and interviews in the next municipality. The cycle was employed from one town to another with Key Informant Interviews (KII) yielding genuine data (in vitro), while Focus Group Discussions (FGDs) resulting to data that were already adulterated since data generation was influenced by the focus group members; hence in vivo.

Instrumentation

Guide Questions for KIIs and FGDs. There were eight questions asked both in KIIs and FGDs. These items were designed to generate responses as to the major issues in the community that have direct impact on the poverty situation; how widespread the problem was; their causes and effects; solutions; programs addressing the problems; needed assistance.

Samples

Respondents were selected in multi-stages. The first stage was the identification of two poorest municipalities in every province based on their socio-economic profiles released by NEDA and Peace and Equity Foundation (PEF) which resulted in the inclusion of the following: Bulalacao and Mansalay in Oriental Mindoro; Calintaan and Rizal in Occidental Mindoro; Aborlan and Española in Palawan; Buenavista and Mogpog in Marinduque; and Corcuera and Santa Maria in Romblon.

The second stage was the identification of key informants and focus groups. In each of the 10 identified towns representing the five MIMAROPA provinces, 11 KIIs (a total of 110) and three FGDs (a total of 30) were conducted. Informants and focus group participants were purposively selected. For KIIs, the following were chosen per municipality: 1 Municipal mayor/vice mayor; 1 Municipal Planning &

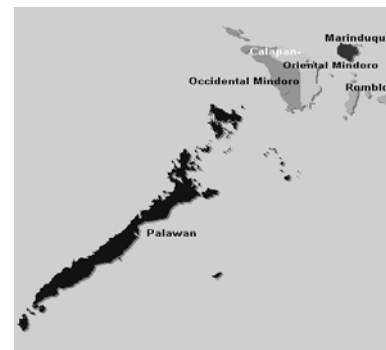


Figure 1. Map of the MIMAROPA Region

Development Coordinator (MPDC); 1 Religious Leader; 1 Barangay/Municipal Councilor; 2 NGO Board Chairmen/BOT Member; 2 Barangay Captains; 1 respected informal leader in the community; and 2 appointed Barangay LGU (BNS/BHW).

Participants of the FGDs were selected from among these groups: one (1) FGD with the Vice Mayor and the Sangguniang Bayan members; Two FGDs with any of the Local Government Units, Teachers from DepEd, youth and students, non-government organizations, socio-civic or religious organization. Aside from the two depressed municipalities in every province, several marginalized groups were highlighted in this research project: the Rebel Returnees of Oriental Mindoro; the Indigenous People of Occidental Mindoro; the Inmates in the Penal Colony in Iwahig, Puerto Princesa; the Cooperative Groups of Marinduque; and the Women's Association of Romblon.

Data Collection Methods

1. *Key Informant Interview (KII).* Using the questionnaire, the survey team members individually got the information needed from the pre-selected key informants who held key information about the topic/issues covered in the interview guide.

2. *Focus Group Discussion (FGD.)* This was the method used in gathering or validating first-hand information data through a small group discussion focused on specific key questions.

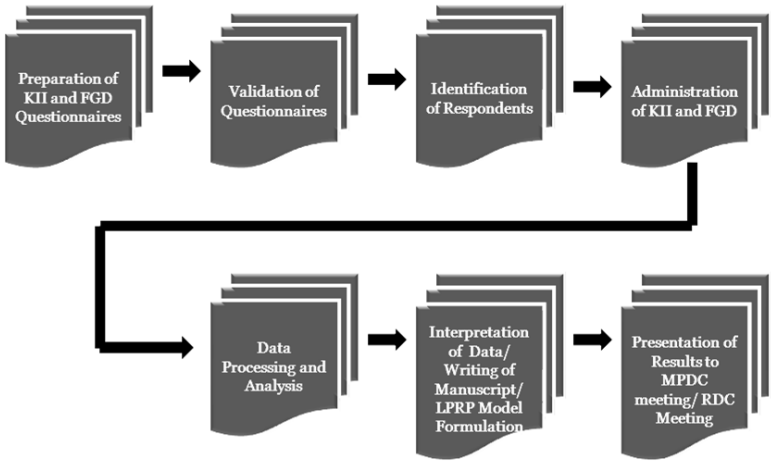


Figure 2. Process Flow of the Study

3. *Collection of Secondary Data*. The researchers secured copies of the socio-economic profile of the selected municipalities, Comprehensive Land Use Plan (CLUP), Five-Year Development Plan, Executive Legislative Agenda, Community-Based Monitoring System (CBMS), Provincial Annual Report, Provincial Poverty Map and the like.

4. The researchers established linkages with the State Colleges and Universities Administration and staff in MIMAROPA for the necessary assistance in the implementation of the project.

RESULTS

Major Issues with Direct Impact on Poverty

Table 1. Summary of poverty related problems among depressed municipalities in the MIMAROPA Region

POVERTY RELATED PROBLEMS	ROMBLON		MARINDUQUE		PALAWAN		OCC. MINDORO		OR. MINDORO		TOTAL SCORE
	Sta. Maria	Corcuera	Buenvista	Mogpog	Aborlan	Española	Calintaan	Rizal	Bulalacao	Mansalay	
1 Unemployment/Lack of Job Opportunity	3	1	2	3			3	2	1		15
2 Culture/Attitude of the People/Leaders		2	3	2	3	1	1		3		15
3 No Access to Potable Water						3				2	5
4 Poor Road Networks/ Infrastructures						2		3			5
5 Insufficient Water Supply/Irrigation	1	3						1			5
6 Patronage Politics/ Weak Political Will				1	2		2				5
7 Health/Sanitation/ Malnutrition	2		1								3
8 Insurgency									2	1	3
9 Environmental Destruction										3	3
10 Inequitable Land Distribution					2						2

SCORING: 3 – Top problem 2 – Second problem 1-Third problem

Table 2. Major issues with direct impact on poverty

RANK	POVERTY INDICATORS
1	Unemployment/Lack of job opportunity
2	Culture/Attitude of the people/leaders
3	No access to potable water
4	Poor road network
5	Insufficient water supply (Irrigation)
6	Patronage Politics/ Weak Political Will
7	Health and Sanitation/Malnutrition
8	Insurgency
9	Environmental Destruction
10	Inequitable Land Distribution

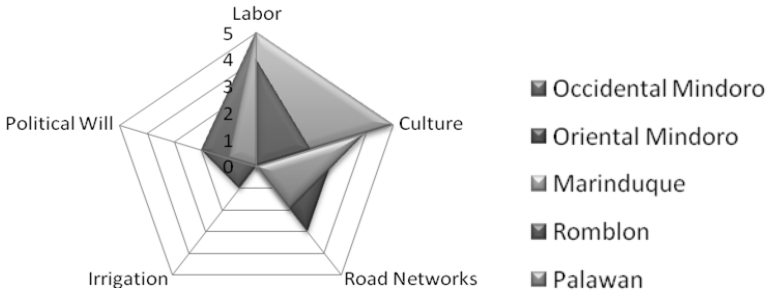


Figure 3. A radar map summarizing the poverty related problems among depressed municipalities in the MIMAROPA Region

Five major issues were identified in the radar map. Labor problems like unemployment and lack of employment opportunities were major issues in Marinduque, Occidental Mindoro, and Romblon. Cultural issues like people's passive attitudes and 'culture of silence' were problems in Marinduque, Palawan, Oriental Mindoro and Romblon while road networks in Oriental Mindoro and Palawan. Politics were issues of concern in Occidental Mindoro and Marinduque while irrigation was of concern in Occidental Mindoro.

2. Causes and Effects of the issues with direct impact to poverty situation

Results of the study revealed that poverty levels are strongly associated with educational attainment. Low educational attainment resulted to unemployment. It was also confirmed that usually poor families have five or more members. Responsible parenting is critical for an effective poverty reduction program. In the focus group discussions with non-government organization and socio-civic groups, it was pointed out that there are governance and institutional constraints. Many government

leaders have poor political will to implement local reforms. Respondents said that local government capacity for implementing poverty programs is weak. Revealed also were the serious resource gaps for effective basic services delivery.

3. Current programs of various institutions in the locality

The Local Government Units have several poverty reduction programs downloaded by the national agencies but all these registered a very negligible impact. The DSWD as the key implementer of the poverty reduction programs of the government became a dole out agency. The DTI, DOLE and TESDA are some of the agencies mentioned that participate and offer trainings for livelihood programs, but again each of these local agencies packaged their own programs distinct from each other. Respondents attributed these results to the poor political will of the leaders, patronage politics, and cultural values and attitude of the recipients. The initiative and active participation of non-government organizations in the whole region is commendable. The Peace and Equity Foundation (PEF) together with the Partner Access Center (PAC) in each province (AROPAD in Romblon, ORNET in Mindoro, PNNI in Palawan) have successfully delivered major poverty reduction projects. These NGO's focused more on basic services like water and health facilities. The social action groups, mostly with religious affiliation are also mobile and visible but their funds and services are limited. In some parts of the region like Marinduque and Romblon, the cooperatives are well-organized and have established partners of the government that address poverty through micro financing and various livelihood programs. The study also revealed the vast natural resources unique in every province and municipality.

4. Resources and capabilities available

The five provinces are gifted with rich natural resources; from marine to forest, minerals and agricultural lands, vast ecotourism potential, and human resources. However, a large percentage of these resources are endangered if not devastated. The marine ecosystem is disturbed, the potential ecotourism is underdeveloped and the human resources end to migration resulting to brain drain.

5. Areas for State Universities and Colleges (SUC) Intervention

The study identified potential entry points for research and extension programs for SUCs. The unique picture of each province needs a particular intervention program such as:

1. Mindoro Oriental has the Rebel Returnee group who is in need of a holistic package of development program so that members can live a normal life and be productive citizens.
2. Mindoro Occidental has the Indigenous People (IP) with unique culture that has to be addressed and transformed for them to be key players of community development.
3. Marinduque is the home of progressive sectoral cooperatives that contribute in terms of values and social responsibility. The issue of environmental degradation is still a dilemma to the Marinduqueños.
4. Romblon has the empowered women's group aside from established cooperatives who contribute much in the economic and cultural development of the province. These groups need support to sustain their local economic development programs.
5. Palawan is the home of the inmates in the Iwahig Penal Colony. Thousands of them unceasingly pray that someday someone could help review their cases and work for their pardon and be given a chance to live a normal life outside the prison cell.

Findings and Discussions

The study revealed that the major constraint in the attempts to alleviate poverty in the Southern Tagalog island provinces is deeply rooted on the culture and value system of the beneficiaries, program implementer, and the will of political leaders. The poverty alleviation programs initiated by the national government are top down packaged programs that exclude sense of ownership on the part of the recipients. Consequently, it develops "dole-out mentality" and passive attitude towards sustainability of the program. Results further revealed that there is a gap between the program and the actual need of the local community because the social preparation, an important aspect had been missed out.

In recent past, several poverty alleviation programs sponsored by various agencies were disintegrated. Respondents also revealed that these programs were politically attached and discontinued after each term of office.

Respondents further agreed that the ten poverty indicators were offshoots of the three major constraints mentioned above. Research

revealed that the poorest of the poor including inmates in the penal colony, rebel returnees and indigenous people need urgent attention to alleviate them from inadequate condition. The study identified that the existing poverty reduction top-to-bottom programs are not suited to address their needs. Thus, the bottoms-up approach is designed as strategy to truly address the poverty alleviation program issues. The SLPRP is a customized model to ensure maximum results.

CONCLUSIONS

The analysis of the data revealed the following:

1. Majority of the poor in the Region belong to the agricultural sectors in rural areas primarily farmers and fisherfolks, and the marginalized sector;
2. Poverty levels are strongly related to the low educational attainment of the people;
3. The poor have large families with 5 or more dependents;
4. Poor governance and weak political will of elected leaders were identified to be the institutional constraints towards success in poverty alleviation program;
5. Deficient poverty programs are anchored on unreliable and inaccurate poverty information that mismatched with poverty program designs and implementation;
6. Serious resource gaps for poverty reduction activities are prevalent in almost all areas in Region IV-B ; and
7. A multi-dimensional and multi-sectoral approach to poverty reduction is urgently needed to escape poverty traps.

RECOMMENDATIONS

The government should improve its strategy in addressing poverty issues. Poverty problem is multidimensional hence the response should involve multiple sectors, agencies, institutions and stakeholders. The convergence approach is recommended to be scaled up and practiced extensively. This is spelled out in the SLPRP Model diagram. It is further recommended:

1. that values reorientation be the core of the packaged SLPRP model;
2. that efficiencies and capacities be improved among institutions tasked to coordinate poverty policies and implement poverty programs;
3. that cooperating institutions help reduce graft and corruption within their ranks;

4. to consider the unique picture of each province, region and its local characteristics in designing poverty program interventions;
5. to involve the marginalized groups and the stakeholders in the planning and designing of poverty programs through public hearing, assembly meeting or consultation forum;
6. to encourage non-government organizations and key stakeholders to complement the government poverty programs in specific localities and communities from planning to implementation, then to monitoring and evaluation;
7. to define the specific roles of agencies and key stakeholders at various levels of intervention into a new poverty framework to have a unified action; and
8. to formulate a management plan with corresponding organizational diagram depicting the flow of communication and coordination among and between agencies and key stakeholders.

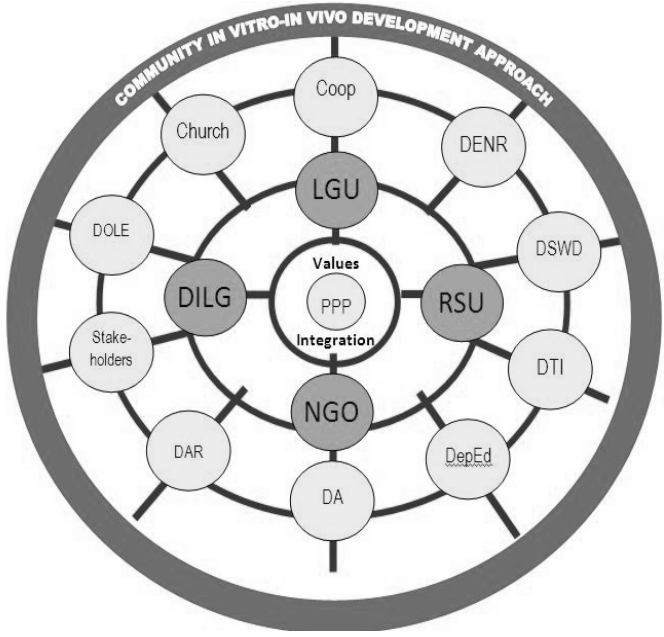


Figure 4. The SLPRP Model

The Sustainable Livelihood Poverty Reduction model explains that every government and non-government agency has a poverty related program. Each program has a distinct approach but the goal is focused on the government's Medium Term Development Plan on poverty alleviation. However, the piecemeal approach in program implementation lessens its impact on the socio-economic conditions of the beneficiaries. Only when resources of different GOs, NGOs and stakeholders are pooled together and

their services properly bundled in a common but differentiated responsibilities shall poverty alleviation programs become more sustainable. For example, DOLE trains the manpower resource, DOST provides funding and DTI markets the technology.

Central to the model are the core agencies that must converge first before reaching out to other stakeholders. LGU controls a lot of human and financial resources, however the agency is known for a political inkling. In this case DILG becomes the arbiter of political motives in any poverty program. NGOs on the other hand have some misgivings on LGU's participation in poverty related projects, thus, RSU, a state university comes into the picture as a neutralizer and convenor to put all efforts together to a common vision and goal. For the purpose of the model above, the following acronyms have been defined:

Acronyms:

PPP – Public-Private Partnership
LGU – Local Government Unit
RSU – Romblon State University
DILG – Department of Interior of Local Government
DOLE – Department of Labor and Employment
DAR – Department of Agrarian Reform
DepEd – Department of Education
DTI – Department of Trade and Industry
DSWD – Department of Social Welfare and Development
DENR – Department of Environment and Natural Resources
DA – Department of Agriculture

Hi-Five Rules in the SLPRP Model Formulation

1. Conduct thorough environmental scanning and public consultation;
2. Proceed with a participative road mapping to design the SLPRP model;
3. Presentation of SLPRP model for consensus building to engage sectoral participation; and
4. Implementation of the SLPRP model using Public Private Partnership.
5. Establish a healthy feedback mechanism through regular monitoring and evaluation

REFERENCES

Asian Development Bank. 2009. Poverty in the Philippines: Causes, Constraints, and Opportunities. ADB Mandaluyong City, Philippines.

Balisacan, Arsenio M. 2001. Growth and Poverty Reduction: Trends, Determinants, and Policies. Asian Development Bank. PO Box789, Manila, Philippines.

Balisacan, Arsenio M., and E. M. Pernia. 2002.What Else Besides Growth Matters to Poverty Reduction? Philippines. ERD Policy Brief N. 5. Asian Development Bank. PO Box789, Manila, Philippines.

Constantino, Winifreda. 1999. A Survey of Poverty Related Researches and Monitoring Systems in the Philippines. MIMAP Research Paper No. 42. MIMAP Project Policy and Development Foundation Inc. Metro Manila, Philippines.

Lam, Le Thi Ai. 2005. Human Resource Development and Poverty in the Philippines. Discussion Paper Series No. 2005-17. Philippines Institute for Development Studies. Makati City, Philippines.

National Statistical Coordination Board. 2005. Estimation of Local Poverty in the Philippines, November 2005, In Cooperation with the World Bank. http://www.ncsb.gov.ph

Schreiner, Mark. 2009. A Simple Poverty Scorecard for the Philippines. http//www.microfinance.#Philippines.

UNDP. 2008. Strong Institutions, Inclusive Growth: Poverty Reduction and Achievement of the MDG's. In UNDP Annual Report 2008: Poverty Reduction. UN, New York.

NSCB 2000 Poverty Estimates, www.nscb.gov.ph/poverty/2000/mapping

Romblon Medium Term Dev. Plan and Provincial Annual Report For C.Y. 2009

MIMAROPA 2003 Development Plan from NEDA

An Integrated Reforestation, Conservation and Sustainable Livelihood Program for Kanawan Aytas in Morong, Bataan: A Science-Based Community Empowerment Model[1]

Borromeo B. Motin[2], Merian C. Mani[3] and Jeter S. Sespeñe[4]

ABSTRACT

The Mabukún Aytas in Morong, Bataan is a semi-nomadic indigenous community whose livelihood is primarily dependent on the bounty of nature. Since time immemorial, the Aytas observed sustainable hunting and gathering practices. The conservation of nature is integrated in their culture. However, due to massive destruction of habitat caused by logging, unsustainable hunting methods by non-indigenous poachers, and politically backed conversion of forest land into mono-crop plantation, farm and grazing lands, their livelihoods become insufficient to their needs forcing them to eat only twice or once a day. Our previous studies showed that an Ayta earned only $0.40/day, a value way below the $2/day extreme poverty line.

This paper aims to share lessons learned in the implementation of the science-based community development program entitled "Establishment of Integrated Reforestation, Conservation and Sustainable Livelihood Program for Kanawan Aytas in Morong, Bataan-Philippines." This program provides Ayta community the opportunity to demonstrate their traditional knowledge in preserving and conserving remaining resources and helps them to develop a culture-based sustainable livelihood program. Particularly, this paper is on the interplay of social science aspects and synergism of scientific and traditional knowledge in the implementation of the program. It also tackles the methods and processes developed and used by the community to nurture the sense of community ownership and the community-based management mechanisms as strategies to strengthen their capacity and to promote empowerment of the community.

Key words: *Science-based community development, forest conservation and rehabilitation, synergism of scientific and traditional knowledge*

---

[1]Paper and poster presented during the 2nd Bansomdejchoapraya Rajabhat University International Conference on March 25-27, 2011 at Ban Chaopraya Hotel, Bangkok, Thailand.

[2] PhD in Philippine Studies; Director for Extension, RSU

[3] Ed.D.; Vice President for Research, Extension and Production, RSU

[4] PhD in Commerce; University President, RSU

INTRODUCTION

In Philippine history, the Negritos are believed to be the first inhabitants of the country found in different areas all over the Philippines and the Aytas are among the Negrito group of indigenous people located in central Luzon provinces of Tarlac, Pampanga, and also in Bataan and Zambales.

Forest is the lifeblood of the Aytas. It is the main source of living that interlink with their culture, tradition and practices. Hunting and gathering are among the important economic activities and traditional practices that symbolize the Aytas' way-of-life. Conservation of natural resources is integrated in their culture as they only get need-for-the-day and conscientiously avoid to "salanta." *Salanta* means damaging of natural resources by over harvesting. This culture is evident in their daily subsistence lifestyle practiced thru seasonal hunting of wild pig and deer from June to December while fowl monitor lizard throughout the year. Honey, the most important forest product, is gathered only from December or January to May while hunting of wild pig and deer are conducted from June to December. Both traditional practices are strictly observed even by the younger generation.

The Aytas are keen in identifying the signs of nature. Collection of honey is started only when honey source plants bloom and is stopped when the beehives have formed a protective canal against rain which signifies that the rainy season is about to begin. Hunting is partly conducted only during rainy season because food such as nuts, fruits, grass and worm are abundant in the forest.

Despite their sustainable traditional utilization practices, the signs of over-harvesting are now manifested due to unsound methods by non-indigenous peoples and the destruction of forest. These practices affect the production of honey that beehives become more and more difficult to find and smaller in size while wild animals have declined in number.

METHODOLOGY

This research was accomplished based on the The United Nations Declaration on the Rights of Indigenous Peoples affirming that indigenous peoples are equals of all others in different Nations. They should be recognized with individual differences. This paper features the *sui generis* perspective on conservation and utilization of natural resources of the Aytas,

and the participation of migrant upland farmers and fishermen in Morong, Bataan.

This study was conducted with utmost respect to the Aytas' traditionally observed protocol. First, seek permission from tribal leaders and community members to conduct research. Second, presenting the topic with its procedure and activities to the leaders and for community assessment and evaluation.

Information in this paper is gathered over the span of a five-year (2004-2009) period. Borromeo B. Motin had voluntarily immersed with the Ayta community as social scientist and community development officer for the Center for BioMolecular Science Foundation and of the Bataan Center for Innovative Science and Technology, Inc., respectively.

The community permitted the gathering of data through participatory observation of the researcher who started as outsider of the community later as friend and advocate of Aytas' rights. They also approved the conduct of the following activities: 1) formal and informal interviews with tribal leaders, committee members, and workers; 2) focused group discussions; 3) and validation of data.

Other information was culled from workshop outputs, minutes of meetings, field notes/diaries, and results of project implementation. Bits of information were endorsed through the community consensus which is the most important and respected process. Agreements, though primarily oral, were treated as legally binding and final with all information cited in this study validated and allowed by the community leaders.

HISTORY OF THE AYTAS IN MORONG, BATAAN

Historical accounts handed down through generations highlighted the ordeals of the Magbukún tribe who started in their first encounter with non-indigenous settlers in Mabayo. Apo Alipon initially welcomes newcomers and treated his guest as friends. Suddenly, Apo Alipon discovered that newcomers had the tendency to be selfish and so they took advantage of their generosity. This did not please the Aytas so they decided to talk and tried to put up a set of rules to regulate the use of land in their territory. Talks between the two parties were not successful that resulted in a heated dispute until the new settlers drove the Aytas out of Mabayo.

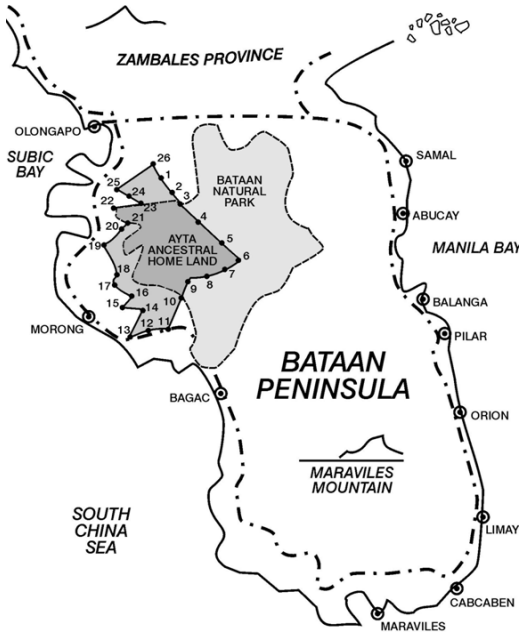


Figure 1. Map of Aytas' Ancestral Domain

Apo Alipon and Lola Moray moved far northward until they reached the bountiful areas around Boton, now located inside Subic Bay Freeport Zone (SBFZ). As a practice, the first time they reached the place a hut was built, cleared small piece of land, and planted crops. Apo Alipon continued their journey and trekked to the west and northwest side of Mt. Natib and established territorial boundary that now belongs to the ancestral domain of Kanawan Aytas.

Origin of Magbukún Tribe

In an interview with Aquino Malunic, a tribal leader, Apo Malu and Lola Unhik were the first Ayta couple to set foot in Bataan province while Apo Alipon and Lola Moray, blessed with six children, were the first Ayta couple to settle in Morong.

Apo Alipon and Lola Moray originally came from Zambales. They traveled to the coastal area of Morong to look for a better place to live in and settled in an uninhabited area now called Barangay Mabayo and never returned to Zambales. The term "Mabayo" was derived from the Ayta word "bayo" which means "new people arrived" and it was probably used to mark where they met new friends who are believed to be Moros.

The Kanawan Aytas belong to the Magbukún tribe, descendants of Apo Alipon and Lola Moray. The term "Magbukún" literally means "on his own." Since Apo Alipon and Lola Moray never returned to Zambales they were considered to be on their own by the tribe from which they originated.

When Apo Alipon reached the ripe age of approximately 123 years and in preparation for his passing away, he decided to hold a gathering of all members of his clan including his children and grandchildren from different parts of Bataan. It was held along Kabuyaw River where he worshipped and gave thanks to *Anito* (god of nature). He counseled and admonished his descendants and blessed each of his children and grandchildren before sending them off. He asked them to make an oath to *Anito* and requested them to dip their hands in water called "kanaw" as a symbol of purity and to place their hands on their chests. He then said aloud in their language:

> "*You from my race, this is what you should do for all time. You should love one another, help one another, care for and respect the land I gave you, plant, take care and nurture it, and treat it as a community property."*

Settlement of Kanawan Aytas

The word "Kanawan" was derived from the place where Apo Alipon requested his descendants to dip their hands before they took their oath. It is located in Sitio Kanawan, Barangay Binaritan, Morong, Bataan.

In 1932, the Legislative Act No. 3915 entitled "An Act Providing for the Establishment of National Park Declaring such Park as Game Refuges and for other Purposes" was enacted. Old conservation philosophy prescribed that a protected area should be free from any human activity. Thus, the semi-nomadic indigenous communities all over the country were forced to live in one settlement.

The Aytas in Morong preferred to settle in Sitio Lemon in Barangay Sabang. According to tribal chieftain Rudy Tamundog, though they were ordered to select only one settlement, the Aytas furtively moved back and forth between Sitio Lemon and San Isidro for better sources of water.

But in 1972, they evacuated to a temporary settlement at the nearby town proper called "Timbungan" due to continued fighting between the government military forces and the New Peoples Army, the armed group of the Communist Party in Philippines. Years later, former First Lady Imelda

Marcos chose Sitio Lemon as suitable site for the Philippine Refugees Processing Center (PRPC). Aytas were evicted from their ancestral land to give way to the Vietnamese refugees. Their burial site was desecrated while the spring which served as water source was flattened to give way to the construction of cottages.

On 27 November 1987, former President Corazon C. Aquino signed a Presidential Proclamation No. 192 declaring 165 hectares of the Bataan National Park as Kanawan Negritos Reservation Area (KNRA). Engr. Alberto Mangalindan however claimed that the area of reservation was 227 hectares after a ground survey was conducted in January 2008.

The KNRA is now the home of Aytas and non-Aytas settlers. Today there are about 41 hectares of land occupied by 13 non-indigenous migrant families and 186 hectares are used by the Aytas with about 156 hectares for agricultural and agro-forestry use, two hectares for residential use, one hectare for the elementary school and 30 hectares protected, reforested and sloped areas that are not suitable for farming.

The Socio-Cultural Development Index (SCDI)

In one of the public forums, Berlinda Restum, an Ayta women organization president, asked this question: "How can you ensure protection of our culture from the development brought about by your project in our community?" This question led to the development of a "Modified Socio-Cultural Development Index for Kanawan Aytas in Bataan "to benchmark the present condition and assess the long-term impact of development intervention in their community."

Figure 2. The 4-Helix Model for Sustainable Development

Standard economic indicator like Human Development Index (HDI) is not applicable to a predominantly non-monetary economy and it does not include cultural indicator. For Kanawan Aytas, the most important factor in assessing development is the status of their cultural integrity and heritage that ensure communal ownership of the land, Magbukún language, traditional costume and tools. To address the deficiency, the researchers devised a modified socio-cultural development index (SCDI) to help assess the effect of future bio-diversity and other initiatives in Ayta community. The SCDI is a composite of four indicators that are weighted according to the Aytas' consensus: 40 percent cultural integrity, 30 percent education, 20 percent income and livelihood, and 10 percent health.

Using the formula, a relatively low value of SCDI (0.524) was obtained for the Kanawan Aytas despite the high value and indicator weight for cultural integrity (0.889 out of a possible 1.0). The low SCDI reflects the poor educational status (0.268), poor income and livelihood (0.230) and poor health statistics (0.425) of the community.

ANCESTRAL DOMAINS OF THE AYTAS IN MORONG, BATAAN

The Magbukún Aytas have an estimated 10,970 hectares ancestral domain (AD) out of 21,910 hectares land area of Morong town that covers part of the Subic Bay Freeport Zone (SBFZ), Bataan Technology Park, Inc. (BTPI) and Bataan Natural Park (BNP). The AD claim is located in the northwestern side of the province about 165 kilometers away from Manila.

Their ancestral domain is rich in natural resources. It is part of the 10^{nth} priority Key Bio-diversity Areas (KBA) in the Philippines with over 6,490 hectares forestland. There are several rivers and creeks that support the agricultural and domestic needs of the community downstream. There are no data on mineral resources to show because the Aytas strongly opposed the conduct of mineral analysis to discourage mining groups in their ancestral domain. The prevailing climate is characterized by pronounced dry and wet seasons that are categorized under type 1 of the Modified Corona's Classification with mean annual rainfall of 1,173 mm (2004).

However, this biodiversity-rich area is under threat. Illegal logging operations backed by politicians are continuously intruding into the protected area. The indiscriminate charcoal making, conversion of forest land into farm and grazing lands, and unregulated hunting by non-indigenous poachers even during off-season are conspicuously encroaching in all sides of their AD.

REFORESTATION AND CONSERVATION PROJECT

The Kanawan Aytas have been alarmed about the rapid degradation of bioresources in their ancestral domain. The Aytas appealed to loggers to spare the beautiful Bisay Falls area and its surrounding forest. Loggers obliged, at least for the time being, by moving operations farther away from Kanawan.

In 2004, the Ayta leaders composed of council of elders, tribal council, peoples' organization, women organization leaders, and youth representatives discussed a five-year development plan of forest conservation to be presented to government and non-government organization for assistance. The primary objective is to conserve and revive their traditional source of living.

Vision and Mission of the Ayta Community

The tribal leaders, with assistance of Borromeo B. Motin, the project's social scientisit formulated their vision and mission to set a guide on the kind of development appropriate for their community and the mechanism to ensure respect for their rights and spur community empowerment. Their vision and mission state:

Vision
Respect the rights of indigenous peoples.

Revive, protect, and preserve the Ayta culture, language, tradition, and natural resources to provide and sustain the needs in sending children to school and assert the rights to roam freely in the forest, improve livelihood opportunities, ensure access to potable water, and other basic social services.

Mission

To inform all concerned about the rights of the indigenous peoples

To sustainably protect, preserve, and improve the traditional knowledge, culture, tradition, language, and skills to be able to assert the rights of indigenous peoples to ancestral domain, livelihood, and health

Objectives of the Project

1. To establish a partnership between the community and the Center for Bio-molecular Science Foundation (CBMSF) and Bataan Center for Innovative Science and Technology, Inc.

2. The (BCISTI) should cooperate and secure financial support from the Philippine Tropical Forest Foundation to implement the reforestation and conservation program of the community.

3. To motivate, empower, and mobilize the Aytas of Kanawan to rehabilitate and conserve two critical areas of their ancestral domain within the Bataan National Park (BNP).

Development of Sustainable Livelihood

In attaining the opportunity of receiving the fund for conservation, the establishment of sustainable livelihood project is a prerequisite for community-based forest rehabilitation program and conservation efforts; however, it must be borne in mind that among the major factors that contribute to the failure of many reforestation projects are the following:

1. Lack of community participation and ownership.
2. Local stakeholders may lose potential income and access to resources forcing them to bear an undue economic burden as the result of conservation activities.

Following are the livelihood systems identified by the communities:

First, the tribal leaders identified nature-based livelihood symbiotic with the philosophy of conservation program and among the priorities were the establishment of ecotourism, agro-forestry/perma-culture and utilization of non-wood forest products.

Second, the Aytas agreed to seek partnership with different specialized organizations to assist them in the development of identified livelihood projects.

Third, the University of the Philippines Asian Institute of Tourism (ATI) helped identify the tourism assets embedded in their indigenous culture and traditions. These were limited not only to cultural presentations and indigenous cuisine.

Fourth, the ATI also assisted in packaging interpretative trails to Bisay Falls, in hosting members of the Bird Watchers' Club, mountain hikers

and other associations and in training for the tourism managers in the community requiring the partnership to formulate the tourism management mechanism was installed. Its formulation urged the advocators to apply the principles of agro-forestry and perma-culture were integrated in planning and development of the community. Permaculture or "permanent agriculture", the science and art of integrating indigenous resources with appropriate technology, an environment-friendly method for sustainable and intensive farming throughout the year. Agro-forestry and permaculture experts volunteered their services while marketing of excess agricultural products will be purchased by partner women organization engaged in food processing.

Non-wood forest products were explored as herbal teas, wines, fruit preserves and raw materials for handicrafts.

Indigenous Environmental Management

The tribal council (TC) is the main governing body of the Magbukún Ayta community while the Council of Elders (CE) serves as spiritual and cultural adviser. The TC is headed by the tribal chieftain who leads and represents the community in internal and external affairs. The leaders are selected from members of seven original families that have qualities to assume the position.

The philosophy of indigenous environment protection, conservation, and utilization is primarily based on Apo Alipon's doctrine. Aytas conscientiously abide by the cycle of nature. Among the traditional practices that are unconsciously conducted are the following: (a) dispersing forest seeds like birds by picking seeds found along the way and throwing them in other areas, (b) periodic hunting and gathering practices, and (c) taking only what is needed for a day to prevent imbalance of nature (*salanta*).

Development Framework and Sustainability

The development framework is based on modified S&T economic model called the Four-Helix model. This model is a partnership between government, academe, industry, and community. The original Three-Helix Model, a partnership between government, academe and industry that had been successful in its technology incubator in developed countries like Silicon Valley in California, U.S. East Coast, Europe, Japan, Singapore, Taiwan and Korea but failed in the Philippines. It was proposed that the community be the fourth component of the S&T economic model included but it should be capacitated and empowered to be an active partner in development.

The researchers believe that real empowerment can happen only if there is a program for sustainable community development. A holistic approach was tested in Ayta community that included relevant education, culture-sensitive development, health, and livelihood appropriate to their culture, skills and resources.

Sustainability of project management was ensured through a transition model in which Ayta leaders suggested a five-year development scheme based on their learning and empowerment capability. In the first year of project implementation, management was ninety percent (90%) controlled by partner organizations while with the ten percent (10%) management was shared by the community. In the succeeding years, community management responsibility increases from 40 to 60, 80 and 90 percent while partner organization decreases from 80 then 60, 40 and 10 percent respectively. Community leaders appealed to CBMSF and BCISTI not to phase it out entirely after five years because they need advice from time to time.

In addition, the Aytas developed a mechanism to ensure financial capability to support the community conservation project. Earnings from projects and services will be taxed ten percent. They also developed benefit sharing mechanism for any project that develops commercial products from community resources.

CONCLUSIONS

The scientific basis for strategies used in eco-restoration is very important in ensuring the success of the bio-diversity and conservation program. The social science component is equally significant in terms of community preparation, training design, and study of culture in order to identify the community values and sensitivities. Innovation through science and technology is best accepted by the community when a good rapport is well established. Cooperation with neighboring communities is also indispensible in the success of the project.

Most of the Kanawan Aytas do not yet have a practical knowledge on nutrition, hygiene, and sanitation, a prerequisite to food processing as a livelihood activity. Development of livelihood opportunities should be made based on their ability, skills, and resources.

The holistic development approach had been successful because it responded to the condition and needs of the community. An ethically preferred process by the community should be respected to facilitate active

participation, trust, empowerment, and ownership. Respect the indigenous peoples rights, ideas and views, self determination and self governance, transparency, and sensitivity to differences of culture, tradition, knowledge, systems, and practices should strictly observed. Securing free and prior informed consent (FPIC) of the community is a precondition to program/project implementation.

REFERENCES

Ancestral Domain Sustainable Development and Protection Plan of the Ayta community in Sitio Kanawan Magbukún Aytas, Morong, Bataan, 2008.

_____. Bataan Natural Park Management Plan, 1999.

_____. Indigenous Peoples Rights Act (Republic Act 8371), Republic of the Philippines

_____. Morong Comprehensive Land Use Plan, 2007.

Motin, Borromeo B. and JL Cruz. 2005. *The Clan of Apo Alipon: An Ethnographic Study of the History of the Aytas in Kanawan, Morong, Bataan, Philippines*, (unpublished document attached in CADT application).

Motin, Borromeo B., JL Cruz, Gifford F, MA Kron. 2006. *A Modified Socio-Cultural Development Index (SCDI) for the Aytas of Kanawan, Morong, Bataan, Philippines, in Indigenous Perspective.* Tebtebba Foundation, Baguio City, vol.8 (1), pp.51-71.

Motin, Borromeo B. and JL Cruz. 2008. *"An Index to Assess the Impact of Development Intervention on the Community of Kanawan Aytas" in Indicators Relevant for Indigenous Peoples: Source Book*. Tebtebba Foundation, Baguio City, pp. 327-335.

Motin, Borromeo B. and U.F. Ferreras. *Life in the Forest: Survival Strategies and Foraging Practices of Magbukún Aytas in Bataan Natural Park, Philippines.* (Unpublished document)

National Integrated Protected Areas Program. 2001. Final Report: 1995-2001. Quezon City.

Regpala, Ma. Elena, Borromeo B. Motin and Balawag, Grace. 2010. *Philippine Indigenous Peoples and Protected Areas: Review of Policy and Implementation.* Tebtebba Foundation, Baguio City.

Rovillos, Raymundo. 2000. *"Aeta Communities and the Conservation of Priority Protected Areas System project", in Indigenous Perspectives*, Vol. 3, No. 1.

Salonga, J.H., RM Quitain and B.B. Motin. 2010. *"Nurturing the Forest" in Dunong at Batas: Documenting Indigenous Wisdom and Customary Law.* Tebtebba Foundation, Baguio City, pp.69-86.

Design, Fabrication and Test Performance of a Modified Rice Hull Gasifier Stove[1]

Orley G. Fadriquel[2]

ABSTRACT

The focus of this study is to design, fabricate and test the performance of the modified rice hull gasifier stove based on the original design of Engr. Alex Belonio of the Central Philippine University.

Modification was made by increasing the size of the reactor, the part where rice hulls are placed and burned. This reactor is cylindrical in shape having a diameter of 170 mm and a height of 700 mm. The cylinder is made of an ordinary galvanized iron sheet gauge no. 16, with an annular space of 250 mm preventing heat loss in the gasifier. At the lower end of the reactor is a G.I. sheet fuel grate which is used to hold the rice hulls during gasification.

The fan assembly is the component of the stove that provides the air needed by the fuel during gasification. The fan used for the standard model is a 4-inch diameter axial-type fan that is commonly used for computers. It has a rated power input of 16 watts using a 220 volt AC line. A manually-operated rotary switch is used to control the speed of the fan which, in turn, controls the flow of gas to the burner during operation, which consists of a series of holes, 3/16-inch in diameter spaced at 1/8 inch. On top of it is a pot support that holds the pot in place upon cooking. The burner is removable for easy loading of fuel into the reactor and is set in place upon operation. Based on the actual test conducted for one loading of rice hull (1.3 kg) the stove can cook rice and fish within an average of 43.08 minutes. Likewise, cooking pork "sinigang" can only consume an average time of 35.83 minutes; and that the remaining fuel in the stove can still simmer or boil one liter of water within an average of 7.47 minutes. For an investment, the payback period of the project is six months.

Key words: *Rice hull gasifier stove, rice hull, gasifier stove, alternative energy*

[1] Paper and poster presented during the 23rd Regional Symposium on R&D Highlights sponsored by STARRDEC at A&A Plaza Hotel, Puerto Princesa City, Palawan on August 19, 2010.

[2] Assistant Professor II; Mechanical Engineer; Faculty, College of Engineering and Technology, RSU

INTRODUCTION

Rice hull *(darak)* biomass waste can be found almost in any part of the Philippines. It is dumped along roadsides and some are burned to minimize its volume. In Romblon, particularly in Odiongan, reducing the volume of rice hull waste is a big problem because it clogs irrigation canals and drainage and emits foul odor when soaked in water for long periods.

One of the conventional sources of cooking fuel in the Philippines is Liquified Petroleum Gas (LPG). It is used in both rural and urban areas where the supply is accessible. Convenience is the main reason why it is widely adopted for household, as well as for food business establishments because it is easy to control and to use. However, the unpredictable increase of oil price in the international market also brought the increase of LPG fuel. The tremendous and continuous increase in LPG prices prompted household members and some business establishments to look for an alternative cooking fuel.

Wood is a good source of cooking fuel but unlike LPG, its flame is not clean and it emits a considerable amount of carbon dioxide that darkens the bottom part of pots and casserole. Charcoal, on the other hand, is also a good source of cooking fuel, especially charcoal from coconut shell it emits bluish flame like the LPG. Wood charcoal, despite its advantages over wood as fuel, is not recommended to be used for cooking because it causes forest denudation.

The soaring of LPG price, the disadvantages brought by using wood as fuel and the forest denudation caused by cutting of trees for wood and wood charcoal purposes have challenged research centers and institutions to develop technology that will utilize alternative sources of cooking fuel. The potential of biomass as alternative fuel source is one of the options to augment the needs for cooking fuel.

Gasification is a process of producing gas by burning biomass fuel. The gas produced is then ignited in the burner. For several years, gasifier stoves have been developed in many countries which may replace LPG stoves. In the Philippines, there are research institutions that developed gasification stoves and one of which is the Central Philippine University in Iloilo City.

Belonio, A. T. (2005) mentioned in his manual "*in year 2000, with the establishment of the Appropriate Technology Center (ATC) under the Department, different designs of cookstoves were developed utilizing rice hull as fuel. Through a collaborative program with The Asian Alliance of Appropriate*

Technology Practitioner Inc. (APROTECH ASIA) and the Asia Regional Cookstove Program (ARECOP), the Author was given an opportunity to attend the Training on Wood Gasifier Stove at the Asian Institute of Technology in Thailand in 2003. In this training, an Inverted Down-Draft (IDD) or Top-Lit Updraft (TLUD) wood gasifier was demonstrated by a Sri Lankan participant, who found out that such wood gasifier is promising to be used for rice hulls as fuel without experiencing the problems encountered in the previous designs of rice hull gasifier".

Engr. Belonio permits other researchers to improve on his work as seen here: *"Permission is hereby granted for the reproduction of this material, in whole or in part for educational, scientific, or development-related purposes provided that (a) full citation of the source is given and (b) notification in writing is given to the author".*

With the preceding premise, the researcher got interested in the gasification technology of Engr. Belonio in making use of the rice hull biomass waste in our locality. In September 2009, after a series of communication with Engr. Alexis T. Belonio, the proponent was granted the authority to adapt the rice hull gas stove technology. Adaptors form was sent and within the same month, the proponent started modifying the design of Engr. Belonio.

OBJECTIVES

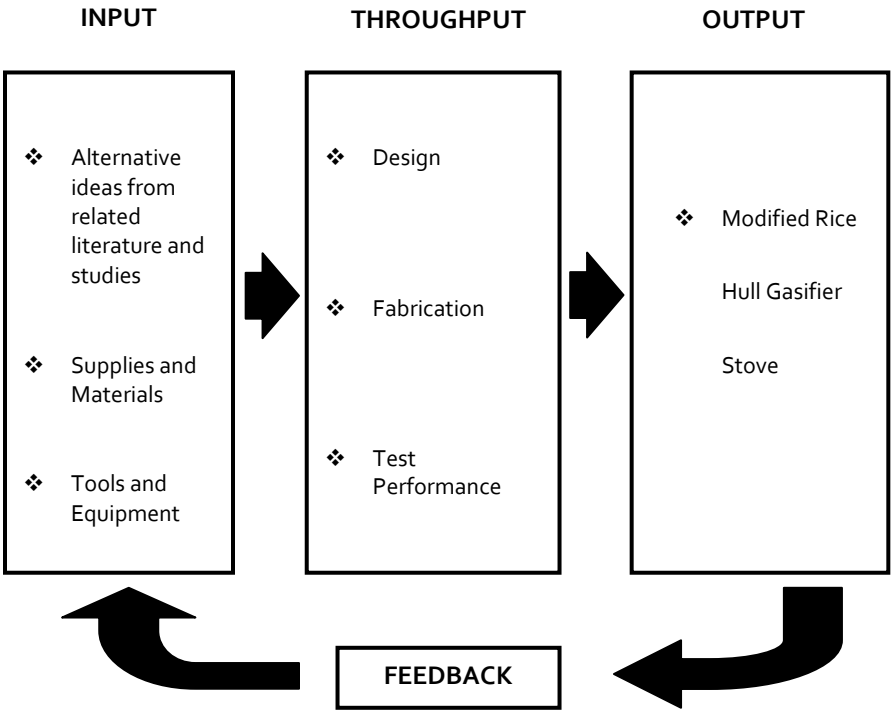
This study was conducted to design, fabricate and test the performance of the modified rice hull gasifier stove. Specifically, the objectives of the study are the following:

1. To help address problems along climate change and mitigation through a study that would utilize cheap and at times problematic material as rice hull;
2. To modify the design of the components of a rice hull gasifier stove, namely:
    a. the gasifier stove reactor
    b. the burner
3. To fabricate the rice hull gasifier stove based on the new design parameters/ standards.
4. To test the performance of the machine to determine the following:

a. Start up time
b. Operating time
c. Total operating time
d. Fuel consumption rate
e. Specific Gasification rate
f. Combustion Zone rate
g. Boiling time of water
h. Cooking time (Rice)
i. Frying of Fish
j. Cooking time of Pork Sinigang
k. Sensible heat
l. Latent heat
m. Power input
n. Power Output
o. Thermal Efficiency
p. Heat Energy Input
q. Percent char

5. To determine the payback period for an investment.

CONCEPTUAL FRAMEWORK



The conceptual model of the study is shown in the form of a paradigm in Figure 1. It utilizes the input, throughput and output model. The INPUT of the study consists of alternative ideas from related literature and studies, supplies and materials, tools and equipment, and cost of construction of the project. The THROUGHPUT covers the different

processes involved in the development of the model namely: designing, fabrication and testing. The OUTPUT is the modified rice hull gasifier stove.

SIGNIFICANCE OF THE STUDY

The modified rice hull gasifier stove technology has been found to have the following qualities:

- It can significantly reduce the cost of household spending for conventional fuel sources such as LPG, electricity, kerosene, wood and wood charcoal.
- It can help reduce the problem of rice hull disposal which contributes a lot to environmental pollution, especially the burning of rice hull along roadside.
- It can help preserve the forest by reducing the cutting of trees for the production of wood fuel and wood charcoal.

MATERIALS AND METHODS

Materials

Table 1. Materials used in the project

Qty	Specs.	Description
1 pc	# 16	Galvanized Iron Sheet
1 pc	4" x 4"	Computer Fan (5V, AC)
1 kg	Ordinary	Welding Rod
1 pc		Rotary Switch (dimmer)
1 pc	½"x½"x20'	Square bar
1 pc	Ordinary	Male plug
2 m	# 16	Electric wire

Tools and Equipment Used

1. For Fabrication
    - Electric arc welding machine
    - Rubber mallet
    - Hammer
    - Gas welding machine
    - Grinding machine
    - Tin Snip

- Hacksaw
- Anvil
- Sandpaper
- Sheet roller
- Bench shear

2. For Testing
   - Spring Balance
   - Measuring cup
   - Thermometer
   - Stopwatch

Methods

Design Parameters Used in Modifying the Rice Hull Gasifier Stove

To come up with the modified rice hull gasifier stove, the following parameters/ standards below were used by the researcher, thus, deviating from the original design of Engr. Belonio.

Table 2. Design Requirements/Standard used in the modified rice hull gas stove

Design Requirement	Value
The heat requirement to cook food	810 kcal/kg
Fuel consumption rate	1.5 kg/hr
Reactor Diameter	170 mm
Height of the reactor	700 mm
Time to consume rice hull	0.999 hrs.
Air needed for gasification	1.7172 m^3/kg
Air Velocity	2.19 cm/sec
Resistance to air flow	0.35 m H_20

Fabrication Procedure

The fabrication of the gasifier stove is simple. Accuracy in measuring and cutting of sheets is an important aspect since measurement is in millimeters. It is necessary however, to procure all the supplies and materials needed in the fabrication of the machine. Shop tools and equipment had to be prepared. It was also necessary to contact an expert welder prior to fabrication. The procedure is as follows:

1. A layout of the various parts of the stove starting from the reactor cylinder to fuel grate and support leg was done.
2. The various plates were cut to the required sizes.
3. The plate was rolled for the inner cylinder to make a shell reactor.

4. A hole was drilled for the outer cylinder.
5. Two circular plates were cut for the top flange and the base plate of the outer cylinder.
6. Another circular plate for the bottom flange of the reactor inner cylinder was cut.
7. The bottom flange at the base of the inner cylinder was welded.
8. A circular plate was made to form a grate.
9. Holes were drilled in plate.
10. The grate inside the inner cylinder was welded on the same plane with the bottom flange.
11. The inner cylinder assembly was inserted into the outer cylinder.
12. The bottom flange was welded to the outer cylinder. Then, the top flange was welded to the inner and outer cylinders.
13. The base plate was welded at the bottom of the outer cylinder.
14. A square hole was cut at the lower end of the outer cylinder for fan casing attachment.
15. A plate was cut for fan casing assembly.
16. The casing was welded to the outer cylinder.
17. A round iron bar for support legs was cut.
18. The iron bar was bent to form angular support legs
19. The legs were welded to the outer cylinder equidistant to each other.
20. A round iron bar for the handles was cut.
21. The iron bar was bent to form handle for proper gripping.
22. The handles were welded to the outer cylinder with one at the top end and the other at the lower end, slightly above the fan casing.
23. A circular plate for the burner and plates for the sleeve were cut.
24. Holes were drilled on top of the plate to form burner.
25. Two rounds of holes were formed, one row at the inner ream and another at the outer ream of the burner plate.
26. Plates for the pot support were cut such as rings, stands and handle.
27. The pot support ring was formed first, then the pot support stands to the rings were welded, starting from the inner to the outer rings.
28. The stand of the burner plate was cut to form the entire burner structure.
29. The pot support handle was welded to the outer ring.

Data Collection and Computation

The following test parameters were used in evaluating the performance of the rice hull gasifier stove:

1.	Start up time	10.	Frying of Fish
2.	Operating time	11.	Cooking Pork Sinigang
3.	Total operating time	12.	Sensible heat
4.	Fuel consumption rate	13.	Latent heat
5.	Specific Gasification rate	14.	Power input
6.	Combustion Zone rate	15.	Power Output
7.	Boiling time of water	16.	Thermal Efficiency
8.	Cooking time (Rice)	17.	Heat Energy Input
9.	Cooking time (Rice)	18.	% char

1. Start-Up Time – is the time required to ignite the rice hulls and consequently to produce combustible gas. This parameter is measured from the time the burning pieces of paper are introduced to the fuel in the reactor until combustible gas is produced at the burner.

2. Operating Time - is the duration from the time the gasifier produced a combustible gas until no more gas is obtained from the burning rice hulls.

3. Total Operating Time- is the duration from the time the rice hull is ignited until no more combustible gas is produced in the stove. Basically, it is the sum of the start-up time and the operating time of the stove.

4. Fuel Consumption Rate (FCR) – is the amount of Rice Hull fuel used in operating the stove divided by the operating time. This is computed using the formula,

$$FCR = \frac{\text{Weight of Rice Hull Fuel Used (kg)}}{\text{Operating Time (hr)}}$$

5. Specific Gasification Rate (SGR) – is the amount of rice hull fuel use for unit area of reactor. This is computed using the formula,

$$SGR = \frac{\text{Weight of Rice Hull Fuel Used (kg)}}{\text{Reactor Area } (m^2) \times \text{Operating Time (hr)}}$$

6. Combustion Zone Rate(CZR)- is the time required for the combustion zone to move down the reactor. This is computed using the formula,

$$CZR = \frac{\text{Length of the reactor (m)}}{\text{Operating Time (hr)}}$$

7. Boiling Time- is the time required for the water to boil starting from the moment the pot is placed on the burner until the temperature of water reaches 100°C.

8. Sensible Heat – is the amount of heat energy required to raise the temperature of water. This is measured before and after the water reaches the boiling temperature and computed using the following formula:

$$SH = Mw \times Cp \times (Tf - Ti)$$

where:

SH - Sensible Heat, Kcal
Mw - Mass of water, kg (1kg/liter)
Cp -Specific Heat of Water, 1 kcal/kg-°C
Tf – Temperature of water at boiling, Approx 100 °C
Ti- Temperature of water before boiling, 27-30 °C

9. Latent Heat – is the amount of heat energy used in evaporating water and is computed using this formula below:

$$LH = We \times Hfg$$

Where:

LH-Latent Heat, Kcal
We- weight of water evaporated, kg
Hfg- latent heat of water, 540 Kcal/kg

10. Heat Energy Input- is the amount of heat energy available in the fuel and is computed using this formula:

$$QF = WFQ \times HVF$$

Where:

QF- heat Energy Available in Fuel, Kcal
WFU-weight of fuel used in the stove,kg
HVF- heating value of fuel, Kcal/kg

11. Thermal Efficiency – is the ratio of the energy used in boiling and in evaporating water to the heat energy available in the fuel and is computed using the formula:

$$TE = \frac{(QT)}{(FCR)(HVF)}$$

Where:

TE – the stove thermal efficiency, %
QT = the total heat needed in cooking, kcal/hr
HVF = heating value of fuel, kcal/kg
FCR = Fuel consumption rate, kg/hr

12. Power Input – is the amount of energy supplied to the stove based on the amount of fuel consumed and is computed using this formula:

$$Pi = 0.0012 \times FCR \times HVF$$

Where:

Pi - Power Input, kW
FCR –Fuel Consumption Rate, Kg/hr
HVF – Heating value of fuel, Kcal/kg

13. Power Output- is the amount of energy released by the stove for cooking and is computed using this formula:

$$Po = FCR \times HVF \times TE$$

Where:

Po- Power output, kW
FCR- fuel consumption Rate, Kg/hr
HVF- heating Value of Fuel, Kcal/kg
TE- thermal efficiency,%

14. Percentage (%) Char Produced- is the ratio of the amount of Char produced and the amount of rice hulls used and can be computed using the formula:

$$\% \text{ Char} = \frac{\text{Weight of Char (kg)}}{\text{Weight of Rice Hull Used (kg)}} \times 100$$

Testing Procedure

The following procedures below are the basic steps done to test the rice hull gas stove:

1. Preparation of materials.
    a. Rice hulls were gathered.
    b. The commodities to be tested were procured from the market: rice, fish, water and pork.
    c. The rice hulls needed were hauled into place.

d. The gasifier stove was cleaned.
e. Rice hulls were weighed.

2. Gasifying
   a. A full load of rice hulls was put inside the cylinder.
   b. A piece of paper was lit and dropped to the top of the cylinder. The fan was switched until the top portion of the rice hull was fully burned.
   c. The burner was placed into the top of cylinder head.
   d. The smoke had come out of the burner. Waiting varies.
   e. The burner was lit.

How to Use the Stove

1. Cooking time

   For Water
   a. Pour a liter of water into the kettle and place it on the burner.
   b. Start timing.
   c. Wait until it boils.
   d. Record the time.

   For Rice
   a. Put 1 kg of rice into the pot and wash it.
   b. Add a desired amount of water and place it on the burner.
   c. Start timing.
   d. Wait until it is cooked.
   e. Record the time.

   For Pork
   a. Prepare the meat and the spices.
   b. Boil two liters of water with some of the spices and start timing.
   c. Put the pork and wait until it becomes tender.
   d. Put the vegetables and other spices.
   e. Wait until it is cooked.
   f. Record the time.

   For Fish
   a. Prepare the frying pan and put it on the burner.
   b. Put the cooking oil and start timing.
   c. Start frying.
   d. Wait until it is cooked.
   e. Record the time.

Note: Repeat the procedure in all commodities in five replications.

RESULTS AND DISCUSSIONS

Project Cost

The cost of the fabricated rice hull gasifier stove was based on the expenditures for supplies and materials, labor and other expenditures. The total cost of the project is summarized below.

Table 3. Project Cost (PhP)

Bill of Materials for Fabrication	2,654.00
Contract Labor(cutting, laying-out and welding)	1,000.00
Administrative Cost	700.00
Incidental Expenditure	146.00
TOTAL PROJECT COST	**4,500.00**

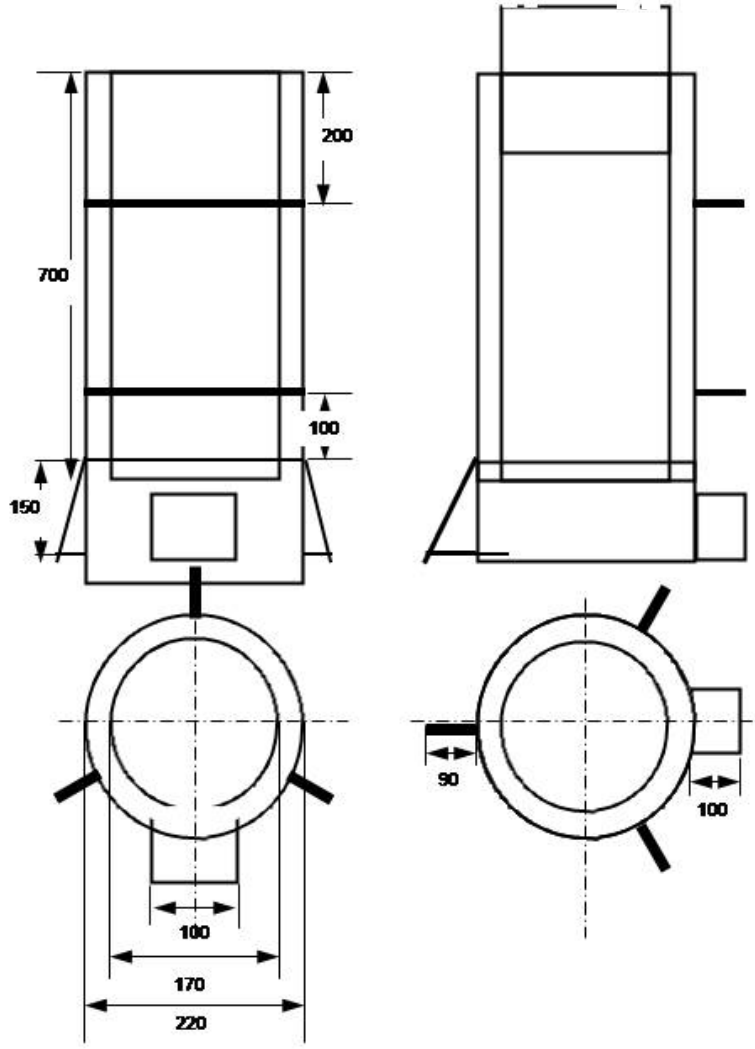
The total cost of the rice hull gasifier stove amounted to P 4,500.00 as shown in Table 3. If mass production will be undertaken, the cost of production will be lesser since two gasifier stoves can be made in one full length of GI sheet.

The gasifier stove reactor is the component of the stove where rice hulls are placed and burned with limited amount of air. This reactor is cylindrical in shape having a diameter of 170 mm and the cylinder with the height of 700 mm. The latter is made from an ordinary galvanized iron sheet gauge no. 16 and is provided with an annular space of 250 mm that serves as insulation in order to prevent heat loss in the gasifier. At the lower end of the reactor is a fuel grate also made of G.I. sheet, which is used to hold the rice hulls during gasification.

The Fan Assembly

The fan assembly is the component of the stove that provides the air needed by the fuel during gasification. It is fastened to the cylinder, to directly push the air into the column of rice hulls in the reactor. The fan used for the standard model is a 4-inch diameter axial-type fan that is commonly used for computers. It has a rated power input of 16 watts using a 220 volt AC line. A manually-operated rotary switch is used to control the speed of the fan which in turn, controls the flow of gas to the burner during operation.

THE MODIFIED GASIFIER STOVE REACTOR



The Burner

The burner converts the gas coming out from the reactor to a bluish flame. It consists of series of holes, 3/16-inch in diameter spaced at 1/8 of an inch, where combustible gas is allowed to pass through. The secondary holes

located at the periphery of the burner are used to supply the air necessary for the combustion of gases. On top of the burner is a pot support that holds the pot in place while cooking. The burner is removable for easy loading of fuel into the reactor and is set in place during operation.

RESULTS AND DISCUSSION

The data below is the cooking performance of the modifier rice hull gasifier stove.

Table 4. Cooking performance of the gasifier stove

Trials	Rice	Fish	Water	Pork
1	15.08	28.27	7.13	35.00
2	15.67	26.93	8.03	35.08
3	16.18	25.57	7.08	37.00
4	14.75	29.00	8.00	36.08
5	15.08	27.75	7.12	36.00
Average	15.58	27.50	7.47	35.83

1. It was found out that one full load (¾ of the cylinder) of rice hull weighed 1.3 kilograms.
2. Start up time for gasifier is 1 minute, operating time is 46.63 minutes and the total operating time is 47.63 minutes.
3. The designed rice hull gasifier stove can cook 1 kg of rice and 1 kg of fish in the combined time of 43.08 minutes.
4. The designed rice hull gasifier stove can cook 1 kg of pork mixed with vegetables within 35.83 minutes and the remaining heat can simmer a liter of water.

The data below are the comparative result of the performance of the gasifier based on the design concept or standard and the actual results of the test.

Table 5. Comparative Results of Data

Test Parameters	Based on Design Standards	Results of Actual Tests
Fuel Consumption rate	1.59 kg/hr	1.64 kg/hr
Specific gasification rate	70 kg/m^2-hr	55.55 kg/m^2-hr
Combustion zone rate	0.7777 m/hr	0.882 m/hr
Cooking time- 1 kg of rice	15 minutes	15.35 minutes
Frying fish – 1 kg	26 minutes	27.50 minutes
Cooking time – 1 kg of pork	Not considered	35.83 minutes
Boiling Time – 1 liter of water	13 minutes	7.47 minutes
Sensible heat	73 kcal	73 kcal
Latent heat	Not computed	151.2 kcal
Thermal efficiency	17%	9.1%

Heat energy input	3,000 kcal	3,900 kcal
Power input	5.724 kW	5.904 kW
Power output	810.9 kW	447.72 kW
Percentage of (%) char	No data	19.23%

Economic Viability

To determine the viability of the project, it is imperative to determine the time when the cost of investment in a certain project may be recovered. In this project, payback period analysis is applied to determine the number of months or years the investment can be recovered. The shorter span of time to recover the investment, the better is the project.

The following data were gathered based on actual interview with the LPG retailers. It is assumed that within one month, one 11-kg tank of Liquified Petroleum Gas (LPG) could be consumed.

Expenses incurred in using LPG	
Prevailing average refill price of LPG	P 870.00
Transportation cost	30.00
Total cost in using LPG	900.00
For Rice Hull Gasifier Stove	
Power consumption per month in using computer fan	12.75
Transportation cost	132.00
Cost of Match box	6.00
Total cost in using gasifier	150.75
Cost of Rice Hull Gasifier Stove	P 4,500.00

Payback Period

$$\text{Payback period} = \frac{\text{initial investment}}{\text{savings month}}$$

where: initial investment = P 4,500.00
savings per year = LPG cost – Gasifier cost
= P 900.00 – P 150.75
= P 749.25

$$\text{Payback period} = \frac{\text{P } 4{,}500}{\text{P } 749.25/\text{month}}$$

$$= 6 \text{ months}$$

It was found out that an investment for a gasifier stove can be recovered in six months.

SUMMARY AND CONCLUSIONS

Modification was made on the original stove of Belonio (2004) by increasing the size of the reactor. The gasifier stove reactor is the component of the stove where rice hulls are placed and burned with limited amount of air. This reactor is cylindrical in shape having a diameter of 170 mm and the cylinder with the height of 700 mm. Such is made from an ordinary galvanized iron sheet gauge no. 16 and is provided with an annular space of 250 mm that serves as insulation in order to prevent heat loss in the gasifier. At the lower end of the reactor is a fuel grate also made from G.I. sheet, used to hold the rice hulls during gasification.

The fan assembly is the component of the stove that provides the air needed by the fuel during gasification. The fan used for the standard model is a 4-inch diameter axial-type fan that is commonly used for computers. It has a rated power input of 16 watts using a 220 volt AC line. A manually-operated rotary switch is used to control the speed of the fan which, in turn, controls the flow of gas to the burner during operation.

The burner converts the gas coming out from the reactor. It consists of series of holes, 3/16 inch in diameter spaced at 1/8 of an inch. On top of the burner is a pot support that holds the pot in place while cooking. The burner is removable for easy loading of fuel into the reactor and is set in place during operation.

Based on the actual tests conducted, the following data were obtained. During the conduct of the test, the proponents observed that in 1 loading of rice hull (1.3 kg) the stove can cook rice and fish in an average time of 43.08 minutes. It was also observed that cooking pork sinigang consumes only an average time of 35.83 minutes and the remaining fuel in the stove can simmer or boil 1 liter of water at an average time of 7.47 minutes. As computed, the payback period for utilizing the rice husk gas stove is 6 months.

It was concluded that the modified rice hull gasifier stove is a great help in the reduction of rice hull biomass waste. For a family that consumes a kilo of rice and a kilo of fish per meal, the rice hull gasifier stove can be an alternative cooking stove.

RECOMMENDATIONS

Based on the findings and conclusions previously stated, the following courses of action have been recommended:

1. That a rice husk gas stove gasifier be used as an alternative cooking stove in rural areas where rice husk is abundant.
2. That the technology be extended to the community not only in the municipality of Odiongan, but in the entire province of Romblon or even nationwide.
3. That continuous research endeavor be conducted in similar technology using indigenous materials.

REFERENCES

Belonio, A.T. (2005). Rice hull gas stove manual. Appropriate Technology Center, Department of Agricultural Engineering and Environmental Management, College of Agriculture, Central Philippine University, Iloilo City, Philippines.

Belonio, A.T. (2009). Rice hull gas stove manual. Appropriate Technology Center, Department of Agricultural Engineering and Environmental Management, College of Agriculture, Central Philippine University, Iloilo City, Philippines.

Belonio. A. T. Rice hull quasi gasifier stove with side-in steam injector. Appropriate Technology Center, Department of Agricultural Engineering and Environmental Management, College of Agriculture, Central Philippine University, Iloilo City, Philippines.

Belonio, A. T., et. Al. (Small-scale industry coal gasifier stove for frying food products. Minang Jordanindo Approtech, Jakarta Selatan, Indonesia

Hoki, Makoto. Regional Circulation and Utilization of Biomass. Tsu City, Mie, Japan

Join and Powers of Some Wedge Graphs as Segment Intersection Graph[1]

Elucila M. Sespeñe[2]

ABSTRACT

In graph theory, we can always make a graph representation of a collection of objects. This is commonly done with "intersection graphs", in which every vertex is defined as a collection of objects and the two vertices are adjacent if their collections intersect. A segment intersection graph (SEG) is an intersection graph of a non-empty family $\mathscr{S}$ of line segments in the plane denoted by $\Omega(\mathscr{S})$ whose vertex-set is $\mathscr{S}$ where there is an edge between two vertices ℓ_1 and ℓ_2 in $\mathscr{S}$ if $\ell_1 \cap \ell_2 \neq \varnothing$. If $\mathscr{S}$ is a family of half-lines, $\Omega(\mathscr{S})$ is called a half-line intersection graph. It is known that recognition of such graphs is NPhard. Here, we consider an intersection graph of half-lines contained in an arbitrarily thin θ-slice of the plane (the convex subset of R^2 bounded by two half-lines with a common end-point and making an angle of θ (radians) with each other, $0 < \theta < \pi$ called wedge graphs (WEDG). We show that wedge graphs are segment intersection graphs and unit segment intersection graphs. In particular, we prove that the join and powers of some paths, cycles, fans and wheels are wedge graphs and consequently, segment intersection graphs.

Key words: *Graph theory, segment intersection graph, intersection graph*

[1] Paper presented during the International Conference for Higher Education Researches, University of Northern Philippines, Vigan, Ilocos Sur on April 28 to May 1, 2010.

[2] PhD in Mathematics; Dean, College of Engineering and Technology, RSU

INTRODUCTION

All graphs considered here are finite, loopless and without multiple edges. We call the graph with only one vertex as the trivial graph. If G is a graph, we denote by V (G), the set of vertices of G; and E (G); the set of edges of G.

Given a set $\mathscr{L}$ of line segments in the plane R^2, its intersection graph denoted by $\Omega(\mathscr{L})$, is the graph with a vertex for every segment and two vertices are adjacent if the corresponding line segment intersect. We call $\Omega(\mathscr{L})$ a segment of intersection graph. The set of $\mathscr{L}$ of line segments is said to be the line segment representation of the graph $\Omega(\mathscr{L})$. An example is the graph G shown in Figure 1. The vertices of G are represented by straight line segments and the edges of G are represented by intersection points.

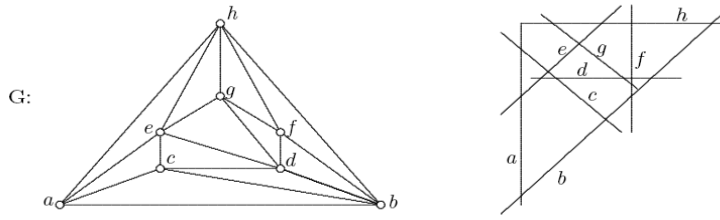


Figure 1. G as Intersection Graph of Line Segments

Note that not all graphs are segment intersection graphs. An example was given by J. Pach, et. al [11], wherein the graph was obtained from the complete graph K_5 by inserting one vertex in each of the ten edges. The general case was given by Gervacio [4], where the graph is obtained from non-planar graph N by inserting a vertex in every edge of N.

The question whether every planar graph allows a representation of straight line segments has become a well-known problem in the area of geometric graph theory. This arose from Scheinerman's conjecture [12] that all planar graphs are segment intersection graphs. The conjecture was formulated by E.R. Scheinerman in his PhD thesis (1984), following the results due to Ehrlich et.al in 1976 that every planar graph could be represented as the intersection graph of a set of simple curves in the plane. Some special cases of this conjecture have been resolved. In 1991, Hartman et.al [7] and de Fraysseix et.al [2] proved that every bipartite planar graph can be represented as the intersection graph of horizontal and vertical line segments. H. De Fraysseix and J. Kratochvil [3] writes, "The result stating that planar triangle-free graphs are intersection graphs of segments in three directions in the plane proved in Triangle-free Planar Graphs and Segment

Intersection Graphs by de Castro, Cobos, Dana, Marquez and Noy is still today, 2 years after the GD'99 conference, the strongest result in the area."

Other studies on segment intersection graphs were made by Gervacio, particularly the intersection graph of halfplanes and of line segments in the plane. In [5], he proved the characterization theorems for intersection graph of halfplanes and showed that these graphs are isomorphic to some halfline intersection graph. He also proved that every intersection graph of a finite family of halfplanes is isomorphic to some segment intersection graph. Gervacio [4] also showed that half-line intersection graphs are segment intersection graphs and proved that a finite join of trees is a half-line intersection graph.

WEDGE GRAPHS

Gervacio [5] defined a half-line as an unbounded line segment with one endpoint. An example of which is the positive x-axis.

Definition 2.1

Let $\mathscr{L}$ be a non-empty finite family of subsets of the plane R^2. The intersection graph of $\mathscr{L}$, denoted by $\Omega(\mathscr{L})$, is the graph with vertex set $\mathscr{L}$, where $\ell_1\ell_2$ is an edge if and only if $\ell_1 \neq \ell_2$ and $\ell_1 \cap \ell_2 \neq \emptyset$. If $\mathscr{L}$ is a finite family of half-lines, any graph isomorphic to $\Omega(\mathscr{L})$ is called a half-line intersection graph. In other words, G is a half-line intersection graph if there exists a family of half-lines $\mathscr{L}$, such that G is isomorphic to $\Omega(\mathscr{L})$. The family of halflines $\mathscr{L}$ is called a half-line representation of G.

The trivial graph is a half-line intersection graph. The complete graph K_n is a half-line intersection graph which can be represented by concurrent half-lines. Gervacio [4] proved the existence of a special representation of trees as a half-line intersection graph and used the result to prove that the join of a finite number of trees is a half-line intersection graph.

Definition 2.2

Let θ be any real number satisfying $0 < \theta < \pi$. By a θ-slice of the plane (or simply slice of the plane) we mean the convex subset of R^2 bounded by two distinct half-lines with a common end-point and making an angle θ (radians) with each other. We say that a slice of the plane is arbitrarily small if θ is arbitrarily small.

Definition 2.3

A graph G is a wedge graph denoted by WEDG, if and only if for every θ-slice S_θ of the plane, there exists a family $\mathscr{L}$ of half-lines satisfying the following conditions:

a.) Every $\ell \in \mathscr{L}$ is contained in S_θ.
b.) The half-lines in L together with the boundaries of S_θ are non-parallel, and
c.) $\Omega(\mathscr{L}) \cong G$.

Example 2.1

The graph shown in Figure 2 together with its half-line representation is a wedge graph for every $0 < \theta < \pi$.

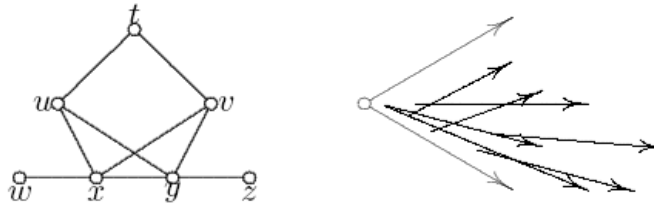


Figure 2. An example of a wedge graph

Theorem 2.2

The special graphs such as the trees, paths, stars, complete graphs and null graphs are wedge graphs.

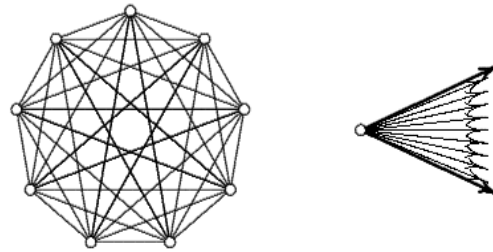


Figure 3. The Complete Graph K_9 and its Half-line Representation

Definition 2.4

The segments $\ell_1, \ell_2, \ldots, \ell_k$ ($k \geq 3$) form a closed chain if there is a k-gon whose sides are segments of $\ell_1, \ell_2, \ldots, \ell_k$.

Example 2.2

Consider the segments $\ell_1, \ell_2, \ell_3, \ell_4$ in Figure 4 which form a closed chain of four segments.

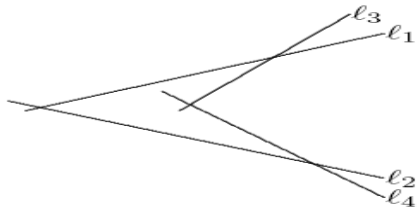


Figure 4. Segments that form a closed chain

Lemma 2.3

If $G \cong \Omega(\mathscr{S})$, and G has a cycle C_k, $k \geq 3$ as a subgraph, then there exists segments $\mathscr{S}'$ such that $G \cong \Omega(\mathscr{S}')$ and the segments $\mathscr{S}'$ representing the vertices of C_k space form a closed chain of k segments.

Theorem 2.4

The cycle and the crown are wedge graphs.

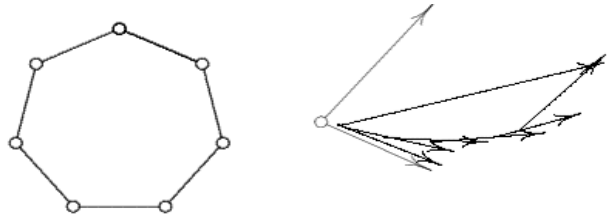


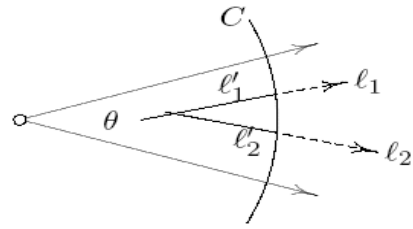
Figure 5: The cycle C_7 and its Half-line Representation

WEDGE GRAPHS AS SEGMENT INTERSECTION GRAPHS

Theorem 3.1

Every wedge graph is a segment intersection graph.

Proof. Let $\mathscr{S}$ be a non-empty, non-parallel finite family of half-lines contained in a θ-slice of the plane. Let I be the set of points of intersection of the half-lines in $\mathscr{S}$ together with the endpoints of the half-lines in $\mathscr{S}$. Since I is finite, there exists a circle C which encloses I. For each $\ell \subset \mathscr{S}$, let $i_\ell = C \cap \ell$. Let ℓ' be the bounded line segment whose end points are i_ℓ and the end-point of ℓ. Let $\mathscr{S}$ be the family of all ℓ', where ℓ ranges all the half-lines in $\mathscr{S}$. Then clearly, $\Omega(\mathscr{S}) \cong \Omega(\mathscr{S}')$. □



The converse of the Theorem is not true as in the case of the θ-graph G(5,5,5). We show here that there exist segment intersection graphs which cannot be classified as wedge graphs, thus establishing the relationship WEDG⊂SEG.

Remark 3.2

A graph G is not a half-line intersection graph if for every segment representation of G, there is a segment interior to a closed chain of line segments.

Theorem 3.3

The graph G(5,5,5) is a segment intersection graph but not a wedge graph.

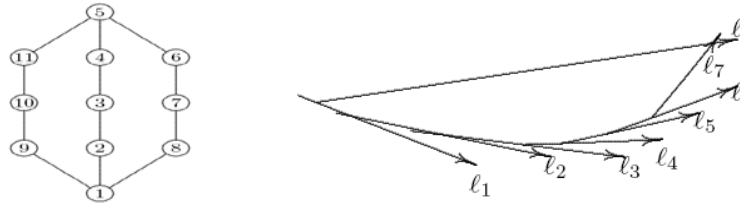


Figure 6. The graph G(5,5,5)

The next theorem gives us a criterion in determining whether a graph G does not belong to the class of wedge graphs.

Theorem 3.4

If a graph G contains an induced subgraph H which is not a wedge graph, then G itself is not a wedge graph.

Corollary 3.5

A graph G is not a wedge graph if it contains G(5,5,5) as an induced subgraph.

JOIN WEDGE OF GRAPHS

Definition 2.4.2

Let G and H be graphs with disjoint vertex-sets, their join or sum, denoted by G+H, is formed by taking G∪H and adding all edges of the form (x,y) where x is in G and y is in H.

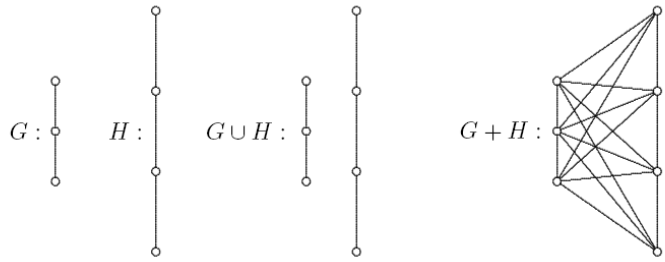


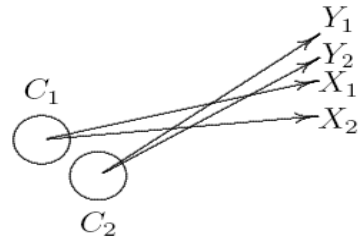
Figure 7. The union and join of two graphs

Theorem 4.2.1

If a finite number of graphs G_1, G_2,...,G_k is a wedge graph then their sum or join ($G_1 + G_2 + ... + G_k$) is also a wedge graph.

Proof. The proof is based on the Theorem by Gervacio [3] which states that the finite join of trees is a half-line intersection graph. The statement is true when k = 1. Let $k > 1$ and assume that the theorem is true for k-1. Given k number of graphs and an arbitrary θ with $0 < \theta < \pi$, let $\beta = \frac{1}{4}\theta$. By hypothesis of induction, the join G_1, G_2,...,G_{k-1} is contained in a β-slice of the plane, S_β that is $G_1+G_2+...+G_{k-1} \cong \Omega(\mathscr{L}_1)$. Let C_1 be a circle centered at the vertex of S_β which encloses all the points of intersection of the half-lines in $\mathscr{L}_1$. Let $\mathscr{L}_2$ be the family of half-lines contained in a θ_k-slice of the plane, $S_{\theta k}$, that is $G_k \cong \Omega(\mathscr{L}_2)$ and C2 be a circle centered at the vertex of $S_{\theta k}$

enclosing all the points of intersection of the half-lines in $\mathscr{L}_2$. By suitably translating and rotating $S_{\theta k}$ together with the half-lines in it, we can form the join $G_1+G_2+\ldots+G_k$. Let us assume that the boundaries of S_β are the half-lines X_1 and X_2. Let α_1 be the angle of inclination of X_1 and let $\alpha_1 + \beta$ be the angle of inclination of X2. We position $S_{\theta k}$ such that C1 and C2 do not intersect. Let Y_1 and Y_2 be the half-lines bounding $S_{\theta k}$. Let α_2 be the angle of inclination of Y_1 and let $\alpha_2 + \theta_k$ be the angle of inclination of Y_2. By rotating $S_{\theta k}$ about its vertex, we can make $\alpha_2 = \alpha_1 + \beta$. Then every half-line in $\mathscr{L}_1$ will intersect all the half-lines in $\mathscr{L}_2$. Furthermore, $\mathscr{L}_1 \cup \mathscr{L}_2$ is clearly contained in a $\frac{3}{4}\theta$-slice of the plane, and hence in a θ-slice of the plane. □



The following statements are direct consequences of the above theorem because the graphs are obtained as sum of two wedge graphs.

Corollary 4.2.2

The plane graphs with triangle such as the Fan (F_n). Generalized Fan ($F_{2,n}$), and the Wheel (W_n, $n \geq 3$, are wedge graphs and hence, segment intersection graphs.

Proof. The Fan (F_n) by definition is the sum of a Path P_n and a single vertex (K_1) which are wedge graphs. An example is the Fan F_5 and its half-line representation shown below.

Figure 8. The Fan F_5 and its half-line representation

The Generalized Fan ($_{F2,n}$) is the sum of the Path P_n and K_2 which are wedge graphs.

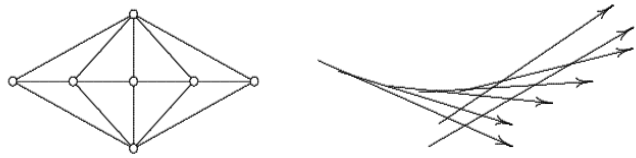


Figure 9. The Generalized Fan $F_{2,5}$ and its half-line representation

The Wheel (W_n, $n \geq 3$) is the sum of a cycle Cn and a single vertex which are wedge graphs. By Theorem 4.2.1, W_n, $n \geq 3$ is a wedge graph.

Corollary 4.2.3

Let m>2 and n>2. The non-planar graphs such as the Generalized Fan ($F_{m,n}$) and Complete Bipartite Graph ($K_{m,n}$) are wedge graphs and hence, segment intersection graphs.

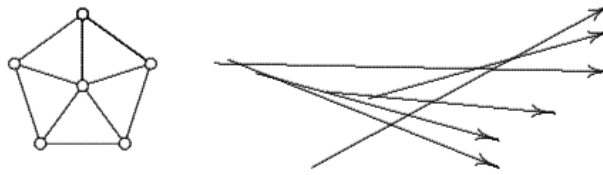


Figure 10. The Wheel W_5 and its half-line representation

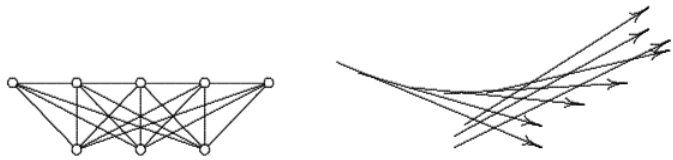


Figure 11. The Generalized Fan $F_{2,5}$ and its half-line representation

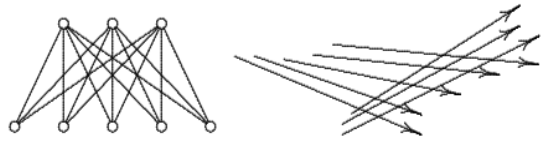


Figure 12. The Complete Bipartite Graph $K_{2,5}$ and its half-line representation

POWERS OF PATHS, FANS AND GENERALIZED FANS

Recall that the kth power of a graph G, denoted G^k is the graph with vertex set same as that of G and an edge (x,y) whenever $1 \leq d(x,y) \leq k$.

Consider the square of a path P_n. If the vertex set of P_n is $V(P_n)$ = {1,2,...,n} then $V(P_n^k)$ = $V(P_n)$ and the edge set is {[1,2],[2,3],...,[n-1,n], [2,4], [3,5],...,[n-2,n]}.

A pictorial representation of P_5^2 is shown in the figure below.

Figure 13. The square of the path P_5 and its half-line representation

The next theorem shows that the square of any path is a wedge graph.

Theorem 6.3.1

The square of the path P_n, denoted by P_n^2, is a wedge graph.

Remark 6.3.2

*The (n-1)th power of P_n, is isomorphic to the complete graph of order **n** which is a wedge graph.*

Theorem 6.3.3

The (n-2)th power of P_n, P_n^{n-2} for $n \geq 4$, is a wedge graph.

The result of Theorem 6.3.1 can be extended up to the kth power of P_n for any integer $k \leq n-1$.

Theorem 6.3.4

For any integer $k \leq n-1$, the kth power of Pn, P_n^k is a wedge graph.

The result of Theorem 6.3.4 is useful in establishing that the kth power of a Fan and Generalized Fan are wedge graphs.

Theorem 6.3.5

For any integer k≤n-1, the kth power of a Fan, F_n^k is a wedge graph.

Theorem 6.3.6

For any integer k≤n-1, the kth power of the generalized fan, $F_{m,n}^k$ is a wedge graph.

Figure 14. F_6^3 and $F_{3,6}^3$

POWER OF CYCLES, WHEELS AND STARS

Theorem 6.4.1

The square of a cycle, denoted by C_n^2 is a wedge graph.

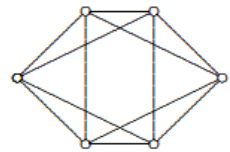


Figure 15. The square of C_6

Remark 6.4.2

For any integer k, such that $k \geq \frac{n-1}{2}$, $C_n^k \cong K_n$.

Theorem 6.4.3

For any integer $k \geq \frac{n-1}{2}$, the kth power of a cycle, C_n^k is a wedge graph.

We use Theorem 6.4.3 to establish that the kth power of a wheel and a star is a wedge graph.

Theorem 6.4.4

For any integer $k \geq \frac{n-1}{2}$*, the kth powerof a wheel,* W_n^k *is a wedge graph.*

Theorem 6.4.5

For any integer $k \geq \frac{n-1}{2}$*, the kth powerof a Star,* S_{m+1}^k *is a wedge graph.*

The question of whether the class of wedge graphs is closed under the operation of taking powers of graphs is not yet established and is still an open problem.

REFERENCES

[1] de Castro, N., F.J. Cobos, J.C. Dana, A.M. Marquez and M. Noy. "Triangle-Free Planar Graphs as Segment Intersection Graphs." *Journal of Graph Algorithms and Applications* vol. 6 no. 1, 2002, pp 7-26.

[2] de Frayseix, H., P.O. de Mendez and J. Pach. "Representation of Planar Graphs by Segments." *Colloquia Mathematics Societas Janos Bolyai Intuitive Geometry, Szeged, (Hungary)* 1991.

[3] De Frayseix, H. and J. Krachtovil, "Foreword." *Journal of Graph Algorithms and Applications,* vol. 6 no. 1, 2002, pp 3-5

[4] Gervacio, S.V. "Join of Trees as a Segment Intersection Graph" De La Salle University, Manila, 2007.

[5] Gervacio, S.V. "On the Intersection Graphs of Halfplanes and of Line Segments in the Plane." De La Salle University, Manila, 2007.

[6] Harary, F. *Graph Theory.* Addison-Wesley, USA.

[7] Hartman, I.B., A.I. Newman and R. Ziv. "On Grid Intersection Graphs." *Discrete Mathematics,* 1991.

[8] Kratochvil, J. and J. Matousek. "NP-Hardness results for intersection graphs." *Commentationes mathematicae Universitatis Carolinae,* Vol. 30 No. 4. 1989, pp 791-773.

[9] Kratochvil, J. and J. Matousek. "Intersection graphs of segments." *J. combin. Theory Ser. B.,* Vol. 62, 1994, pp 289-315.

[10] McKee, Terry A. and F.R. McMorris. *Topics in Intersection Graph Theory.*, Philadelphia:SIAM, 1999

[11] Pach, J. and J. Solymosi, "Crossing Patterns of Segments", *Journal of Combinatorial Theory,* Series A 96, 2001, pp 316-325.

[12] Scheinerman, E.R. "Intersection Classes and Multiple Intersection Parameters of Graphs." Ph.D. Thesis, Princeton University, 1984.

What Makes Students Succeed in Performing Assessment Tasks? Evidences from a Physical Science Class[1]

Eddie G. Fetalvero[2]

ABSTRACT

Successful learning is brought about by an interaction of a lot of factors. An important factor is what the learners already possess before a new learning experience begins. This paper presents evidences from a physical science class about the significant learner-related factors that could explain why students are successful or unsuccessful in performing assessment tasks. Self-assessment rubrics of teachers are included as tools in checking the students' concepts and understanding while assessment and learning are going on simultaneously. It also addresses some important issues in selecting assessment tasks; designing cognitive structures to ensure that learning can occur while students are being assessed; and developing, validating and testing the reliability of rubrics.

Key words: *Alternative Assessment, Performance Assessment, Rubrics Assessment, Scientific Attitude, Self-Concept and Learning Styles*

[1] Paper presented during the 2010 International Conference in Science and Mathematics Education held at the University of the Philippines National Institute for Science and Mathematics Education (UP NISMED) on October 28-30, 2010.

[2] MA in Science Education; Director for Research, RSU.

BACKGROUND OF THE STUDY

Assessment of student performance is emerging as a crucial ingredient in the recipe for on-going improvement of school science. As programmatic change is occurring, there is a need to align student assessment practices with curricular aims, instructional practices, and performance standards. In the words of Iris Carl (1993), "What we teach must be valued; what we test is what must be taught."

Before considering alternative approaches to assessing student performance, it is important to consider the various functions that assessment serves. Various reasons for assessing student performance have been described in both specific and general terms, with distinctions being made between assessment for reporting purposes and for purposes of diagnosis and program evaluation.

On assessment in the service of instruction, its purpose is to help students, teachers and parents monitor learning (Haury, 1993). Assessment plays an important part in the learning process, having both formative and summative aspects. Formative assessment involves the use of assessment as a diagnostic tool so teachers may appropriately cater to the individual needs of their students and so students can determine their areas of strengths and weaknesses, celebrating their strengths and giving greater attention to improving their weaknesses. Summative assessment is used to report progress, for certification, for accountability or for monitoring (Caygil & Eley, 2001).

Performance Assessment

Performance assessment is one of the newest forms of testing that requires students to perform a task rather than select an answer from a ready-made list. Rudner and Boston as cited by Wangsatorntanakhun (n.d) defined performance assessment as a continuum of assessment formats which allows teachers to observe student behavior ranging from simple responses to demonstrations to work collected over time.

As opposed to most traditional forms of testing, performance assessment does not have clear-cut or wrong answers. Rather, there are degrees to which a student is successful or unsuccessful. This can be accomplished by creating rubrics.

Airasian, (1991) Popham, (1995) and Stiggins, 1994) were cited by Brualdi (2000) on their definition of rubric as a rating system by which teachers can determine at what level of proficiency a student is able to

perform a task or display knowledge of a concept. With rubrics, the different levels of proficiency for each criterion can be defined. Scoring rubrics are descriptive scoring schemes that are developed by teachers or other evaluators to guide the analysis of the products or processes of students' efforts (Brookhart, 1999). Scoring rubrics are typically employed when a judgment of quality is required and maybe used to evaluate broad range of subjects.

In the article by Heidi Goodrich Andrade published in American Leadership in 1999, he defined rubric as a scoring tool that lists the criteria for a piece of work or what counts. It also articulates gradations of quality for each criterion, from excellent to poor. The term defies a dictionary definition, but it seems to have established itself.

Types of Rubrics

There are many types of scoring rubrics. An analytic scoring rubric allows for the separate evaluation of each independent criterion scored on a different descriptive scale. But when there is an overlap between the criteria set, a holistic rubric is preferable. In this type of scoring rubric, the criteria are considered in combination on a single descriptive scale which supports broader judgments concerning the quality of the process or the product (Brookhart, 1999). Scoring rubric may either be general or task specific. General scoring rubrics are designed to evaluate broader category of tasks while task specific scoring rubrics are designed to evaluate students' performance on a single-assessment event. However, scoring rubrics may contain both general and task-specific components (Moskal, 2000). Wiggins (1993) as cited by Brualdi (1993) has cautioned that not all hands-on activities can be used as performance-based assessments. Stix (1997) as cited by Brualdi (1993) further stressed that in constructing rubrics, the varying levels of proficiency must be properly communicated. This may be done by using impartial words instead of numerical or letter grades.

Why Rubrics Appeal to Teachers and Students

Rubrics appeal to teachers and students for many reasons. First, they are powerful tools for both teaching and assessment. Rubrics can improve student performance, as well as monitor it. By making teachers' expectations clear and by showing students how to meet these expectations, the result is often marked improvements in the quality of student work and in learning (Marcus, 1995 as cited by Andrade, 1997).

A second reason that rubrics are useful is that they help students become more thoughtful judges of the quality of their own and others' work.

When rubrics are used to guide self and peer-assessment, students become increasingly able to spot and solve problems in their own and one another's work. Repeated practice with peer assessment and specially self-assessment, increases students' sense of responsibility for their own work and cuts down on the number of "Am I done yet?" questions (Andrade, 1997).

Third, rubrics reduce the amount of time teachers spend evaluating student work. Teachers tend to find that by the time a piece has been self and peer assessed according to a rubric, they have little left to say about it. When they do have something to say, they can often simply circle an item in the rubric, rather than struggling to explain the flaw or strength they have noticed and figuring out what to suggest in terms of improvements. Rubrics provide students with more informative feedback about their strengths and areas in need of improvement (Andrade, 1997).

Fourth, teachers appreciate rubrics because their accordion nature allows it to accommodate heterogeneous classes. Finally, rubrics are easy to use and explain (Andrade, 1997).

Rubrics are becoming increasingly popular among educators moving towards more authentic, performance-based assessments. Andrade suggested some steps in rubric design process among students to boost the learning leverage of rubrics: look at models, list criteria, articulate gradations of quality, practice on models, use self and peer assessment, revise and use teacher assessment using the same rubric students used in assessing their work.

In 2006, a comprehensive semester long investigation on the antecedents of performance in rubrics assessment among physical science students was conducted at Romblon State College Main Campus in Odiongan, Romblon.

OBJECTIVES

This study was conducted to determine the factors that explain performance in assessment tasks among physical science students at Romblon State University. Specifically, the study sought to:

- Develop assessment tasks in physical science, determine the validity and reliability of rubrics, and use rubrics in determining student performance;
- Determine the factors that explain the performance in assessment tasks; and

- Propose a novel approach in the construction and use of rubrics

This study is anchored on Jerome Bruner's Constructivist Theory (1966). In Bruner's theoretical framework, learning is viewed as an active process in which learners construct new ideas or concepts based upon their current or past knowledge. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so. Cognitive structure provides meaning and organization to experiences and allows the individual to "go beyond the information given".

In this study, students performed tasks based on agreed criteria as to what levels of performance were expected of them. Most tasks were open-ended. Students' skills and intelligences were demonstrated in the way they wanted to construct their own understanding of the scientific concepts in physical science. These levels of understanding were reflected in their outputs.

As far as instruction is concerned, a constructivist instructor tries and encourages students to discover principles by themselves. The instructor and students engage in an active dialogue. The task of the instructor is to translate information to be learned into a format appropriate to the learner's current state of understanding.

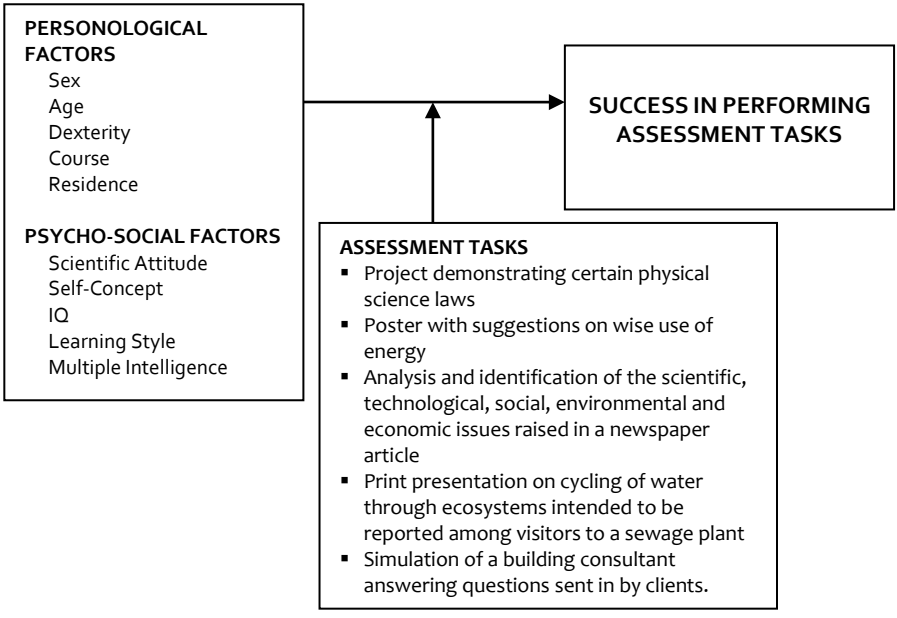


Figure 1. Conceptual Framework

One of the offshoots of the aforementioned theory was the birth of performance assessment. Performance assessment is an umbrella term that embraces both alternative assessment and authentic assessment. Alternative assessment was coined to distinguish it from what it was not: traditional paper-and-pencil testing - assessments which are meaningful in an academic context while "authentic" assessment are those which have meaning and value in the context of the real world (Rudner & Boston as cited by Wangsatorntanakhun). From the outset, one thing must be made clear, assessment encompasses more than testing, and much more than standardized testing.

RESEARCH INSTRUMENTS

The variables included in this study were all student variables which are categorized into three: personological factors which include sex, age, dexterity, course and residence; psycho-social factors which include the respondents' scientific attitude, self-concept, IQ, learning style and multiple intelligence; and aptitude factors which include their science and over-all ratings in the college admission test.

Inventory instruments and tests were used to measure some of the antecedents. The following validated instruments were adopted with permission from authors in measuring some of the variables included in this study.

Salmorin's Scientific Attitude Scale. This 47-item Likert-scale instrument developed by Dr. Lolita M. Salmorin, contains positive and negative statements where students were asked to indicate their reaction indicative of their scientific attitude like curiosity, questioning attitude, believing in cause-and-effect relationship, open-mindedness, respect for evidence, honesty, humility, patience and determination, resourcefulness and creativity, and intellectual responsibility. Answer choices were strongly agree, agree, disagree and strongly disagree with their corresponding numerical values of 4, 3, 2 and 1 respectively.

Self-Concept Test. This 36-item dichotomous test developed by Tan in 1991, measures the student's self-concept which includes the student's self-image, self-confidence and self-esteem.

Manila Self-Administering Test of Mental Ability. This 80-item multiple choice test is used in determining the student's intelligence quotient (IQ). The instrument measures the student's verbal, abstract, numerical and logical abilities.

Learning Style Inventory. This is adapted from Barsch Learning Style Inventory by Jeffrey Barsch, Ed D. and Sensory Modality Checklist by Nancy A. Haynie, which are both based on Dunn & Dunn Physiological Element of Learning Style Model specially on Perceptual Modalities. This determined the learning styles of the respondents as to visual, auditory, tactile and varied or multiple.

Multiple Intelligences Inventory. This instrument was developed by Walter McKenzie and was used in determining the dominant intelligence of the respondents based on Howard Gardner's Theory of Multiple Intelligences which includes: naturalist, musical, logical, existential, interpersonal, kinesthetic, verbal, intrapersonal, and visual.

DEVELOPMENT OF ASSESSMENT TASKS

Task Identification. The assessment tasks were identified by carefully studying the list of topics in the Physical Science course syllabus. A specific task was matched with a particular topic in the syllabus. The task list was presented to five Physical Science instructors at Romblon State University in a brainstorming session. After incorporating their comments, suggestions, and recommendations, the task list was again shown them for the identification of each of their top 10 preferred tasks with consideration to the science skills that students would develop in the process. Their responses were tallied and the tasks with the most number of responses were considered for selection. Table 1 shows the assessment task per representative topic.

Table 1. The Assessment Tasks

Assessment Task	Representative Topic	Category
1. Project demonstrating certain physical science laws	Introduction to Physical Science (Scientific Method)	Displayed Medium
2. Poster with suggestions on wise use of energy	Physics (Energy and Its Forms)	Displayed Medium
3. Analysis and identification of the scientific, technological, social, environmental and economic issues about an oil spill raised in a newspaper article	Chemistry (Physical and Chemical Change and Basic Chemistry of Petroleum)	Written Essay

Assessment Task	Representative Topic	Category
4. Print presentation on cycling of water through ecosystems intended to be reported among visitors to a sewage plant	Meteorology (The Water Cycle and Sewage Treatment)	Displayed Medium
5. Simulation of a building consultant answering questions asked by clients	Geology (Classification and Properties of Rocks)	Written Essay

Development of the Assessment Tasks and Rubrics. The tips on task and rubric preparation from various literatures read were considered in framing the mechanics of each of the five tasks. Each task has six (6) major components: nature of the assessment task, objectives, background learning, science skills, tasks which include the lead-up activities and the assessment task itself, and the rubrics for student and teacher's use.

VALIDITY OF RUBRICS

The mechanics of the assessment tasks and rubrics were validated by four recognized experts in the field of science education: a high school principal, a department head, the Vice President for Academic Affairs and the Dean of RSU graduate studies. They validated the assessment tasks and rubrics using the criteria suggested by Religioso (2002). The experts unanimously agreed that the criteria below be the basis for the development of student and teacher rubrics.

1. It relates to the outcome being measured.
2. It covers important dimensions of student performance.
3. Expected quality reflects current conceptions of excellence in the field.
4. The indicators of student performance (scale points) are well defined.
5. There is a basis for assigning scores in each scale point.
6. It can be used consistently by different scorers.
7. It can be understood by the students.
8. It can be applied to a variety of tasks.
9. It is fair and free from bias.
10. It is useful, feasible, manageable and practical.

RELIABILITY OF THE TEACHER RUBRICS

The reliability of the rubrics defined in this study is the inter-rater's reliability. This is the degree of agreement in scoring between two or more raters who used the same rubrics in assessing the task accomplished by the students. The twenty-five samples of students' work from the researcher's science class were rated by the researcher himself and another physical science teacher using the teacher rubric.

Table 2 . Inter-Rater's Reliability of the Teacher Rubrics (n = 25)

Teacher Rubric	r value	Interpretation
1. Project demonstrating certain physical science laws	0.95	Excellent
2. Poster with suggestions on wise use of energy	0.91	Excellent
3. Analysis and identification of the scientific, technological, social and environmental issues about an oil spill raised in a newspaper article	0.85	Good
4. Print presentation on cycling of water through ecosystems intended to be reported among visitors to a sewage plant	0.92	Excellent
5. Simulation of a building consultant answering questions asked by clients.	0.90	Good

The scores given by the two teachers to the 25 work samples were analyzed using the *Pearson's r* correlation. Results of reliability testing are shown in Table 2.

In interpreting values for reliability analysis, a rule of the thumb that applies to most situations indicates that an r value of >.9 is an excellent instrument, >.8 is a good instrument, >.7 is an acceptable instrument, >.6 is a questionable instrument, >.5 is a poor instrument, and <.5 is an unacceptable instrument (George & Mallery, 2000).

ADMINISTRATION OF THE ASSESSMENT TASKS

Five assessment tasks which are representative of each of the major components of Physical Science were carried out by the respondents. They were provided with the mechanics of each task as well as the lead-up activities. The student and teacher rubrics were discussed among them. The ratings of the students are valued in this study since self-assessment offers reliable and valid strategy in assessing students (Butcher and Stefani as cited by Kilic, 2003). The student rubric served as an immediate feedback generator of performance and comprised 40 percent of their rating in each

task. On the other hand, the score given by the teacher using the teacher rubric comprised the remaining 60 percent. The following sections described how the tasks were administered to the respondents.

Assessment Task 1. The first assessment task required the respondents to prepare a project that demonstrated certain physical science laws. As a lead-up activity, the class was grouped into five and given a problem to be solved using the scientific method. The solutions that they had come up with will be the presented to the class after a given time. Other lead-up activities are discussions on the list of discoveries and significant events in science, science superheroes from the prehistoric date up to present, Filipino scientists and their contributions in science and technology After carrying out the lead-up activities, the assessment task was then introduced. Their outputs were rated using the student and teacher rubrics which contain the following parameters: science concept and understanding, aesthetic appeal and creativity.

Assessment Task 2. The second assessment task required the respondents to prepare a poster with suggestions on wise use of energy at home. Two activities were done before the assessment task was carried out. The first activity enabled the respondents to identify the different forms of energy depicted in a certain picture. A game called 'energy cards' was also played. This game strengthened the concept of the respondents in identifying the form of energy used by the appliance that was drawn on a card. The second activity was conducted to determine whether the different forms of energy used wisely around the home of the respondents. They were given a form to be filled up. This activity required them to observe, describe, record and look for patterns of use of the appliances they have at home. The data gathered from this activity were used in performing the assessment task. Their posters were rated based on the rubrics containing the following parameters on expected quality: science understanding, making sense of information, applying understanding and communicating understanding.

Assessment Task 3. The third assessment task required the respondents to analyze and identify the scientific, technological, social, environmental and economic issues about a major oil spill raised in a newspaper article. Before this task was administered, the class was divided into groups. They were given a copy of the newspaper report about a major oil spill. This was discussed in the group level and various issues were identified from the report. Issues that needed further clarification and further investigation were marked. There were series of activities performed: investigating the physical and chemical properties of oil; simulating an oil spill; and investigating possible methods of cleaning it up. After doing these activities, the assessment task was introduced to them. Their experiences in

the activities performed served as inputs so that the issues that needed further clarification would be answered. Their written works were rated based on the following parameters on expected quality: identification of issues, science knowledge and understanding, application of understanding, and communication of information and understanding

Assessment Task 4. The fourth assessment task called for the respondents to prepare a print presentation about water cycle intended to be reported among visitors to a sewage plant. Before the task was carried out, a grouped activity was performed investigating the change of state in water in terms of the behavior of water particles associated with energy input and energy loss. Their understanding of the change of state was applied to a natural phenomena - the water cycle. A diagram was studied and the factors that could likely interrupt or affect the water cycle were enumerated and discussed. After performing those activities, the assessment task was explained to them. Their print presentations were rated according to the subsequent parameters on expected quality: science concept and understanding, applying understanding, and communicating information. Indicators of performance were expert, developing and beginner.

Assessment Task 5. The fifth assessment task required the respondents to simulate a building consultant answering questions asked by clients. Prior to the task administration, activities were carried out by the respondents. Through experiments, they investigated some physical properties of different kinds of rocks. They also simulated the action of chemical weathering on different types of rocks. The knowledge they learned from these activities served as inputs in preparing the assessment task. Four questions were asked by the clients and the respondents gave their advices based on the lead-up activities. Their works were rated based on the following parameters on expected quality: science concept and understanding, applying understanding and communicating information.

The indicators of performance for the five (5) assessment tasks are the following: beginner, developer and expert.

RESPONDENTS OF THE STUDY

The assessment tasks were administered to 88 students of Romblon State University taking up physical science subjects chosen through incidental sampling, a purposive process of selecting samples based on their availability and researcher's control to ascertain their participation until the completion of the study.

RESULTS AND DISCUSSION

Performance on Assessment Tasks

The table below presents the performance of the respondents in doing the assessment tasks based on the student and teacher rubrics used. Result of the first assessment task appears in Table 3.

Table 3. Student Performance in the Five Assessment Tasks

Performance	Self Rating		Teacher Rating		Joint Rating	
Indicators	F	%	F	%	F	%
TASK 1						
Expert	41	46.6	36	40.9	42	47.7
Developing	47	53.4	35	39.8	42	47.7
Beginner	0	0	17	19.3	4	4.5
Total	88	100	88	100	88	100
TASK 2						
Expert	48	54.5	17	19.3	19	21.6
Developing	39	44.3	61	69.3	62	70.5
Beginner	1	1.1	10	11.4	7	8.0
Total	88	100	88	100	88	100
TASK 3						
Expert	15	17	14	15.9	13	14.8
Developing	67	76.1	37	42	56	63.6
Beginner	6	6.8	37	42	19	21.6
Total	88	100	88	100	88	100
TASK 4						
Expert	19	21.6	20	22.7	20	22.7
Developing	66	75	49	55.7	53	60.2
Beginner	3	3.4	19	21.6	15	17
Total	88	100	88	100	88	100
TASK 5						
Expert	22	25.0	20	22.7	18	20.5
Developing	62	70.5	54	61.4	60	68.2
Beginner	4	4.5	14	15.9	10	11.4
Total	88	100	88	100	88	100
OVER-ALL PERFORMANCE						
Expert	19	21.6	7	8.0	22	25.0
Developing	69	78.4	77	87.5	62	70.5
Beginner	0	0	4	4.5	4	4.5
Total	88	100	88	100	88	100

Overall Performance. As reflected in Table 3, 62 or 70.5 percent of the respondents were developers, 22 or 25 percent were experts and 4 or 4.5 percent of the respondents were beginners. Difficulty of the respondents in expressing themselves in the English language and the heterogeneity of the

class influenced to some degree the students' achievement in the five assessment tasks as shown by their outputs.

Factors Explaining Student Performance

A factor analysis was employed to explain which student-related factors accounted for the demonstrated performance the students in the five assessment tasks given them. Table 3a shows the researcher's description/label of each factor.

Table 3. Factor Analysis of the Antecedent Variables

	COMPONENT					
	1	**2**	**3**	**4**	**5**	**6**
FACTOR 1						
Intrapersonal Intelligence	**.757**	.125	.028	.049	.112	-.021
Logical Intelligence	**.747**	-.166	-.028	.002	-.169	-.217
Visual Intelligence	**.740**	-.015	.107	.257	-.054	.222
Verbal Intelligence	**.736**	.001	-.198	.094	.006	-.025
Interpersonal Intelligence	**.729**	.052	.249	.004	.067	.006
Existential Intelligence	**.703**	-.152	.083	-.047	.112	.233
Naturalistic Intelligence	**.700**	-.148	-.017	.040	.235	-.030
Musical Intelligence	**.675**	-.102	.078	-.049	-.101	-.214
Kinesthetic Intelligence	**.624**	-.154	-.086	.284	.108	.348
FACTOR 2						
ROSCAT Rating	-.029	**.885**	-.046	-.078	-.124	-.024
ROSCAT Science Score	-.078	**.799**	-.048	.010	-.072	.091
Mental Ability	-.083	**.678**	.195	.212	.260	-.008
Course	-.174	**.635**	.181	-.195	.185	-.091
FACTOR 3						
Sex	-.011	-.058	**-.819**	-.120	.209	-.099
Self Concept	.120	.360	**.664**	.105	.150	-.278
Age	.120	-.082	**.538**	.052	-.028	.409
FACTOR 4						
Auditory Learning Style	.073	.046	.246	**.735**	.043	-.129
Tactile Learning Style	.020	-.234	.145	**.692**	.103	.035
Visual Learning Style	.193	.232	-.333	**.642**	-.065	.177
FACTOR 5						
Residence	-.065	.059	-.005	.010	**-.780**	-.089
Scientific Attitude	.135	.314	-.223	.183	**.632**	-.176

FACTOR 6						
Handedness	-.041	.033	.047	-.012	-.002	**.790**

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalizati

Table 3a. Factor Label / Description

FACTOR #	Description
Factor 1	Multiple Intelligence
Factor 2	Intellectual Competence
Factor 3	Idiosyncratic Factor
Factor 4	Learning Style
Factor 5	None
Factor 6	None

Regression Analysis

To determine the factor that reflects best student performance in the five assessment tasks, the stepwise regression analysis was run and produced four regression models. The fourth model with its characteristics shown in Tables 4, 5 and 6 was considered.

Table 4 shows the four predictor variables that meet the entry requirement to be included in the regression equation (scientific attitude, self-concept, RSUCAT Rating, and tactile learning style). The B values are the non-standardized regression coefficients of the independent variables and the constant for the regression equation that measures predicted values of student performance. B may be thought of as a weighted constant that describes the magnitude of influence of a particular predictor variable on the criterion variable. A positive value for B indicates an increase in the value of the criterion variable, a negative value for B a decrease. The regression equation for a student performance in the five assessment tasks in physical science is shown below.

$$\text{Performance in Rubrics Assessment}_{(\text{predicted})} = -0.36 + 0.443(\text{scientific attitude}) + 0.024\ (\text{self concept}) + 0.014\ (\text{tactile learning style}) + 0.010\ (\text{RSUCAT rating})$$

This could be interpreted that in every unit increase in the scientific attitudes of respondents, a corresponding 0.443 increase occurs proportionately in their performance, provided that the values of the other three variables like self-concept, RSUCAT rating and tactile learning style remain constant. The same interpretation is true for the other three variables.

Table 4. Regression Analysis of Student Performance in Five Assessment Tasks

	B	Sig.
(Constant)	-.136	
Scientific Attitude	.443	.001
Self-Concept	.024	.030
RSUCAT Rating	.010	.003
Tactile Learning Style	.014	.022

Tables 5 and 6 present the regression model summary and the significance of the regression model.

Table 5. Regression Model Summary

R	R Square	Adjusted R Square
0.572	0.327	0.295

Table 6. Significance of the Regression Model

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.517	4	.629	10.096	.000
Residual	5.174	83	.062		
Total	7.692	87			

As shown in Table 5, multiple correlation (R) shows a moderate relationship between the four predictor variables taken as one and the criterion variable which is the students' performance in rubrics assessment (R = .572). The R-Square value (0.327) indicates that about 32.7 percent of the variance in student performance is explained by the four predictor variables. The R-square or the multiple coefficient of determination is the proportion of variance in students' performance that is explained by the combined influence of the four predictor variables that entered the regression equation, namely, scientific attitude, self-concept, RSUCAT Rating, and Tactile Learning Style (Table 4). The adjusted R square is for population estimate purposes only. This regression model was significant at the 0.05 level as shown by the one-way analysis of variance in Table 6.

RUBRICS: THE RSU EXPERIENCE

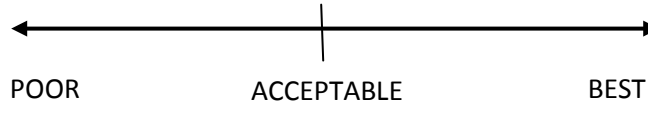
This study was one of the initial efforts done to investigate performance assessment in Romblon State University. After this investigation, rubrics were popularized in the campus and issues like objectivity, scoring and reliability were given solutions. In RSU, general rubrics like an oral report for example, found place in other disciplines like psychology, biological sciences, education, etc. With the number of teachers resorting to rubrics, a modification was proposed to resolve issues

surrounding the use of this form of assessment. Rubrics, in the Romblon State University experience, resolved some of the following issues:

Student involvement in the preparation of rubrics. After a task is determined, teachers should ask the students: "What do you think is an excellent *oral report*? How would you describe a very good *oral report*." Students would surely give varied answers but the role of the teacher is to group which of the characteristics measure the same thing. The characteristic should be given a common name and be placed into the first column (expected quality). Then the teachers should guide the students in determining which of these qualities matters most. The class together with the teacher should decide how many points should be apportioned in each criterion (expected quality). This will be the basis in making a scale. It should be taken into consideration that the narrower the range of the scale, the better judgment could be made on the work.

Ease in making indicators of performance. As opposed to most rubrics where each gradation of quality is described, RSU rubrics just describes the best performance. For example, how would you say that an *oral report* is delivered excellently? This is done so that students will aim for the best and would try to satisfy what is expected of them in a certain criterion.

Establishment of a 'continuum' scale where performance could be graded. Unlike other rubrics where indicators of student performance are fixed to beginner, developer or expert, the RSU rubrics provide a 'continuum scale'. The midpoint of the scale is the 'acceptable' performance, leaning towards its right is the best performance, and on its left is the poor performance. A scorer, upon inspecting students' work will determine from the scale the level of student performance for a particular task and plot this against the point scale allotted for a particular criterion where half of the value means an 'acceptable performance'. As much as possible, raters should refrain from giving decimal scores. The use of whole numbers is recommended.



Sample Scales: 0 – 3; 0-4, 0-5

Figure 2. The Continuum Scale

Ease in converting the score into percent and grade points. Since RSU's grading system is commonly in percent form and then converted only

to a grade point, it is recommended that the total score from the rubrics be transmuted into a percent grade using the equation:

$$\text{Grade} = \frac{\text{Score (100-Base Grade)}}{\text{Highest Possible Score}} + \text{Base Grade}$$

In this case, the common problem of how a letter/descriptive grade are converted into numerical measure is given a creative solution.

CONCLUSIONS AND RECOMMENDATIONS

Since the respondents of the study were non-probability samples, findings cannot be inferred to the population. However, evidences from this study support the following big concepts in performance assessment:

a. Not all hands-on activities can be used for rubrics assessments. Extra care particularly in the procedural aspect is needed in selecting assessment tasks.
b. Assessment tasks should be structured in such a way that students will have cognitive guides on how to go about performing a task. Lead-up activities related to the task are also recommended to be done first by the students before the actual assessment.
c. Experts' opinions and students' inputs should be validated and tested for reliability before use.
d. The use of performance assessment gives students the chance to know beforehand what is expected of them and to improve on areas which would meet the specified criteria. Though rubrics mirror real-life performance assessment, issues on language facility still hamper students from performing at a higher level.
e. Scientific attitude is the independent variable that explains to a greater degree student performance in rubrics assessment in physical science. Other significant predictors are self-concept, tactility and rating in the College Admission Test. In the rally for science literacy and culture, the best way to start is with students' scientific attitude which should be greatly encouraged by science teachers.
f. Rubrics can be modified and tailored according to the culture of the school. Issues around objectivity, standardization and transmutation can be settled by providing manuals on how to use teacher-made rubrics and receiving feedbacks from users.

REFERENCES

Andrade, H.G. (1997). Understanding Rubrics. *Educational Leadership, 54(4)*

Brookhart, S.M. (1999). *The art and science of classroom assessment: The missing part of pedagogy.* ASHE-ERIC Higher Education Report (Vol. 27, No. 1). Washington, DC: The George Washington University, Graduate School of Education and Human Development.

Brualdi, A. (2000). Implementing performance assessment in the classroom. *Practical Assessment, Research & Evaluation, 6 (2).* Retrieved March 18, 2003 from http://ericae.net/pare/getvn.asp?v=6&n=2

George, D., Mallery P. (2000). *SPSS for windows step by step: A simple guide and reference 9.0 update.* Massachusetts: Allyn & Bacon Pearson Education Company

Kilic, G. B. (2003). *Application of self and peer assessment in an elementary science teaching methods course.* Retrieved October 20, 2004 from http://www.upd.edu.ph/~ismed/

Moskal, B.M. (2000). Scoring rubrics: What, when and how? *ERIC CSMEE Digest.* Retrieved March 20, 2003 from http://ericae.net/pare/getvn.asp?v=7&n=3

Religioso, T.F. (2002). Performance assessment: A St. Scholastica's Experience. *Sangguni, 13 (1&2),* 256-268

Salmorin, L. M. (1987) *Some Factors Asscociated with Academic Achievement in Physics of 4th year Mapa High School Students.* Unpublished Doctoral Dissertation. CEU Manila

Wangsatorntanakhun, J.A. (____). *Designing performance assessments: Challenges for the three-story intellect.* Retrieved March 15, 2003 from http://www.geocities.com/Athens/Parthenon/8658

_____. (____). *Performance assessment.* Retrieved March 15, 2003 from http://www.exit109.com/~learn/perfases.htm

Agronomic Characteristics of Three Varieties of Bell Pepper as Affected by the Same Level of Different Organic Fertilizers[1]

Alice F. Foja[2], Rebecca Ll. Gervacio[3] and Efren B. Largueza[4]

ABSTRACT

The study was conducted at the Romblon State College experimental lot from June to November 2007 to determine the effects of different organic fertilizers on the growth and yield of three varieties of bell pepper: majesty, trinity and kalahari. These three varieties of bell pepper were grown and fertilized with guano, chicken and carabao manure at the same level following the complete randomized block design with three treatments and three replications. The agronomic characteristics like height, number of fruits, and weight of fruits were gathered and analyzed using analysis of variance and Duncan Multiple range test at 5% level of significance.

The findings show that there are no significant differences in height between varieties of bell pepper. There are significant differences on the mean number of fruits of bell pepper as affected by the same level of organic fertilizers. The number of fruits produced by plants fertilized with organic fertilizers are significantly higher compared to control. Plants fertilized with bat and chicken manure produced more fruits compared to those fertilized with carabao manure. The mean number of fruits of majesty and trinity variety is significantly higher compared to Kalahari. The effects of the organic fertilizers on the mean weight of fruits of three varieties are not significant; however, the mean weight of fruits of Majesty variety is significantly higher compared to Trinity and Kalahari varieties.

Key words: *Organic fertilizer, Bell pepper varieties, Agronomic characteristics, Animal manure*

[1] Paper presented during the National Environmental Summit on August 26-27, 2008 at Romblon State College (now University).

[2] PhD in Extension Education; Vice President for Academic Affairs, RSU

[3] Former Director for Extension, RSU

[4] PhD in Educational Management; MS in Agriculture; Dean, Graduate School, RSU

INTRODUCTION

Animal manure contributes not more than just nitrogen, phosphorus and potassium to the soil, its continued application builds the presence of organic matter in the soil, improves its structure, water holding capacity, aeration, and friability. The presence of manure assists in the slow release of nutrients making these elements available to the plants for a longer time.

The importance of soil fertility helps in making the plants grow vigorously and become productive. This could be achieved by applying organic fertilizers which can be derived from chicken dung, guano, cattle, horse, carabao and swine, commonly found in poultry farms, pasture lands area, caves and horse barns.

The addition of these materials could enrich the soil with nitrogen, phosphorus, potassium and other micronutrients; however its addition to the soil should be based on the stages of plant growth, types of soil and kinds of crop planted. These materials are known to contribute about 30% to 50% increase in the yield of crops.

The continued practice of organic farming has been observed in some parts of the country. According to De la Cruz (2004) organic way of raising vegetables is very common in Region 10, where farmers are found to grow their vegetables in an organic way, a practice that must contribute to the intensive production of vegetables which resulted in the sufficiency of the commodity in provinces and in various markets in Luzon and Visayas during off-season months.

Wide varieties and sources of organic fertilizers have resulted in the production of processed products like liquefied and pellet forms which are sold commercially. In fact, the presence of these forms has given farmers enough supply of organic fertilizers for their plants throughout the vegetable production season.

The use of organic fertilizers provides more advantages than disadvantages to food producers, these are the improvement of soil fertility and structure, increase water holding capacity, and add beneficial biota in the soil (Kuepper, 2003). The continued use of this fertilizer also resulted in high crop yields that are at par with that of chemical or synthetic fertilizers. Colting and Bernard (PCARRD 2001 Highlight 2000) revealed that the use of organic fertilizer resulted in a reduction of soil acidity and lead to the replacement of synthetic inorganic fertilizer with organically produced soil enhancers.

One of the natural sources of organic fertilizer is chicken manure or chicken dung. The use of chicken manure/dung as fertilizer has been a highly recommended material for agricultural production. This manure is composted and converted into "a black gold". It is usually added to the soil by spreading on the surface or by gently working the manure into existing soil. If used in its fresh form, care should be considered because fresh chicken manure contains disease organisms that may contaminate the vegetable gardens and kill the plants.

Farmers have also resorted to guano sourced out from droppings of seabirds or bat. This guano had become an integral partner of farmers in their agricultural activities as natural source of nitrogen, phosphorus, potassium and minor trace elements for plants overall health (Malcolm). Everything in guano, even the microbes are considered useful and necessary for the soil, roots development and foliage of plant life. Guano is considered a 100 percent natural organic soil amendment. However, since this pellet manure does not decompose easily it becomes dangerous to apply to plants, thus it is recommended that this should be incorporated properly to the soil before planting and should be decomposed first to make it more effective in supplying the nutrients for the plants. Care is therefore necessary in the above practice.

One of the vegetables that is highly in demand is bell pepper, a vegetable commonly grown in highland areas, noted for its cool and humid weather. However, its productivity is affected by the type and fertility of the soil which are the basic requirements in the cultural aspects of plant production. Because of this, it could be found that the supply of bell pepper in the market is limited, not enough to cater to the needs of the consumers besides being expensive for the ordinary consumer. It is therefore necessity of making bell pepper more accessible to most people.

The present study was conducted to determine the effects of different organic fertilizers applied at the same level on the growth and yield of sweet bell pepper under Romblon State College conditions.

STATEMENT OF THE PROBLEM

The study was conducted to determine the effect of different organic fertilizers applied at the same level on the growth and yield of different varieties of bell pepper under Romblon Sate College condition. Specifically, it sought answers to the following questions:

1. Are there significant differences in the growth and yield of three varieties of bell pepper treated with the same level of bat, chicken, and carabao manure?
2. Which organic fertilizer is found to produce a significantly higher growth and yield of bell pepper?
3. Which variety of bell pepper is highly responsive to organic fertilizer?

MATERIALS AND METHODS

The experimental method of research particularly the randomized complete block design (RCBD) factorial was used in this study. The experiment had four treatments and three replications. The treatments used were the same level of organic fertilizers (40 grams bat manure, 40 grams chicken manure, 40 grams carabao manure, and control- no fertilizer). Three varieties of bell pepper and the three varieties (Majesty, Trinity, and Kalahari) were used in this study.

The three varieties of hybrid sweet bell pepper were obtained from the East West Seed company and the three kinds of organic fertilizers were gathered from pasture lands, poultry farm and caves in the province of Romblon.

The organic fertilizers were dried, pulverized and weighed, and this were basally applied to the soil with a rate of 40 grams per plant by treatment and replications. The three varieties of hybrid sweet bell pepper were planted at the distance of 50 cm by 50 cm to 1 m by 1 m plot at the experimental area from June to November 2007.

Seeds of three varieties of bell pepper were sowed separately in the respective seed boxes and maintained daily until such time that the plants were ready for transplanting.

The agronomic characteristics of bell pepper gathered were the height (cm) number of fruits and weight (grams) of fruits. The data gathered were analyzed using analysis of variance (ANOVA) for the randomized complete block design and Duncan's Multiple Range Test (DMRT) at the 5% level of significance, was used.

RESULTS AND DISCUSSION

As shown in Table 1, the same levels of different organic fertilizers namely bat, chicken, and carabao manure did not significantly affect the height of the three varieties of bell pepper. The differences in height between varieties of the bell pepper is not significant.

Table 1. Average Height (cm) of Three Varieties of Bell Pepper as Affected by the Same Level of Organic Fertilizers

Treatment	Varieties of Bell Pepper			Total	Mean
	Majesty	Trinity	Kalahari		
Bat manure	31.33	31.33	32.33	94.99	31.66a
Chicken manure	40.67	29.50	33.00	103.17	34.39a
Carabao manure	30.67	31.33	29.67	91.67	30.56ab
Control	28.67	27.00	24.33	80	26.67b
Total	131.34	119.16	119.33		
Mean	32.84 a	29.79a	29.83a		30.82

CV = 18.45%

Means followed by a common letter in rows or column are not significantly different at 5% level using DMRT

The number of fruits produced by majesty and trinity varieties was significantly higher compared to Kalahari variety (Table2). The number of fruits obtained by plants fertilized with organic fertilizers was significantly higher compared to control. Plants fertilized with bat and chicken manure produced significantly higher number of fruits of bell pepper compared to fertilized with carabao manure.

Table 2. Average Number of Fruits of Three Varieties of Bell Pepper as Affected by Same Level of Organic Fertilizers

Treatment	Varieties of Bell Pepper			Total	Mean
	Majesty	Trinity	Kalahari		
Bat manure	6.67	8.33	4.33	19.33	6.44a
Chicken Manure	6.0	5.67	5	16.67	5.56ab
Carabao Manure	4.33	5.67	4	14.0	4.67b
Control	3.67	3.33	2.67	9.67	3.22c
Total	20.67	23.00	16		
Mean	5.18a	5.75a	4b		4.97

CV = 18.66%

Means followed by a common letters in row and column are not significantly different at 5% level using DMRT.

Table 3. Average Weight (grams) of Fruits of Three Varieties of Bell Pepper as Affected by the Same Level of Organic Fertilizers

Treatment	Varieties of Bell Pepper			Total	Mean
	Majesty	Trinity	Kalahari		
Bat manure	86.67	61.67	74.33	222.67	74.22a
Chicken manure	80.00	59.67	68.67	208.34	69.45a
Carabao manure	91.00	62.00	71.33	224.33	74.78a
Control	84.00	56.00	67.20	207.20	69.07a
Total	341.67	239.34	281.53		
Mean	85.42a	59.83b	70.38b		71.88

CV=18.71%

Means followed by the same letter in row or column are not significantly different at 5% level using DMRT.

Table 3, reveals interesting observations among the three varieties in terms of yield (weight of fruits) using the three organic fertilizers. Majesty has higher mean weight in terms of yield of fruit followed by Trinity and Kalahari.

CONCLUSIONS

1. There are no significant differences in terms of the height of the three varieties of bell pepper treated with the same level of different organic fertilizers.
2. There is a significant difference observed in the number of fruits of the three varieties of bell pepper treated with the same level of organic fertilizers.
3. No significant differences are observed in the mean weight of fruits of the three varieties of bell pepper treated with the same level of organic fertilizers.
4. Majesty variety is found to be more responsive to organic fertilizer compared to Trinity and Kalahari.
5. Processed/dried organic fertilizers as bat, guano, chicken, etc. may be good alternative to commercially prepared fertilizers for growing the three varieties of pepper namely majesty, trinity and Kalahari.

BIBLIOGRAPHY

COSICO, WELFREDO C. 1985. Organic Fertilizers; Their Nature, Properties, and Use. Farming System and Soil Resources Institute, College of Agriculture, UPLB, Laguna.

DELA CRUZ, RITA. 2004. Archives Growing Vegetables Organically, BAR Digest, Research and Development, Formerly BAR Today, Official Quarterly Publication of the Bureau of Agricultural Research.

HABY, V.A. MARVIN, L. BAKER et. al. Soils and Fertilizers

RIOFRIO, MARIANNE, Growing Pepper in the Home Garden HYC 1618-92, Ohio State University Extension Facts Sheet Horticulture and Crop Science, 2021 Coffey Road, Columbus, Ohio

SEVILLA-MOJICA FLORENCE.2006. The Philippine Fertilizer Industry, Market Information, Agri-Food Trade Service Canada.

Tiger Grass Industry in Marigondon Norte, San Andres, Romblon: Implications for Research and Development[1]

Jeter S. Sespeñe[2], Eddie G. Fetalvero[3] and Tomas T. Faminial[4]

ABSTRACT

Tiger grass (Thysanolaena maxima) grows in abundance in the mountainous regions of the three adjoining municipalities in Tablasisland in the province of Romblon. The grass has been identified by Indian researchers as a perennial, high value, non-perishable cash crop for wide range of agro-climatic conditions. It is a multipurpose species which provides brooms, fuel, feedstock and has high soil conservation value. Literatures reported that as of 2004, there were about 400 farmers in around 300-hectare tiger grass plantation all over the island. Marigondon Norte in San Andres, Romblon is one of the upland villages known for 'luway' production. The industry has been around for decades but its potential remains unexplored. Records revealed that a number of interventions were made for the industry to gain market but they were short-lived. It was not until the Department of Trade and Industry (DTI) identified tiger grass as a crop for One Town, One Product (OTOP) program of San Andres that efforts were rekindled to help develop the potential of this industry. To establish a comprehensive baseline data upon which developmental efforts are to be anchored, DTI collaborated with Romblon State University (RSU) in conducting a survey among 100 out of the reported 120 tiger grass farmers in the area. Farmers' demographic and socio-economic profiles were determined. Farm-related variables such as farm profiles, farm inputs, farm outputs, farming practices and marketing practices were also described. It was found out that if the farming and marketing practices of the farmers were to be improved, the industry can be a promising economic activity in the village. Findings further support the advocacy that tiger grass could be a potential commodity for agri-business in the uplands. RSU and other agencies can utilize the findings of this study as benchmark in initiating R&D program for tiger grass.

Key words: *Tiger Grass Industry, Luway, Baseline Study on Tiger Grass, Soft brooms*

---

[1] Baseline study funded by the Department of Trade and Industry and Romblon State University. Presented during the STARRDEC Agency In-House Review on July 28-29, 2010.

[2] PhD in Commerce; University President, RSU

[3] MA in Science Education; Director for Research, RSU

[4] CPA; MABA; Dean, College of Business and Accountancy

BACKGROUND OF THE STUDY

Tiger grass has been identified by Indian researchers as a perennial, high value, non-perishable cash crop for wide range of agro-climatic conditions. It is a multipurpose species which provides brooms, fuel, feed stuff and has high soil conservation value. The decoction of roots of this plant is used as mouth wash during fever. It has the comparative advantage of tolerance to harsh environmental conditions such as steep rocky mountain slopes, shallow soil, drought and high rainfall conditions. Therefore, it is suitable to grow on wastelands as well as in farms. The fibrous root system of the plant is very useful in checking soil erosion on steep slopes. After the harvest, the broom sticks are used as wall building material. The sticks have also been tried by paper and pulp industries for the manufacture of paper. The cultivation of this grass can wean away the practice of shifting cultivation and reduce the dependence of people on forests (Bisht and Ahlawat, 1998).

Marigondon Norte is one of the 13 barangays of San Andres which is a typical remote agricultural village, barely reached by technological breakthroughs because of its rugged trails and far-flung distance (about 14-18km) from the town proper. The residents are dependent on coconut and copra making. The production of copra is quarterly which cannot sustain the daily needs of the people. Rice is grown but very minimal. Tiger grass (luway) farming is one important economic activity in the locality with large areas of land being devoted to tiger grass farming. Tiger grass production comes every first quarter of the year and are sold semi-processed or dried.

A considerable number of farmers are engaged in planting and harvesting this crop and manufacturing brooms out of it. In fact, the crop has been chosen as the municipality's One Town, One Product (OTOP). Literature says that about 1.5 to 3 million pesos worth of tiger grass materials are harvested annually and are sold to nearby municipality of San Agustin where broom making is the major livelihood. It has been also noted that worth of tiger grass could double up to 250 percent if they were processed into brooms. Thus, the activity could be translated into income aside from generating employment and livelihood among farmers' housewives and children.

It was reported in the website of DTI-OTOP section that farmers and processors have already been organized in the municipality. One was the Mari-Norte Development Association which produces around 60,000 to 80,000 straight weave brooms. The other one was the Romblon Malipayon Development Multi-Purpose Cooperative in Marigondon Sur whose capacity

of broom production was 90,000 pieces per year. However, these organizations did not last long.

At present, efforts at rekindling entrepreneurial energies and optimizing the potential of tiger grass are underway with the Department of Trade and Industry (DTI) on the lead. However, data gaps have been observed, thus delaying developmental interventions on tiger grass production. There appears no comprehensive baseline data as to the identity of the farmers, the farm location and plantation areas and availability of resource map locators, among others. It has been observed too, that available figures about the industry in the municipality need to be validated. These concerns imperiled the identification of the appropriate programs geared towards the establishment of a comprehensive and sustainable development plan for the industry.

Recognizing the continuing effort of the government to develop rural-based economic activities and at the same time facilitate the provision of assistance to promising industries, the need to establish database information system as support mechanism for the development of the tiger grass industry in the municipality of San Andres is deemed timely and relevant.

OBJECTIVES

This study was conducted to establish baseline information about the tiger grass industry in Marigondon Norte, San Andres, Romblon during the months of December 2009 and February 2010 as basis for research and development interventions. Specifically the survey sought to:

a. Describe the demographic profiles of the tiger grass farmers in terms of sex, age, civil status and number of dependents;
b. Describe the socio-economic profiles of the tiger grass farmers in terms of highest educational attainment, estimated annual income, sources of income and membership in organization;
c. Determine the profiles of the tiger grass industry in terms of type of industry, years of operation, farm profiles, farm inputs, farm outputs, farming practices and marketing practices; and
d. Identify the problems encountered by the farmers concerning the tiger grass industry.

SIGNIFICANCE OF THE STUDY

The success stories of small and medium enterprises that were able to penetrate the market through the Department of Trade and Industry's One Town, One Product Program (OTOP) inspired other towns with rich resources to do the same. Baseline data from this study are important for government agencies like Department of Science and Technology, Department of Trade and Industry, and Department of Labor and Employment for any possible program or project they could introduce in the area. The local government unit of San Andres particularly the barangay council of Marigondon Norte will also benefit from this study.

Funds are appropriated by the DOST, DTI, DOLE and other government agencies for income-generating projects like tiger grass industry. In order for these funds to be downloaded, project proposals are required. The rich data gathered in this study will help project proponents to plan out better project proposals from tiger grass farming to tiger grass processing. Through the results of this study, decisions as to where the starting point will be in helping the industry can be made better.

The local government of San Andres will be able to update their community resource map through the data from this study. These data could also serve as benchmarks in initiating policies about the industry or in introducing interventions to improve the tiger grass products, the farmers' behavior and their farming and marketing practices.

The Research and Development Unit of the Romblon State University can review the baseline data generated by this study and examine in which aspect it can be of help in developing the tiger grass industry in Marigondon Norte. The unit can take the lead in tiger grass knowledge and technology transfer and techno-demo farms establishment.

SCOPE, DELIMITATION AND LIMITATIONS OF THE STUDY

This study was conducted to establish baseline information about the tiger grass industry in Marigondon Norte, San Andres, Romblon during the months of December 2009 and January 2010. It covered 100 out of the 120 reported tiger grass farmers in the community. The following are the limitations of this survey:

a. This survey could not speak for the general picture of the tiger grass industry in the whole municipality since there were reports that small-scale tiger grass farms are also grown in other villages in the

municipality. Due to limited resources to cover a wider scope, findings are only true among Marigondon Norte tiger grass farmers.

b. Random selection was not possible because the sampling frame provided by the Barangay Council was outdated and incomplete, thus during the actual survey, 20 of the identified farmers were no longer in the community.

c. Some data contained in this study resulted from recall, and in some respondents, were rough estimates only like annual income, income from tiger grass and production volume.

METHODOLOGY

Since the very purpose of the study was to describe the current condition of the tiger grass farmers, the tiger grass industry and the problems they encountered, the research method used was descriptive. Below is the schematic diagram of the design followed in conducting this study.

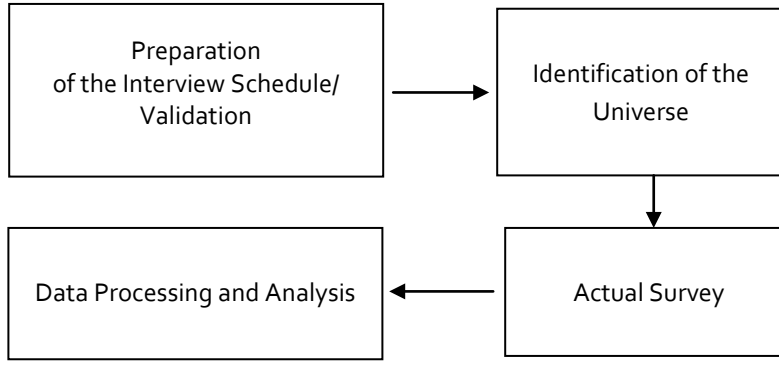


Figure 1. Research Design

Locale and Time of Study

Locale. Marigondon Norte is a tiger grass growing village in San Andres, Romblon. It is located on the north easternmost part of the municipality along with the mountainous region of central Tablas. It has a total land area of approximately 2,800 hectares, a population of about 1,175 (2005), and about 221 households.

Transportation is a major problem in the village because it is about 18km away from the town proper and the roads that cut through the mountains and rivers although passable are really in bad shape and condition. It can be reached by a single motorcycle or a service truck via the Jun Carlo or Mari-Sur routes. Travel time lasts from 45 minutes to one hour. It can also be reached by brisk walk lasting from 2 to 3 hours. Shown in Figure 2 is the spot map of Mari-Norte and its location alongside with other barangays in the municipality of San Andres.

*Time of Study.*This study was conducted from December 2009 to February 2010. The actual survey took place from December 28 to 31, 2009 and January 9 and 10, 2010.

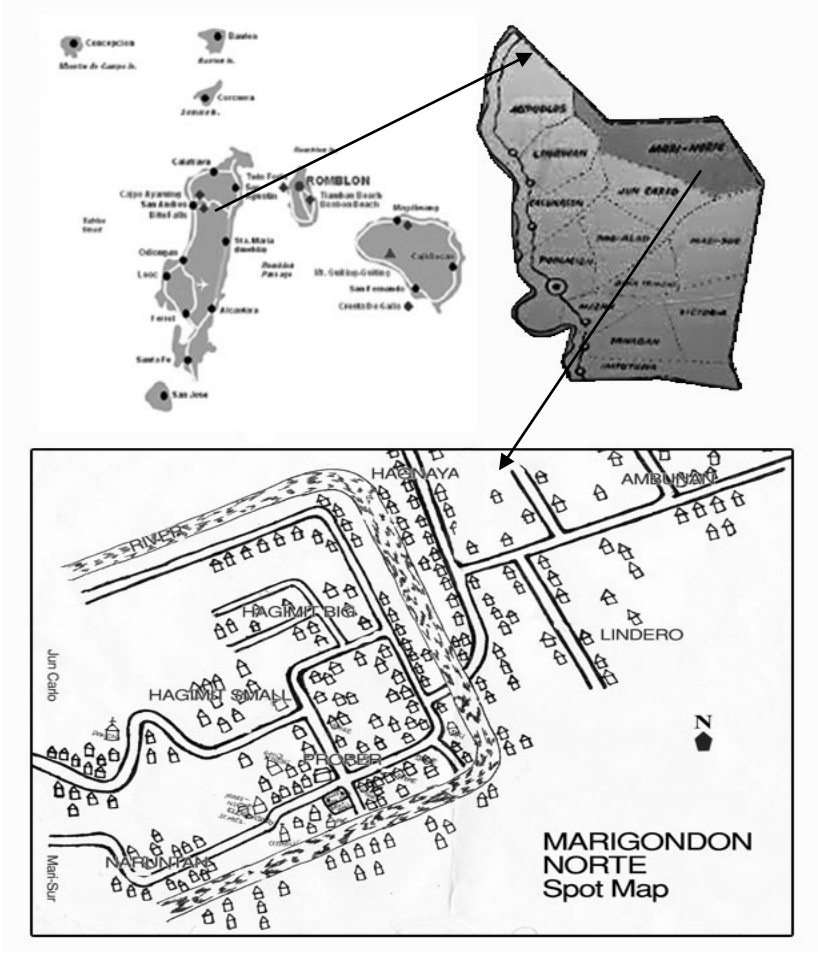


Figure 2. Spot Map of Marigondon Norte

The Respondents

Based on the list provided by the Barangay Council of Mari-Norte, there were 120 tiger grass farmers in the area. But during the actual survey, 20 of those who were enlisted were already out of the locality. The remaining 100 tiger grass farmers in the list were completely enumerated. The table below shows the number of respondents from each *sitio*.

Table 1.Distribution of Respondents Per Sitio

SITIO	FREQUENCY	PERCENT
Lindero	10	10
Proper	19	19
Hagimit Big	24	24
Hagimit Small	5	5
Hagnaya	16	16
Naruntan	22	22
Ambunan	4	4
Total	100	100

The Research Instrument

Nature and Purpose. The data-gathering instrument used in this study was a structured interview schedule. It asked pertinent data about the tiger grass farmer profile, tiger grass industry profile and problems encountered relevant to tiger grass industry. The interview schedule was a combination of closed and open-ended questions. It was worded in Filipino to ensure that the questions were understood by the respondents.

Validation. The interview questionnaire was validated by two employees from the Department of Trade and Industry (DTI) provincial office and an instructor at RSU. Their suggestions were incorporated in the final questionnaire. It was pre-tested among five former tiger grass farmers which were already living in San Andres town proper.

Data Collection and Data Source

The method of data collection employed was a survey particularly the face-to-face structured interview technique. The questionnaire for interview was used in gathering information. Sources of information included the following: the barangay captain provided the list of tiger grass farmers in the locality, the *SangguniangKabataan* Chairman served as a guide in locating the homes of the farmers, and the tiger grass farmers who provided first-hand information about the tiger grass industry.

Method of Data Processing and Analysis

Results of the interview were systematically encoded with the aid of coding manual and coding sheets. These were processed using the program Microsoft Excel. MS Excel data files were converted into an SPSS format (Statistical Packages for Social Sciences). The statistical measures used in analyzing the data were frequency count, range, median (*when there were extreme values*) and mean.

RESULTS AND DISCUSSION

Sex, Civil Status, No. of Dependents, Educational Attainment, Annual Income, Annual Income from Tiger Grass and Affiliation to Social Organizations

Results showed that out of the 100 tiger grass farmers surveyed, 71 were males and 29 were females. Most were married with an average of 4 dependents. The ages of farmers ranged from 22 to 79 years old but most were 42 years old. About 80 percent of them were not able to receive a college education and majority spent few years only in high school. Their approximate annual income varied between P2,500 to P130,000 with an average of P20,500 per farmer. The combined annual income of these farmers was P2,683,000 which was usually sourced from tiger grass farming, copra production, poultry, tiger grass processing and *nito* handicrafts. Most of these farmers were not affiliated with any social organization.

Type of Tiger Grass Industry and Years Engaged in the Industry

There were 86 farmers whose economic activity was concentrated on tiger grass farming alone while 14 doubled to farming and processing. There was some hesitance on the part of most farmers to venture into soft broom making because the process entailed additional labor and they preferred quick cash. The length of their farming experience ranged from 1 to 38 years with an average of 10 ½ years. Most of the broom processors were engaged in the industry for about 20 years already, others for 38 years.

Farm Profiles

Most of the tiger grass farms were owned by farmers but some were tilled by tenants. Essentially, it is very common to see farms that are two kilometers away from the farmers' homes. Although some farms are situated just beside homes, others are located as far as 5 km away. The farm area estimates ranged from 0.3 to 9 hectares with an average of 1 hectare per

farmer. The total farm size was 130.6 hectares distributed in the following locations: Ambunan (39 hectares), Hagnaya (37.8), Naruntan (24.75), Lindero (14.3) Hagimit Big (7.75) and Hagimit Small (7 hectares).

Tiger grass farms were also planted with coconut, other rootcrops and palay while others were solely dedicated to tiger grass plantation. The crop calendar usually begins with site clearing using the slash and burn (kaingin) technique as early as January or February. By May, the land is ready for the sowing of palay seeds. Around June or July, when the palays are already about a foot tall, tiger grasses are planted alongside with the palays. By September or October, palays are harvested but the tiger grasses are left growing. By January to February of the next year, the tiger grasses began producing flowers and by March or April, these are already harvested.

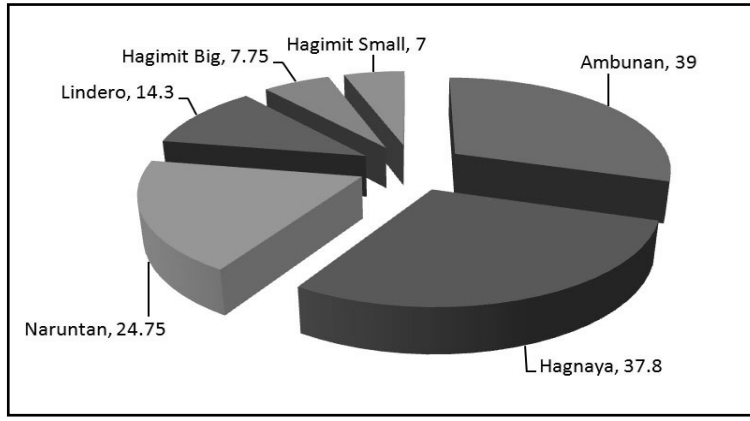


Figure 3.Pie graph for estimated areas of tiger grass farm per sitio (in has.)

Farm Inputs

Managing a tiger grass plantation required an estimated annual expenses of P100 to P15,000 depending on farm size. However, the average expense per farmer was estimated at P2,000 a year. The reported cumulative annual expense including farm inputs and farm help was P284,600. Farm help was usually provided for free by family members, neighbors, nephews, cousins and friends. But some paid about P120 to P150 a day per worker.

Farming Practices

The ideal months for planting tiger grass are from June to July. There is no day or time preference for planting because the crop can be planted any time and any day within those months. Up to this time, no

superstition related to tiger grass planting has already been reported. The different farm implements used in planting were *tara-tara*, a sharp rectangular iron attached to a long wooden handle; *tagad*, a long piece of wood tapered and sharpened in one end; bolo; *pala*; and *piko*.

The most common farming practice was to plant 1 to 5 tiger grass hills (seedlings) per hole with intervals 1 m x 1 m intervals. Others were spacing the crops by 1.5 m x 1.5 m and 3 m x 3 m. With this practice, a hectare of land can be planted with 1,000 to 10,000 hills. Weeding and clearing the underside of the plants were factors affecting flowering performance. These were commonly done once a year by most farmers while others were doing this twice or thrice a year. The following harvest and post-harvest practices were observed: cutting the stalks while the panicles were still green and not yet fully mature, sun drying of panicles for three days; and patting sun dried panicles against rocks to shake off the flowers and pollens.

Farm Outputs

The production volume is measured in terms of bundle, a pack of about 100 stalks of cleaned and sun-dried tiger grass panicles. As of last harvest season, the reported average production volume was 600 bundles per farmer or approximately 80,630 bundles for all farmers. In seasons of low production, volume ranged from 3 to 1,500 bundles with an average of 200 bundles per farmer. In seasons of normal produce, volume ranged from 5 to 3,000 bundles with an average of 400 bundles per farmer. And in seasons of high produce, volume ranged from 30 to 5,000 bundles with an average of 500 bundles per farmer.

Two tiger grass products are produced in the locality: dried luway, the material used in making soft brooms; and the soft broom itself (walistambo). In harvest months, the tendered price for luway ranged from P10 to P35 per bundle. The average price per bundle was P12. During off-peak months, the tendered price increased between P12 to P50 and the average price of each bundle also increased to P20. Price of walistambo also varied between peak and off peak months ranging from P10 to P60.

The estimated annual income earned by a farmer for dried luway production alone was about P9,500. It was found out that an estimated P1,122,500 income could be realized from this industry representing about 50 percent of the farmers' total annual income estimate which was P2,263,000.

Marketing Practices and Buyers of Produce

Farmers commonly sold their produce to luway wholesalers and to luway sales agents. In 2009, the estimated volume of 80,630 bundles were sold to these local agents: Mr. Manasan of Doña Juana (22,200 bundles), Mr. Robert Gabon (20,830 bundles), other agents in Mari-Norte (17,450 bundles), Mr. Gaciles of San Andres (8,650 bundles), agent for Mindoro (4,000 bundles), agent in Mari-Sur (3,600 bundles), agent for Aklan (3,200 bundles) and agent for Odiongan (700 bundles).

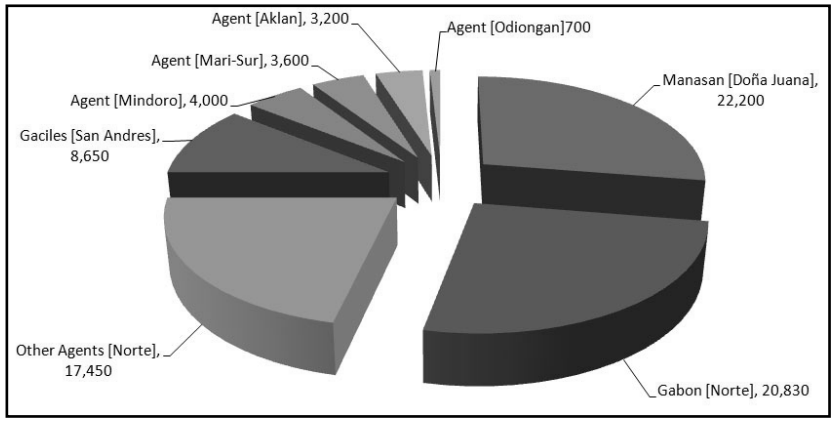


Figure 4. Buyers and Volume of Dried Luway Bought (in bundles)

Problems Encountered by the Industry

Common problems encountered by farmers were lack of financial resource for clearing, labor pay and seedling acquisition; attack of rodents like rats specially when the farms are not cleaned; lack of support from the local government in terms of finding a market; low tendered price for products; poor product quality particularly when it rained during harvest and drying process; and absence of tiger grass processing facilities.

Given proper attention, focus and sustained support, tiger grass production and soft broom processing promise a potential multi-million industry for Barangay Marigondon Norte and for the municipality of San Andres in general. If the industry's 2009 production volume of 80,630 bundles can be maintained or improved, it can generate estimated revenue of P1M to P2M depending on the prevailing market prices. However, if these raw materials were to be processed into soft brooms, an estimated 241,890 brooms can be produced creating an annual revenue ranging from P3.6M to P7.3M. Figures may be higher if their primitive farming and traditional marketing practices could be improved.

CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn:

1. Tiger grass farmers in Marigondon Norte are generally poor, earning only an estimated income of P1,700 a month. This might have been brought about by their low educational attainment and income sources that are limited to seasonal agricultural activities. Evidences are also suggestive of their lack of social empowerment.

2. Tiger grass industry in Marigondon Norte is concentrated more on propagating activities and production of raw materials for soft brooms. Very few ventured in soft broom processing because of the human, technical and financial costs it demands. The industry has been a major economic activity in the locality for long years already but it has not risen from the grassroots because of the absence of baseline production data and of sustained developmental efforts. Aside from these, farmers reported lack of financial sources to defray farm related expenses.

3. More than 130.6 hectares of land in Marigondon Norte are cultivated for tiger grass farming. The industry requires very minimal farm inputs. The average expense for a one-hectare farm was P2,000 usually paid to workers for weeding the farm. Seedlings are collected in the wild while farm implements are just simple farm tools. Once the crops have grown, maintenance is very minimal since farmers have to clear only the farm off weeds at least once a year.

4. The tiger grass industry is a promising economic activity in Marigondon Norte. Around 50 percent of farmer's annual income came from tiger grass production. If its 2009 production volume of 80,630 bundles can be sustained or improved, it can generate an estimated revenue of P1M to P2M depending on prevailing market prices. However, if these were to be processed into soft brooms, an estimated revenue between P3.6M to P7.3M is expected to be realized. Figures may be higher if their primitive farming and traditional marketing practices could be improved.

IMPLICATIONS FOR RESEARCH AND DEVELOPMENT

1. On linkages, the Department of Trade and Industry can help the locals find market for their products through attendance in trade

fairs and other promotional activities. As soon as the local producers feel the demand and profitability of the industry and a market is established, they will not sell anymore their produce to nearby municipalities, they will be encouraged to plant more tiger grasses and process these into soft brooms.

2. On cooperative formation, there is a need to reorganize the tiger grass farmers of Marigondon Norte. The Romblon State University Research and Extension unit in collaboration with the Department of Trade and Industry, Department of Science and Technology, Department of Agriculture and the Local Government Unit of San Andres can the take the lead in this reorganization effort. The ultimate goal is to come up with a cooperative but conducting pre-membership seminars can be done to prepare them for greater responsibilities.

3. On technology transfer, there is also a need to develop the potential for soft broom processing in the locality. DTI and DOST can help introduce mature technologies on tiger grass production such as those invented at Don Mariano Marcos State University which was adopted already by the softbroom processors in San Agustin.

4. On techno-demo farm establishment, the Research Unit of RSU can establish a techno-demo farm in the area and employ the prevailing farming and propagating practices and management of tiger grass plantation. They can make a project proposal to the Land Bank of the Philippines (LBP) to fund the validation of whatever mature tiger grass technologies available under the Marigondon Norte condition.

5. On breaking the monopoly, the University Research, Extension and Production Unit can come up with a Comprehensive plan of breaking the monopoly of purchasing tiger grass products in the area. One suggested strategy is for the Unit to encourage the tiger grass farmers to send their children to RSU much like a study now pay later scheme. An agreement will be forged between RSU and the farmers that upon harvest, they will sell the products to RSU and pay the fees of their children. A warehouse can be put up at RSU San Andres and the production unit can come up with a storage plan so that tiger grass materials could be processed into soft brooms during off-peak seasons, where the value of the product is on its all-time high.

6. On implication in the business curriculum, the College of Business and Accountancy in coordination with DTI, NEDA, DOST and DA can integrate into its BSBA curriculum an "Enterpreneurial Camp." This proposed encampment will be a two-month immersion activity of the business students in a potential community with economic activity to boast like the tiger grass of Mari-Norte. During the encampment, the students will be taught and guided on the preparation of a project proposal and the best proposal could be packaged for possible funding. This activity is expected to broaden the social concept of the students and learn on hand what community development is all about.

7. On gender and development, a program for the women tiger grass farmers can be packaged since this group of farmers manifest sincerity in taking the tiger grass farming and soft broom processing by heart.

8. On further studies, the following may be conducted or initiated by the University REP office :
    a. Profile of tiger grass industries in other barangays like Jun Carlo, Mari-Sur and Victoria;
    b. Case study on the positive contribution of kaingin system on tiger grass farming; and
    c. Tiger grass product development or improvement.

BIBLIOGRAPHY

OTOP.(n.d.).*About San Andres.* Retrieved February 1, 2009, from OTOP Philippines: http://www.otopphilippines.gov.ph/microsite.aspx?rid=5&provid=67&prodid-157&sec=2

OTOP.(n.d.).*One Cluster One Vision.*Retrieved February 1, 209, from DILG: http://www.dilg.gov.ph/Region4B/bestpractices.htm

OTOP.(n.d.).*Tiger Grass of San Andres.*Retrieved February 1,2009, from OTOP Philippines: http://otopphilippines.gov.ph/microsite.aspx?rid=5&provid=67&townid=1277&prodid=157

OTOP.(n.d.).*Tiger Grass Processing.*Retrieved February 1, 2009, from DOST: http://mis.dost.gov.ph/region4/webapps/ProjMonitor/details.php?id=72

OTOP.(n.d). *Tiger Grass Producers in San Andres.*Retrieved February 1, 2009, from OTOP Philippines:

http://www.otopphilippines.gov.ph?sme.aspx?smeid=29&rid=5&provid=67&proid=157

Palma, N.A. (1993). *Sucker and Panicle Production of Tiger Grass in Plantations.*Retrieved February 1,2009, from PCARRD:http://www.pcarrd.dost.gov.ph/consortia/nomcarrd/researches/1993/1993_r12.htm

Servañez B.F and Servañez, M.V. (n.d.).*The Tiger Grass Industry in Romblon – Rising from the Grassroots.*Document available at the DOST-PSTC Romblon Office.

Servañez, M. (n.d.).*A Project Proposal on Techno-Demo cum Forum on Tiger Grass Technologies in San Andres Romblon.*Document available at the DOST-PSTC Romblon Office.

Viernes, R. (n.d.). *A Project Proposal on the Utilization of Tiger Grass Materials into Soft Brooms by Tiger Grass Broom Weavers of Mari-Norte, San Andres, Romblon.*Document available at the Office of the Municipal Agriculturist, San Andres, Romblon.

_____(n.d.) . *A Training Design on the Operation and Maintenance of Tiger Grass Kiln Dryer and Broom Handle Making* Equipmen in Doña Juana, San Agustin, Romblon.Document available at the DOST-PSTC Romblon Office.

_____(1992). *Propagation, management and harvesting of Tiger grass in the highlands.*DENR-CAR, Technology Transfer Series, Vol. 2 (2). Retrieved on February 20, 2010 from http://maidon.pcarrd.dost.gov.ph/cin/afin/propagation-management-and-harvesting-of-tiger-grass-in-the-highlands.htm

_____(n.d.). *Quick Facts: The Tiger Grass Broom Industry in the Province of Romblon*. Document available at the DOST-PSTC Romblon Office.

_____ (2004).*Tiger Grass Industry Porfile at Doña Juana, San Agustin, Romblon*. Document available at the DOST-PSTC Romblon.

_____(n.d.). *Tiger Grass Processing: A Project Proposal of theTiger Grass Farmers and Processors Association at Doña Juana, San Agustin, Romblon*. Document available at the DOST-PSTC Romblon Office.

Design, Fabrication and Test Performance of a Multi-Crop Grating Machine[1]

Orley G. Fadriquel[2]

ABSTRACT

The objective of this study is to design, fabricate and test the performance of the Multi-Crop Grating Machine. The multi-purpose grating machine was composed of four major components, namely: the hopper/ feeding assembly, the grating and the power units, and the machine frame or support. The over-all dimension of the machine measured 300 mm in length, 300 mm in width and 1000 mm in height. In testing the machine, two types of grating blades, the coarse and the fine ones were used. The capacity of the machine in grating cassava using the coarse blade was 161 kg/hr and that for the fine blade was 107. While the grating of papaya requires the machine's capacity of using the coarse blade for 71.43 kg/hr, that for the fine blade was 68.96. The grating of ginger showed that the capacity of the machine of using the coarse blade was 111.11 kg/hr, that for the fine blade was 80.54. To determine the viability of the machine economic analysis was made using the Internal Rate of Return. Results show that an investment for the multi-purpose grating machine is profitable. The grating machine designed, fabricated and performance tested is found to be useful to the cassava, papaya and ginger processors because it lessen the time in grating the commodities.

Key words: *grating machine, cassava grater, papaya grater, ginger grater, multi-crop grater*

[1] Presented during the Southern Luzon Cluster Invention Contests and Exhibits, Legaspi City, Albay on September 6-9, 2010 sponsored by DOST IV A&B and DOST V. Best R&D Poster, 24th Regional Symposium on Research and Development Highlights

[2] Assistant Professor II; Mechanical Engineer; Faculty, College of Engineering and Technology, RSU

INTRODUCTION

During my high school days, my mother occasionally would ask me to do the favor of grating cassava for cassava cake and sometimes of papaya for pickled papaya to augment our income. I would always obey her in exchange for bigger allowance for the following school days. Grating would require me more than two hours to finish half sack of cassava while grating papaya would just enable me to spend enough time but after the grating session, my arms could not be moved easily for aches caused by manual grating.

Ginger rhizome, commonly known as "luya", is a common morning drink in exchange for coffee for those who are health-conscious. The traditional process to make ginger rhizome tea is to boil pieces of peeled and washed ginger rhizome and after boiling it for several minutes, it could be served together with boiled "camote" or cassava.

Nowadays, cassava is still being processed as cakes, "suman", "bibingka" and "sago" and being used and explored as source of starch, flour and feeds. Its demand is bound to increase in the years to come. "Papaya", on the other hand is still processed as pickles because it adds palatability to lechon and other fried foods. "Luya" is being processed as tea labeled and attractively packaged, can be found in many stores.

Commercial instant "salabat" is also processed by grating the ginger rhizome, which is squeezed later to extract the juice. The juice will then be mixed with sugar and simmered until it dries. From that of course, comes the source of instant "salabat". In most parts of the Philippines, crops earlier pointed out have evolved from being sources of human food to key commercial crops with high-value and marketable products.

Commercial production with sufficient and sustained volume of this type of products will surely give economic impact to the community, therefore, more researches and development interventions must be pursued so as to enhance production from planting to processing.

Grated cassava products, pickled papaya or "atsara" and instant ginger rhizome or "salabat" are the products commonly processed by self employed women to earn income for the family. Even working mothers are engaged in this type of business to earn extra income. These women activities which add economic stability to the family and to the community must be enhanced. Interventions should be continuously pursued with full integration of all efforts from crop production to products.

The facts mentioned have encouraged the researcher to conceptualize the design, fabrication and test the performance of the multi-purpose grating machine to help ease the burden of food processors in grating cassava, papaya and ginger rhizome.

OBJECTIVES OF THE STUDY

This study was conducted to design, fabricate and test the performance of the multi-purpose grating machine conducted at Romblon State University, Odiongan, Romblon during the school year 2009 – 2010. Specifically, the objectives of the study are:

1. To design the components of the multi-purpose grating machine such as the hopper/ feeding chute, the grating and the power units and the frame.
2. To fabricate the multi-purpose grating machine based on the design parameters as the:
    a. Hopper
    b. Feeding chute
    c. Grating Unit
    d. Power Unit
    e. Frame
3. To test the performance of the machine in terms of production output using three crops namely cassava, papaya and ginger rhizome.
4. To determine the economic viability of the machine if used commercially.

CONCEPTUAL FRAMEWORK

The conceptual model of the study is shown in the form of a paradigm in figure 1. It utilizes the input, throughput and output approach. The INPUT of the study consisted of alternative ideas from related literature and studies, supplies and materials, tools and equipment and cost of construction of the project. The THROUGHPUT covers the different processes involved in the development of the model namely: designing, fabrication and testing. The OUTPUT is the completed Multi-purpose Grating Machine.

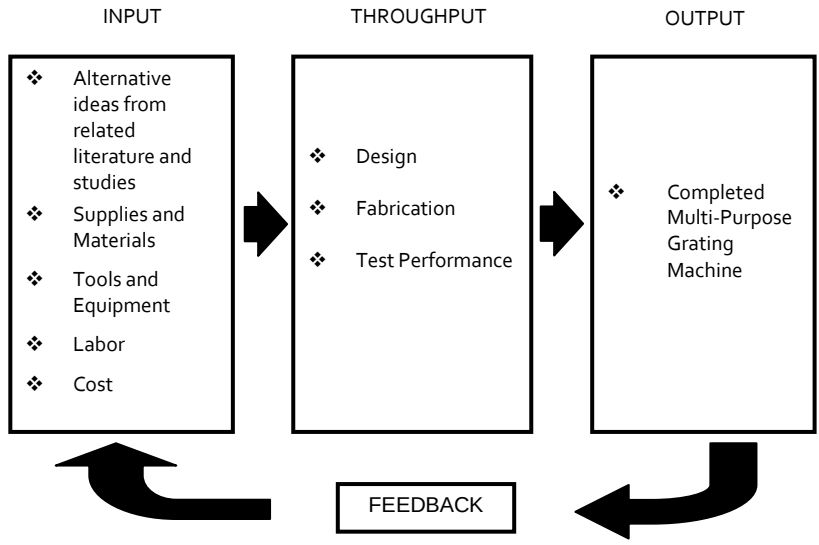


Figure 1. Conceptual Framework

MATERIALS AND METHODS

Materials

Table 1. Materials used in the project

Quantity	Unit	Description
1	Full sheet	Stainless sheet (8 mm thick)
1	Full length	Mild steel 1 x 3/16 x 20 Angle bar
1	Full length	Mild steel 1 x 3/16 x 20 Flat bar
1	Pc	V-belt B-23
¼	Kg	Tying wire
1	Pc	Hacksaw blade (Sandflex)
1	Kg	Electrode gauge 12
1	Kg	Stainless Electrode gauge 12
4	Pcs	3/8 x 1 ½ Bolts
2	Pcs	1/2 inch Nuts
2	Pcs.	1/2 inch Nuts (Stainless)
1	Pc	3/4" ID Pillow block
1	ft	3/4" Ø stainless steel shaft
2	Pcs	Nut washer
2	pcs	Nut washer (stainless)
1	Pc	4x13x1 pulley
1	Pc	1 hp single phase electric motor
1	can	Spray paint no.36 silver(300 ml)
3	pcs	Sandpaper (No. 120)

Tools and Equipment Used

Electric arc welding machine
Rubber mallet
Hammer
Gas welding machine
Grinding machine
Sheet metal cutter
Hacksaw
Anvil
Sandpaper
Bench tools (long nose, fliers, vise grip, screwdriver, wrenches)
Molder

Fabrication Procedure

The fabricate procedure of the multi-purpose grating machine was presented in detail but it is necessary to procure all the supplies and materials needed in the fabrication of the machine. Shop tools and equipment must also be prepared. It is also necessary to contact first an expert welder for labor before fabrication commences.

1. The Frame
    a. Measure and cut the pieces to the required dimension.
    b. Assemble the frame. Use an electric arc welding in joining the angle bars.
    c. Grind the protruding welded parts of the frame with a portable grinder.
    d. Use file to grind the protruding parts that are not removed by the grinder.

2. The Hopper/ Feeding Assembly
    a. Measure and cut the sheet with a tin cutter.
    b. Form the necessary cylinder for the hopper and for the feeding chute.
    c. Solder the hopper cylinder.
    d. Solder the feeding chute cylinders.
    e. Measure and cut a separate sheet for the feeding chute support.
    f. Measure, cut and round the necessary size of the flat bar.
    g. Solder the feeding chute to the feeding support.
    h. Grind the protruding soldered parts.
    i. Use sandpaper for a smooth finish.

3. The Grating Unit
    a. Measure and cut the sheet with a tin cutter.
    b. Weld the nut at the center. The nut will act as the holder of the blade to the shaft.
    c. Nail punch the bottom to make grating blade at the top portion. The protruding parts will act as the grating blade.
    d. Grind using electric grinder and sandpaper the protruding parts but make sure that the nail punched protruding parts are not included in grinding.

4. The Shaft
    a. Using lathe machine, make a screw at one side of the shaft. The screw will hold the nut mounted at the grating blade.
    b. On the other side of the shaft, make a hole that will then hold the bigger pulley.
    c. Insert the pillow block in the shaft using hydraulic press.
    d. Insert the bigger pulley.
    e. Assemble and weld the shaft to the frame.
    f. Grind the welded parts for smooth finish.

5. The Catch Basin
    a. Measure and cut the sheet with a tin cutter.
    b. Make a center hole to accommodate the passage of the shaft.
    c. Lay out the catch basin.
    d. Weld the catch basin to the main frame just above the pillow block of shaft. Make sure proper angle is observed for ease sliding of the grated cassava to the collection box.
    e. Grind using electric grinder and sandpaper.

6. The Power Unit
    a. Measure the distance of the two pulleys.
    b. Lay out the motor.
    c. Screw the motor to the frame.
    d. Assemble the switch to the main frame.
    e. Make sure electric wirings are in place.
    f. Connect the male plug to the wire.

7. Cover
    a. Top cover
        i. Measure and cut the sheet with a tin cutter.
        ii. Grind using sandpaper to ensure smooth finish to avoid scratches when holding the cover.

iii. Weld the makeshift hinge to the cover and the hopper cylinder.
iv. Weld the wire that will act as holder to the top cover.

b. Side cover
i. Measure and cut the sheet with a tin cutter.
ii. Grind the sides using sandpaper.
iii. Weld the sheet to the main frame.
iv. Grind using electric grinder the welded parts.

8. Finishing
a. Grind using sand paper all the rough surfaces of metal.
b. Use number 120 sand paper.
c. Spray the welded parts with a silver paint to avoid accumulation of rusts. Spray the whole body.

Testing Procedure

In testing the grated commodities, the researcher used two types of blade, the rough blade and fine blade to determine which blade is fitted to the purpose of grating. The diameter of the punched hole for fine blade is half the size of the rough blade. Rough blade has a diameter of 5 mm while the fine blade has 2.5 mm diameter.

1. Cassava
a. Peel the cassava tubers.
b. Wash the cassava tubers.
c. Weight the cassava tubers.
d. Put the tubers in the feeding chute.
e. Switch on the power and push the timer simultaneously.
f. Record the time consumed in grating the cassava.

2. Papaya
a. Peel the papaya.
b. Cut the papaya lengthwise into three.
c. Remove the seeds.
d. Wash the papaya.
e. Weight the papaya.
f. Slice the papaya in order to fit to the chute.
g. Put the papaya in the feeding chute.
h. Switch on the power and push the timer simultaneously.
i. Record the time consumed in grating the papaya.

3. Ginger rhizome
    a. Wash the ginger rhizome roots thoroughly using brass to remove soil.
    b. Weight the ginger rhizome roots.
    c. Put the roots in the feeding chute.
    d. Switch on the power and push the timer simultaneously.
    e. Record the time consumed in grating the ginger rhizome roots.

Note: The procedure was repeated for all the commodities in five replications and blades were cleaned every after testing.

Data Analysis

The result of the test was tabulated and analyzed using the average method. In each type of blade used, actual time recorded per batch of feeding was summarized and divided by the number of replications made.

Economic Analysis

To determine the extent of the project's viability and that of the machine used for commercial purposes the five basic methods for making economic analysis were used: annual, present and future worth methods, Internal Rate of Return and the External Rate of Return.

To establish data needed for the financial analysis, the proponent conducted interview to food processors in the municipality of Odiongan. It was found out that only one food processor used machine in grating cassava. No data were established for ginger and papaya processors using grating machine because there's no available grating machine for such crops.

Other data gathered:

Grating fee	₱ 10.00 per kg
Average mass of cassava grated per day	15 kg/day
Average of operating days/month	20 days/month

Other assumptions

- Prevailing bank interest rate 21% per annum
- Straight Line method was used to determine depreciation cost
- Maintenance cost was ten percent (10%) of the investment cost.
- The salary of machine operator was assumed to be P1,500.00 per month since operation of the machine was 8.4 minutes/ day only.

- Life span of the machine is estimated to be 5 years only.
- It was assumed that the investment capital of P15,000.00 was borrowed payable in uniform annual repayment within 5 years.
- Power cost was computed based on the prevailing price of P 8.50 per kW-hr of the Tablas Island Electric Cooperative, that only 36.24% was for generation charge and the remaining 63.76% were for other charges.
- It is assumed that the machine has zero salvage value after five years.

The Machine Components

In the first stage of the conceptualization of this research, the researcher determines the size of the components of the machine. The size of the machine was based on size of the crops to be grated. The chute was first designed to hold six cassavas each having 3 inches in diameter. From there, other components were designed. The proponent also decided to determine what materials are available in the market.

During the conduct of this research, the only available pulley in the market was for B-type belt. The researcher decided to use the same type of pulley. As indicated in the motor plate, the rpm of 1 hp motor is 1730 rpm. The proponent also decided to use a 2-inch pulley for the motor. From the interviews conducted to food grinder machine operators in Odiongan market, most of them said that the average rpm of the food grinder machine ranged from 800 to 900 rpm, so the researcher decided to use 850 rpm for the grater. To determine the size of pulley to be used in the grater shafting, the following formula shown below was used:

$$n_1 D_1 = n_2 D_2$$

where: n_1 – rpm of motor = 1730 rpm
D_1 – size of the motor pulley = 2 inches
n_2 – desired rpm of the grater = 850 rpm
D_2 – size of the shaft pulley = inches

$$D_2 = \frac{N_1 D_1}{N_2} = \frac{(1730\ rpm)(2\ inches)}{850\ rpm} = 4.07\ inches\ \approx 4.0\ inches$$

The shaft is the major component of the machine since it carries the load for grating therefore proper sizing is necessary.

To determine the size of the shaft, the researcher referred to the Phil. Society of Mechanical Engineers Code (PSME), p.18, equation 5b, for

line shafts carrying pulleys, assuming that transmission losses is neglected and on dead load based.

$$D_s = \sqrt[3]{\frac{53.5\ P}{n_2}}$$

where:

P = the power delivered by motor in horsepower. It is also the power received by the shaft in which the blade and the driving pulley are connected

D_s = the shaft diameter in inches

n_2 = the rpm of the shaft where the blade is fastened

$$D_s = \sqrt[3]{\frac{53.5\ (1)}{(850)}}$$

$$D_s = 0.39 \approx 0.5\ in$$

The belt used was the open belt, B-type.

To proportion the frame of the motor support to the multi-purpose grating machine frame, the researcher decided to use the shortest open type, V-belt, and it was B-23, with actual length of 25 inches.

The center to center distance of the belt will determine the distance between the shaft of motor and shaft of the grater. To determine the center to center distance, the formula as illustrated below was used:

$$L = 1.57\ (D_2 + D_1) + 2C + \frac{(D_2 - D_1)}{4C}$$

Rearranging the equation, and substituting the other values, the center to center distance was:

$$C = 7.71\ inches = 196\ mm$$

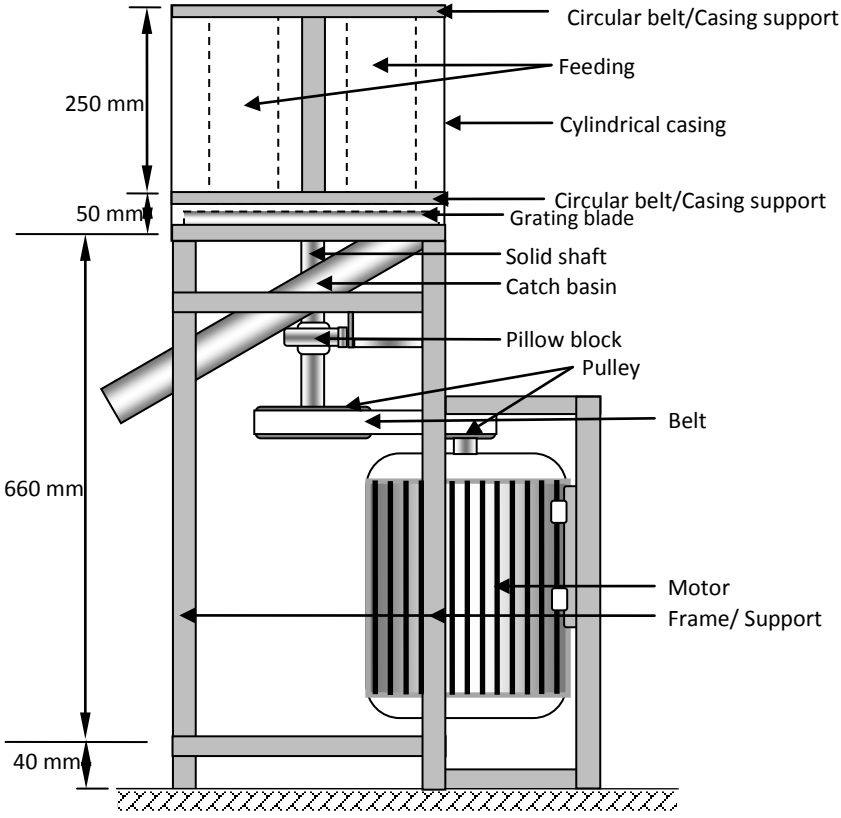
RESULTS AND DISCUSSION

Major Components of the Cassava Grater Machine

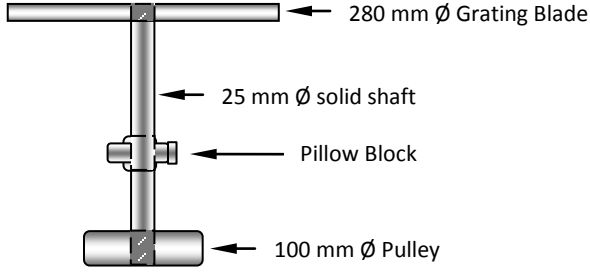
The Hopper/ Feeding Assembly. The Hopper is 300 mm Ø cylindrical drum that holds the 76 mm Ø cylindrical feeding chute. It is made of stainless sheet 8 mm thick, reinforced with a flat bar and is attached permanently to the main frame. It is designed mainly to hold peeled cassava tubers while the operator feeds tubers singly through the feeding chute. The

feeding chute is incorporated into the hopper assembly which is also supported by a belt made of a rounded flat bar.

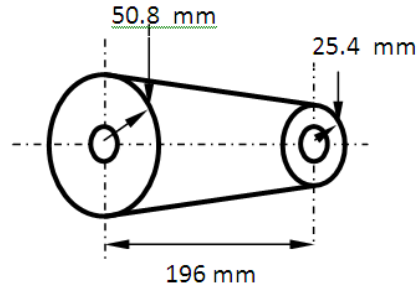
THE WORKING DRAWING



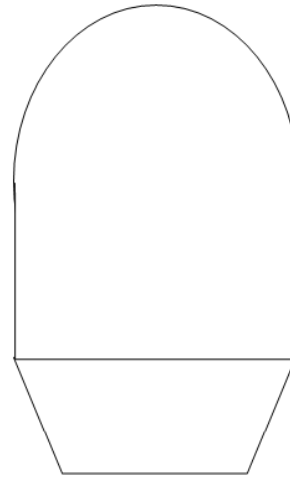
SIDE VIEW OF THE PROJECT



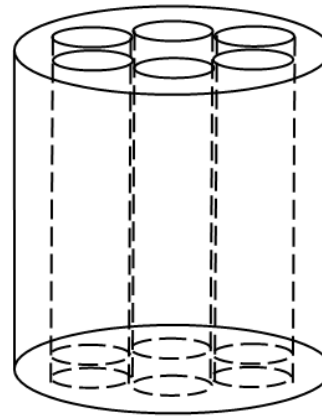
THE GRATING ASSEMBLY



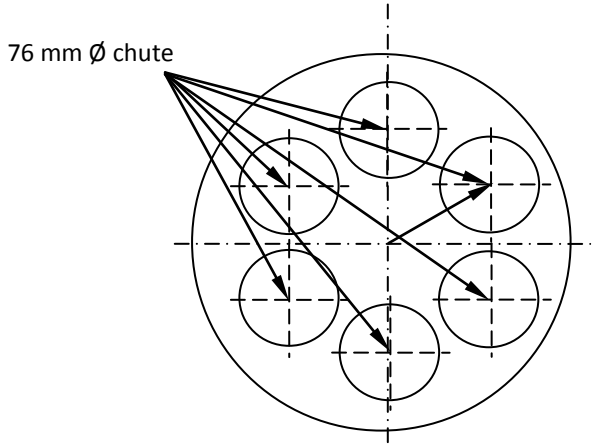
THE BELT AND PULLEY



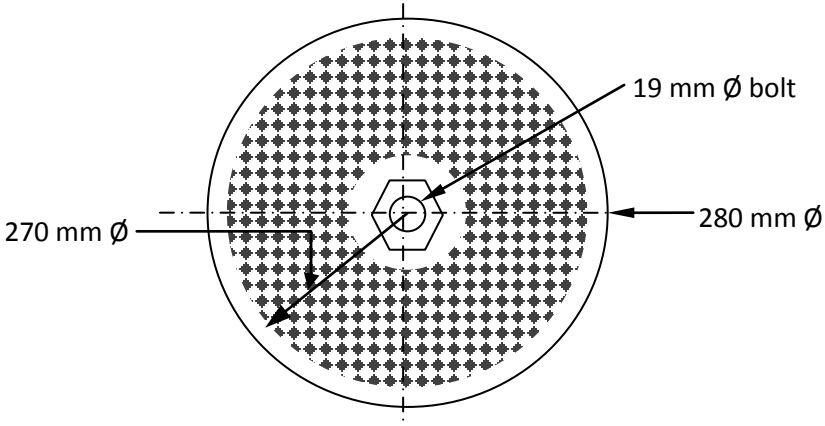
THE CATCH BASIN



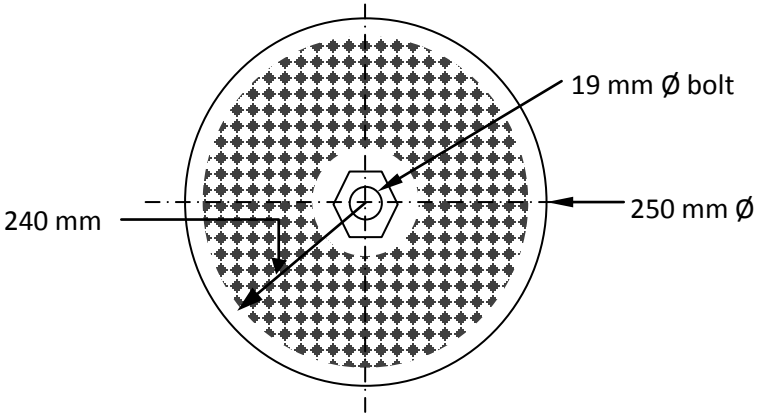
THE HOPPER/ FEEDING CHUTE



TOP VIEW OF THE HOPPER/ FEEDING CHUTE



THE GRATING BLADE (COARSE)



THE GRATING BLADE (FINE)

The Grating Unit. The grating unit is a circular case housing the rotor plate and the grating blade. It extends downward towards an inclined catch basin which allows the grated cassava to slide and drop into a collection box. The grating blade is mounted to the shaft connected to a motor being driven by pulley and v-belt is also supported by bolts and nuts for easy assembly and dismantling, and for easy access for cleaning. The rotor plate 280 mm Ø is made of 8 mm thick stainless sheet while the grating blades are from a nail-punched hole at the bottom thereby creating the grating blade in the upper portion of the rotor.

The Power Unit. The power unit consists of an electric motor, v-belt and pulleys. The electric motor with shaft pulley of 2-inch Ø and another one of 4-inch Ø has 1 horsepower capacity. Such motor is the prime mover of the machine and also serves as the means through which the belt transmits power to the shaft. The computed size of the shaft is 0.5 inch in diameter, but since the shaft was threaded to hold the grating unit, ¾ inch was used. The researcher used the open (Type B) v-belt.

Machine Frame. The machine frame that measures 300 mm x 300 mm x 700 mm carries the components of the machine. The frame is made of 1" x 1" x 20' angle bar. The joints are shielded metal arc welded to insure strength of the joints.

Machine Cost

The total project cost of the completed grating machine was based on the expenditures for supplies and materials, labor and other expenditures summarized below.

Table 3. Project Cost (Php)

Bill of Materials for Fabrication	8,168.00
Contract Labor (cutting, laying-out and welding)	2,500.00
Research of Related Literature and Studies and other data	750.00
Supplies and Materials (encoding, printing, editing)	250.00
Incidental Cost	1,332.00
Administrative Cost	2,000.00
TOTAL PROJECT COST	15,000.00

The total cost of the Multi-purpose grating machine amounted to P15,000.00 as shown in Table 3 but the labor cost was computed based on the actual verbal contract with the laborer. Production cost per unit could be minimized however if mass production will be undertaken.

Machine Performance

Cassava grating. Ten kilograms of medium sized peeled cassava were tested in the machine and were divided into 5 batches, with 2 kilograms each batch placed inside the feeding chute. Each batch was placed inside the feeding chute. Clock is started simultaneously as the switch is "on" and the test was repeated for other batches with the following results below:

Table 4. Machine performance in grating cassava (2 kg)

Batch (2 kg each)	Coarse Blade (time)	Fine Blade (time)
1	47 seconds	69 seconds
2	43 seconds	67 seconds
3	45 seconds	65 seconds
4	45 seconds	69 seconds
5	44 seconds	67 seconds
Average time	44.8 seconds	67.4 seconds

The result shows that 2 kilograms of cassava can be grated with an average time of 44.8 seconds using the coarse blade with the machine's capacity of using the coarse blade.

$$\frac{2\ kg}{44.8\ sec}\ x\ \frac{3600\ sec}{hr} = 161\ \frac{kg}{hr}$$

On the other hand, 2 kg of cassava can be grated with an average time of 67.4 seconds with the machine's capacity of 107 kg/hr using the fine blade.

$$\frac{2\ kg}{67.4\ sec}\ x\ \frac{3600\ sec}{hr} = 107\ \frac{kg}{hr}$$

As can be noted, the result of the test conducted differs since the coarse blade has greater capacity than the fine blade.

Papaya Grating. A ten-kilogram big-sized peeled papaya was tested in the machine. Such papaya was divided into 5 batches with each batch weighing 2 kg placed inside the feeding chute. Simultaneously, time was started as the switch is "on" and such test was repeated for other batches with the results shown in Table 5. The result shows that 2 kilograms of papaya can be grated with an average time of 1.68 minutes using the coarse blade with the machine's capacity of 71.43 kg/hr using the coarse blade.

$$\frac{2\ kg}{1.68\ min}\ x\ \frac{60min}{hr} = 71.43\ \frac{kg}{hr}$$

Table 5. Machine performance in grating papaya (2 kg)

Batch (2 kg each)	Coarse Blade (time)	Fine Blade (time)
1	1.70 minutes	1.76 minutes
2	1.72 minutes	1.83 minutes
3	1.65 minutes	1.80 minutes
4	1.63 minutes	1.78 minutes
5	1.71 minutes	1.75 minutes
Average time	1.68 minutes	1.74 minutes

On the other hand, 2 kg of papaya can be grated with an average time of 1.75 minutes using the coarse blade but for the fine blade, the capacity of the machine is 68.96 kg/hr.

$$\frac{2\ kg}{1.75\ min}\ x\ \frac{60 min}{hr} = 68.96\ \frac{kg}{hr}$$

Ginger Rhizome Grating. A ten-kilogram medium-sized washed ginger rhizome was also tested in the machine and such was divided into 5 batches, with each batch weighing 2 kg placed inside the feeding chute. Simultaneously, time was started and such test was also repeated for other batches . Results are as follows:

Table 6. Machine performance in grating rhizome (2 kg)

Batch (2 kg each)	Coarse Blade (time)	Fine Blade (time)
1	1.0 minute	1.43 minutes
2	1.2 minute	1.45 minutes
3	1.3 minute	1.55 minutes
4	0.9 minute	1.4 minutes
5	1.0 minute	1.63 minutes
Average time	1.08 minutes	1.49 minutes

The result shows that 2 kilograms of ginger rhizome can be grated with an average time of 1.08 minutes using the coarse blade with the machine's capacity of 111.11 kg/hr.

$$\frac{2kg}{1.08\ minutes}\ x\ \frac{60\ minutes}{hr} = 111.11\frac{kg}{hr}$$

On the other hand, 2 kg of ginger rhizome can be grated with an average time of 1.49 minutes using the fine blade having the machine's capacity of 80.54 kg/hr using the fine blade.

$$\frac{2kg}{1.49\ minutes}\ x\ \frac{60\ minutes}{hr} = 80.54\frac{kg}{hr}$$

As noted, the result of the test conducted differs since the coarse blade has a greater capacity than the fine blade.

The Power Consumption

The motor is rated at 1 horsepower or equivalent to 0.746 kW. According to the Tablas Island Electric Cooperative, the prevailing price of electric power is P8.50/kW-hr. If the machine will run in 1 hour, the power consumption will be P6.34, as the computation shows:

$$0.746\ kW\ x\ hr\ x\ \frac{P8.50}{kW-hr} = P\ 6.34$$

Economic Analysis

Using the five basic methods for making economic analysis to determine the extent of the projects' viability, the Annual Worth Method showed that an investment would have a profit of P3,153.92 annually. The Present Worth Method showed that the present worth of an investment is P24,228.32, higher than the initial investment. The Future Worth Method showed that the net future worth was P210,370.97 much greater than the future worth of investment amounting to just P38,906.14. The Internal Rate of Return Method showed that the internal rate of return for an investment was 47.96% higher than the 21% prevailing bank interest, while the External Rate of Return Method showed that the external rate of return is 69.5% much higher than the 21% prevailing bank interest.

The five methods used in determining the viability of a project indicated that an investment for the multi-purpose grating machine is profitable.

SUMMARY AND CONCLUSION

The grating machine designed, constructed and performance tested is found to be useful especially to the cassava, papaya and ginger processors because it lessen the time in grating the commodities. The multi-purpose grating machine that measures 300 mm x 300 mm x 1000 mm is composed of four major components, namely the hopper/ feeding assembly, the grating and the power units, and the machine frame or support. It is powered by a 1-hp electric motor and can grate cassava with an average capacity of 134 kg/hr, grate papaya with 70.195 kg/hr and can grate ginger with an average

capacity of 95.83 kg/hr. As noted, the results of the tests conducted differed because the coarse blade has greater capacity than the fine blade. In the economic analysis, the five methods used in determining the viability of a project indicated that an investment for the multi-purpose grating machine is profitable.

The multi-purpose grating machine is beneficial to food processor because the grating of different crops is much easier and faster than the manual grating. It was found out that an investment of P15,000.00 was viable for the project.

IMPLICATIONS AND RECOMMENDATION

Based on the findings and conclusions previously stated, the following courses of action have been recommended:

1. That the designed, fabricated and performance tested multi-purpose grating machine be used for the purpose.
2. That the designed, fabricated and performance tested grating machine be extended to the community especially to the identified areas where cassava, papaya and ginger are abundant.
3. That the designed, fabricated and performance tested grating machine be commercialized.
4. That test using other commodities like potato, arrow roots, carrots, gabi, sweet potato, and other root crops be conducted.

REFERENCES

Adekunlee, A.A, Fatunbi, A.O. and Sanni, L. O. Commercial utilization of cassava in Nigeria, and illustrated guide. Nigeria.

Hansethsuk, Jinnajar. Processing cassava into flour for human food. Rayong Field Crop Research Center. Department of Agriculture, Thailand.

Loreto, A.B., Orias, R.R. New products of future potential in the philippines: cassava flour and grates.

Philippine Council for Agriculture, Forestry and Natural Resources and Development. New machines for processing cassava roots into dried cassava grates. Los Banos, Laguna, Philippines

www.quezon.gov.ph/commerce/quezon.../atsara.htm

www.filipinovegetarianrecipe.com/.../papaya_achara.php

www.thenewstoday.info/.../iloilos.instant.salabat

www.neda8.ph/ProjectMonitoring/projectView.php?projID

www.region4a.dost.gov.ph/databases/proj_details.php?pid

R&D
Management Papers

Strategies in Promoting Research Culture in SUCs and Countryside Development[1]

Merian C. Mani,[2] Jeter S. Sespeñe[3] and Eddie G. Fetalvero[4]

ABSTRACT

The Research, Extension and Production Center of Romblon State University employed strategic solutions to create a research climate, foster research interests and confidence and sustain the enthusiasm of faculty members through varied research capability building seminar workshops (RCBSW) and paper presentations. The R&D performance of the University was evaluated based on the indicators provided by the Commission on Higher Education, accreditation organizations, Department of Budget and Management and a self–assessment of R&D activities from 2003 to the present. The conduct of mandatory RCBSW in all the five colleges and eight campuses of the University increased substantially the number of active researchers and upgraded the performance of the faculty members and the University as a whole. The interventions made by the Southern Tagalog Agriculture and Resources Research and Development Consortium ignited the enthusiasm of the R&D unit causing the institutes and campuses to follow suit. The Philippine Association of Research Managers, Inc. (PHILARM) through its President and the Commission on Higher Education – University of the Philippines, Los Banos, Zonal Research Center (CHED-UPLB-ZRC) have also played great roles in the awakening of the center. The series of collaborative RCBSW conducted by Philippine Association of Research Managers served as the groundwork in setting the directions and prioritizing the programs of the University. It also helped the University in defining its course of actions and in formulating annual performance targets for Research and Development. Institutional initiatives were fully implemented. Policies and guidelines on benefits, opportunities and grants were realized. Research linkages and networks were forged with local and international entities. Research climate was established and sustained. Research outputs were presented, published, disseminated and adopted, some were commercialized. Local government units facilitated the adoption of technologies in the countryside. Private entrepreneurs were also benefited from the technologies generated.

---

[1] Winner, W.C. Medrano Award for Best R&D Management Paper and Poster during the 19th National Convention of Research Managers, Inc. in Mergrande Ocean Park, Talomo, Davao City on April 21-24, 2009. This paper was prepared before RSC was converted into a University.

[2] Doctor of Education; Vice President for Research, Extension and Production, RSU

[3] Doctor of Philosophy in Commerce; University President, RSU

[4] MA Science Education; Director for Research, RSU

Key words: *research capability building, research culture and research climate in SUCs, RDE management experience, PHILARM, STARRDEC and CHED-UPLB-ZRC's interventions in improving R&D management*

RATIONALE

Romblon State College (RSC) is the only state college in the province of Romblon. Founded in 1915 as the Odiongan Farm School offering immediate courses in agriculture, it was converted into Odiongan Rural High School in 1929 offering complete secondary agricultural curriculum until 1946. In the following year, it was again converted into Odiongan High School offering four-year General Type A curriculum until 1956.

On December 31, 1956, by virtue of Republic Act 1391, the Odiongan High School was converted into Odiongan National Agricultural School offering complete Secondary Vocational Agricultural curriculum but was later renamed as the Romblon National Agricultural School by virtue of the General Appropriations Act of 1958. By virtue of Republic Act 4286 passed on July 1, 1965, Romblon National Agricultural School was converted into Romblon National Agricultural College in 1969 . After five years, it became Romblon Agricultural College offering two-year Associate in Agriculture Technology under the Department of Education Culture and Sports Circular No. 8 S. 1974. On June 25, 1975, several four-year degree programs like Bachelor of Science in Agriculture, Bachelor of Science in Agricultural Education and Bachelor of Science in Home Technology were offered upon approval of then DECS Secretary Hon. Juan L. Manuel.

In 1983, the Hon. Nemesio V. Ganan, Jr. authored Parliamentary Bill 131 which was passed into law on May 18, 1983 known as Batas Pambansa Blg. 393 which mandated the college to offer eight undergraduate programs and three graduate degree programs.

The Board of Trustees of the College is empowered to offer additional programs aside from those that are embodied in the charter. Today the College offers nine graduate degree programs, 15 undergraduate degree programs, five ladderized courses, seven vocational/technical courses and a secondary course program. More over, there are two HEI's supervised by the Commission on Higher Education (CHED) namely, the Romblon College of Fisheries and Forestry in San Andres, Romblon with eight satellite campuses and the Sibuyan Polytechnic College in San Fernando, Romblon that have been integrated with RSC. Being a Level II state college, RSC is tasked to perform instruction, research, extension and production. From its humble beginning as a farm school, it has grown into a comprehensive

college which now offers a Doctoral program in Educational Management, a consortium with the Philippine Normal University.

RSC is aggressively pushing to be a center of excellence for *instruction* in Agriculture, the art, sciences and functional scientific, social and technological *researches*; relevant *extension* services and quality *production* towards empowerment of graduates for sustainable development. It provides quality *education* through modernization, accreditation and effective consultation and linkages. It enhances *research* through expansion of commodity coverage and empowerment of faculty and staff members; intensifies *extension* through provision of impact projects; and improves *production* through the optimal utilization of available resources making its graduates effective development managers and useful citizens in the community.

In the previous years, R&D focused on the four areas of discipline: agriculture and fisheries, social sciences and education, vocational and technical education and arts and sciences. Now, the unit has metamorphosed into a Research and Development Center with eight areas. It has institutionalized the research function of the College. The 14- hectare campus in Odiongan is utilized for agricultural researches. It has acquired another 82 hectare agricultural land in Agpudlos, San Andres, Romblon where the AgroMet, RATC, ROCKS and the small ruminants are housed. It has expanded into campuses. Today the college has 13 research centers.

Side by side with the research function, the extension function is in close coordination in order to complete the RD&E continuum thus making the College responsive to the needs and concerns of the stakeholders in various areas.

OBJECTIVES

1. To assess the research capability of the faculty members and the extent of the R&D functions of the College as a whole from school year 2003-04 to 2008-09;
2. To promote research capability building activities as a strategic solution in fostering interests of faculty and in establishing research culture among SUCs with poor R&D performance;
3. To account the extent of utilization of the research outputs by different stakeholders;
4. To trace how R&D outputs contribute in countryside development

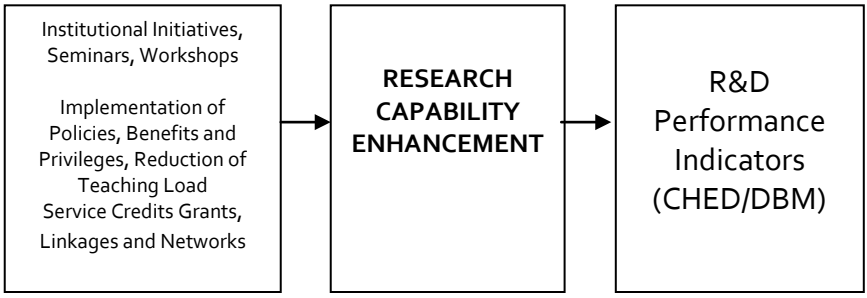


Figure1. Conceptual Framework

METHODOLOGY

The study was conducted to assess the performance of the research and development function of the College. It specifically determined the research capability of the faculty members and the College as a whole after interventions had been provided. These activities involved the conduct of research capability building seminars and workshops, implementation of guidelines in the conduct of research, provisions of benefits and privileges and other institutional initiatives to further motivate faculty members to engage in research. After these activities and interventions had been made, the outputs of the faculty members and the College as a whole were summarized using the criteria set by the Commission on Higher Education and Department of Budget and Management.

Research capability indicators of faculty members and the College are the following:

1. Number of active researchers
2. Number of researches published in refereed journals locally and abroad
3. Number of research outputs utilized
4. Number of research disseminated in appropriate scientific symposia, seminars, conferences
5. Number of R&D proposals endorsed by DBM for funding
6. Number of R&D projects funded by external sources locally and abroad.
7. Number of GAA and locally funded R&D projects
8. Number of completed R & D projects not yet reported and published
9. Number of awards of distinction given to faculty R &D projects
10. Number of R&D reviews , seminars and symposia conducted

11. Annual appropriation (GAA) for research in pesos

Other indicators to evaluate the College which served as bases in determining research capability are:

1. Publications (flyers, brochures, books, newsletters, video CD)
2. Patents
3. Copyrights
4. MOA
5. Technology adopters

FINDINGS AND DISCUSSIONS

The RDE Unit: Then and Now

Research activities have never been attractive to the faculty members since the school was established in 1915 until it became an Agricultural College in 1969. Within almost 40 years of existence as a college, its Research Development and Extension Center (RDEC) has not fully matured. The RDE unit of the college was established in 1980 only. The unit then focused on agricultural researches particularly crop and animal sciences. In 1988 the unit was manned by an agricultural engineer who planned the organizational structure of the unit and established linkages with other State Universities and Colleges, Government and Non-Government Agencies. The directorship of the unit was then transferred in 1996 to another expert whose leadership focused on the framing of the RDE Manual of Operations aside from the experimental researches conducted. After three years, the headship of the RDE unit was given to another senior faculty member. From 2002 until October 2007, three more directors were appointed one at a time. There was a fast turn over of leadership of the unit. This might be accounted to the earnest desire of the administration to make the unit functional and operational. Unfortunately, earning the first point in Research and Development was not met. In October 2007, the administration decided to appoint one director for research and one extension director under the office of the Vice President for Research Development and Extension. This decision was in compliance with one of the recommendations made by the AACCUP Accreditation team. The outset of 2008 brought new opportunities for the college' RDE unit.

Agenda Setting and Program Prioritization Through PHILARM, CHED-UPLB-ZRC and STARRDEC

The new leadership believed in the scientific and teamwork management approach in sustaining the research climate in a comprehensive college. The director believed that success in research could

only be possible by joining the loop and networking with other SUCs, NGOs, GAs and funding agencies, thus, breaking the wall of inculturation and paving the way for the new ideas and methodology in RDE. The RDE management had to employ unique strategies and appropriate and relevant techniques. The research and development activities must jibe with the national, regional, and local research agenda. Most likely these agenda spelled out the needs and concerns of stakeholders. Guided by the above principles, the unit conducted an RCBSW. This was a rigid situational analysis which involved participation from different agencies, whose thrusts and priorities were highly considered and SWOT Analysis. In the environmental analysis, the opportunities and threats were summarized. The organizational analysis dissected the assessment areas with the corresponding strengths and weaknesses. This was followed by the identification of the Key Areas of Concern using the external and internal analysis method. The process moved to the criteria setting employing the "must" and "discriminating" criteria. Then, the evaluation and priority setting was done. Finally the College was able to come up with a reliable and clear R&D program priorities. This was one of the most helpful activities among the many research capability building seminars and workshops done in the past.

The above activity facilitated by an expert from PHILARM, CHED-UPLB Zonal Research Center and STARRDEC confirmed the data gathered by the RDE Center through its director in an area scanning which revealed the following findings: that RSC has potential researchers and rich researchable areas; that the previous directors of the unit conducted several basic and applied researches, but only two were presented in a research symposium; many experimental researches were conducted but were not properly documented and completed; funding was insufficient; the administration and faculty members have concentrated more on instruction, production and extension thereby neglecting research. Only three percent of the 218 faculty members were actively involved in research. Findings also revealed that research proposals were not subjected to panel or audience for critiquing. Very few research proposals were processed and completed. It was also found out that for the first 15 years of operation of the unit; only three R&D agenda were set: agricultural development, home technology and agricultural education. Thus, the research function was not able to cater the entire needs of the College particularly the faculty members and the community. The direction of the unit was vague and funding was very scarce.

Joining the Loop:
The Conduct of Research Capability Building Seminars and Workshops

The conduct of research capability building seminar workshops (RCBSW) was planned and implemented to solve the problems of low profile and interests along research function. Prior to 2003-04, RCBSW conducted were limited to (1) research agenda setting, (2) identification of research problems and (3) research format. Only those who had interests in the field joined the research capability building. With this situation, not many were convinced and motivated to conduct researches. Many would see research as a tedious and unrewarding job.

In 2006, one of the policies of the college was to require all faculty members with a rank of Assistant Professor up to conduct researches related to the field of their specialization hence they were obliged to undergo RCBSW to prepare them for the job. At the start, there was some animosity on the part of the faculty maybe because they had not yet fully realized the value of research. In the middle part of 2007, the RDE unit conducted an area scanning among the institutes in the main campus and the eight campuses of RSC. Findings revealed that the faculty members were passive towards research activities because they lacked the knowledge and skills in the conduct of research. This was where the PHILARM and STARRDEC came to the picture.

R&D Agenda Formation and Program Prioritization. The collaborative activity on RCBSW was sponsored by the two organizations on May 4-5, 2008. The first was the R&D Agenda Formation and Program Prioritization followed by the formulation of the RDE Manual and the Organizational Set Up. Policies and procedures were presented, discussed and finalized. One of the outputs in the RCBSW was the formulation of the Annual Performance Target based on the results of the R&D agenda setting. Few months later, the RCBSW was replicated in different campuses.

Research Proposal Writeshop. The next phases of training assistance given by PHILARM, STARRDEC and CHED-UPLB-ZRC came last August 25-26, 2008, where they facilitated a Research Proposal Writeshop con review. This was participated in by all Research Coordinators and selected researchers from the five institutes in the main campus and the other eight campuses of the RSC system. In this activity, all participants were required to write and present their research proposals for critiquing and evaluation in front of panelists coming from the pool of experts from different government and non-government agencies. The Vice President and Director of the RDE Unit and the facilitators were part of the panel.

National Environmental Summit. In the same month, the RDE Unit spearheaded the first ever national research event hosted by the college, the National Environmental Summit. The summit featured Paper Presentation, Symposia, Ugnayan at Talakyan sa Isyu ng Pagmimina, Essay Writing and On-the –Spot Poster making Contests. The activity was in collaboration with the DENR, DA, DOLE, DOST, DTI, STARRDEC, PHILARM, CHED-UPLB-ZRC, NGO's, SUCS and LGU's. The theme centered on: "Enhancing Sustainable Agriculture, Economic and Environmental DevelopmentThrough R & D Initiatives". The Summit made an indelible mark in the R&D aspect of the College because there were six researchers from RSC who presented their papers and three of them were adjudged as first, second and third in the Environment and Sustainable Development Category. The participants came from SUCS, NGO's, the religious sector and private institutions from different regions. Twenty eight papers were submitted for presentation and 16 were chosen and presented. The activity boosted the morale of the local researchers. Many faculty members showed interest in RDE after that experience because local presenters were given plaque of recognition and cash incentives by the College President. This ignited the enthusiasm of many faculty members to engage in research. Majority of the faculty members witnessed the presentation which made them realize that they, too, had potentials of their own.

IBA Research Symposium. A month after (Oct. 3-4, 2008), the Institute of Business and Accountancy initiated the first Research Symposium on the institute level. They highlighted presentations of eight papers relevant to the theme "Cultivation of Research CultureTowards a State of the Art Business Education." This was participated in by amateur researchers from other institutes and campuses. The highlights of the papers presented were released in monographs and journals. After this experience, they gained confidence towards research works and were highly motivated to undertake or be a part of a research project.

Going International for the First Time. In the same month, two researchers of the College participated in international conferences on separate occasions, where they presented a paper and a poster, the first time for the College. This was a bold step towards higher achievement of the RDE unit.

R&D Initiatives in Full Swing. Inspired by the events and opportunities, the College administration declared full support to the Research and Development programs and thrusts, and to the faculty researchers. The RDE team conducted several RCBSWs in different campuses as requested. Various institutes and campuses initiated In-house Reviews. Last February 2-4, 2009, the RDE Center sponsored the Research

Capability Building and Agency In-House Review to screen research proposals for institutional funding. Twenty of these proposals were funded by the GAA and three were submitted to DBM for possible financial assistance. Another inspiring event concerning the RDE happened last February 17-20, 2009, where two RSC researchers were accepted to present their papers in the 2nd International Conference of State Universities and Colleges Teacher Educators Association (SUCTEA), held at the University of Rizal System in Morong, Rizal.

Recently, Romblon State College was one of the eleven research proponents from Region IV and V that received a two hundred thousand peso-grant from CHED-UPLB-ZRC to fund its research project. Aside from this grant, four proposals were accepted by various funding agencies like PCARRD, NEDA, FIDA and DA. The releases were programmed for 2009.

Moreover, as the researchers gained confidence through various exposure and capability building, they tried to embrace and promote a culture of research, thus, the research climate in the college has tremendously heightened within a short span of time.

After the conduct of RCBSW and the attendance of research coordinators and researchers in off-campus research capability building, the research climate of the College was strengthened thereby fostering a research culture. This was manifested by the submission of research proposals attuned to the research agenda of the College, the region and the country. The number of active researchers quantum leaped from 3 percent to 8.72 percent. These were the faculty members who had actually conducted and presented their outputs in local, regional, national and international conferences. Several research outputs were published as monographs, sporadic papers, and journals. These researches were self-financed; others were partly funded by NGOs, NGAs and GAA. The figures show that now, there are already 52 faculty members out of 218 who are actively involved in research. Said figures are much higher than the figures prior to 2004.

Table 1a. Number of RCBSWs conducted in the College

SEMINARS-WORKSHOPS	2003 - 04	2004 – 05	2005 – 06	2006 – 07	2007-08	2008 – 09
Main Campus:						
Institute of Business & Accountancy	0	1	1	2	3	4
Institute of Arts and Sciences	0	1	1	1	2	2
Institute of Agriculture, Fishery & Forestry	0	1	1	1	2	2
Institute of Engineering &	0	1	1	2	2	2

SEMINARS-WORKSHOPS	2003 - 04	2004 – 05	2005 – 06	2006 – 07	2007-08	2008 – 09
Technology Institute of Professional Studies & Teacher Education	0	1	1	2	2	3
Science Laboratory High School	0	1	1	1	1	2
Satellite Campuses:						
San Andres Campus	0	0	1	1	2	2
Calatrava Campus	0	0	1	1	2	2
Cabolutan Campus (RCFF)	0	0	1	2	2	2
Sta. Maria Campus	0	0	1	0	1	2
Sawang Campus	0	0	1	0	1	2
San Fernando Campus	0	1	1	2	2	2
Cajidiocan Campus	0	0	1	1	1	2
Institutional Level						
Research Agenda Setting	-	/	/	/	/	/
In-House Review- Research Proposal	-	-	/	/	/	/
In-House-Review-Completed Researches	-	-	-	-	/	/
Research Proposal Writeshop	-	-	-	-	/	/
Technical Writing	-	-	-	-	/	
Intellectual Property Rights/Patenting	-	-	-	-	/	/
Ethics in Research	-	-	-	-	/	/
Prescribe Research Proposal Formats	-	-	-	-	-	/
RDE Manual, Rules & Procedures	-	-	-	-	-	/
Workshop on the Preparation of Annual Performance Target of RDE	-	-	-	-	/	/

Table 1b. Number of RCBSWs Attended Off-Campus

AY	TOTAL	OFF-CAMPUS RCBSW
2004-05	2	▪ Strengthening Research Capability of Educators, Researchers and Thesis Advisers in Humanities, Social Sciences and Communication-UP-QC ▪ Statistical Data Processing and Interpretation
2005-06	2	▪ National Seminar Workshop on Research Education & Development ▪ 21st Century and Beyond Research Forum-Ramon Magsaysay Technological University
2006-07	1	▪ Research Capability Enhancement Training Workshop-DOST
2007-08	7	▪ Technical Report Writing-PCARRD ▪ Research Symposium-STARRDEC ▪ Women's International Conference – Thailand ▪ Research Proposal Writeshop (4 RCBSWs) ▪ STARRDEC - 2

AY	TOTAL	OFF-CAMPUS RCBSW
		▪ PCARRD - 1 ▪ DA-BAR – 1
2008-09	11	▪ Intellectual Property Rights/Patenting ▪ CHED_UPLB_ZRC Orientation on MOA and Fund Management ▪ SUCTEA International Conference- URS- Morong, Rizal ▪ International Research Capability Building – CLSU – Laguna ▪ Research Proposal Writeshop (7 RCBSWs) ▪ STARRDEC - 1 ▪ PCARRD - 2 ▪ DA-BAR – 2 ▪ CHED-UPLB-CRC - 2

Research proposals submitted and reviewed are prioritized by the RDE Center. Researches with significance to the regional and national agenda are endorsed to various government agencies and to linkages and networks of the College. Some even financed their own projects due to limited budget.

Table 2. Comparison of Research Information

Research Information	BEFORE 2003	2004 – 2009
No. of Research Areas	3	8
No. of active researchers	3	52
No. of Research Centers	1	15

There are now eight areas of R & D at the college. These are the following:

1. Agriculture, Forestry, Fishery and Natural Resources
2. Business, Management and Cooperatives Researches
3. Marine and Freshwater Researches
4. Education , Curriculum, Culture and Sports Researches
5. Socio-Economics, Political Science and Gender Studies
6. Industry & Energy Researches
7. Mining, Ecotourism, and Environmental Researches
8. Information Technology and other Field of Engineering Researches

The rise in enthusiasm and motivations of the faculty researchers paved the way to the creation of new areas of discipline. Originally, there were only three, by 2004 - 2007 there were already eight. With the varied expertise and the education the researchers finished in graduate studies, new research and research-related centers were established . Five centers have been established recently; the Agricultural Meteorological Station (AgroMet), Banana Tissue Culture and Diagnostic Laboratory, the Romblon Agriculture Technology Center (RATC),

The Romblon Center for Kanidugan Studies (ROCKS) and the Organic Vegetable Experimental Station (OVES).

Implementation of Policies Benefits, Incentives and Motivations

The Research and Development Office which is tasked to oversee all research programs and projects, policies and guidelines conducted a one day orientation on the RDE Manual and Research Institutional Format. Procedures were discussed thoroughly. It was made clear that upon notification on the approval for funding, researchers are required to submit their operational plans, conduct their activities and submit their accomplishments. The researchers are required to prepare a publishable copy of the results of their outputs upon incorporating all suggestions for publication. Service credits are given to them as long as their regular teaching load is not lessened. Such is attested by the VPAA. Their works are to be published in the RSC Research Journal and endorsed to refereed journals . Any approved research that cannot be completed at the approved time frame is to be accompanied with a written explanation which will be evaluated and recommended by the Research Council for another grant in the succeeding year depending on its merit.

The researchers are to be provided with funding after presenting their research output in local, regional and international venues. These will be endorsed by the R&D Office after presenting a letter of acceptance from organizing or sponsoring agencies. Researches that have been completed and published are given two points in the NBC 461. Researches are packaged into matured technologies. The College provides funds for production of flyers, brochures, patenting and copyright applications and processing.

Linkages and Networks

During 2004 -2009, the College got a substantial number of linkages and networks. Much effort was spent and the initiative was spearheaded by the RDE office and other college offices including the Office of the President and the Office of the VPRDE. The R&D Office has eight international and 45 national and regional linkages thus contributing to the sustained increase in the indicators. The partnerships and collaborations they generated and forged paved the way to a better and sustained performance of the researchers. Highlights included the memberships of RSC to STARRDEC, a regional agriculture consortium, and the Philippine Council for Agriculture Research and Resources Development (PCARRD). PHILARM and CHED-UPLB-ZRC have been very influential in the revitalization of the RDE center of the

college. The RCBSW on R&D Agenda Formation and Program Prioritization facilitated by the Dr. Erlinda B. Aromin of PHILARM in collaboration with STARRDEC served as the take off point of the R&D activities of the college. This was followed by the team from DOST that conducted a one day orientation on funding assistance and grants for qualifiers to their S & T Priority Thrust.

The existence of collaborations between the College and each of the organizations facilitated the fast movement of expertise to and from the collaborators. All started from the spirit of partnership and cooperation which brought the College to join the loop and into global perspectives. With each organization working hand in hand with RSC, the college, which was on the height of working hard for the accreditation of programs and its quest for its university status, benefited a lot. The College passed several evaluation committees, particularly in the RDE aspect and recently has been favorably recommended for university conversion by the evaluators from the office of the CHED Commissioner, Hon. Emmanuel Y. Angeles.

Table 4. Research Linkages and Networks of RSC

LINKAGES AND NETWORKS	OFFICE LOCATION	YEAR
INTERNATIONAL		
1. Australian Agricultural Technology Center	Australia	2000
2. Intl Timber Trade Organization (ITTO)	Nagoya, Japan	2002
3. Romblon Discussion List – Cultural, Livelihood	Chicago, Illinois, USA	2003
4. and Educational Assistance for Romblon		
5. Ministry of Education and Training-Vietnam	Vietnam	2004
6. JICA	Japan	2005
7. Cuban Government	Cuba	2005
8. Intl Network for Bamboo & Rattan (INBAR)	Beijing, China	2006
9. Japan Businessmen Organization	Japan	2007
10. Theresian International Foundation	Phoenix, Arizona USA	2008
NATIONAL AND REGIONAL		
1. DEPEd	Romblon	1983
2. NEDA	Quezon City	1986
3. NRCP	Taguig City	1986
4. Department of Agriculture	Quezon City	1990
5. DBM	Quezon City	1997
6. Natural Products Society of the Philippines (NPSP)	UP Diliman, Q.C.	1997
7. STARRDEC-PCARRD	Los Banos, Laguna	1998
8. BFAR	Quezon City	1998
9. Cavite State University	Indang, Cavite	2000
10. DOST	Bicutan, Metro Manila	2000
11. PCIERD	Taguig City, Manila	2000
12. UPLB-FPRDI-ERDB-BioTech-CFNR	Los Banos, Laguna	2000
13. Agriculture Technology Institute	Quezon City	2000
14. TESDA		2000
15. Batangas State University	Batangas City	2004
16. Mindoro College of Agriculture and	Oriental, Mindoro	2004

	LINKAGES AND NETWORKS	OFFICE LOCATION	YEAR
	Technology		
17.	Occidental Mindoro National College	Occidental, Mindoro	2004
18.	Palawan State University	Puerto Princesa City	2004
19.	UST	Espana, Manila	2004
20.	De la Salle University	Manila	2005
21.	UP Diliman –NISMED	Quezon City	2005
22.	NIA Reg. !V-B	Metro Manila	2005
23.	KALAHI-DAR	Quezon City	2005
24.	Development Academy of the Philippines	Pasig City	2005
25.	National Commission for Indigenous People	Quezon City	2005
26.	Central Phil. University	Iloilo City	2005
27.	University of Northern Philippines	Ilocos Norte	2005
28.	DOLE	Metro Manila	2006
29.	AACCUP		2006
30.	PASUC		2006
31.	STAVE		2006
32.	CHEd-UPLB-ZRC	OVCRE-Los Banos	2007
33.	Grassland Society of the Philippines	ERDB, Laguna	2007
34.	Local Government Training Research Institute Philippine Network	Mandaluyong	2007
35.	PUP	Sta. Mesa, Manila	2007
36.	Western Philippine University	Aborlan, Palawan	2007
37.	UCPB-CIF	Metro Manila	2007
38.	DTI	Makati City	2007
39.	Peace and Equity Foundation	Quezon City	2007
40.	AROPAD	Romblon	2007
41.	University of Asia and the Pacific	Ortigas, Pasig City	2008
42.	West Visayas State University	La Paz, Iloilo	2008
43.	FIDA	Quezon City	2008
44.	PHILRICE	Nueva Ecija	2008
45.	OVCRE-UPLB	Los Banos, Laguna	2008

Indicators

As shown by the dramatic change in values and work attitudes towards research work, the performance of the faculty members improved after the series of RCBSW had been conducted to them. The activity created an awareness and provided motivations for them to start and think of research topics in their respective fields of discipline (Table 5). The capability of the researcher was measured through his finished outputs, like research papers or posters presented locally or internationally and the publications of these papers in research journals. There were RSC researchers who were able to present their outputs in Thailand and Japan. Some faculty researches presented their papers in International Conferences held here in the Philippines. Three research proposals have been presented recently at DBM and have been endorsed for funding. Another four proposals have been evaluated and approved for funding by other funding institutions. Fifteen proposals are now funded under GAA. There is a more substantial increase of proposals and GAA funded projects compared to the earlier time frame. The RDE unit already received a Php2.4 million

funding assistance for R&D and Php 1.4 million for Extension from the Congressional Development Fund for 2009.

Table 5. RSC R&D Performance from AY 2003-04 to AY 2008-09

INDICATORS		03-04	04-05	05-06	06-07	07-08	08-09	TOTAL
1.	No. of faculty involved in research	3	18	14	10	28	52	**125**
2.	No. of researches published in refereed journals local & international	0	0	4	1	1	0	**6**
3.	No. of research outputs utilized	0	0	2	5	6	8	**21**
4.	No. of research disseminated in symposia, seminars and conferences	0	1	2	5	5	12	**25**
5.	No. of R&D proposals endorsed by DBM for funding	0	0	0	1	1	3	**5**
6.	No. of R&D projects funded by external sources: a. DA – (P3M) b. DOST- (P250,000.00) c. PEF-AROPAD – (P70,000.00) d. CHED-UPLB-ZRC – (P200,000.00) e. DTI – (P17,000.00) f. Cong. Madrona's CDF – (P3.8M)	0	0	2	2	3	6	**13**
7.	7. No. of GAA and locally funded R&D Projects	0	0	0	0	3	15	**18**
8.	No. of completed R&D not yet reported and published	5	9	7	6	16	20	**63**
9.	No. of Awards of distinction given to faculty R& D Projects a. *National- 3 b. **International – 4	1	0	0	0	3	 3* 4**	**11**
10.	No. of R&D reviews, seminars and symposia conducted	0	5	1	2	4	6	**18**
11.	Annual Appropriation (GAA) for Research (in thousand pesos)	145	365	365	365	335	511	**2,086**

Research Results Dissemination and Utilization

The research generated were packaged in forms understood and utilized by the target clients, beneficiaries and end-users. From 2003 to 2009, 19 out of 23 or 52.1 percent were utilized. Flyers, brochures and CDs of the technologies were also distributed to the end-users. Other media include the assembly called by the local executives where seminars and workshops were conducted. Furthermore, demonstration of matured technologies was done in the presence of the participants.

People in the countryside were the primary targets of the utilization of matured technologies. Some technologies were adopted for commercialization. The R&D Office and the Extension Services Office of the College arranged with local chief executives and officials on the dispersion of technologies and research findings. Needs assessment data were the bases for the delivery of appropriate technologies and research findings in the countryside. After which, a Memorandum of Agreement (MOA) between the College and the stakeholders were forged. The significant findings of researches and the technologies generated, disseminated, utilized and adopted helped upgrade the living conditions of the people in the countryside of Romblon and neighboring island provinces. Several R&D outputs were utilized to wit:

1. The research output of the Socio-Economic Profiling of the five poorest municipalities in the province of Romblon conducted by the Institute of Business and Accountancy was utilized by the NGOs and LGUs in formulating a five-year Development Plan to help alleviate poverty in the province.
2. The results of the study initiated by the RDE unit on the Plight of Filipino Women in Rural Communities were utilized as bases of the advocacy and program identification of the RWL-KALIPI.
3. The research outputs on the graduate tracer studies conducted by various institutes served as bases for curriculum revision and program enhancement.
4. The R&D outputs on Environmental Researches resulted to the production of instructional materials for environmental education.
5. The technologies generated on agricultural R&D about Off-Season Vegetable Production Organic Farming, High Valued Vegetable Production, etc. were now adopted by local farmers.

The RDE center had eight programs that served about 2,500 clients through seminars, information dissemination and trainings conducted from 2005 to date. Dissemination of present programs of the College on the utilization of matured technologies was highly commendable. A sample of matured technologies was popularized locally and nationally consisting of related technologies duly accepted by scientists, researchers, farmers and households.

CONCLUSION

Research capability building activities created a research climate at the Romblon State College. Institutional initiatives along research functions were geared towards faculty motivation to go into research. Interests, enthusiasm and confidence that were established in the faculty members ushered a sustained performance in R&D putting the College in the local, national and international perspectives. Most importantly, the effort expended by the researchers helped win the most sought endorsement by various evaluators for the university conversion of the College. With the scientific generation of information resulting from research findings, the College was able to disseminate, utilize and convince people, particularly in the rural areas, to use local technologies that will surely protect and benefit them. In totality, R&D projects are highly valued when the results are utilized by stakeholders in policy formulation or revision and program prioritization towards sustainable countryside development.

RCBSW is only effective when it is conducted by experts and is based on what the clients really need. It could be instrumental to promote a culture of research when the top and middle managers are good role models. They need to establish their own credibility in terms of R&D achievement before they can make their colleagues follow suit. Their very own performance is more than enough motivation for others to see the value of R&D to their chosen profession, to the organization, to the community, and to the countryside development. However, the importance of merits and incentives to the researchers should not be discounted to sustain their enthusiasm.

Finally, empowered researchers can easily get their research proposals funded. The question of scarcity of funds due to limited GAA seems not to be a major concern. The few thousands from GAA, when spent for a well-organized RCBSW, will generate millions if properly mentored.

RECOMMENDATIONS

Linkaging, networking and mentoring of SUCs with well-established R&D centers should be developed. The RCBSW should be based from a scientific diagnosis to be more effective and must be a continuous program. Sufficient funding for R&D centers is indispensable. Everyone is expected to help source out funds for research by preparing quality research proposals knowing that financial assistance for R&D is all proposal driven.

Different units of the SUCs must be furnished with the R&D performance indicators for them to have a guide in the quest for excellence and relevance in research and development. The administration should assign competent staff with strong team spirit and high sense of professionalism to run the RDE unit. Government agencies must assist and be deeply interested in SUCs in the realization of the R&D functions. There must be a monitoring mechanism in assisting SUCs in order to determine the status and extent of their R&D activities.

REFERENCES

Foja, Alice F. 2005-2008. *Research , Development & Extension Unit Annual Reports*, Romblon State College, Odiongan, Romblon

Foja, Lou. 2007. Personal Communications. Budget Office, Odiongan, Romblon

Mani, M. & Foja, A. 2007. *R & D Manual of Operations*, RSC, Odiongan, Romblon

Papa, A. 2006. Personal Communications on NBC 461. Special Paper, Cavite State University

Puriran, M.T. V. *SUCs Levelling Evaluation*, CHED, Pasig City

Reyes, R. 2007. Personal Communications. Accounting Office, RSC Odiongan, Romblon

Sespene, J. 2004 -2008. *College Annual Reports*. RSC, Odiongan, Romblon

_____ . 2007. *RSC Manual of Operations* , Odiongan, Romblon

_____. *College Code*, RSC Odiongan, Romblon

Best Practices in Managing Resource-Limited Research: The Case of Comprehensive Analysis of the Poverty Situation in the Southern Tagalog Island Provinces[1]

Merian C. Mani[2], Jeter S. Sespeñe[3], Erlinda B. Aromin[4], Eddie G. Fetalvero[5] and Lou V. Foja[6]

ABSTRACT

The paper presents the researcher's experience in managing and completing a qualitative research on the comprehensive analysis of the poverty situations in Region IV-B known as the MIMAROPA Region under very limited time and budget. Constrained with the issues, the researchers employed various strategies to complete the research study. Along the process, best practices were discovered. These experiences gave birth to a new R&D management framework the "Community In Vitro and In Vivo Development Approach", the novelty of this study. The Key Informant Interview (KII) and Focus Group Discussion (FGD) are the main tool used in gathering data to draw the real picture of the poverty situations in the five island provinces (Mindoro Occidental, Mindoro Oriental, Marinduque, Romblon and Palawan) in region IV-B. The respondents of the study were from two least progressive municipalities in each province which were identified based on the National Economic and Development Authority classification and that of the Peace and Equity Foundation poverty mapping in 2006. Eleven (11) Key Informants were purposely identified to gather sufficient data. Three Focus Group Discussions were conducted in each municipality from multi-sector groups, and with special groups like; the inmates, rebel returnees, indigenous people and the women's organization. The whole new approach yielded very interesting and relevant results thus showing the efficiency and effectiveness of the new R&D management framework.

---

[1] Paper and poster presented during the 2nd Bansomdejchoapraya Rajabhat University International Conference on March 25-27, 2011 at Ban Chaopraya Hotel, Bangkok, Thailand;
Winner, Best Poster during the International Conference for Higher Education Researches held at the University of Northern Philippines, Vigan, Ilocos Sur on April 28 to May 1, 2010;
Winner, T.M. Aganon Award for Best R&D Management Poster during the 20th National Convention of Philippine Association of Research Managers, Inc. at Aklan State University, Banga, Aklan on April 6-9, 2010

[2] Doctor of Education; Vice President for Research, Extension and Production, RSU
[3] Doctor of Philosophy in Commerce; University President, RSU
[4] Doctor of Philosophy in Community Development; Project Manager, CHED-UPLB-ZRC
[5] MA Science Education; Director for Research, RSU
[6] CPA; Budget Officer, RSU

Key words: *Community In Vitro and In Vivo Development Approach, Managing Resource-Limited Research, Poverty Situation in MIMAROPA Region*

INTRODUCTION

Challenged to come up with sensitized and credible data, the Deming's PDSA cycle was employed to ensure continuous quality improvement using the logical sequence of four repetitive steps such as; Plan, Do, Study (Check) and Act. Consistently, Deming's principle on Total Quality Management (TQM) which is synonymous to excellence has been applied in the processes as well.

Aware of the limited time, budget and resources, the researchers were motivated to link with State Universities and Colleges Administrators and Research Managers (VP's and Directors) to provide transportation and accommodation assistance. The researchers did reconnect with friends and relatives in each province for logistics and the PHILARM members served as KII enumerators and FGD facilitators and documenters. The RSU strategy was devised to efficiently manage a resource limited research.

OBJECTIVES

The study aimed to validate the efficiency of the PDSA cycle as R&D management approach, elucidate the TQM principle as a requisite to R&D project study, show the important qualities of R&D managers and device a paradigm that suits the identified gap in the R&D management.

SCOPE OF THE STUDY

The study focused on the evaluation of the best practices learned in managing a research project with limited time and financial resources, particularly the case of the comprehensive analysis of the poverty situation in the Southern Tagalong island provinces in the Philippines which consistently belong to the top 40 poorest provinces in the country. The respondents were purposively chosen from the two least progressive municipalities identified in each of the five provinces in the region.

This study aims to identify the three major concerns that have direct impact on the poverty situation that need to be addressed immediately and its causes and effects to community development. The study examined the

implications of the current programs as well as planned projects of various institutions relative to poverty issue. The available resources of the selected municipalities were evaluated and the possible areas of intervention for State Colleges and Universities were identified.

MATERIALS AND PROCEDURE

The study uses a comprehensive framework for assessing top three issues in the ten (10) selected municipalities. It uses quantitative (trend in poverty and related indicators) and qualitative analysis (Key Informant Interview) to assess the poverty situations as it relates to the overall development of the municipality and province. A Focus Group Discussion was organized to confirm the findings in the Key Informant Interviews and gather feedback from key stakeholders, and to identify present programs that address the local poverty situation. An institutional plotting analysis was undertaken to assess the current responses to the state of poverty in the region.

Moreover, the KII & FGD considered as a framework, the use of PDSA teaming with the Total Quality Management (TQM) principle brought the hybrid idea of Community *In Vitro* and *In Vivo* Development Approach in R&D Management.

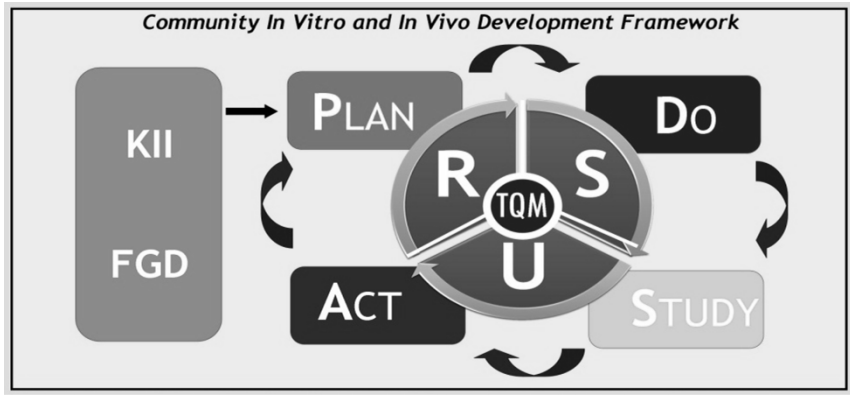


Figure 1. Community In Vitro and In Vivo Development Framework

MANAGEMENT PRACTICES

The researchers gathered data in the two least progressive municipalities in Romblon and completed the task after ten days. The team

convened to evaluate the first phase of the project implementation using the PDSA cycle as the master guide of the project management. The strengths and weaknesses, and the problems encountered by the researchers were identified and discussed. Possible solutions were pointed out. Later, the research team agreed to repackage the strategy by considering the lessons learned in the previous activity. The feed-backing mechanism was consistently done to improve the system of project management all throughout the data gathering.

The project leader opted to tap local research assistants from each province during data gathering to save on travel costs. The situation prompted the researcher to reconnect with friends, relatives and old acquaintances to facilitate the data gathering. Aware that the budget is limited for the region wide study, the proponent opted to request for logistical support from administrators and R & D managers among the SUC's in Region IV-B.

Included in the study were the following areas:

FINDINGS AND DISCUSSION

Management Problems Encountered

The main problem that plagued the researchers were limited time and budget. Hence the researchers devised the RSU strategy to address the problems. The researchers Ride On Official Travels (ROOT), every time there was a scheduled R & D related seminar in the region, the project leader volunteered to represent the university and take the opportunity to gather data together with the pre-contacted team members. The Shop for the Lowest Price in Everything (SLOPE) was a rule observed all throughout in buying all the needs relative to the implementation of the project. Transportation, lodging and accommodation, supplies and materials were reused and services were shopped (the lowest price is taken). The Use of Austerity Measures (AUM) was the mantra of everyone involved in the project.

With the insurgency threat in Mindoro, a clearance from the officials of the Philippine Army was secured before proceeding to Bulalacao and Mansalay. In the same way the researchers sought clearance from the rebel returnee group.

The "culture of silence" was one of the most challenging issues encountered by the researchers. Nonetheless, the group made their way to

win the trust and confidence of the target respondents by discovering the least common denominator that existed between and among them, may it be a driver, an employee, an LGU official, a teacher, a Barangay Official, and the like. Commonalities like "Coming from the same province or region", "Having met in previous conferences", "having gone through the same experience" and many other situation that would relate them or anything that can make a connection with the other person to be interviewed. The data gathering ran smoothly on the second day until it was completed.

Dealing with the IP's is another interesting experience, the researchers requested assistance from the Occidental Mindoro State College to secure pass from the elders and gatekeepers of the tribe. Orientation on the culture of the tribe was done prior to the conduct of FGD and KII sessions.

The issues on poor road network and long travel hours were beyond the control of the researchers. The team addressed these issues by developing the values of humility, patience and cheerfulness while doing the job. The safety of the researchers while on travel and visit to far flung areas was another major issue, yet it did not stop the team to successfully complete the study.

It was found out that the use of the PDSA cycle as the guiding principle in the management of the project was effective. As the Total Quality Management principle was highly emphasized to all team members in the entire duration of the study the data were reliable and authentic. With the devised RSU strategy, the project was completed even with limited time, budget and resources. The network and linkages established strengthened the Research Development and Extension resources of the university.

Despite the limitations in conducting research at the local context, different management strategies and principles categorically explained the pragmatic application in qualitative research. These approaches hastened the overall process of planning up to obtaining the sets of objectives stated in the particular study. The devised being formed at the culminating part of the study summarized the desire to answer the perennial problem for an ideal framework and working systems that could possibly address the present situation. The flexibility lies on the role playing aspects of completing the different components of study to be made. This management study reflects the different possibilities of capturing the research managers imagination for assuming the appropriate answers for the given case analyses.

Consequences of the Management Decisions and Actions

The use of the PDSA cycle guaranteed that the data generated were sensitized and credible. It led to an improved approach of the KII and FGD processes from one province to another. Thus, the research procedures consistently improved. The RSU strategy was a major factor that made the completion of the project possible. The Researchers took the risk of crossing rough seas and rugged mountains to meet the respondents and gather the data. They widen their linkages and network that opened new avenues for bigger projects and programs to the university.

Precisely the decision to adapt the In Vitro In Vivo Development Framework in RD management perfectly suited the issues and concerns that confronted the researchers. The decisions made through consensus hinging from constant feed-backing mechanism participated by the team work well all the way to the project completion.

Implications on Management Decisions and Actions

The unconventional approach in managing a research project constrained with limited time and budget resulted in several insights; enriched the existing body of knowledge on the methodology and possibly lay down the foundation on doing such approach and using the same principles in future R&D Management studies. The strategies undertaken helped attain the objectives of the study effectively and efficiently to the optimum with the least resource input. Additional funds for new projects and potential extension programs were unveiled. Finally the concept of the "Community *In Vitro* and *In Vivo* Development Framework and the Convergence Web Approach" in R & D Management proved to be an effective strategy.

CONCLUSION

The findings confirmed that PDSA cycle as R&D management approach is an efficient tool that facilitates the fast and accurate level of data collection. While the TQM principle illustrates the different steps to which this R&D project had undergone proved to be an effective manner of filtering the gathered data for the specific purpose of study. Furthermore, the role of the RSU strategy showed how the R&D managers enhanced the facility of the holistic management of the study and its completion.

Moreover, the KII & FGD considered as a framework, the use of PDSA teaming with the Total Quality Management (TQM) principle brought the hybrid idea of Community *In Vitro* and *In Vivo* Development Approach in

R&D Management. The whole process resulted to a sensitized data that guaranteed the integrity of research output. Results led the researchers to conclude that the use of the In Vitro, In Vivo Development framework in RD project implementation and management is indeed effective.

RECOMMENDATIONS

Research Managers are encouraged to use a combination or multi strategies and approaches in the R&D Management Studies. The Community *In Vitro* and *In Vivo* Development Approach be tried out by other research managers in other research projects. R & D Managers should try using a combination of different framework or methodology using multi-agency program application similar to the Convergence Web Approach that the researchers used in the project management. The regular feedback mechanism is recommended to be adapted by RD managers. Research Managers and Research Institutions should come up with a unified policy on fund management from funding agencies, to institutions and to the proponent so as not to hamper the implementation of any project.

REFERENCES

Asian Development Bank. 2009. Poverty in the Philippines: Causes, Constraints, and Opportunities. ADB Mandaluyong City, Philippines

Balisacan, Arsenio M., and E. M. Pernia. 2002.What Else Besides Growth Matters to Poverty Reduction? Philippines. ERD Policy Brief N. 5. Asian Development Bank. PO Box789, Manila, Philippines

Constantino, Winifreda. 1999. A Survey of Poverty Related Researches and Monitoring Systems in the Philippines. MIMAP Research Paper No. 42. MIMAP Project Policy and Development Foundation Inc. Metro Manila, Philippines

Deming, Walton and Edwards Deming, 1986. The Deming Management Method,. ttp/www.valuebased manageman/methods-demingcycle.html

Lam, Le Thi Ai. 2005. Human Resource Development and Poverty in the Philippines. Discussion Paper Series No. 2005-17. Philippines Institute for Development Studies. Makati City, Philippines

National Statistical Coordination Board. 2005. Estimation of Local Poverty in the Philippines, November 2005, In Cooperation with the World Bank http://www.ncsb.gov.ph

Schreiner, Mark. 2009. A Simple Poverty Scorecard for the Philippines. http//www.microfinance.#Philippines.

UNDP. 2008. Strong Institutions, Inclusive Growth: Poverty Reduction and Achievement of the MDG's. In UNDP Annual Report 2008: Poverty Reduction. UN, New York.

Social Mobilization Through Environment and Disaster Risk Management Advocacy for Climate Change Adaptation[1]

Merian C. Mani[2], Jeter S. Sespeñe[3],
Dulce B. Paloma[4] and Juniel G. Lucidos[5]

ABSTRACT

The growing demand for environmental education is grounded on the recommendation of majority of both national and international environmental experts as the issue on climate change became a global concern. This project went a long way of conceptualization for as early as 1993 by Dr. Mani after conducting a study on the environmental status of Romblon uncovering issues such as forest denudation, degradation of coral colonies, solid waste management, pollution, and poverty. These problems have been attributed to the poor implementation of environmental laws, massive poverty, and ignorance of the people on environmental protection and preservation. The project evolved from a research study that would establish the validity and acceptability of the 6-module Instructional Materials (IM) for Environmental Education (2004) involving 550 persons coming from members of the Local Government Unit, Parent-Teacher-Community Association officers/representatives, and Graduate students to an extension project that allowed multi-sectoral, inter-agency convergence in educating the 2,500 BLGUs, LGUs, and other sectoral representatives of the 17 Municipalities of Romblon using the validated IMs with Romblon State University as the lead agency. The project used the Community In Vitro and In Vivo Development Approach in managing a resource-limited research involving multi-sectors, agencies, institutions, and stakeholders. The project's fund grew from P500, 000.00- granted by Local Government Academy (LGA) after winning the Search for Best Project to P1.5 M counterparts of participating agencies. The project is now on Phase I with the Local Government Units and Heads of National Agencies as their partner agencies. The Phase II of the project would target to educate women and youth sectors of Romblon.

[1] Paper presented and awarded as Best Poster during the 4th International Conference and Scientific Meeting of the Environmental Education Network of the Philippines, Inc. (EENP) held at Central Bicol State University of Agriculture, Pili, Camarines Sur on February 16-18, 2011.

[2] Ed.D.; Vice President for Research, Extension and Production, RSU

[3] PhD in Commerce; University President, RSU

[4] Faculty Researcher, RSU

[5] AgriTech II, RSU-REP

Key words: *BLGU, LGU, LGA, Community In Vitro and In Vivo Development Approach, Environmental Education*

INTRODUCTION

Climate change is the world's major concern today. Its manifestation has a direct impact on a highly complex system consisting of five interacting components: the atmosphere (air), the hydrosphere (water), the lithosphere (land), the cryosphere (frozen part of the earth) and the biosphere (part of the earth where life exist).

Changes in the world's climate are not new. In fact, human have been able to cope and adapt to these changes. It is one factor which has influenced the course of human history and human evolution. It refers to any change in climate over time, whether due to natural variability or as a result of human activity (anthropogenic causes). It can also result from the interaction of the atmosphere and ocean. But the United Nations Frameworks Convention on Climate Change (UNFCCC) put more emphasis on human activities which cause climate change.

World leaders of 192 countries recognized that the climate system is a shared resource whose stability can be affected by industrial and other emission of carbon dioxide and other greenhouse gases. Their main goal is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic human induced interference with the climate system.

The Philippines, although a minor contributor in greenhouse gas emissions, poses vulnerability to some climate change impact like sea level rise because of its archipelagic geography. Agricultural and marine resources are also at high risk of being damaged due to prolong rain or dry season and increase of sea temperature.

Romblon is not excluded from these creeping effects of climate change being an island province composed of 7 major islands and islets, it is highly vulnerable to risk and disasters. As a third class province it belongs to the top 20 poorest provinces in the country. The political leadership is striving towards maturity. Development is elusive due to its geographic location. More so, the economic activity of the people revolves around farming, fishing, mining, etc which are all dependent on the richness of its natural resources. There is a high risk that the natural resources of the province will come to exhaustion that would increase its vulnerability to the effects of climate change and natural calamities. The Romblon State

University (RSU) as a Higher Education Institution commits to conduct a massive information and education campaign to collaborate collectively in developing doable and sustainable climate change adaptation and mitigation plans in every municipality of Romblon. Each barangay, being the nucleus of society have important roles in efforts towards climate change mitigation and adaptation activities.

The study of Mani in 2004 unearthed the following environmental issues in Romblon such as: forest denudation, degradation of coral colonies, solid waste management, pollution and poverty. These problems have been attributed to the poor implementation of environmental laws, massive poverty, and ignorance of the people on environmental protection and preservation. Her recommendations were to immediately address the environmental issues and for local authorities to prepare for the inevitable.

Grounded on this concern, Mani in 2007 came up with a study on the Validation of a Learning Package for Environmental Education. The validation exhibited a high acceptability of the modules. With the two related studies she was competent to transform its results to extension programs. In 2009 when the Local Government Academy through the provincial DILG units made an open invitation for grant competition, the author made her way for the grant through the proposal entitled "Environment and Disaster Risk management Advocacy for Climate Change Adaptation" hence this project was born.

This project is a two-day seminar-workshop for Local Government Officials and other stakeholders in the whole province of Romblon. It is intended to address the urgent demand for education in ecological responsibility as recommended by Earth Summit in the Agenda 21 which aims to foster Environmental Education and reiterated by UNEP, WHO, and NEPC. This demand is grounded on the recommendation of majority of environmental experts (both national and international) based on the observations and research findings that the "breakdown of the system of environmental awareness and conservation has significant relationship to the problems of knowledge and attitudes at the values level."

The DILG Romblon in coordination with the Romblon state University-Research, Extension and Production Center (RSU-REP) designed the program suited to local setting considering the environmental issues to be addressed, appropriate environment-friendly technology/lifestyle and practical solid waste management strategies to be transferred, as well as sustainable agri-economic program, to be initiated that would help attain food sufficiency without jeopardizing the environment.

The LGUs, NGOs, and other People's Organizations were the target participants of this project because the proponent believed that it is everyone's duty to preserve and protect mother earth. The LGUs play a tremendous role in saving what is left for the future generation, because they are the law makers and enforcers. Other sectors should move in unison if we are to mend the damaged environment. This project expects to develop an empowered community lead by the LGU from the barangay to the provincial level, ready to mitigate and adapt to the short term and long term effects of climate change particularly disasters due to extreme weather conditions by promoting balance of the ecosystem through environment friendly lifestyle.

METHODOLOGY

The conduct of information and education campaign on climate change awareness and understanding the risks posed by the increase of global temperature was made through interactive seminar-workshops per municipality. A long-term engagement and partnership was encouraged to conduct follow-up, and ensure sustained efforts in monitoring and evaluation.

Implementation Activities

Planning and Clustering

Series of consultation meetings with partner and cooperating agencies were made to lay down all activities needed in the conduct of seminar-workshops, the expected output, and the continuing activities that will be integrated in the municipal plan and will be implemented at the barangay level.

Each municipality was divided per cluster. Each college was assigned to lead the conduct of the seminar-workshop as part of their extension activities. Local experts per topic were identified and pool of speakers was established. Each college had formed a team of facilitators, moderators, and documenters to sit per group in thematic sessions. A dry run was conducted to test time allotment per topic, pacing, and schedule of activities.

Coordination and Communication

Coordination with Local Government Unit regarding the conduct of seminar-workshops was made by the project proponent with the assistance of College deans. Schedule of activities, number and

composition of participants, and solicited counterparts were agreed and finalized. Barangay officials of each municipality were the target priority to actively participate in the workshop. Expected output and action plan after the workshop was emphasized.

The Romblon State University's (RSU) Convergence Web Framework (Fig. 1), a novelty output of the previous research conducted by RSU was used consistently in the project implementation as an approach to establish partnership, cooperation and ownership among stakeholders; LGU, line government agencies, academe, church, and non-government organizations.

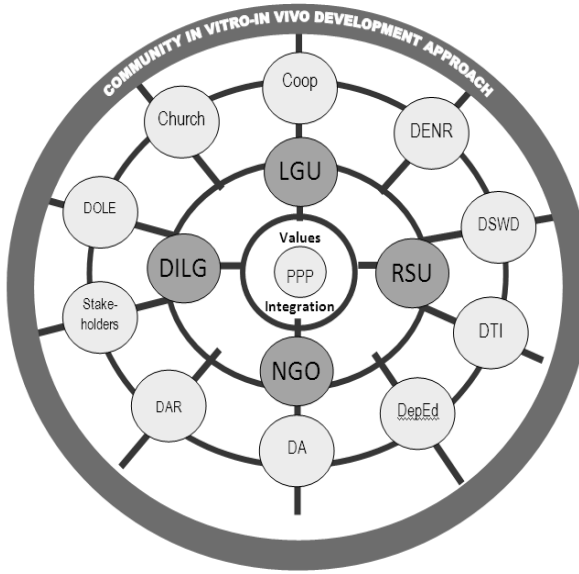


Fig.1.The RSU Convergence Web Framework

Plenary Session

Selected resource speakers have been invited to talk on assigned topic to be delivered in a plenary. Topics presented in the plenary sessions were as follows: Understanding and Appreciating Creation; Inner Ecology; Impact of Climate Change; Impact of Climate Change on Agriculture; Solid Waste Management; Disaster Risk Management and Synthesis.

Parallel Thematic Learning Sessions

Participants were divided into five groups. Five parallel thematic sessions were held to discuss the following topics: Ecosystem Health,

Sustainable Agriculture, Coastal Resource management, Zero Waste Management and Disaster Risk Management. These parallel sessions served as an avenue for the resource speakers and participants to discuss within a smaller group specific issues and concerns about climate change mitigation and disaster risk management.

Focus Group Discussion

In the same grouping, a team of facilitators/moderators and documenters were assigned to guide and record the discussion which focused on specific questions.

Action Planning

From the issues and concerns identified in the FGD, an action plan to mitigate identified problems, the participants were asked to develop a doable action plan.

Panel Evaluation

In the plenary, the action plans made in thematic sessions were presented for other team comments, suggestions and evaluation. These were consolidated as a municipal action plan on environment and disaster risk management. The team of experts who evaluates the action plan are the provincial directors of DOST, DTI, DOLE, TESDA, DA and DENR.

Election of EDRM Technical Working Committee

A technical working committee for Environment and Disaster Risk Management was elected. The Barangay Captain and one Kagawad per barangay were automatically appointed as member of this committee. The formed committee will be in-charge of the monitoring of the implementation of the action plan of every barangay.

FINDINGS AND DISCUSSIONS

From the ten (10) municipalities where the seminar-workshop was already conducted, 72% of the total participants were Barangay officials, 13% came from different NGOs, 8% from Local Government Units composing of Sangguniang Bayan Members and Department Heads and 7% from DepEd personnel.

The composition of participants by sector who attended was proportional to what was projected in the proposal submitted to each municipality. The high participation of each invited sector could be attributed to the established rapport with these sectors as well as the strong collaboration with the different Municipal LGUs prior to the actual 2-day seminar-workshop.

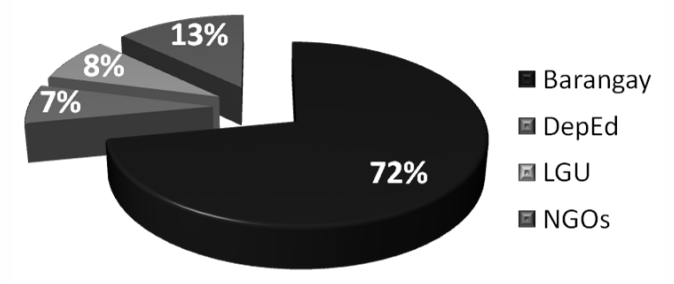


Fig.2. Percentage of attendance per sector from the 10 municipalities in Romblon

Figure 3 shows the high turnout of participants that were able to complete the two-day seminar workshop. This could be attributed to the orientation given to the participants during the opening program that there will be cash incentives to be given to those participating Barangays and agencies who could maintain their attendance, punctuality in coming to the venue and in submitting the required output, would observe discipline, cooperation, and participation on the entire duration of the seminar-workshop.

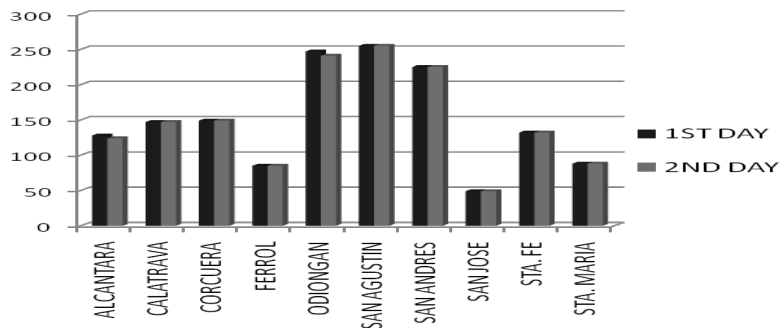


Fig.3. Attendance by municipality in the 2-day seminar-workshop

The objective of mobilizing the whole province of Romblon towards environmental and disaster risk management entails funds that would cover for the different expenses that would be incurred in conducting the seminar-

workshops in the 17 the Municipalities. Figure 4 shows that almost three fourth of the funds was sourced-out from the Municipal LGUs, NGOs and LGA and only one fourth of the funds came from the lead implementer.

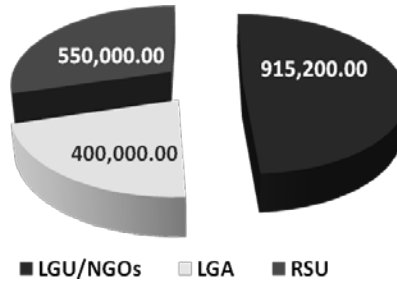


Fig.4. Sources of funds used in the whole project

CONCLUSION

The conduct of the 2-day seminar workshop in environmental and disaster risk management for climate change adaptation was not difficult to sell to every municipality since the effects of climate change have undeniably affected everyone. Mainstreaming of ideas using multi-level collaboration involving different sectors, agencies, institutions, and stakeholders during core group meetings, parallel sessions, focus group discussions, and action planning was found effective in empowering the grassroots level of society. Ownership of the program was smoothly internalized by the participating agencies as the bottom-up approach in planning, implementing and monitoring their own mitigating plans in the barangay and municipal level was adapted. The use of cash incentives also contributed to the high turnout of sustained participation among stakeholders. Feedback and post evaluation from the participants were found beneficial in improving the conduct of the seminar-workshop. It can also be noted that a limited-resource program can be sustained if all sectors of society will be involved and committed to the realization of the program's objectives by investing financial resources and/or by sharing their field of expertise.

At the end, the problem posed by climate change paved the way for all sectors of society regardless of religious and political affiliations to the awareness of their inner ecology and unite towards fulfilling differentiated responsibilities to our environment.

RECOMMENDATIONS

On the basis of the seminar-workshops conducted and evaluated in the Province of Romblon, the authors have arrived on the following recommendations:

1. The program should also be introduced to the women and youth sectors since they belong to large sectors of the society.
2. The lead agency would have to apply for accreditation to LGA for institutionalizing the program to the National Level.
3. Creating database of the participants' profile could well serve as a rich source of information for follow-up programs
4. Strong documentation on the best practices, lessons learned, and findings derived from the program could well serve as a guide for related programs to be conducted in the future.
5. Impact assessment of the program could be conducted using the consolidated municipal action plans vis-à-vis the implemented programs.

Student and Teacher Partnership in the Study of Tiger Grass Industry in Marigondon Norte, San Andres, Romblon: Lessons for Novice Researchers[1]

Eddie G. Fetalvero[2] and Tomas T. Faminial[3]

ABSTRACT

This paper documents the struggle of authors as novice researchers, who although armed with high energy and spirit, almost lost heart to finish the project because of some issues they had to address and which they learned of only during the actual research experience.

Research is one of the mandated functions of State Universities and Colleges. With this, university faculty members have to juggle their time across instruction, extension, production and research. In the newly converted Romblon State University, research efforts were only ignited few years ago when a series of research capability building activities was regularly conducted and the RDE unit was fully strengthened. As novice faculty researchers, their energy to do research was high and research ideas spontaneously flowed as if the world were a big puzzle to solve. However, when they were able to avail funds for a research project about tiger grass industry, problems surfaced which challenged their capacity.

The study about the Profile of the Tiger Grass Industry in Marigondon Norte, San Andres, Romblon financed by the Department of Trade and Industry and the Romblon State University, was the first externally funded and thoroughly documented research output of the College of Business and Accountancy. The project proposal was approved and funds were made available as early as February 2009 but implementation was delayed because the University had no clear-cut and written guidelines for the release of research funds. This caused a lot of anxiety because this was the first approved research project of the authors and they needed to deliver.

So, they initiated a strategy to proceed with the study even if financial help was unavailable. The major problem identified was the need for enumerators and interviewers, since data gathering activity ate the bulk of the funds. They came up with a vision of making Marigondon Norte as the

[1] Top 5, W.C. Medrano Award for Best R&D Management Paper. Presented as paper and poster during the 20th National Convention of Research Managers, Inc. at Aklan State University, Banga, Aklan on April 6-9, 2010.

[2] MA Science Education; Director for Research, RSU

[3] CPA; MBA; Dean, College of Business and Accountancy

soft broom capital in the province of Romblon and shared this with their class. Four students who were residents of the town signified willingness to volunteer their time, effort and money for the project. During their common vacant hours, they oriented and trained their students on how to use the questionnaire for interviews and how to record responses. By Christmas vacation of 2009, they immersed in the remote, mountainous and far-flung community of Marigondon Norte for one week.

By February of this year, findings were already presented to the provincial offices of DTI and DOST. From the findings of the project, programs will be launched this year by DTI and DOST to help the tiger grass industry in Marigondon Norte maximize its production and market potentials through cooperative formation and product development and improvement. With the project already completed and presented, the funds intended for the study were finally released.

Given their research experience, it can be said that vision and initiative are two important qualities in order for researchers not to lose heart when things do not happen as expected. Faculty researchers of SUCs are also reminded by this experience that when other support factors fail, they have their students as available resource to keep their energy up. The vision must be shared to them and let them see things differently and work together as partners. Think about it, can any subject teach students better about community development than letting them live with the people? One of the student volunteers left this very challenging message: "My involvement in the study enabled me to see the real face of poverty – poverty in different forms and shapes. It just saddened me to realize that I can do nothing more but to listen and record what these tiger grass farmers have to say. I pray that help will come to them soon."

Key words: *Student and Teacher Partnership, Tiger Grass Industry, Soft Broom Industry, Lessons for Novice Research Managers*

RATIONALE

In a tertiary academic institution like Romblon State University whose R&D unit has just come to life because of its series of capability building activities, research is one function feared and shunned by the large majority of the faculty. Research sounds like a high hat word for them, a misconception worsened by the frozen concept held by most senior faculty whose minds have been acculturated by fossilized and hackneyed practices. Such was the research culture that impressed us in the university when we

were hired as instructors few years ago. The institution's experts were out of the loop for decades and they already sounded irrelevant.

While we were aware that our functions as SUC faculty included research, extension and production, and while we knew that there was no faculty researches conducted, we were wondering how the senior faculty rose from the ranks. Our personal review of the instrument used in evaluating faculty performance showed that the scale for research was flawed. Instead of assessing research outputs, what was evaluated was the research potential of the faculty. Thus, majority of the faculty got the highest point in the scale, because everybody had the potential. In the eyes of a junior faculty like us, we saw the irony. Every flag ceremony, our President could be heard of long litanies about the need for the faculty to come up with research outputs. We were even scared of the 'publish or perish' belief system citing cases like the University of the Philippines in Los Baños and other universities.

It was then when our interest in research was born. It actually came as a question: "What is in research that many faculty members are afraid of it?"

Our case as SUC faculty is different from among those who were employed in government agencies doing R&D. Since we have to juggle our time among instruction, extension, production and research activities, handling a 24-unit load per semester is already too much for us. Doing research is an add-on burden all the more.

Our foretaste of being a real research manager came last year. Our first externally funded research project was about the profile of the tiger grass industry in a certain village in Romblon which was a collaborative study between the Department of Trade and Industry (DTI) and RSU. Our research energies were up until we encountered problems on funds downloading causing the delay of project implementation. With failed financial support system and the pressure to deliver, we assessed what resources we had and found our students as partners in completing the study.

OBJECTIVES

This R&D management paper aimed to present our experience in managing a research project using our students as research partners. Specifically, the paper intended to:

1. Promote student and teacher partnership as a tool that can be used by novice SUC faculty researchers in carrying out their research projects;

2. Develop a strategic approach on funds management which can be used by faculty researchers of SUCs that do not have clear-cut policies on downloading funds for externally financed researches; and
3. Present the impact of involving students in the conduct of faculty researches

Project Background

The research activity was a baseline study entitled, *Profile of the Tiger Grass Industry in Marigondon Norte, San Andres, Romblon: Basis for Developmental Intervention*. It aimed to describe the demographic and socio-economic characteristics of tiger grass farmers in the area and the tiger grass industry profiles in terms of farm inputs, farm outputs, farming practices, marketing practices and problems encountered concerning the industry. From conceptualization to completion, the project lasted for one year. It was a collaborative research work between the Department of Trade and Industry and Romblon State University with funds amounting to P37,500. DTI subsidized a research assistance of P17,500 and the rest was shouldered by the university.

I (Eddie) am the team leader and was the one who prepared the proposal, implemented the project and prepared the research manuscript. I worked in tandem with Mr. Tomas T. Faminial, a CPA who prepared the work and financial plans and correspondence. He was also the financial manager and at the same time documented the study from proposal to results presentation. The research staff was composed of four students: Baby Vanessa Gubatana, Angelica Manilay, Ma. Angelica Gacu and Melody Galido, three of whom are residents of San Andres.

Management Practice

On May 4-5, 2008, we were among the participants who attended the R&D Agenda Formulation and Program Prioritization of Romblon State College (now University) conducted by STARRDEC in collaboration with PHILARM. Our hunger for new ideas was evident because we took the workshops by heart. In fact, about 80 percent of the programs formulated and prioritized came from the outputs of our group. This was the beginning of our interest in R&D activities.

On February 3, 2009, there was a call for research proposals among the faculty of the College. There were so many proposals presented and reviewed. Few months later a notice was sent to those whose research proposals were approved for funding. Luckily, our proposal on the study of

the tiger grass industry was included in the list. By March 2009, the Department of Trade and Industry released research assistance for the conduct of this baseline study. A memorandum of agreement was forged between DTI and RSU.

As novice researchers, receiving even a small amount of assistance from a funding agency was already a breakthrough for us. We sent a letter to the administration to download the funds in order for the research to start, but far from our expectations, we were asked of so many documents to present. We were told they were ignorant of the study. We were advised to talk to the auditor. And more! In our own evaluation, we did not feel the sincerity of the administration to invest in the capacity of their faculty to conduct researches.

The next time we approached the administration to follow up the funds, we were met with these words: "I know nothing about it." To our dismay, we called the DTI office and shared our burden. This was what their head said: "Okay, we will withdraw the funds. That was too small an amount for your administration not to know how to download."

We thought then that that was already the end of it all. But in our minds were echoing the words of PHILARM President and Head of CHED – UPLB Zonal Research Center, Dr. Erlinda B. Aromin: "For first time researchers, we are only granting small funds in order to gauge their capacity to deliver." This was our very first research project with assistance coming from a potential partner. So we were really challenged to deliver.

My partner and I reviewed the proposal and the memorandum of agreement. We rechecked the program of work and devised a strategy. As we took a look at our financial plans, we found out that the bulk of expenses was the payment for the enumerators and interviewers. We presented the idea among our co-teachers if they were willing to spare their time during the semestral break and join us in this project. We were still hopeful that the funds will be downloaded. But again, every time we followed this up at the administration's office, we were asked again of the documents we already submitted which they even received. October passed and we were not able to conduct the study.

We received a letter from DTI asking us the status of the study. As with anybody who wanted to prove something, our spirits were up despite these situations. We strategized so that the trust of the funding agency on our research capacity would be developed because we really believed that from this very small research project, big things were about to come.

STRATEGIES

Partnership with Students

As we assessed the resources that we had in order to conduct the study before the year 2009 ended, we were able to discover that our most abundant and viable resources were our students. We have noticed that most of our students' theses were just gathering dusts in the library and many of our students too were just forced to do a thesis as an academic requirement.

We were helpless. So this caused us to offer this study to a group of students who were mostly residents of the place. We were relieved when they agreed to work with us because this group could already handle the possible language barrier. They could speak the dialect and that would make the data gathering procedure faster. We shared with them our vision of Marigondon Norte as a soft broom capital of the province. We told them that this was a funded project but we needed to start working even if we were addressing some technical problems. We laid our cards and they laid theirs and soon after, we were already training them on how to gather data. By December of 2009, they joined us in the far-flung and remote barrio of Marigondon Norte in San Andres, Romblon in interviewing tiger grass farmers. Our terms of partnership are reflected in the table below:

Table 1. Roles of SUC Faculty and Student in the Partnership

ASPECT OF THE PROJECT	ROLES	
	SUC FACULTY	STUDENT
PROPOSAL PREPARATION	▪ Presents the outline of a proposed study to a group of students who will be conducting their thesis; ▪ Advises and mentors the students on thesis proposal preparation.	▪ Enhances the background of the study ▪ Improves the literature review ▪ Looks for relevant materials ▪ Polishes the research proposal ▪ Improves the research instrument
TRAINING	▪ Provides training and orients students on data gathering procedures	▪ Attends orientation ▪ Rehearses interviews and recording responses
DATA COLLECTION	▪ Takes the lead in the actual gathering of data. ▪ Shows to students how the instrument will be used for the first two respondents. ▪ Supervises the students for the next 10 respondents. ▪ Leaves them on their own for the rest.	▪ Conducts the survey; ▪ Takes the role of enumerator and interviewer; ▪ Has to stay in the area until the desired number of respondents is met. ▪ Has to pay his/her transportation, board and lodging expenses and reproduction of questionnaires (refundable).

ASPECT OF THE PROJECT	ROLES	
	SUC FACULTY	STUDENT
DATA PROCESSING AND ANALYSIS	▪ Brainstorms with students about the common responses in open-ended items. ▪ Creates a coding manual. ▪ Analyzes the data.	▪ Inputs the responses in the coding sheet based on the coding manual made.
COMPLETION	▪ Becomes the thesis adviser	▪ Becomes the co-researcher/ research staff of the funded study.

Complementary Tandem

Our research team complemented each other's strengths and weaknesses. While I am a passionate researcher, the passion was complemented with the technical skill of a CPA who held a track record of a number of project proposals approved and funded by different agencies. Even if funds were downloaded late, having an accountant as a research partner made the reimbursement and liquidation simpler and faster.

DISCUSSION

It was circumstantial that we picked our students as research partners. Perhaps, partnering with students in a research project is unpopular in the research community because apprehensions about the validity of data collected could surface. We acknowledged this misgiving that was why there was a close supervision in the data gathering process. Partnership with the students could be the most accessible way by which a faculty can start a research project that can be of benefit to the community and at the same time earn a point for doing it. More and more parents were complaining about the financial demands of students doing a thesis because most of their studies were of no immediate significance and were just gathering dusts in the library. In short, it was just a waste of time and resources, a research for the sake of doing it. We were aware that this is happening not only in Romblon State University but also in other colleges and universities all throughout the country.

This strategy could be a feasible approach that can be used in a larger scale by the R&D Unit of the Romblon State University particularly in the campuses in encouraging their faculty members to engage in research activities in collaboration with funding institutions.

Partnering with students in carrying out a research project has resulted to some surprising effects we only realized later. Firstly, this can be

a tool in broadening their social concept. The academic programs at the College of Business and Accountancy are devoid of community immersion activities that students could really assess the situation and create entrepreneurial activities from the resources available. The study on tiger grass industry has brought students closer to the face of poverty. They have gone to places, interacted with the barangay officials, talked to people and empathized with their needs, wishes and wants. Their concept of a society has broadened realizing that poverty is so widespread and something must be done about it. In the words of Baby Vanessa Gubatana, one of our student partners: "My involvement in the study enabled me to see the real face of poverty – poverty in different forms and shapes. It just saddened me to realize that I can do nothing more but to listen and record what these tiger grass farmers have to say. I pray that help will come to them soon."

When results of the study were presented to the provincial DTI and DOST offices, they recommended to the College of Business and Accountancy that instead of sending business students out of the province for educational trips, they should immerse in a community through an entrepreneurial camp that would last for two to three months. They suggested for the inclusion of this course in our business curriculum. The course will be implemented in collaboration with the Department of Agriculture, NEDA, DOST, TESDA and DTI. In this camp, students will be mentored in preparing business proposals for the community. And the group who can come up with the best proposal will be awarded a prize and an opportunity to implement it.

Secondly, with proper guidance and mentoring, the research capability of the students was improved by this strategy. Ma. Angelica Gacu, another student partner, who was our best interviewer, shared her reflections. "I have been a census enumerator but I have mastered the art of interviewing with my involvement in this study. I also learned first-hand how to process data. If another study be done again, I am still willing to be a part of the team."

For novice faculty researchers like us, this study is memorable because this was our first take on research – a research that is no longer self-funded. We have realized what it is to become a research manager: that we need not necessarily do everything to deliver; that we can use people; that we can delegate tasks; that we can change plans; and still achieve our goals. Our involvement in this research project opened wider doors for us to explore and DTI assured us that more baseline studies are coming to us. Their developmental interventions which will focus on production and marketing aspects are expected to come to the community this year. They were also planning to break the monopoly of some businessmen in the area

who controlled pricing by infusing a strategy that will motivate the farmers to process the products into soft brooms since around 86 percent of them chose to sell the raw materials rather than processing them. It was estimated that the value of a bundle of dried tiger grass could increase up to 200 percent if they would be processed into soft brooms.

CONCLUSIONS AND RECOMMENDATIONS

Student and teacher partnership in conducting a research project can help a lot in broadening the social concept of the students. It can also develop their research capability. Partnering with a faculty whose expertise is on financial management can also reduce the burden of preparing taxing financial plans and reports. In our part as faculty research partners, we have become confident of our research management skills as well. We could say that vision and initiative are two important qualities in order for researchers not to lose heart when things do not happen as expected. Faculty researchers of SUCs are also reminded by our experience that when other support factors failed, we have our students as available resource to keep our research energy up. Let us share with them our vision and encourage them to see things the way we do and work together as partners. There is no other subject that can teach our students about social awareness and community development better than letting them live with the people.

Based on this experience, we recommend that the administration of the university through its R&D unit should include in its Research Manual the details of the procedures to be followed in requesting for download of research funds from funding agencies. There should also be coordination between the R&D unit and the administration to prevent repetitive submission of the same documents. First time research managers are encouraged to utilize students in their funded research project as data collectors. We also advise them to start with small research projects. It is good to start small and deliver than start big and fail! We also recommend that novice researchers should tandem with a faculty who is adept at financial management like the budget officer or an accounting educator. In the light of this R&D management experience, we also recommend that the curriculum for the program BS Business Administration of RSU be reviewed and the suggested community immersion 'entrepreneurial camp' be integrated into the curriculum to harness the research potential and widen the social concept of the students thereby making them valuable research partners.

Guide to Authors

Travesía, the official publication of the Research, Extension and Production Center of Romblon State University, is a refereed multidisciplinary journal that publishes reports of original research in agriculture and fishery, science and technology, business, education, arts and sciences, R&D management and other relevant fields of study. It also publishes notes and reviews on relevant and timely topics. Travesía aims to cater to broader readership in the province and beyond thus the highly select composition of its Board of Referees. One issue a year may be published but supplements may be released anytime as necessary.

Preferably, the paper must have been presented at least once in a research forum, convention or conference of relevant professional organization before being considered for publication. This rule, however, may be relaxed for manuscripts of exemplary and meritorious quality and subject to approval by the Board of Referees. Manuscripts should not be considered for publication elsewhere once submitted to the journal.

A consensus of at least two referees is needed for approval to publish. Blinding shall be employed in the process of paper review. The decision of the Board of Referees to accept or reject a manuscript is final.

Page charges may be required of authors to subsidize limited funds of the REP Center, rates will be indicated and provided to the submitting author once a manuscript is accepted for publication. Similarly, the author is entitled to at least a copy of the journal but extra copies may be arranged with the Editor. Only the main author is entitled to a complimentary copy in case of articles with multiple authors.

The following format is suggested: Title, Author/s, Position and Institutional Address including telephone numbers or email, Abstract, Keywords, Introduction, Methodology or Materials and Methods, Results, Discussion (or Results and Discussion), Summary, Conclusion, and Recommendations (if necessary), References, and Acknowledgment.

Author/s citation in the text must be by family name and year (e.g. Sespeñe (2007) or Motin and Mani (2007) for two authors and when more than two authors, Amar et al. (2007). In the list of references, authors must be arranged alphabetically. The APA style should be followed (refer to the specific guide at the REP Office).

Tables, illustrations, and figures/photos must be numbered consecutively. Titles of tables and captions of figures, must be self-explanatory, specific, and must be understood independently of the text. Submit manuscript to the Editor preferably by e-mail attachment for the convenience of the editors and referees. Subscription rates/orders may be arranged with the Editor. Cost will depend on current rates and subject to change without prior notice. For submission or other inquiries you may contact:

THE TRAVESÍA EDITOR

Publication Unit, Research, Extension and Production Center
Romblon State University, Odiongan, Romblon, Philippines
Tel. No. (042) 567-5580 e-mail: travesia_editor@yahoo.com

TRAVESÍA

The Spanish term for 'crossroad'.

In the Romblomanon context, it has evolved over the years into a colloquial term which refers to the narrow strait between the islands of Tablas and Mindoro which navigators avoid because of its strong current and rough waves. However, crossing the travesía is one of the most challenging episodes of a seafarer's sojourn. It signifies faith, courage, determination and breakthrough.

Likewise, research in any academic institution is one hard road to cross. It is a test of the academe's competence of generating ideas, knowledge and technologies of scholarly quality. It is a road, as Robert Frost described, 'less travelled by' but once taken and crossed triumphantly will take the institution into a level of respect and prominence.

Published by
RESEARCH, EXTENSION
AND PRODUCTION CENTER
Romblon State University
Odiongan, Romblon
PHILIPPINES