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SIYASIG

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Bridging the Gap Between Academe-Industry Through Outcomes-Based Curriculum Development

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ABSTRACT

To bridge the gap between academe and industry, the study determined the highly in-demand technical skills and knowledge competencies needed in psychological practice in CALABARZON. Two perspectives were considered in approaching the problem: the perspective of 44 employers or industry partners and the perspective of 120 employees who are graduates from Bachelor of Arts in Psychology in Southern Luzon State University. Both quantitative and qualitative methods in data gathering were employed. The majority (21 or 52.5%) of the 40 identified as very relevant competencies fall within Cluster 22.5% is in Cluster B, and 25% is in Cluster C, wherein; Cluster A - psychological knowledge and skills underpinning the core competencies; Cluster B professional behavior competencies; and, Cluster C - professional activities competencies. It was concluded that psychological knowledge and skills competencies are among the top competencies needed in psychological practice based on the perception of both groups of respondents. However, on top of psychological knowledge and skills are professional behavior competencies which also play an important role in the industry. It was further concluded that the skills and competencies being developed in the AB Psychology curriculum of Southern Luzon State University are highly relevant and responsive to the needs of the industry. Recommendations were forwarded to concerned authorities.

Keywords - Academe, Industry, Knowledge Competencies, Outcomes-Based Curriculum, Relevant Technical Skills

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INTRODUCTION

The Higher Education Institutions (HEIs) are expected to deliver graduates with the technical skills and knowledge competencies that will enable them to maximize their career potential in an ever-changing and globalizing work environment. But it cannot be a mere case of “producing” what employers ask for. HEIs should produce graduates who develop the flexibility and attitude to always look for development, innovation, and adaptability both in the field of expertise and in their personal and career development. Since changes are inevitable even in one’s professional field, there is always a need for a tertiary curriculum that is responsive, adequate, and relevant to the needs and demands of a changing environment.

In the Philippines, the HEIs are considered as instruments of development in regional and national contexts. The State Universities and Colleges (SUCs) are expected to fulfill their social missions which are 1) to produce thoughtful graduates with a humanist orientation; analytical and problem-solving skills; the ability to think through ethical and social implications of a given course of action; and the competency to learn throughout

life; 2) to produce competent graduates for the world of work, entrepreneurship and specialized expertise in the 21st century; 3) to provide focused support to the research required for improved teaching, service, technological innovation, economic growth, and global competitiveness; and 4) to help improve the quality of human life, respond effectively to changing societal needs and conditions; and provide solutions to problems at the local, community, regional and national levels (CMO 9, s of 2012).

This research was conceptualized based on the current reports from both private and public sectors that there is accordingly a mismatch between what graduates “get” from the universities and what employers and industry partners “need” from the incoming workforce. A lot of questions have been raised against the adequacy and relevance of our existing curriculum to respond to the needs of the work setting. In the Western countries, the past two decades have accordingly witnessed an increasing interest in competency-based education, training, and credentialing in professional psychology (Kaslow, 2014). This was echoed in the Philippines through the passing of the RA 10029, none other than the Psychology Law that professionalizes the practice of

psychology. Following the Scientist-Practitioner model, the accreditation of professional education and training programs in psychology is based largely on the program's ability to demonstrate how and the extent to which foundational competencies for the profession are developed in the students they graduate. It is, therefore, imperative for a professional degree program like Psychology, to take a look into the assessment of technical skills and knowledge competencies needed in the work setting to serve as a basis for curriculum revision and development.

OBJECTIVES

The study attempted to determine the highly in-demand technical skills and knowledge competencies needed in psycho-logical practice for the next decade in CALABARZON. Two perspectives were considered in approaching the problem at hand: the perspectives of the employers or industry partners and the perspectives of the employees who are graduates from Bachelor of Arts in Psychology in SLSU. The ultimate purpose of the study is to come up with a curriculum for Psychology programs in SLSU which are responsive to the needs and demands of the work setting.

Specific Objectives:

This study attempted to provide answers to the following objectives:

1. Determine the background characteristics of the two groups of respondents: the SLSU Psychology Graduates and the Employers or Industry Partners;
2. Identify the highly in-demand technical skills and knowledge competencies that are, and which will still be in demand for the next decade within the CALABARZON when it comes to psychological practice;
3. Determine if there is a significant difference in the assessment of the graduates and their employers or industry partners regarding the most relevant technical skills and knowledge competencies;
4. Determine the degree of relevance and responsiveness of the proposed revision of curriculum for Bachelor of Arts in Psychology;
5. Identify strengths and weaknesses of the Bachelor of Arts and Psychology based on the perspectives of the employers/industry partners,

the SLSU Psychology graduates, and the researchers; and,

6. Revise the curriculum for Psychology programs in SLSU in terms of its adequacy, relevance, and preparedness to respond to the needs and demands of the work settings.

psychologists (Nash & Larkin, 2012).

Treuer & Reynolds (2017) asserted that garnering international agreement on psychology core competencies could strengthen the psychology profession and facilitate a global understanding and roadmap for communication, assessment, and benchmarking in the profession. They quoted a list of core competencies in professional psychology from the International Association of Applied Psychology (IAAP) and the International Union of Psychological Science (IUPsyS). These are categorized in three clusters: (A.) Psychological knowledge and skills underpinning the core competencies which involve PK: possessing the necessary knowledge and PS: possessing the necessary skills; (B.) Professional behavior competencies which involve PE: practicing ethically, AP: acting promptly, ER: relates appropriately to clients and others, WD: works with diversity and demonstrates cultural competence, EP: operates as an evidence-based practitioner, SR: reflects on work; and (C.) Professional activities competencies, which involves SG: sets relevant goals, PA: conducts psychological assessments and evaluations, PI: conducts psychological interventions and CO:

REVIEW OF RELATED LITERATURE AND STUDIES

Competencies and the Profession

“Competency is the ability to perform a task and role in accordance to the combination of knowledge, skills, attitudes, personal values, and the ability to develop knowledge, skills and learning experience” (Treuer & Reynolds, 2017). In the world of work, competencies play an important role in being viable and productive, especially in institutions in which skills are required in the workplace. Professionals in any field emphasize that standards of competency represent the foundation for the credibility of any profession. However, despite the integral importance of competencies, the discipline of psychology has accordingly struggled to identify, define, and operationalize the competencies required by registered

communicates effectively and appropriately.

Competencies and the Curriculum

Curriculum is a broad set of experiences that students go through during the entire time they are in school (Hagos, L.C. & Dejarme, E.G., 2008). The curriculum is generally considered as the complete course path that will enable students to attain the goals and general objectives of education. It is the learners' engagement with various aspects of the environment, which is under the direction of the school. The curriculum empowers all students and motivates them towards lifelong learning. But because of technological advancements, the speed of new information media, and the predominance of software and hardware devices, schools' curriculum should be enhanced. It should meet the needs of society and should conform to the actualities of the community. The university curriculum should be restructured and shifted towards a more meaningful course of study. It is indeed very important for an educational institution to have a balanced and well-designed curriculum for all the programs it offers. More important than these, curricula have to be designed in such a way that it is adequate, relevant, and responsive

to the prevailing needs of the society. In doing so, the institution shall have a more stable system in undertaking its goals and mission to make its curricular programs efficient and effective to its major concern – the students.

The Need to Update the Curricula

Since technology is constantly changing due to globalization, the aims of programs and curricula in institutions should be ready to prepare students to meet the changes and needs for knowledge and technical skills in the industry. The era of the borderless world of technology has an impact and brings challenges directly to the graduates. This scenario is made more challenging because the number of graduates who complete their studies is increasing. Due to intense competition for jobs, graduates need to make arrangements and prepare as best as possible so that they will not have a problem in meeting the criteria required by their future potential employers.

Childa & Brown (2011) observed that employers tend to choose potential graduates who are skillful in information technology, innovative, creative and possess a wide range of knowledge and intelligence in predicting the progress of the future organizations. Thus, the

education system and curriculum used need to be more dynamic as technological developments are adjusted based on the views, perspectives, desires, and needs of the industry simply because students are the workforce who will be working in the industry.

In the Philippines, Higher Education Institutions (HEIs) are allowed to design curricula suited to their own contexts and missions provided that they can demonstrate that the same leads to the attainment of the required minimum set of outcomes, albeit by a different route. (Article II, Section 4 of CMO 34, Series of 2017). With the recent shift of the Philippine education system to a K to 12 curricula, all HEIs are impelled to revise and update their respective curriculum to satisfy the demands of the stakeholders and the surrounding environment.

Hagos & Dejarne (2008) pointed out that the curriculum

in Philippines schools today has to be geared to the rapid societal changes and the new responsibilities for the new breed of Filipinos. They enumerated the three most important sectors of society that accordingly give direct input to the improvement of the curriculum and these are the academe (institutions), the government, and the industries (both public and private companies). In this study, the researchers focused on getting inputs from the industries and other work settings to determine the technical skills and knowledge competencies needed by the aforesaid sector and make them the bases for revising our curriculum for Psychology programs.

The diagram below shows the input-process-output flow of the proposed study. Input includes the background characteristics of the two groups of respondents – the SLSU Psychology graduates and their respective employers or

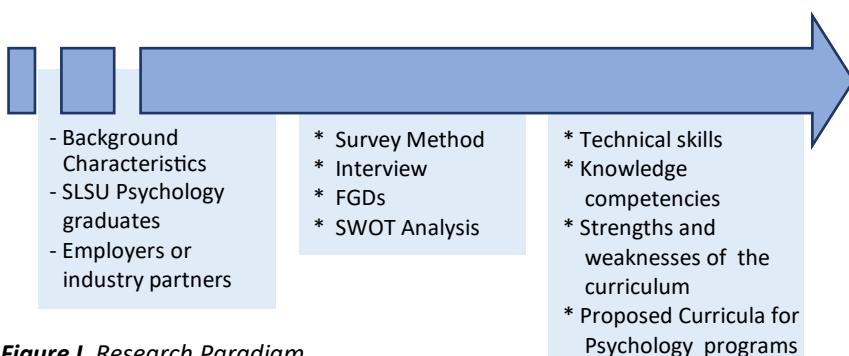


Figure I. Research Paradigm

industry partners. To come up with the expected outputs, the researcher considered the following process which comprises the methods of inquiry. A mixed-method or qualitative-quantitative method was employed in gathering data. This enabled triangulation and counterchecking of data. Moreover, the researcher compared the perceptions of the two groups of respondents. Analysis of data was done through statistical treatment of quantitative data and thematic analysis of the qualitative data. SWOT analysis was also performed relative to the curriculum for Bachelor of Arts in Psychology. All these procedures led to the ultimate goal of the study which is a curriculum for Psychology programs in SLSU that are responsive to the needs and demands of the work setting.

METHODS

Research Design and Data Source

The study employed quantitative and qualitative approaches using survey questionnaires and interview techniques. First, the researcher gathered information about the Psychology graduates of SLSU from the series of tracer studies conducted in the program. For purposes of delimitation, the researcher covered the

graduates from the program during the last decade from 2008 to 2017. There are about five hundred and fifty-one (551) Psychology graduates from SLSU during this period (Please see Table 1). The last batch of graduates (batch 2018) was not included in the target since it is presumed that they may not yet be landed on a job because they have just taken the board examination. Referring to the database, the researchers distributed the research instruments purposively to those who are currently employed in various Psychology-related work – educational, industrial, and clinical settings within CALABARZON only. The target was to reach out to all of them personally or via electronic means of communication. However, due to time constraints, the researchers were not able to cover 100% of the target respondents.

The Data Gathering Instruments

There are three sets of research instruments used in gathering data for this study. The first part is a self-made Survey Questionnaire that was designed to determine the background information of target respondents. There are 2 versions of this Survey Questionnaire: one is tailored for Psychology Alumni respondents while the other one is designed for Industry Partners or Employers of

our Psychology Graduates. The second set of questionnaires, Program Evaluation Instrument is designed for evaluating our Proposed Curriculum for Bachelor of Arts in terms of its relevance and responsiveness to the demands of industry. Attached to it is a sample of the said proposed revision of the curriculum. In the said questionnaire, respondents are free to give comments and suggestions. The last set of questionnaires, the Technical Skills and Competencies Questionnaire, was adapted from the list of core competencies in professional psychology from the International Association of Applied Psychology (IAAP) and the International Union

of Psychological Science (IUPsyS) and some were lifted from the program outcomes as indicated in CMO 34, Series of 2017, Policies ad Standards for Undergraduate Programs in Psychology. This is a rating scale designed to determine the skills and knowledge competencies needed in various settings of psychological practice. The last two sets of questionnaires are common for both groups of respondents.

The researchers traced the target two groups of respondents from March to May 2019. They ensured to have at least one employer or industry partner-respondent per company

Table I. SLSU Psychology graduates in various work setting

Year	No. of Graduates	Psychology Graduates Who are Working in Various Settings in CALABARZON		
		Clinical Setting	Educational Setting	Industrial Setting
2008	62	2	2	6
2009	51	1		8
2010	42		2	9
2011	40		3	6
2012	50		1	9
2013	56	1		7
2014	54		2	8
2015	64	3	2	10
2016	62	4	3	8
2017	70	4	6	13
TOTAL	55	15	21	84

where SLSU Psychology graduates work, regardless of their number. There had been hundreds of questionnaires distributed among respondents during the 3-month period as they traveled to and from the areas in CALABARZON – Batangas, Cavite, Laguna, Rizal, and Quezon. While each questionnaire is being retrieved, follow-up interviews and Focused Group Discussions (FGD) were requested from both groups of respondents. Some questionnaires were sent through google docs. Despite varied means of data gathering and continuous follow-ups, the retrieval of accomplished questionnaires was not made hundred percent for the alumni. On the other hand, most industry partners who participated in the study were from the participants of the Job Fair conducted by the university last May 2019.

Data Analysis

Quantitative data were analyzed with weighted mean and Mann-Whitney U Test of differences. Thematic analysis was employed for qualitative data which were gathered from interviews and FGDs. A SWOT analysis was also conducted to come up with an objective assessment of the existing curriculum and a proposed new curriculum for AB Psychology.

RESULTS

After gathering data, the researchers came up with the following findings which are presented in the following tables.

Background Characteristics of the Respondents

This study involved the participation of two groups of respondents: the SLSU Psychology Graduates and the Employers or Industry Partners. As per records from the Office of the University Registrar, there are 551 Psychology Graduates in SLSU from 2008 to 2017. Out of the 551, 120 or 21.77 % responded to the survey and participated in the FGD. Out of this number, the majority (84 or 70%) works in the industrial setting, 21 or 17.5% work in the educational setting and 15 or 12.5% works in the clinical setting. Out of 84 who work in the industrial setting, the majority (39 or 46.43%) are in the Human Resource Management Office, occupying the position as HR Manager, HR Supervisor, Recruitment Specialist or Officer, or Associate HR Officer, the rest are HR Office Staff.

On the part of industry partners, 44 industry partners participated in the research. The majority (40 or 91%) of these industry partners are private. Just the same, 31 or 70.45% of

industry partners respondents are occupying the positions as HR Manager, supervisor, recruitment officer or specialist, while the remaining 13 are holding higher positions such as Branch or Office Manager, Vice Presidents for Admin and Finance, VP for Academics, VP for Research and Development, Principal, and other middle-level managers.

Highly Relevant Technical Skills and Knowledge Competencies in Psychological Practice in CALABARZON

Table 2 presents the highly relevant technical skills and knowledge competencies needed in psychological practice in CALABARZON. All in all, there were forty (40) skills and competencies identified through the questionnaires. Two perspectives were considered: the perspective of industry partners or employers and the Psychology graduates or alumni who are currently engaged in psychological practice in the region. Only those with overall weighted mean equivalent to very relevant or very important were considered by the researchers. The top twelve in the list consists *Encourage good relations and motivations among personnel* ($W=2.82$); *Facilitate professional training and career development* ($W=2.72$); *Effectively communicating orally and in*

writing using both English and Filipino ($W=2.70$); and, *Recognize professional, social, and ethical responsibility* (both with WM=2.70); *Conduct interviews and communicate well with clients* (both with WM=2.67); *Develop selection procedures, performance appraisal techniques and curricula for training programs* ($W=2.66$); *Facilitate recruitment, assessment, and selection of personnel* ($W=2.64$); *Deal with complaints objectively* ($W=2.59$); *Establish and maintain rapport; Organize seminar workshops and training;* and, *Conduct job performance appraisal* (all with WM=2.59). Analyzing the data based on the cluster of competencies identified by the International Association of Applied Psychology (IAAP) and the International Union of Psychological Science (IUPsyS), the researchers found out that majority (21 or 52.5%) of the 40 identified competencies fall within Cluster A which consists of psychological knowledge and skills underpinning the core competencies, ten (25%) of the identified skills and competencies fall within Cluster C which consists of professional activities competencies and nine (22.5%) fall within Cluster B which consists of professional behavior competencies. This just points out that it is, indeed, fundamental for Psychology graduates to possess the necessary core knowledge and

skills for one's practice. It can be noticed that most of the identified skills and competencies are those expected in an industrial setting and only a few are related to the educational and clinical settings. This is explained by the nature of work of most respondents whose jobs are related to Human Resources Management, like being an HR officer. Thus, another significant finding of this research is the realization that the industrial setting is the most promising area of work for psychology graduates in CALABARZON.

Interviews and FGDs confirmed most of the findings that came out from the data gathered from the survey. The same psychological knowledge and skills underpinning the core competencies in psychological practice were also noted. However, some competencies were added like customer-focused skills, people skills, decision-making skills, time management skills, and the ability to deal with and handle different kinds of people. It appears that the ability to understand individual differences became salient in the interviews. It is interesting to note also that what topped on the list of identified competencies needed in the practice is good communication skills, both oral and written. This skill appeared in almost all interviews and FGDs. Other competencies needed in the

psychological practice which were identified based on the interviews and FGDs are professional behavior competencies that appeared to be connected to personality. Employers and industry partners expect psychology graduates to act professionally, have a continuous drive for achievement and a strong sense of integrity. It is equally important that Psychology graduates are good at multitasking, have good work ethics, have dedication and passion for work even with minimal supervision. Moreover, it is good if a Psychology graduate can work independently but also be a good team player and can work collaboratively. Certain characteristics like being sensitive to the needs of other people, adaptable or flexible, competitive perseverant/patient, responsible and hardworking, fast learner, goal-oriented, compliant, responsible, resourceful, self-confident, broad-minded, flexible, efficient, creative, disciplined, have initiative and trustworthy.

It appears that on top of psychological knowledge and skills and competencies, the work setting needs employees with professional behavior competencies and when we talk of professional behavior competencies, these are something connected to one's personality. This supports the contentions of advocates of emotional intelligence

Table II. Highly relevant technical skills and knowledge competencies needed in psychological practice

SKILLS & COMPETENCIES	ALUMNI		INDUSTRY PARTNERS		OVERALL	
	WM	QI	WM	QI	WM	QI
Conduct interviews	2.65	VR	2.73	VR	2.67	VR
Administer, score and interpret psychological tests	2.53	VR	2.48	VR	2.52	VR
Describe the details of a job and the tasks performed in their own words	2.49	VR	2.39	VR	2.46	VR
Supervise personnel	2.37	VR	2.55	VR	2.41	VR
Record the behaviors that are vital to the successful performance of job	2.40	VR	2.48	VR	2.42	VR
Develop selection procedures, performance appraisal techniques and curricula for training programs	2.67	VR	2.66	VR	2.66	VR
Conduct job performance appraisal	2.57	VR	2.66	VR	2.59	VR
Develop and initiate appropriate behavioral interventions	2.51	VR	2.32	VR	2.46	VR
Facilitate recruitment, assessment, and selection of personnel	2.61	VR	2.73	VR	2.64	VR
Encourage good relations and motivations among personnel	2.85	VR	2.75	VR	2.82	VR
Organize seminar workshops and trainings	2.63	VR	2.45	VR	2.59	VR
Gain commitment to review and evaluate outcomes	2.53	VR	2.36	VR	2.48	VR
Facilitate professional trainings and career development	2.75	VR	2.64	VR	2.72	VR
Design a psychologically healthy working environment	2.59	VR	2.52	VR	2.57	VR
Utilize systematic approach in gathering data to arrive at decision making	2.32	VR	2.34	VR	2.32	VR
Analyze and conceptualize problems	2.26	VR	2.50	VR	2.32	VR
Provide expert guidance or professional assistance in response to a client's needs	2.43	VR	2.48	VR	2.44	VR
Apply the principles of psychological evaluation and interventions as the need arise	2.30	VR	2.23	R	2.28	VR
Score and interpret psychological tests	2.42	VR	2.34	VR	2.40	VR
Communicate well with clients	2.78	VR	2.39	VR	2.67	VR
Meddle between parties in conflicts and settle disputes	2.29	VR	2.43	VR	2.33	VR
Assess human learning process	2.31	VR	2.59	VR	2.38	VR
Utilize information resources and technology relevant to work	2.32	VR	2.27	VR	2.30	VR

Engage in lifelong learning and understanding of the need to keep abreast of the developments in the specific field of practice	2.34	VR	2.30	VR	2.33	VR
Effectively communicate orally and in writing using both English & Filipino	2.73	VR	2.64	VR	2.70	VR
Work effectively & independently in multi-disciplinary & multicultural teams	2.52	VR	2.52	VR	2.52	VR
Recognize professional, social, and ethical responsibility	2.78	VR	2.48	VR	2.70	VR
Use computer tools and programs and other advance technologies for efficient performance of tasks	2.59	VR	2.36	VR	2.53	VR
Interpret data logically, accurately, and understandably	2.53	VR	2.43	VR	2.51	VR
Demonstrate and apply psychological theories and methods in personal and professional setting	2.42	VR	2.36	VR	2.40	VR
Demonstrate the ability to conduct psychological assessment and evaluation	2.38	VR	2.34	VR	2.37	VR
Exhibit competencies to support national, regional & local development plans	2.43	VR	2.27	VR	2.39	VR
Create harmonious interpersonal relationship with colleagues, clients, and others in diverse cultural setting	2.53	VR	2.27	VR	2.46	VR
Show professional & ethical behaviors in research and practice in psychology	2.48	VR	2.5	VR	2.48	VR
Demonstrate capability for self-reflection and independent learning in graduate education or in a professional context	2.23	VR	2.36	VR	2.27	VR
Apply basic skills in counseling and therapy	2.33	VR	2.34	VR	2.33	VR
Establish and maintain trust and respect in the professional relationship	2.58	VR	2.45	VR	2.54	VR
Establish and maintain rapport	2.68	VR	2.34	VR	2.59	VR
Manage crisis situation effectively	2.45	VR	2.41	VR	2.44	VR
Deal with complaints objectively	2.63	VR	2.50	VR	2.59	VR
Legend 1:	Legend 2					
VI/VR (2.26 - 3.0) Very Important/ Relevant/Always Needed	Black psychological knowledge & competencies					
I/R (1.51 - 2.25) Important/ Relevant/Often Needed	Blue professional behavior competencies					
MI/MR (0.76 - 1.5) Moderately Im- portant/Relevant/Sometimes Needed	Red professional activities competencies					
NI/NR (0 - 0.75) Not Important/Not Relevant						

like Daniel Goleman who emphasized the importance of EQ as an important determinant of success in the workplace. Indeed, it is not just knowing the "what's" and the "how's" of the physical aspect of the job but more importantly is how they deal with their superiors, co-workers,

subordinates, and clients since as a whole, the psychological practice involves dealing with people.

Analysis of the Assessment of Respondents on the Most Relevant Technical Skills and Competencies in Psychological Practice

Table III. Test of differences on responses

SKILLS AND COMPETENCIES	Mann-Whitney U	p-value
Directly observe employees (#5)	2135.50	0.044**
Facilitate programming and business processes (#10)	2147.50	0.051*
Develop and initiate appropriate behavioral interventions (#12)	2121.50	0.028**
Organize seminar workshops and trainings (#15)	2234.00	0.065*
Conduct researches (#19)	2173.50	0.059*
Conduct a Mental Status Examination (#22)	2055.00	0.022**
Analyze and conceptualize problems (#25)	2191.00	0.068*
Communicate well with clients (#30)	1888.50	0.000***
Assess human learning process (#32)	2032.00	0.012**
Recognize professional, social and ethical responsibility (#41)	2104.00	0.006***
Use computer tools & programs and other advance technologies for efficient performance of tasks (#42)	2214.00	0.063*
Create harmonious interpersonal relationship with colleagues, clients & others in diverse cultural setting (#48)	2194.00	0.058*
Establish and maintain rapport (#56)	2176.50	0.030**
Apply teaching principles in specific situations (#57)	1965.00	0.007***

***significant at 0.01 level of significance

** significant at 0.05 level of significance

*significant at 0.1 level of significance

To determine if there is a significant difference in the assessment of the two groups of respondents on the most relevant technical skills and competencies, the data was subjected to statistical tests. Table 3 presents the results of the test of difference on responses of the alumni and industry partners using the Mann-Whitney U. It revealed that the responses of the two groups of respondents did not significantly differ in 46 out of 60 skills and competencies. However, their responses significantly differed in fourteen items: #5 *Directly observe employees* ($p=0.044$), #10 *Facilitate programming and business processes* ($p=0.051$), #12 *Develop and initiate appropriate behavioral interventions* (0.028), #15 *Organize seminar workshops and trainings* (0.065), #19 *Conduct researches* ($p=0.059$), #22 *Conduct a Mental Status Examination* ($p=0.022$), #25 *Analyze and conceptualize problems* ($p=0.068$), #30 *Communicate well with clients* ($p=0.000$), #32 *Assess human learning process* ($p=0.012$), #41 *Recognize professional, social and ethical responsibility* ($p=0.006$), #42 *Use computer tools and programs and other advance technologies for efficient performance of tasks* ($p=0.063$), #48 *Create harmonious interpersonal relationship with colleagues, clients and others in diverse cultural settings* ($p=0.058$), #56 *Establish and maintain rapport*

($p=0.030$), and #57 *Apply teaching principles in specific situation* ($p=0.007$). This just indicates that there are skills and competencies which the alumni consider to be very important, but the industry partners think otherwise, or it is vice versa.

Relevance and Responsiveness of the Bachelor of Arts in Psychology Curriculum

Table 4 presents the curriculum evaluation of the two groups of respondents. With a mean rating of 2.16, the industry partners/employers consider that the proposed revision of the AB Psychology curriculum is ***relevant and responsive*** to the demands of the work setting. On the other hand, a mean rating of 2.47 on the part of the alumni means that they assess our new curriculum to be ***very much relevant and responsive*** to the needs of the industry. With the Mann-Whitney U Test value of 1057.5, it was found out that there is a significant difference between the curriculum evaluation of the Psychology graduates and the industry partners at 0.01 level of significance. Alumni significantly had higher ratings on the relevance and responsiveness of the Psychology curriculum than the industry partners/employers. Data from interviews and Focused Group Discussions shed light on these findings. As per interviews

Table IV. Curriculum evaluation of industry partners and psychology alumni

Respondents	Curriculum Evaluation WM	Qualitative Description	Mann-Whitney U	p-value
Industry partners	2.16	Relevant	10.57.50	0.00***
Alumni	2.47	Very Relevant		

with industry partners and employers, the researchers have noted a recurrent theme on the need to strengthen the background of our Psychology students on Human Resource Management. Companies accordingly expect Psychology graduates to be exposed to industrial settings, more specifically on HR systems, HR current updates (statutory benefits), and knowledge and experiences in recruitment and selection. Moreover, it is accordingly a plus point if a Psychology graduate can conduct Training Needs Analysis. They further suggested providing additional subjects like Advanced Industrial Psychology, Organizational Development, Training and Development, and a subject matter on Compensation and Benefits.

Both industry partners and alumni recommended that our psychology students be given management courses so that they may develop skills in management. The offering of the BS Psychology program was also highlighted during the interviews. The respondents also suggested the

offering of Behavioral Psychology or Behavioral Science and/or Social Psychology, and refresher or review courses in Theories of Personality, Industrial Psychology, Abnormal Psychology, and Psychological Assessment.

SWOT Analysis

The SWOT analysis is one of the best means to determine the overall strengths of the program and so to capitalize on them; to see the areas where the program needs improvement and so to reduce the chances of having non-conforming outputs; to maximize the magnified opportunities and to minimize the impact of impending threats. The following findings were based on the existing data as well as the data gathered from interviews and FGDs conducted by the researchers.

Industry partners and employers have positive evaluations and impressions of the Psychology graduates of SLSU. They accordingly possess the psychological knowledge and skills needed in performing their respective jobs, as well as

STRENGTHS
<ul style="list-style-type: none">• Adequate number of qualified and competent faculty in the Psychology program (4 PhD holders, 6 PhD candidates and 2 MA/MS holders)• Presence of a psychological services center• The new AB Psychology curriculum was already approved by CHED and SLSU BOR as of August 29, 2019.• AB Psychology is accredited Level III and is currently a candidate for Level IV accreditation• Adequate psychological testing materials
WEAKNESSES
<ul style="list-style-type: none">• Licensure performance needs further improvement• Needs enhancement in terms of Human Resource Management skills and competencies• Slow and weak establishment of international linkages and collaborations• Inadequate admission and retention policy• 3 or 25% of our Psychology faculty do not yet have appropriate licenses
OPPORTUNITIES
<ul style="list-style-type: none">• Big number of industry partners (44) in CALABARZON that accept and invite SLSU Psych graduates to join their respective companies• Majority of SLSU Psychology graduates (84 or 70% of the alumni respondents) work in the industrial setting and out of 84 who work in the industrial setting, majority, 39 or 46.43% are in the Human Resource Management Office, occupying the position as HR Manager, HR Supervisor, Recruitment Specialist or Officer, or Associate HR Officer, the rest are HR Office Staff.• Free tertiary education in SUCs• Psychology courses belong to CHED-priority programs• Psychology program is a popular course in the College of Arts and Sciences• Increasing demand for psychologists and psychometricians based on trend analysis by the PMHA• Established linkages with both local and national government and non-government agencies• Positive feedbacks from the industry partners on the quality of Psychology graduates in SLSU
THREATS
<ul style="list-style-type: none">• Presence of other equally attractive programs in SLSU• Offering of the same program in all SUCs in CALABARZON• Impact of ASEAN integration and other threats of internationalization• Shift to Industry 4.0

notable professional behavior competencies like being competent, focused, efficient, and effective, dependable, trustworthy, and hardworking. The graduates accordingly have a strong sense of work ethics, are teachable, goal-oriented, creative, and are easy to get along with.

Given these impressions, the researchers were confused whether these are strengths of the program or are these opportunities that we need to capitalize on. Are the positive traits noted among Psychology graduates of SLSU products of individual upbringing or are those cultural values and orientations that our students caught as they were still studying in SLSU? In this case, the researchers would like to dig deeper into this possibility because if this will be validated as a strength of the program, it is something that the institution must work on and sustain.

CONCLUSION AND RECOMMENDATIONS

Based on the findings, it was concluded that the skills and competencies being developed in the AB Psychology curriculum of Southern Luzon State University are highly relevant and responsive to the needs of the industry. Moreover, the proposed revision of

curriculum for AB Psychology is relevant although alumni rate its relevance to be significantly higher than the ratings of the industry partners. Psychological knowledge and skills competencies are among the top competencies needed in psychological practice based on the perception of both groups of respondents. However, it is worthy to emphasize that based on interviews and FGDs, there appears to be special weight given to professional behavior competencies on top of the psychological knowledge and skills.

Based on the findings and conclusions, the following are recommended:

For Future Researchers:

1. Conduct a study on the cultural and work values formation of Psychology students over the four years of stay in the program;
2. A further study on the same area may consider preparing different questionnaires per work setting or area of specialization and increase the number of respondents;

For the SLSU Administration:

3. Continuous support to the Psychology program through the provision of identified

- needs and requirements for further enhancement of the program;
4. Implement the currently approved curriculum effective AY 2019-2020;

For the Psychology Program

Faculty and Staff:

5. Preparation of feasibility studies for the recommended offering of Bachelor of Science in Psychology;
6. Additional subjects to the existing curriculum, e.g. Strategic Human Resource Management, Advanced Industrial Psychology, and Integrative Course in Psychology to ensure that all Psychology graduates in SLSU shall be able to pass the Board Exam;
7. Enhance the On-the-Job Training experiences of the students by increasing the number of hours for OJT in the three practicum sites – educational, clinical, and industrial;
8. Include Management Training in the course syllabus in Human Resource Management; and,
9. Address the issues identified in the SWOT analysis

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Production practices of Cacao (*Theobroma cacao*) Farmers in the Fourth District of Quezon, Philippines

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ABSTRACT

Cacao (*Theobroma cacao*) production is a potentially good source of income for farmers. It is the sole base material for chocolate and ingredient to various products. Global demand is expected to increase from 4.7 to 5 million MT and global supply will be at a deficit of one million MT by the year 2020. CALABARZON produces cacao but is the lowest (0.38%) among all the regions in the country. Among the provinces in CALABARZON Quezon is the highest in terms of area planted, the total number of cacao trees, and number of cacao-bearing trees but is behind Cavite in terms of yield per hectare. Of the 553,152 cacao trees in Quezon 251,170 are in the fourth district. Management practices from planting to harvesting affect productivity among other factors. A survey was conducted among the 10 municipalities in the district where 205 cacao farmers were randomly selected as respondents. Common production practices of cacao farmers include mulching, replanting, and pruning. Quezon is widely planted to coconut thus cacao is commonly intercropped with the coconut trees. The average harvest of cacao among the 10 municipalities is four (4) pods per tree per year. Only Alabat has a respondent with 30 pods per tree per year harvest. Harvesting is generally done by cutting to avoid damaging the flower cushion. Most respondents (73.00%) who have knowledge of GAP on cacao rarely adopt the practices. Improvement of the production practices is necessary to have sustainable production and contribute to the country's target production of 100,000 MT by the year 2020.

Keywords - Cacao farmers, Cacao production, Quezon province

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INTRODUCTION

Cacao (*Theobroma cacao*) is a billion-dollar industry suitable to different production systems: monocrop, intercrop, or agroforestry. Various products can be utilized from cacao. It is the sole and base raw material of chocolate and is incorporated in different types of food, beverage, cosmetics, and pharmaceuticals. Locally, it is processed into *tablea*, which are fermented pure (100%) cacao beans roasted, ground, and molded into discs, blocks, balls, discs, or tablets. It is used to make hot chocolate beverages using a wooden mixing implement or stirrer. Around 2,000 MT of cacao is estimated to be processed into *tablea*. (Cacao Industry Development Association of Mindanao).

The Philippines primarily exports cocoa products to the United States of America (USA) and some European countries but remains a net importer. Average cacao consumption is 50,000 metric tons (MT) but the production is only 10,000 MT annually (Department of Agriculture). This gave rise to the Philippine Cacao Challenge which aims to produce 100,000 MT by the year 2020. Meanwhile, global demand is expected to reach between 4.7M to 5M metric tons (MT) and global supply will be at a

deficit of one million MT. This prompted the government to emphasize on cacao production, thus including it in the High-Value Commercial Crops Development Program (HVCDP).

CALABARZON produces cacao but has the lowest production among all regions in the country. It comprised only 0.38% of the total production or 13.86 MT of which 5.44 MT came from Quezon. Though Quezon is the highest in terms of area planted, the total number of cacao trees, and cacao-bearing trees in the region, it is behind Cavite (7.54 MT) because of low yield per hectare (Quezon Cacao Value Chain Analysis, 2015). Based on Good Agricultural Practices (GAP), cacao yield is low if the production per unit area is 200-700 kg/ha and the farmers will not benefit from growing this crop (Asare & David, 2011). Davao region which has the largest contribution (79.00%) on the total production has a production per unit of 590 kg/ha (DA-Mindanao Regions, 2014). Quezon produces only an average yield of 29 kg/ha (Quezon Cacao Value Chain Analysis, 2015).

Management practices from planting to harvesting affect productivity among other factors. In the four major cocoa-producing countries (Côte d'Ivoire, Ghana, Nigeria, Cameroon) in West Africa,

the identified factors causing low yield in the cocoa production were low input use, inadequate maintenance, and pest and disease control, poor shade management, little or no fertilizer use and old age of cocoa farms (Wessel, Marius, and Quist-Wessel, Foluke, 2015). Meanwhile, Asare and David cited that low productivity can be attributed to small farm size due to fragmentation, old age of trees, widespread planting of traditional varieties, use of planting materials of poor genetic quality, poor farm management practices, and environmental and other socio-economic factors (2011).

In Quezon province, there are 553,152 cacao trees planted. The fourth district has the greatest number of cacao trees with 251,170 (OPA 2017). A need to study the production practices is necessary to improve the yield and contribute significantly to the country's target of 100,000 MT production by the year 2020.

OBJECTIVES

The main objective of this study is to determine the effect of farming practices on the productivity of cacao. Specifically, it aims to:

1. Determine the common practices applied in cacao

- from land preparation to harvesting;
- 2. Determine the common farming system in planting cacao (monocrop, intercrop, etc.);
- 3. Determine the average number of pods harvested per year per tree; and,
- 4. Compare the farmers' practices and Good Agricultural Practices (GAP) in cacao and its effect on productivity.

METHODS

Quezon Province is the sixth-largest province in the Philippines located in the CALABARZON region. Its boundaries extend as far as the province of Aurora in the North and Camarines Norte in the South. The topography of Quezon is characterized by rugged terrain with few plains, valleys, and swamps that permit prime agricultural activities. It has well-drained narrow strips of undulating lowland along the coast and river valley available for growing crops. The average width of the province is about thirty (30) kilometers with a slope ranging from 0-3% slopes and above (<http://calabarzon.dilg.gov.ph/134-old-lqus/old-quezon-lqus/643-provinceofquezon>).

The study was conducted in the fourth district of Quezon

province. Respondents were randomly selected from the 10 municipalities: Atimonan, Alabat, Perez, Quezon, Plaridel, Gumaca,

Lopez, Calauag, Guinayangan and Tagkawayan. A total of 205 cacao farmers represented the cacao farmers in the district.

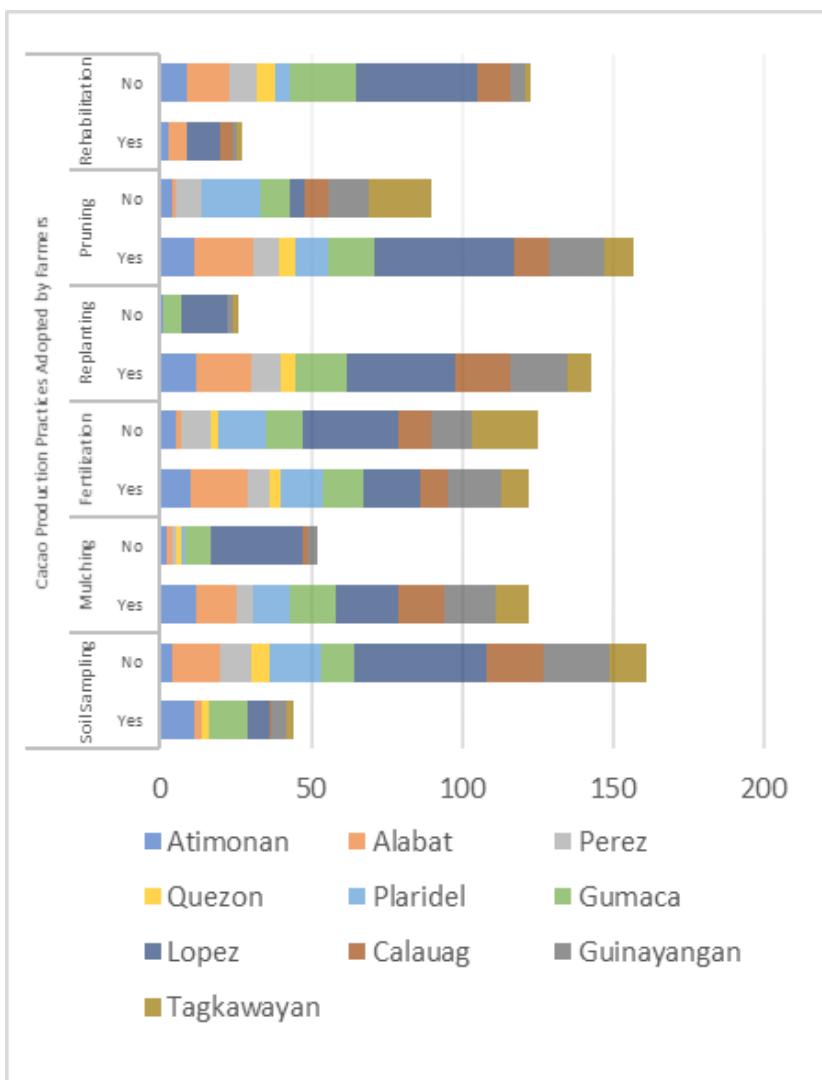


Figure I. Distribution of the respondents adopting cacao production practices

Focus group discussion was used to gather the members of the cacao growers' association through collaboration with the local government units (LGUs). An initial interview was conducted to determine and classify farmers (within selected municipalities) in Quezon through key informant interview (KII) with the help of the Office of the Municipal Agriculturist (OMA). A survey sheet or questionnaire was the main tool of the study which was pre-validated by cacao growers in other municipalities. The farmers were called for a meeting to assess the farmer's knowledge of recommended practices on cacao production.

Request for the conduct of the interview was secured from the local government of the 10 municipalities and the district office.

RESULTS AND DISCUSSION

The findings on the production practices of cacao growers in the fourth district of Quezon are presented in this section.

Primary determinants of the growth and yield potential of cocoa are management factors, soil, climate, and the availability of nutrients for growth and yield.

Soil sampling is not practiced by most of the respondents (78.54%) before planting or fertilization. Among the 10 municipalities in the fourth district of Quezon, Gumaca contributes the highest percentage (30%) with Perez and Quezon as the lowest (0%).

Soil analysis is very important in crop production to optimize yield and minimize the cost of inputs. The usual practice of fertilizer application without soil analysis may lead to an insufficient or excess amount of fertilizer which can contaminate soil due to runoff and leaching. Determination of soil pH is also important as it can affect nutrient availability. As cited in *Nutrition aspects and fertilizer recommendations on cacao (*Theobroma cacao*)* cacao can grow both in acid and alkaline soil (pH 5.0-7.5) but pH \leq 4.0 and pH \geq 8.0 must be avoided. Cacao can tolerate acid soil, but the nutrient content must be high enough and should have high organic matter (3.5%) in the top 15 cm of soil.

Though fertilization is mentioned by the respondent as one of the best practices, without soil analysis it can contribute to high cost and sometimes can be ineffective.

Mulching is practiced by most of the respondents (70.11%).

Water is commonly the problem in the fourth district according to the cacao farmers. Mulching aids in moisture conservation and aids in weed control.

Moisture is the usual limiting factor for plant growth in the tropics (Tibanyeda, C.G.B.). Soil moisture status is enhanced with mulching through improved infiltration and reduction in evaporation, the former being more beneficial than the latter (Webster and Wilson (1971) Mulched soil has lower average temperatures and a restricted diurnal temperature range reducing losses due to evapotranspiration.

Fertilizer application is practiced by 49.39% of the respondents. Fertilizers applied can either be organic, synthetic, or both. Fertilization is done but according to the respondents most of the time it is insufficient because of the cost of fertilizer and usually, fertilization is not based on soil analysis (Figure 1).

In a study *Cocoa production in West Africa, a review and analysis of recent developments*, Wessel, M. and Quist-Wessel, F. cited that yield of mature cocoa can be increased by 50% and more in on-farm trials in the Ashanti region in Ghana where the environment and management are not the main

yields limiting factors. The high response was obtained under favorable conditions in on-farm trials in Côte d'Ivoire where the average yield was increased from 600 to 1000 kg per hectare in the period of 2005-2009. This was on sites of the International Institute of Tropical Agriculture (IITA) Sustainable Tree Crop Program with an almost complete stand of 20–30-year-old trees and with good maintenance and integrated pest and disease control (2015).

Therefore, the application of fertilizers does not guarantee an increase in yield. Several factors must be considered. First, it should be based on the result of soil analysis. Also, it must be considered that cacao responds well to fertilization provided that the management factors, soil, and climatic conditions are favorable for good growth and yield and if the soils cannot supply the nutrients required on time (Applied Agricultural Resources Sdn. Bhd.).

Replanting is generally done by 84.62% of the respondents to maintain the population of cacao on their farms. Part of the program of the local government is the distribution of cacao seedlings which makes replanting possible. According to the respondents, replanting is based on the availability of planting materials. If the local government did not provide

planting materials, they do not have other sources and will not be able to replace the lost or unhealthy plants.

Pruning is practiced by 64.00% of the respondents. It is done mainly for maintenance and pest and disease management.

In a study in Tamil Nadu in India, medium pruning (20%) recorded the highest number of pods per tree than light pruning (10%) (Uchoi, Anok *et al.*, 2018). Higher yields might have been induced by pruning which rejuvenated the tree after it has regrown and attained the optimal height and crown shape (Nair *et al.*, 1994; Rouse *et al.*, 2017). Pruning allows efficient harvest and management (Riedel, Judith *et al.*, 2018).

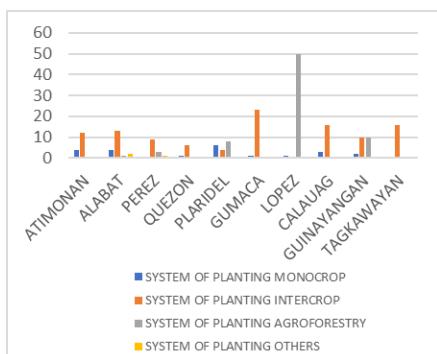


Figure II. Cropping system adopted by cacao farmers in the fourth district of Quezon: monocrop, intercrop, agro-forestry, and other system of cacao production

Rehabilitation is practiced by only 18.00% of the respondents. Most of the respondents have younger trees and old trees were not usually rehabilitated. It is not a common practice of most cacao farmers to rehabilitate cacao trees.

One of the main causes of low yields is the old age of cocoa trees and rehabilitation is one way to deal with this problem (Wessel, M. and Quist-Wessel, F.).

Cacao is suitable for different production systems: monocrop, intercrop, or agroforestry.

Intercropping is practiced by 53.00% of the respondents, agroforestry by 36.00% while monocropping is only 11.00%. Quezon is planted with coconuts and cacao is commonly intercropped along with them.

In a study in West Africa, particularly in Bolivia and Côte d'Ivoire, cocoa yields were 12–46 % higher in agroforestry systems compared to monocultures. Farmers in Bolivia and Côte d'Ivoire observed more soil-related problems and incidences of pests and diseases in monocultures than in agroforestry systems (Andres, Christian *et al.*, 2016)

Meanwhile, a study of cocoa agroforestry in Ghana as cited by Marius Wessel and Foluke

Quist-Wessel (2015), confirmed the sustainability of agroforestry system. Over a very long period, yields of 500 kg were maintained with a medium shade of 10-15 trees per hectare.

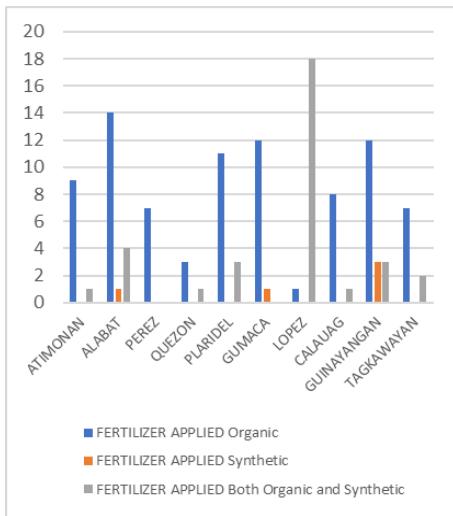


Figure III. Type of fertilizer applied in cacao production

Fertilization is practiced by only 49.39% of the respondents (Figure I). The majority (68.85%) of them uses fertilizer from organic source and only 4.10% use synthetic fertilizer because of its high cost. Meanwhile, 27.05% apply both organic and inorganic fertilizer to augment the soil nutrients. Though cacao farmers apply fertilizer, they admit that the amount is not usually enough because of a lack of capital. Also, because soil sampling is not practiced by the majority (Figure I),

it cannot be determined if the amount that is applied is sufficient to attain the potential yield of cacao.

According to the cacao specialist in the district, organic fertilizer is more efficient than synthetic fertilizer. It was mentioned that if synthetic fertilizer is continually used, is believed that after 10 years, production will decline. Continuous use of organic fertilizer will increase production in the long run.

Method of Harvesting Cacao Pods

Pods are suitable for harvest for 3 to 4 weeks, after which time

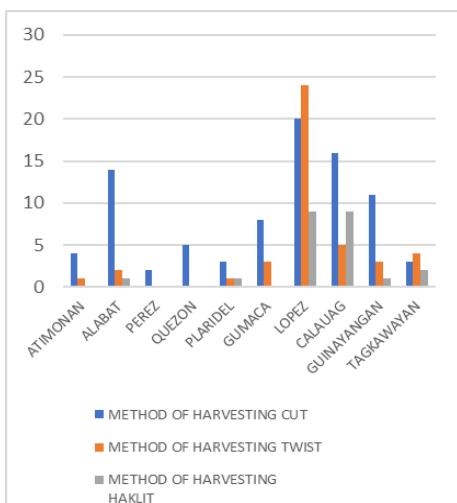


Figure IV. Distribution of cacao farmers harvesting cacao pods by cutting, twisting and haklit system

the beans begin to germinate. Cacao pods must be harvested at regular intervals because pods do not all ripen at the same time. Harvesting frequency might affect the yield.

Most of the respondents in the 10 municipalities of the fourth district harvest cacao pods by cutting.

Pods should be cut with a clean cut through the stalk with a well-sharpened blade. The flower cushion should not be damaged because it will produce the flowers and fruits of subsequent harvests. Trees should also be damaged to avoid parasitic fungi from penetrating the tissues of the tree (ICCO, 1998).

Most of the respondents from the 10 municipalities have a yield of below 5 cacao pods per tree per year. Only a respondent in Plaridel responded with 50 pods per tree annual production. Cacao trees on average will yield 20 to 30 pods per tree per year containing 20 to 40 beans (Rainforest alliance) depending on the management practices, soil and climatic factors, pest and disease management, and age of trees.

Based on cacao GAP, 1,111 trees can produce 1,000 kg dried beans, equivalent to 0.90kg/tree per year. Quezon Cacao Value Chain Analysis (2015) reported that Quezon produces 29 kg dried beans per 197 trees or 0.14 kg/tree/year. Result gave 49.43% of the respondents harvest only four (4) pods per tree annually. If the average number of pods to produce one (1) kilogram of dried beans is 25, then four pods will give 0.16 kilogram of dried beans per tree annually.

Meanwhile, the cacao specialist of the district claimed that they have recorded an average of 23 pods per tree per year within two (2) years on the first harvest following the proper practices in cacao production. Average of 38 and 70 pods were recorded on the second and third fruiting respectively. This is attained with strict monitoring of

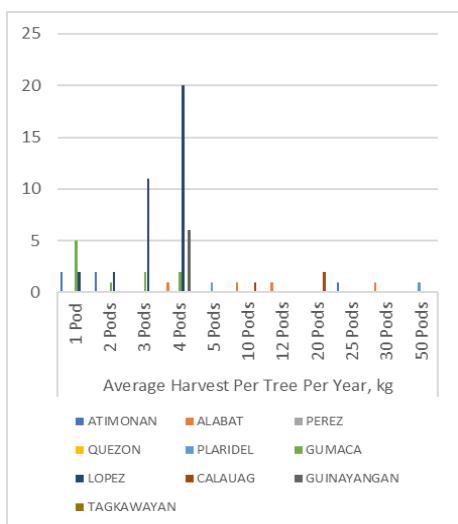


Figure V. Average yield of cacao per tree per year of the respondents

the activities of their cacao farmer-beneficiaries.

It was also mentioned that best practices include the application of organic fertilizer. Basal fertilization is done by the application of two (2) kilograms of vermicompost. After three (3) months, another two (2) kilograms are applied and another three (3) kilograms after three (3) months again. When the cacao trees are already at their productive stage, five (5) kilograms of vermicompost is applied as a side dressing. Every three months, it is practiced applying fully organic fertilizer such as vermicompost and then supplemented with foliar fertilizer every 15 days.

Improvement of production practices will help improve the yield of cacao especially at this stage where most the municipalities have younger trees. Therefore, training along with close monitoring is necessary to guide the cacao farmers to attain the maximum potential yield.

Sanitation is practiced by the respondents for pest and disease management. One way of sanitation is by pruning (Figure 1). The use of pesticides is practiced by only 22.00% of the respondents because as much as possible they do not want to use chemicals on their cacao farms.

Pruning and sanitation were mentioned by the cacao specialist in the area as one of the best practices in pest and disease management. Sanitation is very important to avoid rodent infestation. Sanitation harvesting is done to remove damaged or diseased pods. Cacao pod rot is minimized by pruning as it facilitates proper air circulation. It also removes diseased or damaged parts of the cacao tree.

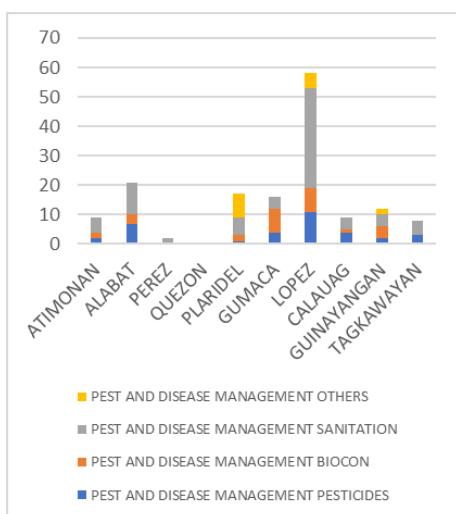


Figure VI. Pest and disease management practiced by the respondents

The Good Agricultural Practices (GAP) for cacao has been presented in the 40th AMAF in 2011 at Hanoi, Vietnam. These include site history management for a new establishment, planting materials, soils and substrates, fertilizers

and soil additives, water, pest and disease management, pesticides - synthetic and biopesticides, harvesting and handling procedures, waste and energy efficiency, diversity and transportation, and record-keeping.

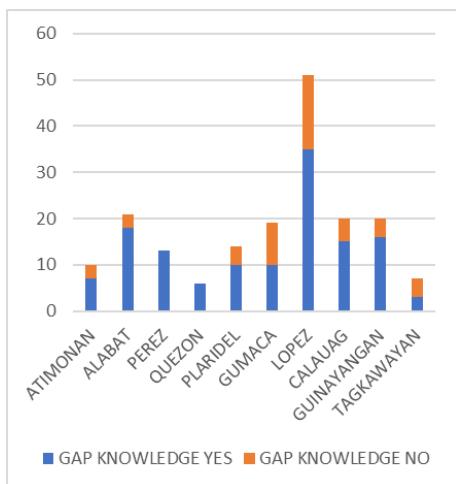


Figure VII. Distribution of farmers with knowledge on GAP for cacao

Most of the respondents (73.00%) are knowledgeable on GAP for cacao but the level of adoption is very low. Figure I reflects the common production practices adopted by the cacao farmers. Record-keeping is not commonly practiced the reason why data collection is hard, and respondents answered with only estimates.

Farmers know the proper production practices of cacao

(Figure VI) but only a few are adopted because of some factors. Most farmers do not know where to bring soil samples for analysis. Also, lack of capital leads to insufficient fertilization.

Strict monitoring of the activities of the cacao farmer is necessary to ensure that proper production management practices are applied. There is a high potential for reaching the optimum yield as reflected on the data of the district office. Strengthened support by the local government unit in terms of linkage, provision of quality planting materials, and fertilizer subsidy will help boost the income of the cacao farmers and help in attaining the target yield of the country of 100,000 MT by the year 2020.

SUMMARY AND CONCLUSION

The recommended practices followed are mostly replanting and pruning since these do not require a high cost of inputs. Seedlings are provided by the government as part of the program enhancement in cacao productivity. Pruning can be done easily with proper training.

Quezon is planted to coconuts; thus, cacao is commonly intercropped. The spaces under coconut trees are commonly

utilized for cacao production. Only a few respondents practice the monocropping system.

The average yield per cacao tree is four (4) pods annually which is below the minimum yield of around 30 pods if good agricultural practices are applied.

Most of the respondents claimed that they have knowledge of cacao GAP but only a few of the recommended practices are adopted because of various factors.

RECOMMENDATION

Strengthening monitoring and support of the local government is necessary to ensure that good agricultural practices are applied in cacao production to reach the optimum yield. A system for the provision of subsidies can be devised. For instance, the subsidy will be given to those who strictly apply good agricultural practices in cacao production. This will encourage farmers to do better, and this can be achieved with strict monitoring to continually guide them.

The establishment of a demo farm is necessary. This will be the show window to the farmers that if good agricultural practices are applied, optimum potential yield

can be realized.

Fertilizer subsidy along with distribution of quality planting materials is important in the cacao productivity enhancement program. Farmers can also be trained in the production of organic fertilizers using locally available materials. This will ease the burden caused by the high cost of fertilizers. Also, the continuous application of organic fertilizer helps maintain the quality of the soil.

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Climate Risk Vulnerability Assessment and Suitability Analysis of Various Crops in San Andres, Quezon

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ABSTRACT

Millions of people around the world depend on agriculture for food and livelihoods. The advent of climate change is threatening this sector. With its high reliance on climate and weather, agriculture is considered the most exposed sector to climate change. Likewise, farmers/fisherfolks are found to have a low ability to adapt to the changing climatic condition. Their poor adaptability of the agricultural sector was also associated with the socio-economic condition of the people, which were found to be poorer compared with those in the industrial sector. In line with this, the Philippine government through the Bureau of Agricultural Research of the Department of Agriculture implemented the Adaptation and Mitigation in Agriculture (AMIA) program that seeks to plan and implement strategies to support local communities in managing climate hazards from long-term climatic changes and extreme weather occurrences through the provision of decision support tools. Taking off from the AMIA Phase 2 framework, SLSU was commissioned to assess the risk and vulnerability of their agricultural sector of hazard-prone municipalities in Quezon Province to climate-related hazards. Using the same methodology, this study was performed to determine the vulnerable areas and crops in San Andres, Quezon which is one of the most vulnerable towns in the province. With the aid of geographic information system software (ArcGIS/QGIS),

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the geospatial analysis was utilized in identifying communities or barangays that will be affected by increased temperature and decreased precipitation during climate change. Among the seven (7) barangays, the study found out that barangay Alibijaban was the most vulnerable. In terms of priority agricultural crops in the municipality, it was found out that bananas will be affected the most. Research results can be used as input for science-based planning in agriculture communities to sustain food production amidst climate change.

Keywords - Climate-Risks, Vulnerability Assessment, Suitability Analysis, San Andres, Quezon

INTRODUCTION

According to World Bank in 2015, as cited by Paquit, *et al.*, in 2018, agriculture plays an important role in the Philippine economy as it provides employment for 1/3 of all the employed populace and contributed 13% to its gross domestic products.

Agricultural sector can be observed in the entire country even in a highly industrialized region like the CALABARZON region. Among the provinces in the region, Quezon is considered the food basket in the region in terms of production in different agricultural commodities of the region such as *palay* (42%), corn (75%), fruits (26%), coconut (86%) and vegetables (62%). This can be attributed to its agricultural land

area with 112.2 thousand farms, covering 341.4 thousand hectares of the entire CALABARZON Region land area (PSA, 2015). However, climate change has begun to impact the agricultural landscape. It threatens agriculture production's stability and productivity through shifting production season, increased pest and disease occurrence, and modification of viable and feasible crops affecting its yield and market price, and the income and livelihood of farmers (Rudinas, Godilano, & Ilaga, 2013). The increasing temperature, irregular precipitation, droughts, floods, typhoon are the most important issues associated with climate change. These are the major threats for crops especially in high which affect not only Quezon province but also the entire country.

In response, the national government through the Department of Agriculture established a national program, the Adaptation and Mitigation in Agriculture (AMIA), which aims to mitigate and adapt the impacts of changing climate to the agriculture sector in the country. One part of the program is to support local communities in managing climate risks and prepare the agricultural sector to become more resilient and sustain food security within the broader food system/value chain setting through climate risk vulnerability assessment of CRVA and prioritization of CRA practices. Oppenheimer *et al.* in 2014 as cited by Parker (2019) believed that vulnerability assessment is developed to provide a decision tool that can guide decision and policy-makers in creating objective decisions and guide them in formulation for adaptation planning amidst climate change.

In 2016-2017, SLSU conducted a climate risk vulnerability assessment for Quezon province to identify which municipalities and agricultural crops were vulnerable to changing climate. Information gathered from this study can provide empirical information that can be useful in establishing a science-based adaptation planning for the agriculture sector in Quezon

province. Gutierrez, Colladilla, Montero & Villasanta (2017) found out that most of the vulnerable municipalities in Quezon can be found in the 3rd congressional district of which the municipality of San Andres, Quezon belongs. This municipality has highly sensitive crops with moderate adaptive capacity due to the poor economic, human, social, and physical capital leading to its very high vulnerability index. Changing climatic conditions affects not only the agricultural yield and production but also the incomes of the farmers.

In support, this study was conducted to come up with a more localized result of the CRVA and crops sensitivity/suitability analysis at the municipal level to provide a science-based decision planning tool to agricultural and rural development using geospatial analysis.

MATERIALS AND METHODS

To come up with the vulnerability assessment of the municipality of San Andres, Quezon to climate risks, this study adopted the framework used by the International Center for Tropical Agriculture, as used in the climate risk vulnerability assessment of the Province of Quezon (see formula below). Two (2) layers of analysis, geographical assessment, and

suitability analysis were done to accomplish the study objectives. Primary data, collected through focus group discussion, workshops, and key informant interviews, and secondary data were gathered. Using the ArcGIS software, gathered data were encoded and processed to produce maps and quantitative indices employed in the analysis.

$$f(Haz, Sens, AC) = \sum_{n=1}^N 1/2((Haz(w_h) + Sens_i(w_s)) + AC(w_a))$$

Where: *haz* = hazard index, *Sens* = sensitivity index, and *AC* adaptive capacity index. *Wh* = weight given for hazard, *Ws* = weight given for sensitivity, and *Wa* = weight given for adaptive capacity

Component 1 - Geospatial assessment of climate risks

1. Climate-risk exposure

Climate-risk exposure or climate-related hazards data were processed from secondary information/historical records of the municipality and narratives of the FGD participants as a reference in predicting climate-related hazards to represent the future climate scenarios. Using a standard instrument adopted from the International Center for Tropical Agriculture (CIAT), the climate-related hazards collected data include tropical cyclones, sea-level rise, storm surge, soil erosion, landslide, drought, flooding, and salt-water intrusion.

Experts from the study site (i.e., Municipal Agriculturist, Agricultural Technician, and farmers) were invited to workshops and focus group discussions to determine the climate-related hazards experienced in the locality. Each participant in the FGD was asked to rate the identified hazard using the standard form based on their knowledge and experience. The hazards identified were validated from the secondary data sources such as reports from Philippine Atmospheric, Geophysical and Astronomical Services Administration (DOST-PAGASA), Provincial and Municipal Disaster Risk Reduction and Management Office (DRRMO), and the Municipal Agriculture Office (MAO). Ratings of the hazards were normalized using geographic information system (GIS) Software (i.e., ARCGIS), from zero (Low) to one (High). The result of multi-hazard indices was the summation of all hazards. Then, five equal breaks categories were used arbitrarily with the following indices: 0-0.20 (Very Low), 0.20-0.40 (Mw), 0.40-0.60 (Moderate), 0.60-0.80 (High), and 0.80-1.00 (Very High) to denote the hazard indices in the municipality. Processed climate-risk exposure data were used to determine the future climate scenarios of the municipality in the year 2050.

2. Sensitivity Analysis

The project team conducted several focus group discussions to collect crop occurrences data from different stakeholders. The use of the fish net method, as adopted from the CIAT led regional CRVA research project, was utilized to determine the crop occurrences in the San Andres, Quezon. Crops considered in this study were *ubi* (*Dioscorea alata*), coconut (*Cocos nucifera*), banana (*Musa acuminata*), and corn (*Zea mays*). These crops were identified by the Municipal Agriculture Office of San Andres, Quezon as the primary crops in the municipality.

The agriculture experts, practitioners, farmers, barangay officials, and stakeholders from the municipality provided inputs using the baseline maps prepared by the project team for this project. Maps with basic references such as the river, roads, barangay, and administrative boundary were used. The fishnet method of 1km cell size was used to pinpoint the specific crop occurrence in a barangay of the municipality. Furthermore, all points were referenced and converted to excel format and save as comma-delimited (*.csv) files. Under these heading is the crop, exact locations point (easting & northings) that were used as inputs to run the

Maximum Entropy Modeling (MaxEnt Model). MaxEnt Model was used to predict the crops' sensitivity in the future states, which in this project considered the 2050 scenario of the study site.

3. Adaptive Capacity

Dataset used to come up with the adaptive capacity index of the municipalities in the province came from the following institutions; 1) Competitive Council of the Philippines (NCCP), 2) Philippine Statistics Authority (PSA), 3) National Mapping and Resource Information Authority of the Department of Environment and Natural Resources (NAMRIA), 4) Quezon Provincial Development and Physical Framework Plan CY 2015-2020, and 5) San Andres, Quezon Socio-Economic, Demographic, Comprehensive Land Use Plan and other pertinent information. Thirty-two (32) indicators for adaptive capacity (AC) capital were cross-checked and more variables were included to complete the representation of the other AC capitals. AC capitals include natural, human, social, economic, institutional, anticipatory, and physical indices of these capitals were determined using the data from the various indicators per capital as stated in Table I.

Table I. Attribute Capital Indicators used to determine the adaptive capacity

Attribute Capital	Indicators
Economic Capital	<ul style="list-style-type: none"> ● Potable water ● Sanitary toilet ● Households have electricity ● Access to credit ● Agricultural insurance ● Employment in Agriculture
Natural Capital	<ul style="list-style-type: none"> ● Soil Organic Matter ● Supporting Ecosystems and their Health ● Groundwater availability ● Reliable water for irrigation
Social Capital	<ul style="list-style-type: none"> ● Existence of farmer's groups or unions ● Participation/Activity of farmer's groups or unions ● Equity of women and men in decision making
Physical Capital	<ul style="list-style-type: none"> ● Farm Size/ HA ● Access to irrigation infrastructure ● Access to post-harvest infrastructure ● Access to quality seeds ● Access fertilizer and pesticides ● Reliable Infrastructure
Institutional Capital	<ul style="list-style-type: none"> ● Effective Gov't and Change ● Adequate gov't response to previous shocks ● Farmers visited by or consulted with agricultural officer
Human Capital	<ul style="list-style-type: none"> ● Literacy rate ● Quality of education in local schools/ Teacher-Students Ratio ● Health centers/ Public health Facilities ● Health workers/ Public Doctors ● Public Health Facilities ● Number of Public Doctors
Anticipatory Capital	<ul style="list-style-type: none"> ● Farmer/Fisher Awareness of climate change and local impacts ● Disaster Preparedness Committee ● Existing Early Warning System ● Access to early warning information ● Access to communication technology

Participants of focus group discussions composed of barangay officials and farmers from seven (7) barangays of San Andres, Quezon together with the Municipal Agriculturist and Agricultural Technicians. They were grouped with their respective barangays and asked to rank each of the indicators per AC Capitals according to importance. Each group discussed and decided on a common value/rate for each indicator. They were provided with 1-5 scores/rates, where 5 is the highest/most important. Overall weights for "Sensitivity (15%)", "Hazards (15%)", and "Adaptive Capacity (70%)" were also identified by the experts during the workshop. The values of the 32 indicators were integrated into the shapefile with municipal and barangay boundaries. Each of the indicators was normalized and was treated with equal weights. The sum of the 32 indicators provided the adaptive capacity index. Five equal breaks were arbitrarily used with 0-0.20 (Very Low), 0.20-0.40 (Low), 0.40-0.60 (Moderate), 0.60-0.80 (High), and 0.80 -1.00 (Very High) to differentiate the indices of AC Capitals of different barangays of San Andres, Quezon.

Component 2 - Suitable areas for crop production amidst changing climatic conditions

Upon producing crop occurrence maps, the data were used to operationalize the Maximum Entropy (MaxEnt) Model to predict the sensitivity of the identified priority crops of the study sites by the year 2050. The outputs of sensitivity analysis were used to determine the crop suitability of the municipality particularly the crop suitable for respective barangays. The average (.avg) data per crop from Baseline Year 2018 and future scenario in the year 2050 served as basis in the analysis of the suitability of priority crops using the ArcGIS Software.

RESULTS AND DISCUSSION

Hazard Exposure or Climate Risks of Barangays in San Andres, Quezon

Figure 1 show the hazards exposure map of barangays in San Andres, Quezon, while Table 2 shows the list of Barangays and its corresponding hazard index. Results show that most of the Barangays in San Andres, Quezon is less exposed to hazard or will have a low exposure index comes changing climate. Based on the MaxEnt model processed data, Barangay Tala has the highest value hazard exposure index, out of the seven barangays in San Andres, Quezon, while Alibijaban

Table II. Hazard indices in San Andres, Quezon

Barangay	Hazard Index	Normalized Value	Vulnerability Category
Camflora	0.136	0.13	Very Low
Mangero	0.126	0.15	Very Low
Pansoy	0.131	0.14	Very Low
Poblacion	0.136	0.16	Very Low
Tata	0.139	0.12	Very Low
Talisav	0.125	0.17	Very Low
Alibiiaban	0.100	0.13	Very Low

*Index Interpretation: 0-0.20 (Very Low), 0.20-0.40 (Low), 0.40-0.60 (Moderate), 0.60-0.80 (High), and 0.80-1.00 (Very High)

an island barangay, has 0.1 hazard exposure index, the lowest among the barangays in the municipality. However, under the normalized value, Barangay Talisay followed by Poblacion and Mangero have the highest hazard exposure index. Among the eight hazards that were assessed only two hazards (typhoon and drought) are commonly observed in the community and the remaining hazards rarely have occurrence in the municipality. However, flooding and erosion were often observed during the rainy seasons in the municipality, which corroborates the records that it occurs during typhoons and monsoon season in the study area.

The factor which affects the area the most is drought, especially in low-lying areas,

which was experienced by the community members once every 5 years as expressed during the focus group discussion. In addition, the geographic location of these barangays contributed to their exposure. San Andres, Quezon is located in the Southern part of Quezon and is facing the Ragay Gulf. PPDO (2015) reported that the municipality is experiencing a Type III climate, which is Basconcillo, et al., (2016) characterized by a comparatively dry season from November to April, and a wet season with the rest of the year. More so, according to the DILG IVA website, the municipality's topography is characterized by broad alluvial plains and average humidity of 80% throughout the year.

Most of the barangays have a very low to low exposure

index to hazard, but considering agricultural crops planted in the area, these are highly responsive to changes in temperature and extreme rainfall. A minor change in weather and climate could have major implications on production which may threaten the livelihood of farmers. This requires farmers in the rural areas to become more cautious in the monitoring of weather and climate to enable them to adjust their planting season or change their crops as part of their adaptation to changing climatic conditions. Hence, farmers in these areas planted climate-

resilient crops such as coconut (*Cocos nucifera*), *ubi* (*Dioscorea alata*), and corn (*Zea mays*) which are known to be less dependent on water and resistant to high temperature.

Sensitivity/Suitability Analysis of Crops in San Andres, Quezon

The municipality of San Andres has four (4) priority commodities namely coconut (*Cocos nucifera*), banana (*Musa acuminata*), corn (*Zea mays*), and *ubi* (*Dioscorea alata*). Changes in climatic conditions could lead to a

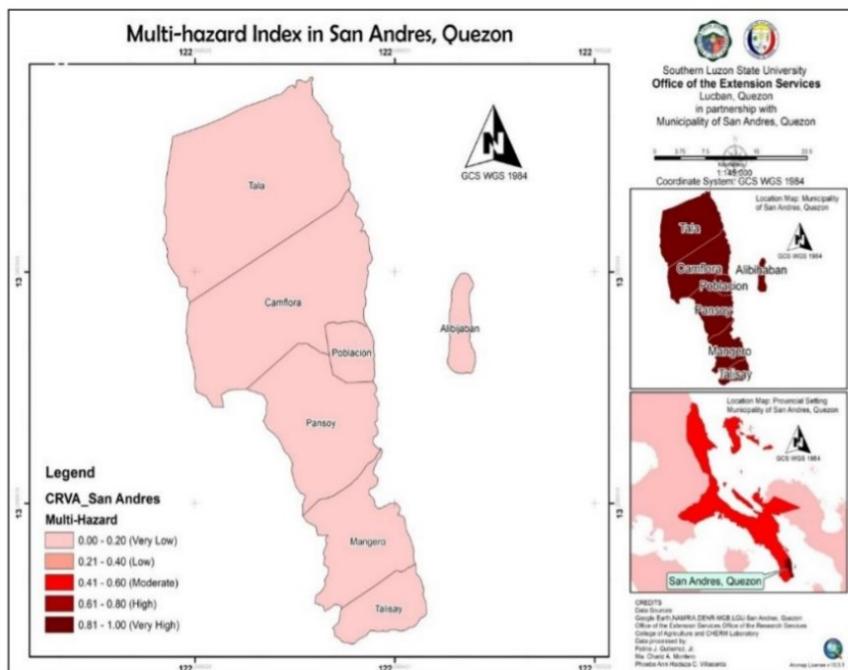


Figure 1. Hazard Exposure Map of Barangays in San Andres, Quezon

decrease in crop production if the crops planted are sensitive to any of the climatic parameters, hence, the sensitivity of crops should be determined. This component is necessary to complete the principles of any vulnerability assessment which is the functions of exposure, sensitivity, and adaptive capacity. Determining crop sensitivity in this study led to understanding the suitability of crops in the present and future scenario using a bio-climatic projection model.

The suitability of each of the priority crops was analyzed using the crop model MaxEnt. The low and high suitability indexes was shown in the figures. The blue color indicates high suitability and the red color indicates low suitability or sensitivity of the crop in a barangay. The projected changes in climatic condition from the present (year 2018) to year 2050 are the increases of both temperature and precipitation. The increases also affect other parameters resulting in to decrease or increase in crop productivity or suitability in the area.

Cocoanut (*Cocos nucifera*)

Figure II shows the resulting suitability index for coconut for the current condition and projected climatic condition for 2050. The map shows that

the municipality of San Andres (all barangays) is currently planted with coconuts and found to be highly suitable in the area. However, with the change in temperature and precipitation in the year 2050, most of these areas (barangays) in the municipality will be sensitive to changing climatic conditions, denoting that coconut is not suitable for production. Climatic factors that could affect coconut suitability are the non-availability of water and increased temperature. In a study by Krishna Kumar *et al.*, (2011), they found out that the absence of precipitation during December to May in India affects the coconut productivity, which is also true to San Andres because of its Climate type III. The map proved that coconut is sensitive to increasing temperature than precipitation; consequently, drought may happen in the area.

Corn (*Zea mays*)

Figure III shows that corn suitability is high at the present condition in barangays Poblacion, Talisay, and Mangero. However, due to changing climate or weather patterns, maize suitability by the year 2050 will change and will be classified as low suitability in the same areas. Corn is more sensitive to changes in precipitation than changes in temperature. The red portion explains that it is low

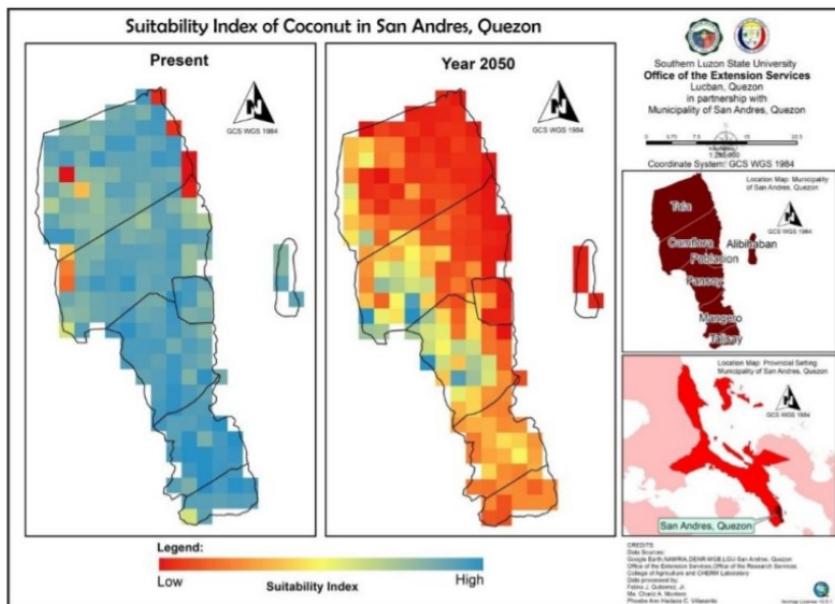


Figure II. Suitability Index map of Coconut (*Cocos nucifera*) in San Andres, Quezon.

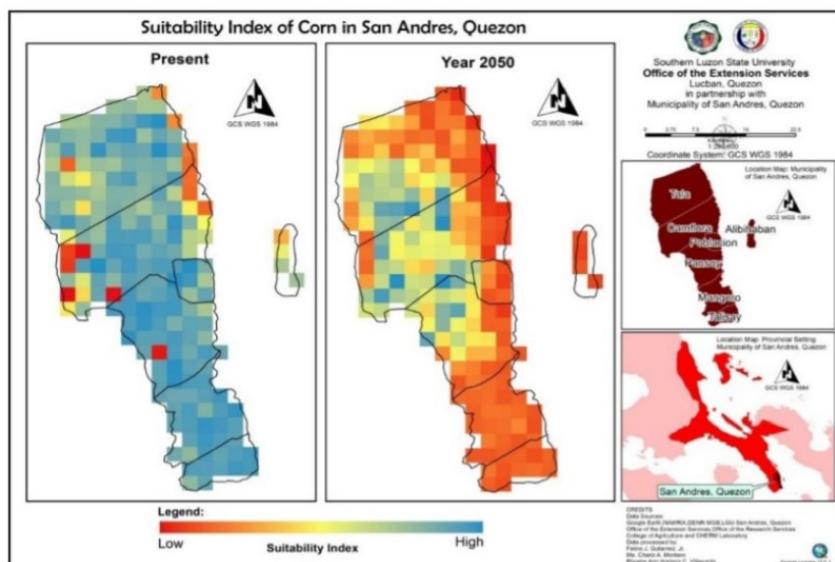


Figure III. Suitability Index map of Corn (*Zea Mays*) in San Andres, Quezon.

suitable in the area which means that corn in the municipality is highly sensitive to climate-related stresses (e.g., drought). If the precipitation variability continues, it is expected to strengthen the frequency and magnitude of drought and flood occurrences, which are both injurious to crop productivity particularly in rainfed agriculture areas (Pachauri and Reisinger 2007), like San Andres, Quezon. The large variations in the suitability index on corn will adversely affect the corn yield and this indicates that decreasing corn production will happen in the projected year.

Banana (*Musa acuminata*)

The results shown in Figure IV exhibited that climate change will impact the banana production in the Barangays Alibijaban and Tala, from high suitability at present to medium suitability in the year 2050. This explains that changing climatic variable, specifically increasing temperature, has an implication to the productivity of bananas. These indicators revealed nearly a similar finding of annual mean temperature and annual precipitation. But in year the 2050, it proved that increasing of annual mean temperature than annual precipitation can decrease the yield of production. Therefore, banana is

sensitive to increasing temperature than precipitation.

***Ubi* (*Dioscorea alata*)**

Ubi production is highly affected in Barangay Alibijaban given the largest change areas in terms of suitability. Figure V shows that in present condition this area is experiencing high suitability but in the year 2050 low suitability will happen. This means that the parameter of low mean temperature with high precipitation of *ubi* resulted in highly suitable. Alarmingly, in the year 2050, low suitability might happen due to low annual precipitation with high mean temperature.

Climate risks vulnerability assessment results presented in Figure IV shows that Barangay Alibijaban, among the barangays of San Andres, Quezon has the highest vulnerability index with a normalized value of 0.49 followed by Camflora with a 0.23 vulnerability index. This barangay has a very low exposure to hazard index but has several crops that are sensitive to changes indices leading to its high vulnerability index.

High vulnerability implies that crops found or grown in the area have high sensitivity,

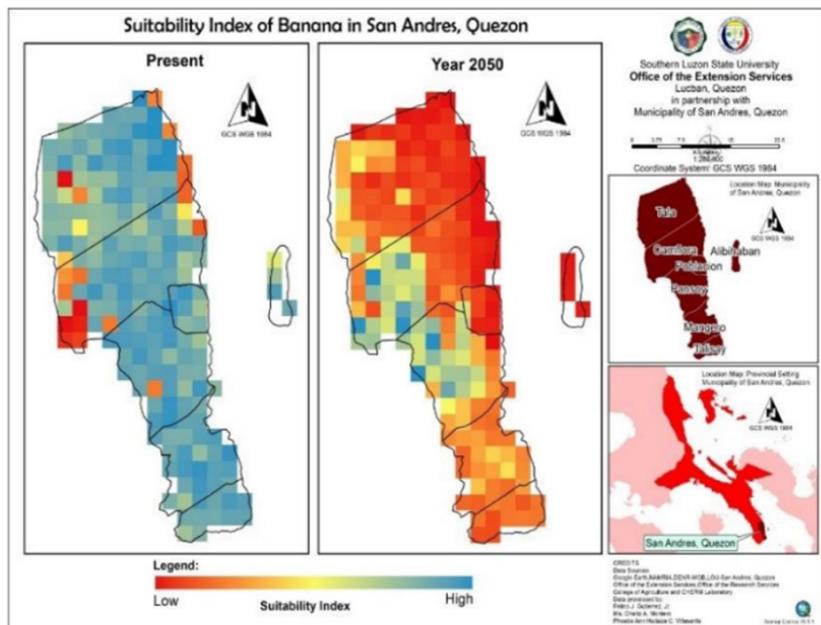


Figure IV. Suitability Index map of Banana (*Musa acuminata*) in San Andres, Quezon

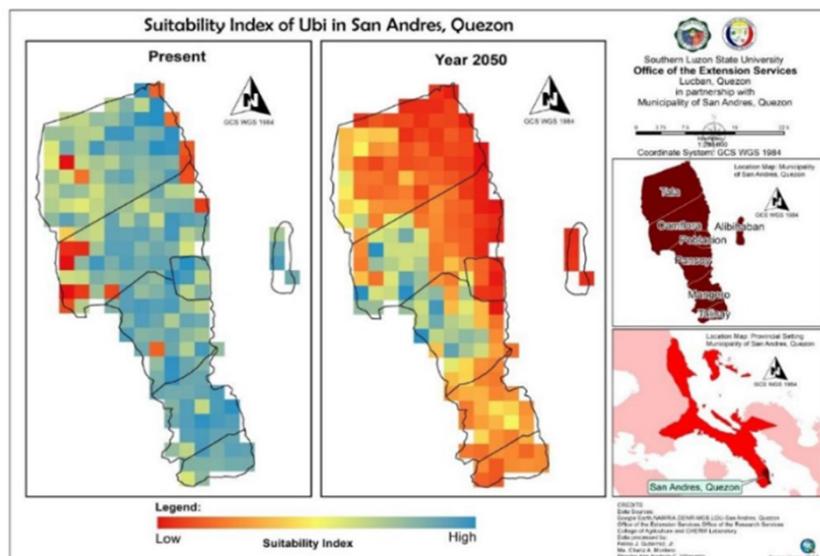


Figure V. Suitability Index map of Ubi (*Dioscorea alata*) in San Andres, Quezon

Table 3. Adaptive Capacity and Capital Indices of Barangays in San Andres, Quezon

Barangay	Physical	Economic	Human	Social	Natural	Institutional	Anticipatory	Adaptive Capacity Index
Camflora	0.111	0.111	0.133	0.186	0.103	0.2	0.157	0.13
Mangero	0.164	0.179	0.137	0.143	0.145	0.099	0.133	0.15
Pansoy	0.121	0.129	0.168	0.148	0.166	0.161	0.107	0.14
Poblacion	0.137	0.113	0.124	0.115	0.118	0.166	0.188	0.16
Tala	0.157	0.171	0.197	0.07	0.177	0.12	0.108	0.12
Talisay	0.189	0.154	0.112	0.167	0.157	0.127	0.93	0.17
Alibijaban	0.108	0.144	0.144	0.116	0.135	0.131	0.222	0.13

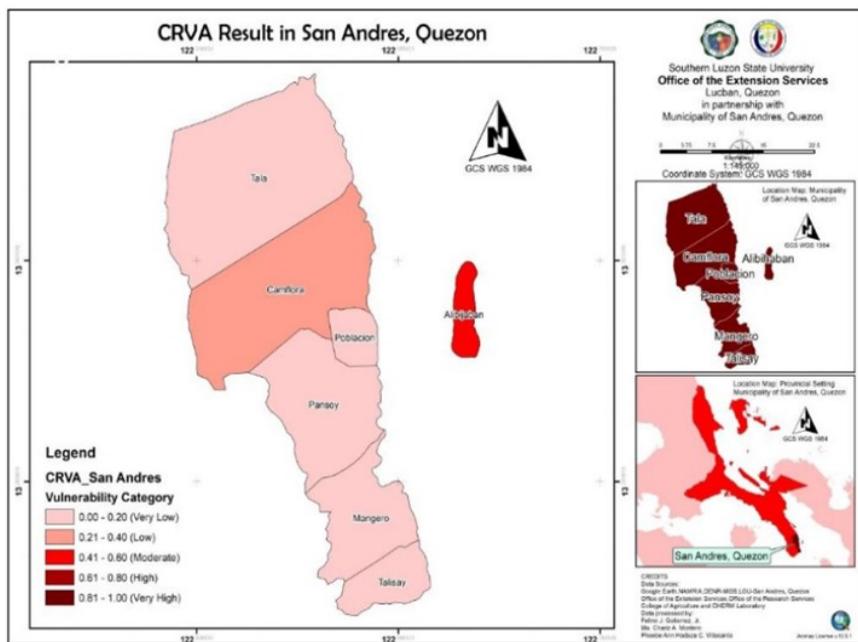


Figure VI. Climate Risk Vulnerability Map of San Andres, Quezon

therefore not suitable in the area if the projected climate changes will take place. Results also show that, in the case of San Andres, a factor that influences the vulnerability of the area is the low adaptive capacity of the barangay. All barangays were found to have a very low

adaptive capacity due to the poor economic condition, poor human, and social capital, but Alibijaban has the lowest adaptive capacity among the seven very low adaptive capacities of the barangays. This indicates that if vulnerability will be reduced, the best strategy is to

increase the social and human capital of the area.

CONCLUSION

The changing climate greatly impacts the agriculture sector, as it is the source of food security for all. Through the climate risk vulnerability assessment, specific areas, and crops vulnerable can be identified and empirical information gathered can be used in science-based climate change adaptation planning to lessen the effects of climate change in the future time.

Using the geospatial analysis, this study found out that the municipality of San Andres in Quezon province is vulnerable to changing climate. Specifically, among its barangays, Alibijaban will have the highest vulnerability index because of its hazard exposure, crops sensitivity, and low adaptive capacity. In terms of crops grown, the study found out that most of the crops will be affected by the impacts of climate change. But among these, an increase in temperature and decrease in precipitation in San Andres will impact banana production. Hence, based on the results of the study, officials of the local government units, municipal and barangay level, are encouraged to initiate science-based adaptation planning. It is

recommended that the officials through the Municipal Agriculture Office promote change in crop production to avoid economic loss and greater economic impacts to farmers in the area.

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Development of K-Sarap Mix as Food Supplement for Preschool Children

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ABSTRACT

This research aims to develop a food supplement for preschool children especially those who are undernourished and with stunted growth. The selected grain and vegetables of K-Sarap Mix were subjected to physicochemical analysis (moisture, water activity) and microbiological test (Heterotrophic plate, Molds, yeast count, Thermotolerant coliform, and Total coliform). The parameters involved in selecting the grain and vegetables for K-Sarap Mix include evaluation of its macro and micronutrient content, availability in the locale, affordability, and moisture content. The composition of K-Sarap Mix is rice (*Oryza sativa*), mung beans (*Vigna radiata*), Acorn Squash (*Cucurbita maxima*), and Upland Kangkong (*Ipomea reptans*). K-Sarap mix is a powder mixture of rice and selected vegetables, green in color, with green leafy leaves odor, with a slightly sweet taste, and with fine texture (mouthful). The formulation of K-Sarap Mix was based on the Recommended Energy Nutrient Intake (RENI) of pre-school children ages 3 to 5 years old, Food and Nutrition Research Institute (FNRI), Department of Science and Technology (DOST) (2018). K-Sarap formulation was subjected to physicochemical analysis (water and moisture activity, lead test), and microbiological test. (Total plate, Molds, Coliform Count, *Escherichia coli*, Yeast, and Mold count). K-Sarap mix passed all the physicochemical analysis and microbiological tests. Based on the nutritional analysis, K-Sarap Mix is rich in macro and micronutrients. The total calories from K-Sarap Mix are 359.97 kcal/100 g. It has Total Carbohydrates of 74.27%, Protein is 50.56 kcal/100 grams, and Fats 25-35%. The micronutrients present in K-Sarap Mix are Calcium 47.33 mg/100 g and Sodium 15.80 mg/ 100 g. It has Vitamin B Complex such as Vit. B1 Thiamine 5.78 mg/ 100 g,

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B3 Niacin 2.82 mg/100 g, B5 Pantothenic 1.24 mg/100 g and Vitamin B6 Pyridoxine 0.42 mg/ 100 g. The product was evaluated by preschool children and experts using Sensory Attribute Test (5-Point Hedonic Sensory Scale with “smiley faces and 7-Point Hedonic Scale). K-Sarap Mix is found so much likely by preschool children and highly acceptable by experts.

Keywords - Development, Food Supplement, K-Sarap Mix, Preschool children, Nutritional Analysis, Physicochemical Analyses

INTRODUCTION

The promising future is built from good health as its foundation. However, many children miss the opportunity to reach their full potential because they lack access to proper health and nutrition (World Vision Organization, 2016). The burden of malnutrition across the world remains unacceptably high, and progress unacceptably slow. Malnutrition is responsible for more ill-health than any other cause. Children under five years of age face multiple burdens: 150.8 million are stunted, 50.5 million are wasted, WHO Global Nutrition Report (2018). Based on the report from UNICEF (2017), nearly half of all deaths in children under 5 are attributable to undernutrition, translating into the loss of about 3 million young lives a year. Malnutrition rates remain alarming with stunting rate declining too slowly while wasting still impacts the lives of far too many young children.

Furthermore, the report also concluded that we are still far from a world without malnutrition UNICEF, (2019). While the 2018 edition of the UNICEF-WHO-The World Bank: Joint Child Malnutrition, estimates show that stunting prevalence has been declining since the year 2000, nearly one in four – 151 million children under 5 –were stunted in 2017, and 51 million suffered from wasting. Southeast Asian nations, including the Philippines, were reported to have a very high incidence of stunting. Based on the report of the World Health Organization (2018), under-nutrition in the Philippines remains a serious problem. The damage to health, physical growth, and brain development of children affected by chronic under nutrition—stunting in the first two years—is often irreversible, impairing them for life and leaving them with lower chances of finishing school and becoming highly-productive adults. Stunting, iron, and iodine

deficiencies impact the learning abilities and intelligence of children.

Undernutrition is the single greatest threat to a child's life according to Dr. Martin Parreno (2014), National Program Officer of the World Food Program of the Philippines. A close look at the development of children in the Philippines, unfortunately, shows the alarming state of nutrition in the country (GMA News, 2018). The Philippines saw a drop-in rank in the latest Save the Children End of Childhood report, which shows the best to worst countries for children to grow up in. From 96th, the country has gone down to 104th, with the decline mainly caused by the increase in stunted growth cases, or the condition where a child does not meet his or her ideal height for his/her age due to improper nutrition among other things. The same report also says poor nutrition, which the World Health Organization defines as "deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients," is "high" in the country. The Philippines records a 33.4 malnutrition score, which makes Filipino children one of the most poorly nourished kids in Southeast Asia – only ranking below Indonesia (36.4) and East Timor (50.2). The Food and Nutrition Research Institute (FNRI, 2018) says one out of three Filipino

children aged 5-10 is stunted or underweight for his or her age. This makes the situation a pressing and alarming matter as it indicates a highly disproportionate growth for their age if not monitored closely. According to FNRI (2018), children in the Philippines are in direct need of the following: Calcium, Protein, Iron, Vitamin D, and other micronutrients. The Provincial Nutrition Action Office (PNAO) of Quezon Province, (2018) revealed that there are 11,141 or 6.4 percent underweight children and 3,766 or 2.2 percent severely underweight children ages 0-71 months based on weight for age. While there are 22,274 or 12.9 percent stunted children and 12,057 or 7.0 percent severely stunted children for ages 0 -71 months based on height for age. Moreover, based on weight for/height under 0-71 months there are 5,769 or 3.3 percent wasted children and 3,356 or 1.9 percent severely wasted children in Quezon. The greatest number of underweight and severely underweight children in Quezon Province comes from the municipalities of Jomalig with 19.2 percent, followed by Burdeos with 17.5 percent, and San Narciso with 17.1 percent.

OBJECTIVES

The main objective of the study is to develop a food

supplement for preschool children which can help to limit under-nutrition and stunted growth.

Specifically, this research aims to:

1. Screen and identify vegetables that will be combined to the original formulation of "K-Sarap Mix" (macro and micro-nutrients, moisture content, locally available, and affordable);
2. Submit the original and selected vegetables on microbial test;
3. Test the new formulation of "K Sarap Mix" in terms of:
 - a) Water activity
 - b) Moisture content
 - c) Microbial content analysis
 - d) Lead content
4. Evaluate the nutritional content and value of the Enhanced K-Sarap Mix; and,
5. Determine the acceptability of the product in terms of taste, odor, texture, and color as evaluated by pre-school children and experts.

REVIEW OF RELATED LITERATURE AND STUDIES

Munggo

Munggo also known as mung beans contain fiber (one cup of boiled beans contains 15 grams or over 50% of RDA). They are low in saturated fat, contain no cholesterol and a cup serving contains 212 calories. Mung beans contain a high amount of protein (14 grams per cup). They contain vitamin A, K, pantothenic acid, niacin, Vitamin B-6, and a cup serving contains 80% of the RD of folate. Minerals in 1 cup of mung beans include iron (16% of the RDA), potassium (15% of the RDA), zinc (11%), phosphorus (10%), magnesium (24%), and (30%). The sugar in a cup is 4 grams.

Munggo is good for people reducing weight because it has very low-fat content, is rich in protein and fiber, and helps lower cholesterol levels in the bloodstream. Its high fiber content aids in digestion while keeping the body energized at a balanced level. Some of the *munggo* health benefits include stimulating bone formation, preventing osteoporosis, nourishing the bone tissue, strengthening muscles, improving memory and brain function, helping prevent certain types of cancer, and boosting the defense of the immune system. It is also a very good antioxidant, fights cellular aging, aids in tissue repair, promotes healthy blood clotting, helps prevent hypertension, and lowers

cholesterol in the body (largerfamilies.com).

Kangkong

Kangkong, or water spinach or swamp cabbage, is scientifically known as *Ipomoea aquatica*. Others considered it as the “King of all vegetables.” It grows practically everywhere in ditches, ponds, and dry land. The plant's long hollow, pale-green stems floats on the water or creep along the damp ground. The leaves are darker green and usually long to heart-shaped, depending on the variety. It can grow up to 10 cm per day when given plenty of water and fertilizer.

Kangkong is high in carotenoids, including lutein and pro-vitamins A. It contains a significant amount of calcium, vitamin B, C, amino acids, and iron. Eaten in a large quantity, *kangkong* can act as a mild laxative. It is also a good source of carotene, which in turn, can be converted to vitamin A by the body. It is beneficial especially to persons with hypertension. It helps to eliminate fatty deposits in the alimentary canal that would otherwise lodge in the blood vessels.

All dark green leafy vegetables are packed with nutrients and *kangkong* are extremely nutritious, containing

abundant quantities of vitamins and minerals. They are excellent sources of dietary fiber, protein, 60 mg calcium, iron, vitamin A and vitamin C. Per 100 servings of *kangkong* it contains 30 calories, 2.7 g protein, 60 mg calcium, 2.25 mg iron, 2.9 mg vitamin A and 45 mg vitamin C.

Studies of *kangkong* revealed the following finding:

- *Hypoglycemic anti-Diabetic anti-oxidant antiproliferative.* The ethanol of the stem had the highest total phenolic compounds. The ethanol extract of leaves had the highest amount of flavonoids; diuretic-methanol extract of *Ipomoea aquatica* showed good activity.
- *Antioxidant.* Methanol extract yielded a compound 7-O-B-D-glucopyranosyl-dihydromquecetin- 30a- D- glucopyranoside that exhibited antioxidant activities with ECS0 value of 83 and showed very strong lipid peroxide-inhibitory activity in a liposome model system.
- *Antimicrobial.* *Ipomea aquatica* exerted a higher amount of antibacterial activity against bacterial strains.
- *Anti-ulcerogenic.* It possesses potent anti-ulcerogenic and

ulcer-healing properties and can act as a potent therapeutic agent against peptic ulcer disease.

- **Cytotoxicity.** The purified bio-active compound from the leaf *Ipomea aquatica* (DHQG) showed cytotoxicity towards cancer cells lines tested.
- **Nootropic memory-enhancing potentials.** Treatment may be of value in reinforcing depressed cholinergic transmission in certain age-related memory disorders and improving memory and learning in normal individuals.
- **Anxiolytic:** A methanol extract potentiated ketamine-induced sleep by a reduction in latency to sleep and increased duration of sleep, suggesting the interaction with CNS depressant.
- **Hypoglycemic activity.** The extract also showed potent free radical scavenging activity with vitamins C.
- **CNS depressant antiepileptic.** Dose-dependent and significant increases in onset to colonic and tonic convulsions or complete protection against seizures and also prolongation of pentobarbitone sleeping time and suppression of exploratory behavior.

Squash

Cucurbita is a genus in the gourd family *Cucurbitaceae*. The *Cucurbita* genus is an important source of human food and is used for other purposes such as beverages, medicine, oil, and detergent. The plants referred to as squash, pumpkin, or gourd depending on species, variety, and local parlance, are grown for good sources of several nutrients such as vitamin A, vitamins C, dietary fiber, niacin, folic acid, and iron. In addition, it is high in manganese, a mineral that helps the body process fats, carbohydrates, and glucose.

Cancer prevention. The yellow squash is abundant in anti-oxidants that keep free radicals at bay. With its high beta-carotene content, yellow squash is a great source of protection from pollutants and chemicals that leads to cancer. It is also high in vitamins C, which helps prevent premature aging and cancer as well as inhibiting cell division.

Heart health. Yellow squash contains negligible fat and no measurable cholesterol. One cup of squash contains about 0.2 g of fat. Cutting down fat cholesterol intake is a giant step towards helping reduce the risk of heart attack and stroke. The magnesium found in yellow squash has been

shown to reduce the risk of heart attack and stroke. Along with its potassium content, magnesium is good for reducing high blood pressure. The vitamin C and beta-carotene levels in yellow squash also aid in preventing the oxidation of cholesterol. As cholesterol in its oxidized form builds up in the walls of blood vessels, the said nutrients may reduce the development of atherosclerosis. The vitamin folate in yellow squash is required by our bodies to remove unhealthy metabolic by-product called homocysteine which may contribute to heart attack and stroke risk. It is also rich in fiber, the perfect ingredients for lowering high cholesterol levels and reducing the potential for atherosclerosis and heart disease.

Colon health. At 2.52 grams per serving the abundant fiber content of yellow squash is indispensable for the excretion of toxins from the body and is an extremely important nutrient for the colon's health since it promotes regularity and adds bulk to the stool.

Prostate health. Yellow squash has been known to alleviate the symptoms of a condition named benign prostatic hypertrophy BPH.

Eye health. Yellow squash is particularly high in concentration of beta carotene and lutein.

Dietary lutein helps to prevent the onset of cataracts and muscular degeneration. Which often leads to blindness. A cup of yellow squash provides about 135 micrograms of beta-carotene and 2400 micrograms of lutein.

Healthy bones. Yellow squash contains a high level of manganese and vitamin C. Manganese aids in maintaining healthy bone structure calcium absorption, enzyme creation, and bone building. It also contributes to the mineral's density of the spinal column. Vitamins C aids in the production of collagen, which is essential for the building of bone mass, and magnesium is indispensable to the health of joints and bones. Iron folate zinc and phosphorus found in yellow squash contribute to the mineral health of bones and help fortify against osteoporosis.

Micronutrients Requirements of Children Ages 4 to 13 Years

The period of the childhood between ages 4 and 13 years is characterized by continued physical growth and rapid cognitive, emotional, and social development. Many children especially girls, undergo their pubertal growth spurt between ages 4 and 13 which is the period between childhood and adulthood. Due to increased

growth metabolism, the nutritional requirements of children are higher in proportion to the bodyweight compared with adults. Good nutrition throughout childhood is important not only to support normal growth and cognitive development but also to establish healthy eating patterns that are associated with decreased risk of chronic conditions and disease in adulthood including obesity type 2 diabetes, cardiovascular diseases, metabolic syndrome, and osteoporosis.

Inadequate intake of nutrients can impair development in children. This article discusses the micronutrients (vitamins and nutritionally essential minerals) requirements of children ages 4 to 13 years. The Food and Nutrition Board (FNB) of the Institute of Medicine establishes dietary reference intakes (DRIs) for each micronutrient, these reference values should be used to plan and assess dietary intakes in healthy people. The DRIs include the estimated average requirement (FAR), the recommended dietary allowance (RDA), the adequate intake (AI), and the tolerable upper intake level (UI). The RDA which is the average daily dietary intake level of a nutrient sufficient to meet the requirement of almost all (97%) healthy individuals in a specific life stage gender group,

should be used in the planning of diets for individuals.

An AI recommendation is set when an RDA cannot be determined. In children, these intake recommendations are based on data regarding average micronutrients intakes of children and certain for micronutrients adequacy. However, because of limited data many of the micronutrient intake recommendations for children are extrapolated from the recommendation for adults using a formula that accounts for metabolic and growth. Metabolic body weight is determined by calculating the 0.75 power of the body mass (body mass \times 0.75). To account for growth, the equation used to derive an RDA or AI involves an age group-specific growth factor. The FNB establishes separate dietary intake recommendations for children between the ages of 4 to 8 years and those between the ages of 9 to 13 years.

Micronutrient Needs of Children Ages 4 to 8 Years

For each micronutrient, the FNB sets as RDA or AI for children ages 4 to 8 years. The micronutrients intake recommendations do not differ with gender for this age group. The table below shows RDA for micronutrients during childhood, ages

Table 1. Micronutrients recommended by the RDA

Dietary Reference Intakes set by the FNRI	RDA for Micro-nutrients During Childhood Ages 4-8 y/o
Micronutrients	Male and Female
Biotin	12 mcg/day (AI)
Folate	200 mcg/day
Niacin	8 mg/day
Panthotenic Acid	3 mg / day (AI)
Riboflavin	600 mcg/day
Thiamin	600 mcg/day
Vitamin A	400 mcg/day (1,333 IU/day)
Vitamin B6	600 mcg/day
Vitamin B12	1.2 mcg/day
Vitamin C	25 mcg/day
Vitamin D	15 mcg/day (600 IU/day)
Vitamin E	7 mg/day (10.5 IU/day)
Vitamin K	55 mcg/day (AI)
Calcium	1,000 mg/day
Chromium	15 mcg/day (AI)
Copper	440 mcg /day
Fluoride	1 mg/day (AI)
Iodine	90 mcg/day
Iron	10 mg/day
Magnesium	130 mg/day
Manganese	1.5 mg/day (AI)
Molybdenum	22 mcg/day
Phosphorus	500 mg/day (AI)
Potassium	3,800 mg/day
Selenium	30 mcg/day
Sodium	1,200 mg/day (AI)
Zinc	5mg/day
Choline	250 mg/day (AI)
Alpha-Linoleic Acid	250 mg/day (AI)
Linoleic Acid	10g/day (AI)
AI Adequate intake	

4 to 8 years, lists the RDA for each micronutrient. As mentioned above, the RDA should be used in the planning of diets for

individuals. A few select micro-nutrients for children are discussed in Table I.

MATERIALS AND METHODS

The researchers developed the formulation of K-Sarap Mix based on FNRI, DOST Philippine Dietary Reference Intakes, (2015), Recommended Dietary Allowances for Filipinos; for Energy and Specific Nutrients (Average per Day), Recommended Energy/Nutrient Intake (RENI) of pre-school children (3-5 years old) with an ideal weight of male 17.5 kilos and female 15 kilos. The basic need for Energy kcal, Protein, Vit A., Vitamin B complex, Folate, Calcium, and Iron requirements for children 3-5 years old was used as the basis for selecting grain and vegetables. The researchers computed the approximate energy and macro, and micronutrients that could be yielded in each vegetable through ratio and proportion to come up with the needed amount of K-Sarap Mix per 100 grams. The desired amount for

each vegetable and grain was mixed and packed in a sterile container with a weight of 100 grams.

The research study was conducted in Lucban, Quezon. There were (100) pupils of Day Care Center from Barangay 7 and 9 and ten (10) experts (faculty) of Southern Luzon State University composed (4) Food technology, (3) Hotel and restaurant management, and (5) Clinical instructors from the College of Allied Medicine handling Nutrition and Dietetics subjects.

An experimental type of research was used in the development of the K-Sarap Mix while descriptive evaluative was applied in determining the acceptability of the product with regards to physical property. The true experimental design was applied which includes process and product characterization, achieving variability reduction, control and

Table II. Grain and Vegetables Content of K-Sarap

Grain/ Vegetables Per 100 grams	Energy (kcal)	Protein (g)	Vit. A (ug RE)	Vit. C (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg NE)	Folate (ugDFE)	Calcium (mg)	Iron (mg)
Rice	129	2.66	0	0	0	0	0	0	10	1.19
Mung beans	347	23.8 6	114 IU	4.8	0.621	0.233	2.251	625	132 mg	6.74
Acorn squash	40	0.8g	367 IU	11.0	0	0	0	0	33mg	0.70
Upland Kangkong	19	2.6 g	6300 IU	55	0.030	0.100	0.900	57	77 mg	1.67
RENI	1350	22	400	45	0.5	0.6	7	200	550	9

stability, process optimization, and designing processes and products. The research study was conducted for one year.

There were two different types of questionnaires used in determining the acceptability of the product with regards to physical property. The first questionnaire is a consumer acceptability test for preschool children. A 5-point Hedonic sensory acceptability using "smiley faces" was applied; 5 as to like very much to 1 as dislike very much. The second questionnaire is a 7-point Hedonic sensory acceptability answered by the experts; 7 highly acceptable to 1 highly not acceptable. The researchers used different sources in gathering data

and procedures. Books and electronic sources were used in selecting grain and vegetables rich in macro and micronutrients needed by pre-school children. Drying and grinding facilities of Southern Luzon State University (SLSU) Lucban, SLSU Judge Guillermo Eleazar in Tagkawayan, Quezon and DOST in Taguig, City were used in the study. The researchers also seek the services of the Microbiology and Testing Laboratory of Southern Luzon State University (SLSU) in Lucban, Quezon, and DOST Region IV in Los Baños, City, and SGS Philippines, Inc. in Makati, City to test the physicochemical analysis and microbiological test of K-Sarap Mix. The lead test was conducted by Sentrotek in Mandaluyong, City



Figure I. Process flow of powdered rice and mung beans

and the nutritional analysis was done by SGS Philippines, Inc. in Makati, City.

For the sensory test, the evaluators were given samples and a descriptive score sheet to record

their evaluation. To determine the acceptability of the product, cookies were made from the K-Sarap mix and given to pre-school children of Day Care Center in Barangay 7 and 9 in Lucban, Quezon.



Figure II. Process flow of powdered squash (*Cucurbita maxima*) and kangkong



Figure III. Process flow of mixing powdered Rice (*Oryza sativa*), Mung beans (*Vigna radiata*), Acorn Squash (*Cucurbita maxima*) and Upland Kangkong (*Ipomea reptans*)

The equipment and utensils used were knives, chopping board, stainless mixing bowl, pan, spoon, strainer, basin, weighing scale, candy thermometer, gas range, drying cabinet, and grinder.

Process flow

RC 122 variety of rice (*Oryza sativa*) and NSIC Mg 14 mung beans (*Vigna radiata*) was used in the study.

Acorn Squash (*Cucurbita maxima*) and Upland Kangkong (*Ipomea reptans*) varieties were used in the study.

The packaged use is a sterile aluminum stand-up pouch 10 cm width, 15 cm height, and with a thickness of 100 microns.

Physicochemical Analysis

The method used to determine the Moisture Content is the AOAC Official Method 977.04, 20th Edition. While the method used to determine the Water, Activity is the AOAC Test Method 978.18 and AOAC Official Method 0.5074 at 25.06 °C. The method used to test the Total Plate Count is Pour Plate Method (FDA BAM Ch.3, January 2001), Coliform Pour Plate Method (FDA Ch. 4, February 2013), *Escherichia coli* MPN Method (FDA BAM Ch.4, February 2013), Yeast and Mold Count Pour Plate Method (FDA BAM Ch. 18, April 2001). While Lead test used Inductively Coupled Plasma-Atomic Emission Spectroscopy.

Nutritional Analysis

The methodology used in determining the nutritional analyses are by computation

(Calories and total Carbohydrates, Calories from Fat, Protein), Gas Chromatography (Saturated Fat, Cholesterol), Dry Ashing Acid Digestion and Quantitation by Atomic Absorption Spectrophotometer (AAS) for Calcium, High-Performance Liquid Chromatography for (Vit. B Complex), Dry Ashing, Acid Digestion, and Quantitation by Inductively Coupled Plasma-Optical Emission Spectrometry for Sodium.

The statistical treatment used was percentage in the computation of RENI while the weighted mean was used in determining the acceptability of K-Sarap Mix. Analysis of the results was adopted in the interpretation of the physicochemical, microbiological test, and nutritional analyses provided by the laboratories.

The scoring of the items on the acceptability test of K-Sarap Mix for pre-school children was based on the Hedonic five-point scale, while the scoring of the items on the acceptability test for the expert was based on Hedonic seven-point scale.

RESULTS AND DISCUSSION

The parameters involved in selecting grain and vegetables include evaluation of the macro and micronutrient content, its availability in the locale, affordability, water activity, and moisture content.

Rice (*Oryza sativa*) and mung beans (*Vigna radiata*) passed on all the parameters of microbiological test while the acorn squash (*Cucurbita maxima*) and

Table III. Grain and Vegetables Content of K-Sarap Mix

Grain/ vegetables	K-Sarap Mix Content/ 100 grams	Percentage
White Rice (<i>Oryza sativa</i>)	50	50
Mung beans (<i>Vigna radiata</i>)	25	25
Acorn Squash (<i>Cucurbita maxima</i>)	8	0.08
Upland Kangkong (<i>Ipomea reptans</i>)	17	0.17
Total	100 grams	100%

kangkong (*Ipomea reptans*) passed on mold and yeast count but failed on plate count and coliform.

The total calories from K-Sarap Mix are 359.97 kcal/100 g and the recommended intake of preschool children is 1350 kcal/day. It means that on 400 grams consumption of K Sarap Mix the preschool children recommended energy intake will be achieved. K-Sarap Mix has complete macronutrients namely carbohydrates, protein, and fats.

The K-Sarap Mix 100 grams has a Total Carbohydrates of 74.27 percent which meets the daily requirement of carbohydrates for preschool children of 55-79 percent. Carbohydrates provide the body with energy and regulation of blood glucose, sparing

proteins for energy and helping in the breakdown of fatty acids, and prevention of ketosis (sparknotes.com, 2019).

The calorie from Protein is 50.56 kcal/100 grams while the recommended energy intake for Protein is 32 grams. It only shows that K-Sarap Mix is a good source of protein and can substitute other sources of protein. Moreover, protein from K-Sarap comes from vegetables which means that it has low cholesterol. Protein does most of the work in the cells and is required for the structure, function, and regulations of the body's tissues and organs. The primary functions of protein are repair and maintenance of body tissues including development and repair; act as a major source of energy, involved in the creation of

Table IV. Individual Microbiological Test of Selected Grain and Vegetables

Parameter	Method	Reference Value	Selected Grain and Vegetables			
			Rice Powder	Mung beans	Kangkong Powder	Squash Powder
Heterotrophic Plate Count, cfu/g	Pour Plating	5 x 10^2	<10	<10	1.42×10^5	8.9×10^3
Molds Count, cfu/g	Spread Plating	5 x 10^3	<10	<10	<100	<100
Yeast Count, cfu/g	Spread Plating	5 x 10^2	<10	<10	<100	<100
Total Coliform, MPN/g	MTFT	5 x 10^2	<30	<30	1.1×10^3	9.2×10^3
Thermotolerant Coliform, MPN/g	MTFT	5 x 10^2	<30	<30	1.1×10^6	1.5×10^4

Table V. Physicochemical Analysis and Microbiological Test Results of K-Sarap Mix

Parameters	Methodology	Reference Values	Result	Analysis
Physicochemical Analysis				
Water Activity		0.84	0.5074	passed
Moisture content		<10	10.00	passed
Lead content	Inductively Coupled Plasma-Atomic Emission Spectroscopy	0.1 mg/kg	<0.10	passed
Microbiological Test				
Total Plate Count	Pour Plate Method (FDA BAM Ch. 3, Jan. 2001)	5 x 10^4	9,600CFU/g	passed
Coliform Count,	Pour Plate Method (FDA BAM Ch. 4 Feb. 2013)	5 x 10	<10CFU/g	passed
<i>Escherichia coli</i>	MPN Method (FDA BAM Ch. 4, Feb. 2013)	5 x 10^2 /	<3.0MPN/g	passed
Yeast & Mold Count	Pour Plate Method (FDA BAM Ch.18, April 2001)	5 x 10^3	13,000CFU/g	passed

Note: Source of Reference 2015 Food and Nutrition Research Institute, Department of Science and Technology

some hormones such as insulin and secretin; enzymes production that increases the rate of chemical reaction in the body; transportation and storage of molecules such as hemoglobin and ferritin; and forms antibodies that help prevent infection, illness, and disease (sciencelearn.org.nz, 2011).

The micronutrients present in K-Sarap Mix are Calcium and Sodium. The Calcium content of K Sarap is 47.33 mg/

100 g while the recommended dietary intake per day is 550 mg. It only means that K-Sarap Mix can supplement the dietary need of preschool children on calcium. Other sources of calcium must be considered to meet the dietary demand of preschool children on calcium. The mineral calcium is stored in the bones, muscle cells, and blood. Calcium is essential for the formation of bone and teeth, muscle contraction, normal functioning of many enzymes,

Table VI. Calories result of K-Sarap

Analysis Name	Methodology	Result	RENI/Average Requirements /day of Preschool Children Per Day	
			Male	Female
Calories from Carbohydrates	By computation	297.08 kcal/100 g	55-79	
Calories from Fat	By computation	12.33 kcal/100 g	15-30	
Calories from Protein	By computation	50.56 kcal/100 g	18 g	32 g
Total Calories	By computation	359.97 kcal/100 g	1350 kcal/day	1,260 kcal/day
Total Carbohydrates	By computation	74.27%	55-79	
Total Dietary Fiber	Based on AOAC Official Method 985.29, 20 th Edition 2016	10.27%	8-10	
Crude Fat	Based on AOAC Official Method 985.29, 20 th Edition 2016	1.37	2.0	
Sodium (Na)	Dry Ashing, Acid Digestion, & Quantitation by Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)	15.80 mg/100 g	300 mg	
Calcium (Ca)	Dry Ashing, Acid Digestion, & Quantitation by Atomic Absorption Spectrophotometer ASS)	47.33 mg/100 g	550 mg	
Vitamin B1 (Thiamine)	High Performance Liquid Chromatography	5.78 mg/100 g	0.5	0.4
Vitamin B3 (Niacin)	High Performance Liquid Chromatography	2.82 mg/100 g	7	
Vitamin B5 (Pantothenic acid)	High Performance Liquid Chromatography	1.24 mg/100 g	2	
Vitamin B6 (Pyridoxine)	High Performance Liquid Chromatography	0.42 mg/100 g	0.6	0.7

blood clotting, and normal heart rhythm, msdmanuals.com/home (2019). K-Sarap Mix has 15.80 mg/100 g of sodium while the preschool need for sodium is 300 mg. It means that the product can supplement the need of preschool children on sodium. Sodium is a mineral that carries an electrical charge, electrolyte. Electrolytes facilitate muscle contraction and nerve cell transmission. It works as fluid balance, in concert with potassium to maintain normal water balance in the body, and maintenance of normal fluid levels controlling body's blood volume, ([healthyeating.sfgate.com](https://www.healthyeating.sfgate.com), 2018).

K-Sarap Mix is a good source of Vitamin B Complex it has Vit. B1 Thiamine, B3 Niacin, B5 Pantothenic acid, and B6

Pyridoxine. B Vitamins are water-soluble, which means the body does not store them thus diet must supply these Vitamins daily. Vitamin B1 helps the body use carbohydrates from food to produce energy, needed for the health of the brain, muscles, and nervous system, needed for the growth, development, and function of cells in the body. Vitamin B3 Niacin aids in the conversion of food into energy, helps enzymes in the body function properly by helping the body use other B vitamins and make and repair DNA (the genetic material found in all body cells), needed to produce hormones, such as sex and stress hormones, and helps with the function of the digestive and nervous systems and skin. Vitamin B5 Pantothenic acid; breaks down

Table VI. Sensory Acceptability of Enhanced K Sarap Mix as Evaluated by Preschool Children and Experts

Parameter	Weighted Mean	Descriptive Analysis	Weighted Mean	Descriptive Analysis
	Preschool Children		Experts	
Taste	4.88	Like very much	6.75	Highly Acceptable
Odor	4.74	Like very much	6.63	Highly Acceptable
Texture	4.76	Like very much	6.0	Slightly Acceptable
Color	4.69	Like very much	6.50	Highly Acceptable
Overall Acceptability	4.86	Like very much	6.50	Highly Acceptable

fats and carbohydrates for energy, plays a role in the production of sex and stress hormones in the adrenal glands and neurotransmitters, helps the body use other vitamins, such as riboflavin, and Vitamin B5 is needed to produce red blood cells and cholesterol. Vitamin B6 Pyridoxine is needed by the body to use and store protein and carbohydrates from food (in the form of glycogen, stored energy in the muscles and liver), required for more than 100 enzyme reactions in the body, it aids in the formation of hemoglobin (a substance in red blood cells that carries oxygen through the blood) and neurotransmitters and hormones that influence mood and regulate the body's clock and, involved in immune function and brain development and function (verywellfit.com, 2019).

The product was evaluated by pre-school children as like very much or highly acceptable in taste, odor, texture, and color. It is highly acceptable on color, odor, and texture while it is slightly acceptable on taste, as evaluated by experts. The overall acceptability is highly acceptable. It only proves that the experts agreed on the product based on sensory evaluation.

K-Sarap Mix is a good food supplement for preschool

children. Its nutritional content showed that the product is useful in addressing macro and micronutrient deficiencies in children especially on calcium and Vitamin B Complex. In addition, K-Sarap Mix is found highly acceptable on Sensory Attribute Test using Hedonic Sensory Acceptability.

CONCLUSION AND RECOMMENDATIONS

K Sarap Mix was enhanced by adding squash and kangkong to the original formulation which only consists of rice and mung beans. The enhanced formulation passed the laboratory test of moisture content, water activity, lead test, and microbiological tests such as standard plate count, E Coli and coliform, yeast, and mold counts. Analysis of its nutritional content showed that the product is useful in addressing macro and micronutrient deficiencies in children, especially on calcium and Vitamin B Complex. In addition, K Sarap Mix is found acceptable on Sensory Attribute Test using Hedonic Sensory Acceptability.

Based on the findings of the study, the following are the recommendations:

- 1) Test the acceptability of K-Sarap Mix in diverse food products;

- 2) Test the effectiveness of Enhanced K Sarap Mix in improving signs of under-nutrition among pre-school children;
- 3) Conduct a study on product marketability;
- 4) Create design for packaging; and,
- 5) Submit the research product for patenting.

Global Nutrition Report (2018)

<https://globalnutritionreport.org/reports/global-nutrition-report-2018>

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2016-2017: country progress
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environments for promoting
healthy diets and nutrition.
www.who.int/publications/item/9789241514873

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United Nations Children's Fund (UNICEF) Annual Report (2017), June 2018 ISBN: 978 94967. https://www.unicef.org/supply/files/Unicef_Annual_report_2017

2020 GUIDE TO AUTHORS

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Immediately after the abstract, please provide 4-6 keywords, alphabetically arranged, with the first letter of every word capitalized.

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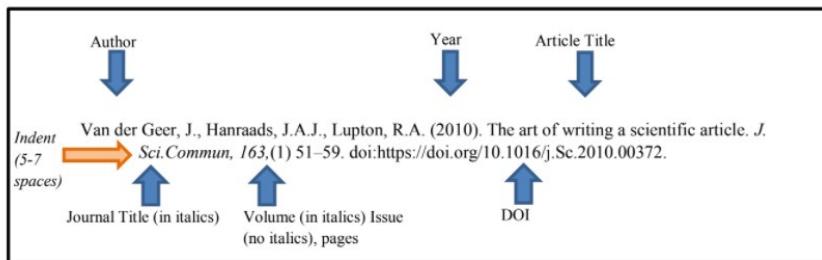
Van der Geer, J., Hanraads, J.A.J., Lupton, R.A., 2018. The art of writing a scientific article. *Heliyon*. 19, e00205. <https://doi.org/10.1016/j.heliyon.2018.e00205>.

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<http://www.cancerresearchuk.org/aboutcancer/statistics/cancerstatsreport>
 (accessed 13 March 2003).

Reference to a dataset:

[dataset] Oguro, M., Imahiro, S., Saito, S., Nakashizuka, T., 2015. Mortality data for Japanese oak wilt disease and surrounding forest compositions. Mendeley Data, v1.
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