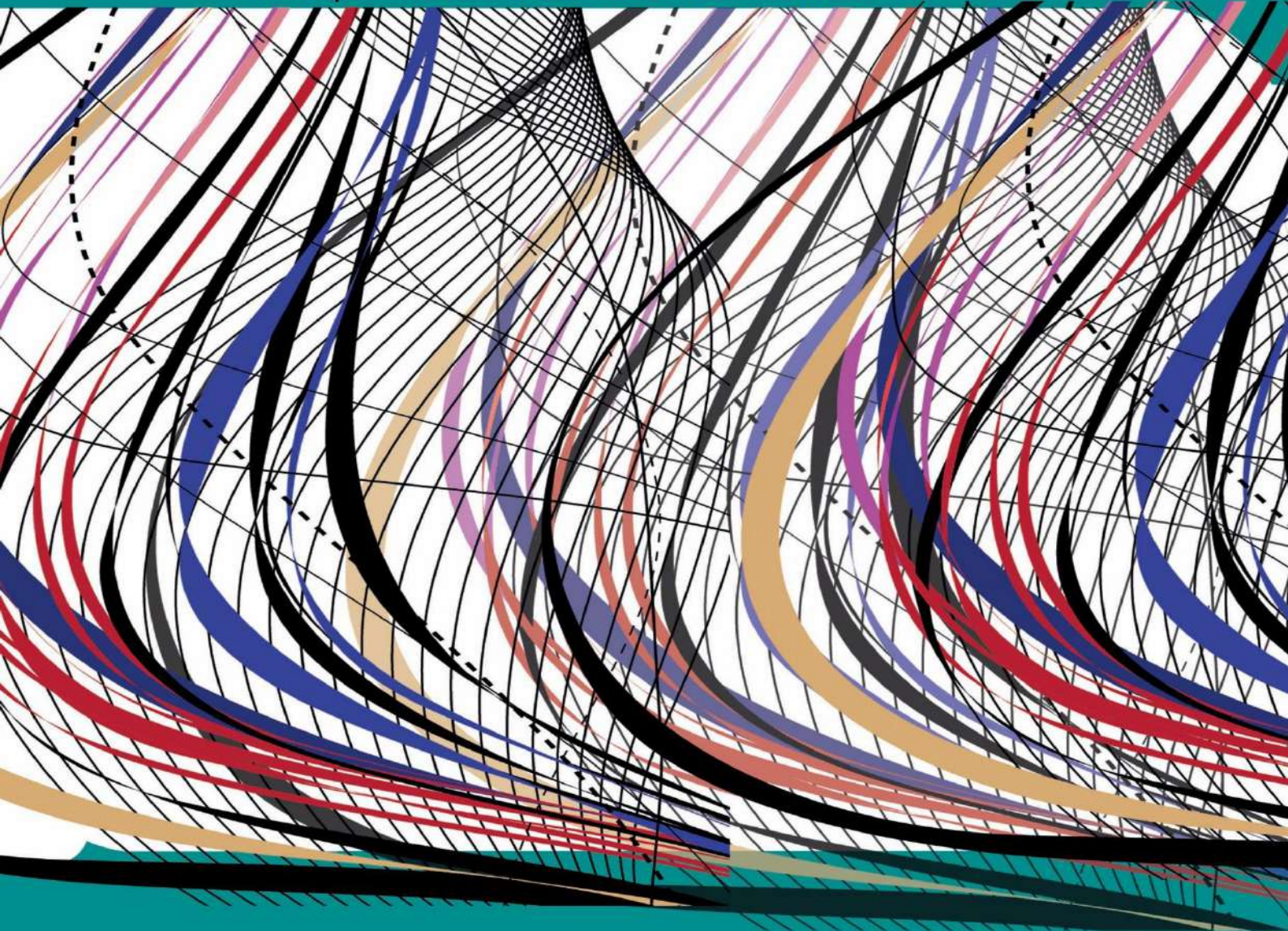


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FOREWORD

I am pleased to put into the hands of readers Volume-7; Issue-2: Feb, 2021 of “**International Journal of Advanced Engineering, Management and Science (IJAEMS) (ISSN: 2454-1311)**”, an international journal which publishes peer reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers.

I thank all the authors of the research papers for contributing their scholarly articles. Despite many challenges, the entire editorial board has worked tirelessly and helped me to bring out this issue of the journal well in time. They all deserve my heartfelt thanks.

Finally, I hope the readers will make good use of this valuable research material and continue to contribute their research finding for publication in this journal. Constructive comments and suggestions from our readers are welcome for further improvement of the quality and usefulness of the journal.

With warm regards.

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Employability of Bachelor of Science in Information Technology (BSIT) Graduates of Nueva Ecija University of Science and Technology-San Isidro Campus

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Abstract— This study generally aimed to trace the current status and employment of the BSIT graduates of Nueva Ecija University of Science and Technology, San Isidro Campus Academic Year 2018-2019. The descriptive method was used with a questionnaire as the major data-gathering instrument. There were 168 total graduates but only 146 of them responded to the study. Descriptive statistics such as frequency counts, ranking, and percentage were used.

This study aimed to determine the profile of employed, self-employed, and unemployed respondents. Based on the tallied results, there is a high rate of employability with regular/permanent status outside Nueva Ecija. The majority of employed respondents landed their job in one to six months duration as walk-in applicants with initial gross monthly earning of 5,000 to less than 10,000 pesos. The findings also revealed that based on the respondents' perspective, the BSIT curriculum is relevant to their first job. The majority of the self-employed respondents were on-line resellers and contented in none existence of a boss. The majority of unemployed respondents considers family concern and decided not to find a job and supported by parents as a way of financing daily living.

Keywords— COVID-19, employment, graduates, information technology, tracer study.

I. INTRODUCTION

Covid-19 affected higher educational institutions not just in Wuhan, China where the virus originated but all other higher educational institutions in 188 countries as of April 06, 2020 (Toquero, C. M., 2020). Educational institutions like the Nueva Ecija University of Science and Technology was also disturbed by this unforeseen event.

Likewise, despite the Covid-19 virus, the university is serious about implementing one of its core values "excellence". The university continually tracks graduates every year as a parameter of excellence by conducting annual tracer studies.

Tracer studies are means of maintaining curriculum relevance and providing targeted benefits to graduates to enhance the marketability of educational programs. Adequate knowledge on employment outcomes of training graduates could assist in formulating policy towards combating some of social problems such as unemployment. Students, particularly graduates of any course, are required to earn a sense of competence in their chosen field and develop confidence to explore new possibilities and new employment specially that there is increasing competition among rivals at work (Mathed, 2008).

The Nueva Ecija University of Science and Technology, specifically, the faculty of the College of Information and

Communications Technology is committed to complying with CHED's mandate to conduct yearly trace study. The essence of a higher education institution or university is to produce employable graduates. It measures the individual institution's success and potential to deliver work-ready students (Latif & Bahroom, 2010). Many universities have the philosophy of strengthening existing connections and building new bridges to the industry. In view of this, the NEUST Mission is to develop new knowledge and technologies and transform human resources into productive citizenry to bring about development impact to local and international communities (NEUST, 2020; Corpuz, 2020).

The researchers aimed to present employment data to show connections to the industry and examine if the university's mission was realized. May the data help the university, faculty, students, and stakeholders in reviewing and enhancing curriculum for the field of Information Technology (IT) is ever dynamic; its advancement and development had been rapid and its evolvement is a continuous process. (CMO 53. S. 2006). The information gained from these can be used by the graduates' alma mater and other educational partners for curriculum development and other new changes by administering and evaluating a survey on the cohort of graduates from a given school, occupation, specialty, level of education, their work characteristics, qualifications and skill development (Gines, 2004).

II. OBJECTIVES OF THE STUDY

The main objective of the study was to trace the BSIT graduates of NEUST San Isidro Campus of A.Y. 2018-2019.

Specifically, this employability study sought to answer the following questions:

1. What is the profile of employed respondents regarding:
 - 1.1 Company Location;
 - 1.2 Present Employment Status;
 - 1.3 Initial Gross Monthly Earning;
 - 1.4 How Respondents Find Their First Job;
 - 1.5 Duration to Land Their First Job; and
 - 1.6 Relevance of the Curriculum in their First Job
2. What is the profile of self-employed respondents regarding:
 - 2.1 Type of Business;
 - 2.2 Reasons for being self-employed; and
 - 2.3 Monthly income of the business

3. What is the profile of unemployed respondents regarding?

3.1 Reasons for being unemployed; and

3.2 How do respondents finance their daily living?

III. METHODOLOGY

The researchers used the descriptive method of research. Descriptive research can be explained as a statement of affairs as they are at present with the researcher having no control over variable. Moreover, "descriptive studies may be characterized as simply the attempt to determine, describe or identify what is, while analytical research attempts to establish why it is that way or how it came to be (John Dudovskiy).

Descriptive research is "aimed at casting light on current issues or problems through a process of data collection that enables them to describe the situation more completely than is possible without employing this method."

The respondents of the study were one hundred sixty-eight (168) BSIT graduates of A.Y. 2018-2019. There were one hundred forty-six (146) who responded to the survey or 86.90%, reliable and credible enough to represent the BSIT population.

The researchers used a modified Commission on Higher Education Graduate Tracer Survey. To easily identify the employability of BSIT 2018-2019, three Google forms consisting of three different links were created. The first Google form and link <https://tinyurl.com/BSIT-2018-2019EMPLOYED> was designed for employed respondents; the second Google form and link <https://tinyurl.com/BSIT-2018-2019-SELF-EMPLOYED>, was designed for self-employed or respondents with business and the last Google form and link <https://tinyurl.com/BSIT-2018-2019-UNEMPLOYED> was designed for unemployed respondents.

The modified questionnaires were planned and created by the researchers. Suggestions for modifications and improvements were done; there was a dry run which was participated by selected BSIT students.

The researchers got data from the Registrar's office containing a list of BSIT graduates with personal information. From November 2019 to August 2020, the links were disseminated to CICT NEUSTSIC closed group, graduates' e-mail account, group chat, and messenger to gather data.

The researchers also composed and sent private messages to BSIT graduates for them to be informed of the tracer study to quickly fill out and submit the questionnaire online.

Upon completion of the data gathering procedure, responses were tabulated to facilitate the analysis during the interpretation of data. The data gathered were tallied, analyzed, and interpreted. Descriptive statistics such as frequency counts, ranking, and percentage were used.

The formula is presented below.

$$P = \frac{f}{N}$$

Where:

P = is the percentage

f = is the frequency

N = total responses

IV. RESULTS AND DISCUSSION

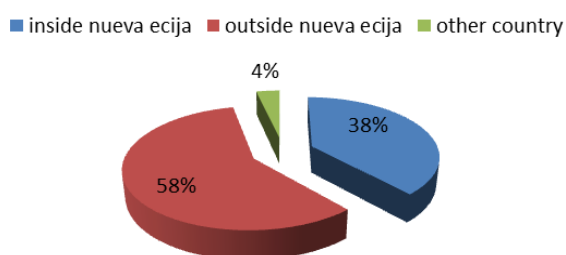
This section provides the presentation of the results of the study. Corresponding analysis and interpretation regarding some presented data were discussed.

Table 1. The Employed Respondents

Total Number of Graduates	Total Number of Respondents	Total Number of Employed Respondents	Percentage
168	146	86	58.90%

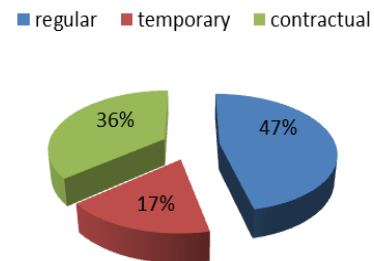
Table 1 shows that only eighty-six (86) or 58.90% were employed one year after graduation. Hiring new employees is one crucial task for any employer. That is why in the absence of in-house training program, employers prefer applicants who can quickly work independently (Kelley & Gaedeke, 1990; Webster & Taylor, 1995). Based on the study of Mina et. al, 2020 these BSIT respondents during their On-the-Job Training, were excellent in perseverance in pursuing goals and continuous improvement, innovative skills, planning and organizing skills and problem solving skills. This study proved that BSIT respondents were ready in the real world of work because of their higher level of personal skills particularly, problem-solving skills.

Figure 1. Company Location



As shown in Fig. 1, majority or 58% of the employed respondents were working outside Nueva Ecija. Curran & Greenwald (2006) emphasized that if graduates want an opportunity to get their feet in the door and prove themselves, they will have to redefine for their future employer what they have really learned after four years.

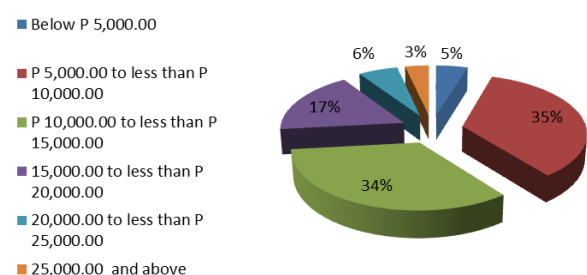
Figure 2. Present Employment Status



The present employment status indicated that majority or 46.51% of employed respondents' status were regular. The findings of the study (Mina et. al, 2020) have shown that the respondents were excellent in numerous personal skills. Likewise, they were very good in most of their technical understanding skills which are hard skills in the field of Information Technology.

Information Technology (IT) may be the most stimulating program in terms of skill gaps for the reason that there is the fast speed of change in terms of hardware and software development (Patacsil & Tablatin, 2017). This feedback study during their On-the-Job training makes a payment for them to be a regular employee.

Figure 3. Initial Gross Monthly Earning



As shown in Fig. 3, majority or 35% of the employed respondents were earning 5,000 to less than 10,000 pesos. These employed graduates were earning minimum salary wage as a stepping stone from different companies outside Nueva Ecija. This finding is the same as the study of Billo et al. (2017) which found out that the majority of the respondents (52.08%) were earning P5,000 to 10,000. This implies that the monthly earning of NEUST BSIT fresh graduates is similar to other colleges or state universities.

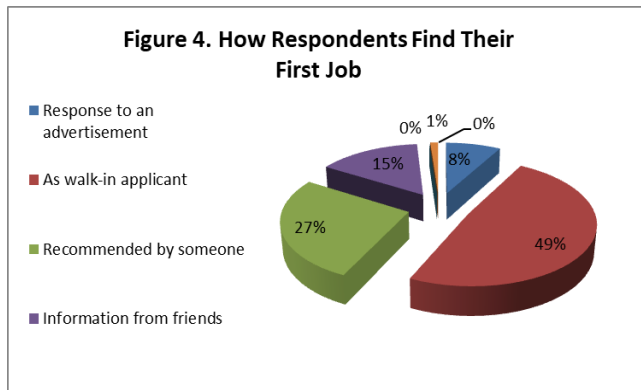
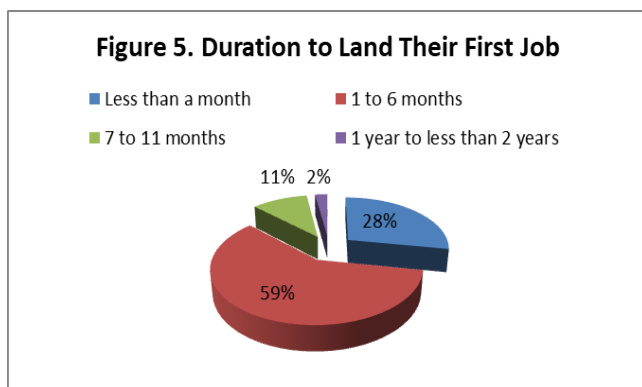
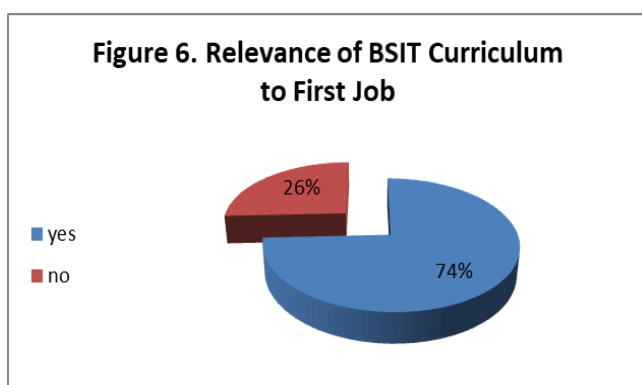


Fig. 4 reveal that, majority or 49% of the respondents find their first job as walk-in applicants. This implies that graduates really tried their best effort to land get their jobs on their own where independence is being emphasized and practiced (Dotong et. al, 2016)



This figure showed that majority or 59% of the employed respondents took 1-6 months to land their first job. The study confirms that most graduates did not spend a long time securing employment mainly because they were equipped with the professional knowledge and skills compatible with the requirements of the industry (Verecio et. al, 2017). Similarly, in the study of Del Rosario (2019), 42% of their respondents were able to find jobs in 2–5 months after graduation.



As shown in Fig. 6, majority or 74% declared that the BSIT Curriculum is relevant to their first job. These are

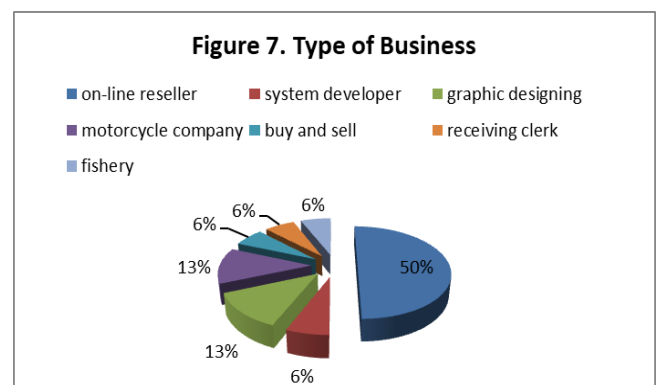
the utilization of computers and computer software to plan, install, customize, operate, administer, and manage information technology infrastructure. The result in this study lends support to the idea that “competitive graduates in the job market often depend on a strong curriculum of the programs” (Ahmad et al., 2012).

It goes beyond telling that the curriculum has to be relevant in relation to the demands of the industry, because “impractical university curriculum is one of the factors that cause graduates’ skills gap, along with other factors like constant changes in the labor market, and students’ passivity in planning and developing their career” (Tran, 2018).

Table 2. The Self-Employed Respondents

Total Number of Graduates	Total Number of Respondents	Total Number of Self-Employed Respondents	Percentage
168	146	16	10.96%

Table 2 manifests that sixteen (16) or 10.96% of the respondents were self-employed. This is a small percentage but it helped respondents to survive and make earnings during the Covid-19 pandemic. Social distancing, self-isolation, and travel restrictions have lead to a reduced workforce across all economic sectors and caused many jobs to be lost (Nicola et al, 2020).



As presented in Fig. 7, the majority or 50% of the self-employed respondents were on-line resellers. The evolution of digital marketing triggers the respondents to engage in this type of business. Small or giant companies are now enthusiasts of on-line selling just to reach out customers. Among those self-employed individuals, a good number are into freelancing work (Hussenot & Sergi, 2019), a job opportunity brought about by the easy access

to the internet. Many of these freelancers were highly educated (Beno, 2019; Burke & Cowling, 2019). It is also a good confirmation that the respondents were excellent in technical understanding skills (Mina, et. al 2019).

The Philippines has been called the social media capital of the world because most of the social media users have an extraordinarily high usage time of about four hours per day (Sanchez, 2020). People are taking advantage of the availability of the internet and technology to get jobs (Al-Hadi & Al-Aufi, 2019).

Figure 8. Reasons for being Self-Employed

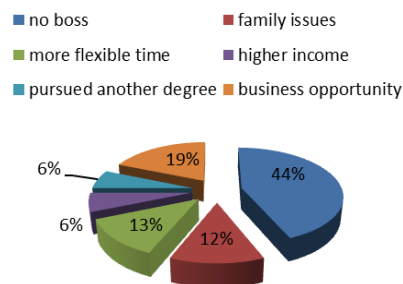


Fig. 8 indicates that the majority or 44% of respondents choose to be self-employed because of none existence of a boss. Respondents can freely use their time; can make actions and decisions without an authority figure.

Self-employed persons are more satisfied with their work than employees, mainly because they enjoy more interesting jobs and greater autonomy (Benz & Frey, 2006). According to psychological theories, both autonomy and the chance to pursue interesting activities should be seen as important elements of a broader human need for self-determination.

Figure 9. Monthly Income of Business

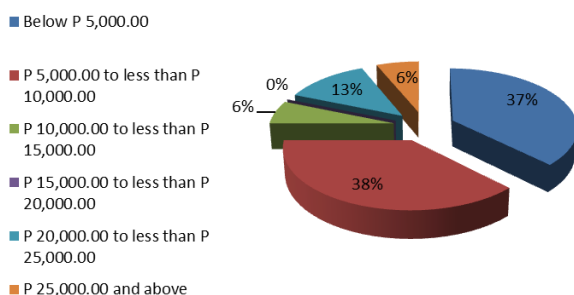


Fig. 9 reveals that the majority or 38% of self-employed businesses were earning 5,000 to less than 10,000 pesos. As respondents are beginning to explore the business opportunity that is not part of the BSIT curriculum, having a minimum monthly income business is quite good.

The respondents during their OJT found out that they were very good in terms of their entrepreneurial thinking skills. Since the students are taking an IT course, they did not excel in this kind of soft skills. (Mina et.al 2020)

Table 3. The Unemployed Respondents

Total Number of Graduates	Total Number of Respondents	Total Number of Unemployed Respondents	Percentage
168	146	44	30.13%

Table 3 shows that forty-four (44) or 30.13% of the respondents were unemployed when the survey was conducted. Compared to the study of Mina et.al (2020) before the spread of the Covid-19 virus, there was only twenty-eight percent (28%) of unemployed graduates.

It indicated that the Covid-19 pandemic greatly affects all aspects of our life. The functioning of global supply chains has been disrupted, affecting companies across the globe. Millions of people could lose their jobs over the coming months (Fernandes, 2020).

Figure 10. Reasons for being Unemployed

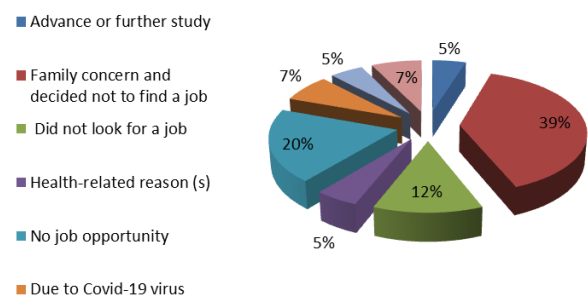


Fig. 10 shows that the foremost reason for being unemployed of the respondents was a family concern and decided not to find a job. Furthermore, family concern was also the primary reason why some graduates are not yet employed in the study of Billo et al. (2017). The bottom reason for being unemployed was "advance or further study", "no job opportunities" and "due to Covid-19".

The data imply that those who are not yet employed at the time this study was conducted did not perceive their qualifications, desire for further studies, health, and interest to look for a job as essential issues for being unemployed (Albina & Sumagaysay, 2020).

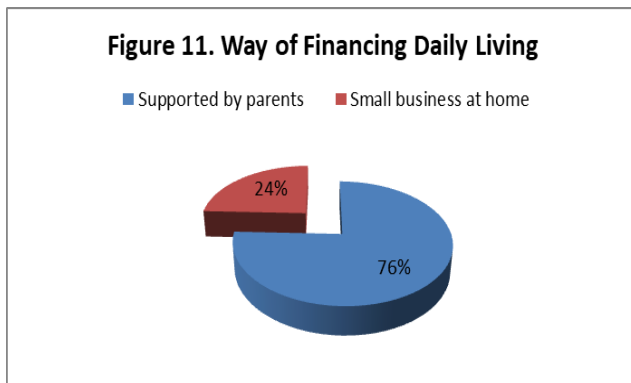


Fig. 11 shows that unemployed respondents were supported by parents to finance their daily living. As a consequence, it is the family's resources which play the most important role in the case of unemployment. As the ties among family members of the larger network are close and as there is a strong sense of interdependence and social solidarity, other family members are called to provide help in this situation of need (Lukas, 2012).

It is indicated that the Philippines have a strong family ties component. Strong family ties are also associated with less geographical mobility since ties are more useful if people live close to each other (Alesina & Giuliano, 2010)

V. CONCLUSION

This study focused on the number and percentage of total employed one year after graduation since it is the need for the university. This tracer study is similar to the study of Verecio, R.L. et al, 2017, where BSIT graduates of 2019-2020 of Leyte Normal University Tacloban City, were tracked to evaluate their employability status, the relevance of curriculum, and duration to land their first job. The OJT factor was also considered to help train the students to become responsible workers in the hereafter. The results of the two studies were the same in terms of high employability rates, declared relevance of curriculum, and 1 to 6 months' time frame to land their first job.

Another tracer study of Wanya (2016), profiled the BSIT graduates of Cagayan State University during the school year 2010-2014 in terms of employment status of the graduates, reasons of the unemployment of graduates and

graduates' insights on their success to their profession. The results of the two studies are similar in terms of high percentage of employability, relevance or usefulness of IT skills to their job, same monthly income of self-employed ranging from 5,000 to 10,000 pesos and the unemployed graduates were also supported by parents.

Lastly, the tracer study of Mina, J.C. et al (2020), profiled the BSIT graduates A.Y. 2016-2018 of Nueva Ecija University of Science and Technology, San Isidro Campus in terms of duration to land their first job, present employment status, monthly salary, and reasons for unemployment. The results of the two studies are similar in terms of 1 to 6 months to land their first job, both BSIT graduates have regular permanent status and the same reason for unemployment is a family concern. The difference is the monthly salary; the latest study indicated that BSIT employed are earning 5,000 to 10,000 which is comparably lower, two years ago.

The employability data of this research was successfully collected and tallied. However, the field of Information Technology (IT) has been ever dynamic; its advancement and development had been rapid, and its involvement is a continuous process. To face the challenges of progress, the Commission on Higher Education (CHED) recognizes the need to be responsive according to the current requirements of the country. Hence, it is essential and necessary that the country's IT capability should be continuously developed and strengthened to be at par globally (CMO No. 53; s. 2006).

After satisfactorily completing all the requirements leading to a BSIT degree, students may qualify for but not limited to applications developer, database administrator, entrepreneur in IT industry, information security administrator, information technology instructor, network administrator, network engineer, systems analyst, technical support specialist, test engineer, web administrator / web master and web developer (CMO no. 53, s. 2006).

A follow-up tracer study must be conducted to carefully analyze if the BSIT graduates of Nueva Ecija University of Science and Technology are in line with the mandated memo.

Table 4 Proposed Measures to Employ BSIT Graduates

Concern	Reasons	Strategy	Responsible Person/s
The majority of employed respondents were working outside Nueva Ecija	The reasons are unknown during the conduct of this tracer study.	Conduct a follow up study about the respondents' reasons for working outside Nueva Ecija	CICT faculty, Chairman, OJT Coordinator
The majority of employed respondents were earning 5,000 to less than 10,000	<ul style="list-style-type: none"> BSIT is a non-board course The only way to be 	<ul style="list-style-type: none"> Revisit the admission policies The applicant must be graduating from an accredited 	Director of Admission and Registration, Students, Faculty, Members of the

pesos only.	admitted to the university is to pass the NEUST College Admission Test (NEUST CAT)	high school, have an acceptable score on English and Math subject since the BSIT course is more logical and project management. <ul style="list-style-type: none"> • Conduct a university admission interview • Survey the perception of BSIT students towards their course 	Administration
The majority of employed respondents find their first job as a walk-in applicant	Lack of linkages to IT companies	<ul style="list-style-type: none"> • Assign OJT to IT-based companies specifically outside the province since there are a limited number of IT companies present in the province. • Establish strong linkage to Industry that offers internship to hiring program 	OJT Director, OJT Coordinators, Students, Faculty, Members of the Administration
The majority of the unemployed respondents decided not to find a job	Lack of initiative to look and apply for a job	<ul style="list-style-type: none"> • Conduct an exit interview • Conduct career guidance and counseling before graduation • Conduct alumni homecoming and job placement program 	Guidance Counselor, Director of Alumni, Students, Faculty, Members of the Administration

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Understanding the Farmers' Environmental Citizenship Behaviors Towards Climate Change: The Moderating Mediating Role of Environmental Knowledge and Ascribed Responsibility

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Abstract— Knowledge is known to be a pre-condition for an individual's behavior. For the most efficient informational strategies for education, it is essential that we identify the types of knowledge that promote behavior effectively and investigate their structure. The purpose of this paper is therefore to examine the factors that affect Kenyan farmers' environmental citizenship behavior (ECB) in the context of Adaptation and mitigation (Climate smart agriculture). To achieve this objective, a theoretical framework has been developed based on value-belief-norm (VBN) theory. Design/methodology/approach – Data were obtained from 350 farmers using a survey method. Partial least square structural equation modelling (PLS-SEM) was used to examine the hypothetical model. The results of PLS analysis confirm the direct and mediating effect of the causal sequences of the variables in the VBN model. The moderating role of Environmental knowledge has been seen to be impactful in Climate Smart Agriculture.

Keywords— Climate Change, Citizenship Responsibility, Environmental behavior, Environmental Knowledge, Local Ecological Knowledge.

I. INTRODUCTION

African countries have been facing enormous challenges in adapting to climate change as well as responding to the slowdown in economic growth in recent years. These twin crises have seen increased their being vulnerable and subsequently the effects of climate change and climate variability (Recha, 2019). Sub-Saharan Africa is heavily dependent on Agriculture and must adopt to the variances caused by variable climatic conditions. Kenyan households that engage in agriculture solely contributed 31.4% to the rural areas poverty reduction, and, agriculture stays as the largest

income source for both poverty stricken and other households in rural areas, according to the most recent World Bank economic analysis (Ayeri, Christian, Josef, & Michael, 2012). The challenges that farmers face are sadly not only the direct effects of climatic variability but also the international demands such as food security, reduction of GHG emissions and many others (Bryan, Ringler, Okoba, Koo, et al., 2013). However, implementing changes is no mean feat due to numerous barriers (Chua et al., 2019 & Moser and Ekstrom, 2010). Policies created for mitigation and adaptation in climate science for rural farmers do not go hand in hand with

the farmers' attitude towards climate change. Besides, in Kenya and other East-African countries, notwithstanding the increase in climate information from scientific institutions on climate, there is no knowledge transfer of that data to decision makers (Bryan, Ringler, Okoba, Koo, et al., 2013) as well as other barriers. (Kabisch et al., 2016) posit the literature varies on determining barriers to mitigation and adaptation measures uptake. Drawing from the argument that mitigation and adaptation are different and can be distinguished by behavioral responses. Indeed, mitigation can be defined as a local response to an international need such as reduction of emission of Greenhouse gases, adaptation focuses on a local need and its response thereof (Bryan, Ringler, Okoba, Koo, et al., 2013) an example is food security. In this study, barriers are defined as that which stands in between climate problems as they are identified and their solution which is classified as climate science, and that generally concern itself around the three dimensions of social, biophysical and economic. Behavioral and institutional barriers make up the category of social barriers. The way institutional organizations and their interactions with individuals influence the way individuals are permitted to make changes up to some limit is the institutional barrier related category. Behavioral barriers, on the other hand, are specifically related to how thought processes influence the way individual actors react to climate change stimuli (Jones and Boyd 2011). Environmentally, environmental citizenship behavior is a vital factor in determining uptake of climate science which is Adaptation and mitigation. This behavior preserves and enhances the environment which in turn contributes to sustainable development. Therefore, factors influencing environmental citizenship behavior in this paper aim at promoting sustainable agriculture and consequently, sustainable development. According to the value-belief-norm (VBN) theory (P. C. Stern, Dietz, Abel, Guagnano, & Kalof, 1999), it is assumed that a consumers' value orientation (VO) affects their Ascribed Responsibility (AR). AR if moderated by Environmental Knowledge (EK), will be eventually expressed in environmental positive significance which is environmental citizenship behavior. In the Kenyan context, there is a limitation in research that look into the moderated relationship between AR and ECB. Moreover, activated knowledge (Priadi, Fatria, Sarkawi, & Oktaviani, 2018) has significance to stimulate environmentally significant behavior. Some scholars have drawn Schwartz' norm-activation theory of altruistic behavior for example Stern & Dietz, 1994; Stern, Dietz, & Black, 1986; Stern, Dietz, & (P. C. Stern et al., 1999); (Liere & Dunlap, 1981) directly apply to positive environmental behavior since these are inner morals and personally upheld norms. In the applications of Schwartz'

theory, awareness of consequences catalyzes pro environmental behavior. This can be merely compared to environmental concern or positive attitude (Paul C Stern, 2000). In line with Berkman (2002) he distinguishes between awareness of ego oriented, social concern, and environmental consequences corresponding to three different underlying value orientations namely; biospheric, egoistic and altruistic. In order for the behavior to be performed, attention to or awareness of consequences must induce an Ascription to Responsibility (AR) to perform the behavior that in turn activates a personal norm or moral responsibility to perform the behavior.

The mediating effect of Ascribed responsibility between value orientation and ECB has not been looked into in the Sub-Saharan context. Additionally, the moderator used in my study has not been explored. The moderating effect shows human duty in providing environmental knowledge drives environmentally significant behavior (Liobikiene & Poškus, 2019).

1.1. Problem Statement

Common among countries in Sub-Saharan Africa, Kenya continuously faces the challenges of climate change (Recha, 2019). The country depends on rainfall agriculture, modern technology adoption has not been prioritized, poverty reduction had not been achieved, and infrastructure is poor thus markets least developed (Bryan, Ringler, Okoba, Koo, et al., 2013) (Odhiambo, 2009). Climate models suggest that the Kenyan Average temperature is higher than most regions worldwide. However, uncertainty looms wide about future changes in rainfall in the region. While many universal models show minimal rise in average precipitation in East Africa (Bryan, Ringler, Okoba, Roncoli, et al., 2013) these may be offset by warming of the Indian ocean, more rainfall variations and more occurrences of extreme events such as droughts. (Eisenack et al., 2014) Regional variations in precipitation are more; It is assumed and expected to get wetter in the Kenyan highlands and Northern Kenya which differs from the coastal region and lowlands which usually get drier (Bryan, Ringler, Okoba, Roncoli, et al., 2013). Furthermore, key staples like maize and wheat may reduce despite there being more rain owing to increased evapotranspiration (Tidwell, 2010).

This paper researches the relationship between agricultural productivity, GHG mitigation in Kenya based on farming practices being used by farmers. The main moderating factor introduced in this paper is Environmental knowledge. Policymakers can be influenced by the results to implement

policies that encourage better management practices which are effective as well as available in achieving different management practices for the various agroecological zones (AEZs) in Kenya and beyond.

1.2. Local Ecological Knowledge

Smallholder farmers are vital in agricultural improvement (Tidwell, 2010 & FAO, 2008). In targeting these farmers and strategies for adaptation on their farm management practices or Climate smart Agriculture, their local knowledge is key to up their adaptive capacity as seen in the literature for climate change, traditional ecological knowledge (Pretty et al., 2009). Both local knowledge and local ecological knowledge refer to the a collection of knowledge, practices and beliefs, that are within a particular locality, only reached through a long-term observation of while being present in that environment, and transferred through oral traditions through generations (Ogalleh, Vogl, Eitzinger, & Hauser, 2012).

Many smallholders often apply this local ecological knowledge in their daily practices. In assessing adaptive capacity, it is vital to look at these practices to improve local knowledge. This illustrates how to merge agricultural practices to up smallholders' adaptive capacity towards climatic variations within the seasons. This knowledge is specific to location, time and culture (Bank & Bank, 2019). Local knowledge is practical and farmers decide wisely and while more informed at certain times to environmental changes and how to make their yield better (Saitabau & Nairobi-kenya, 2014). The test of validity of local knowledge has been proven by science by comparing with quantitative data (Orlove & Caton, 2010). Many results illustrates that farmers' observations matches quantitative data analysis: local knowledge has been used to respond to extreme conditions which farmers have encountered such as droughts, famines, and other condition (Jiri, Mafongoya, Mubaya, & Mafongoya, 2016). There have also been cases where there has been a mismatch between local knowledge and quantified data hence casting doubt on local knowledge (Ochieng, Recha, & Bebe, 2017)

Policy on adaptation policy has not been grounded yet. Despite all the noise on climate change policy agenda, only used during political campaigns, adaptation policy research is not adapted enough. Focus is on how to measure and scale-up to the "dependent variable problem" (Dupuis & Biesbroek, 2013). While the literature on adaptation has dealt with the "how" to understand adaptation concepts from different angles such as resilience, adaptive capacity and vulnerability (Lee, Yang, & Blok, 2020), questions loom on

the practicality of readiness for future climate change. Research uptake thus still remains an emerging field that is not yet very well understood.

Collaborations such as "boundary organizations" try to make scientists and policy-makers have exchange forums for exchange of information, policy learning and decision-making processes (Lee et al., 2020)

The funding for climate modelling and the quality and quantity of climate data available is very variable on a global scale and in Kenya.

II. THEORETICAL BACKGROUND AND MODEL

2.1. Value Belief Norm (VBN) Theory

Based on the value-belief-norm (VBN) theory (Paul C Stern, 2000), For a consumer to have environmental significant behavior, he must have values which affect his beliefs that guide his pro-environmental personal Norm (PPN). PPN obliges one to act pro environmentally (Sponarski, Vaske, & Bath, 2015; Wolf, 1958). Belief is the acceptance that nature is factual and accurate and should be kept as so. According to some authors, values are defined to be concepts acceptable behavior that go beyond normalcy (Bruvold, 1973 & Chua et al., 2019). (Schwartz, 1992) aligns value orientation to what is valuable to humans. Stern et al. (1998) adopted a socio psychological perspective in defining the value orientations. Stern (2000) later added the VO, belief and norm on environmentally significant behavior to create his VBN theory. This study purposes to adopt the said values from the VBN theory and enhance the same using Environmental knowledge to measure the impact of the Environmental knowledge of farmers on the uptake and use of scientific research methods on mitigation and adaptation.

2.2. Environmental Citizenship Behavior (ECB) Model

Some observers define the model predominantly as a "pro-environmental behavior. Andrew Dobson (2010), is of the view that the model argues the principle of fairness and the sharing of what the environment provides, by taking part in and in the co-creation of laws that sustain development where the scope of citizen taking part ranges from individuals personally taking part in environmental decision making process or by using influence to directly sort out environmental concerns and to work with others to reach solutions for environmental crises.

In Agriculture, ECB guides to comprehend environmentally significant behavior (Boon, Quoquab, & Mohammad, 2019).

Environmental citizenship encompasses both activist and non-activist support for support good environment behavior (Paul C Stern, 1995). Individuals may not directly be seen to be promoting pro-environmental behavior but may support groups or even join such initiatives (Abedinpour et al., 2012) in non-activism support. (Van Herzele et al., 2013) observes that to understand environmentally significant behavior in Agriculture, ECB is a key component. Farmers are businessmen who need to be efficient (Del Corso, Kephaliacos, & Plumecocq, 2015) They use all resources available to spread awareness of good environmental behavior. As such, pro-environmentalists preserve and improve the condition of their environment (Gailhard, Bavorová, & Pirscher, 2015) They also form group with subscription membership. Farmers have a tendency to pressure their elected leaders to protect their interests (Taylor & Van Grieken, 2015) In Kenya, they are seen to constantly pursue the government for subsidized fertilizer prices and irrigation initiatives.

ECB is considered as a collective effort which may also include attending seminars (Paul C Stern, 2000).

2.3. Value orientation

Schwartz (1992) says that values improve existent status or are acceptable. (P. C. Stern et al., 1999) adopted measures for value orientation in a socio psychological perspective from specific values in society to study good environmental behavior.

Stern (2000) later added the Value Orientation to and belief and norm to create the VBN theory on environmentally significant behavior. BV Is the farmer's willingness to protect his environment or biosphere without harm (Turaga, Howarth, & Borsuk, 2010). It unites man and his natural resources (Steg, 2007) and non-pollution due to respect of the environment (Berkman, 2002). Emphasis is put on preservation of the environment (Steg, 2007) . Farmers should highly perform Biospheric values (Del Corso et al., 2015).

The Altruistic Value is more inclined towards the farmer taking care of the environment so as not to harm the society and other people (Chen & Sun, 2015a) (Chua et al., 2019). Farmers who have a high altruistic value have environmentally significant behavior (Del Corso et al., 2015).

EV are those for the personal benefit of an individual (Turaga et al., 2010) . the individual considers his needs before safeguarding his environment (Chen & Sun, 2015b) are the basis of EV.

Relationship between value orientation and Ascribed responsibility

AR is believed to be human action impact on the environment. It could be positive or negative (Paul C Stern, 2000). The VBN gives an understanding of the relationship between VO and AR. The relationship between humans and their environment may have consequences depending on how humans treat their environment. (Saleem, Eagle, & Low, 2018) (Fielding, McDonald, & Louis, 2008) (Snelgar, 2006) In this case, farmers are aware that if they use certain agrochemicals, it will be harmful to their environment and as such will desist from using them

H1. Biospheric value has a direct positive effect on Ascribed responsibility

H2. Altruistic Value has a direct positive effect on Ascribed responsibility

H3. Egoistic value has a direct negative effect on Ascribed responsibility

H4. Ascribed responsibility has a direct positive effect on Environmental Citizenship Behavior

Environmental knowledge may lead to pro-environmental behavior especially if there is monitoring of such knowledge. A few scholars have found that such knowledge has an insignificant effect on pro-environmental behavior . (Otto & Kaiser, 2014) However found this relationship to be significant. Their study found that people who know more about environmental problems and have vast knowledge on the environment act more pro-environmentally. This inconsistency is proof that there has to be studies on more than one school of thought on the impact of Environmental knowledge (Liobikiene & Poškus, 2019),

The effect of Action-related knowledge has a greater impact on pro-environmental compared to any other type of environmental knowledge. For example, merely knowing that climate smart agriculture has a better effect on the environment is not enough but knowing that the farmer will get better yields can influence policy decisions. This affects

behavior directly (Liobikiene & Poškus, 2019). Goes without saying that people with higher knowledge behave more appropriately towards the environment as stated by Ting (Otto & Kaiser, 2014). (Zhao, Gao, Wu, Wang, & Zhu, 2014) observed that usage behavior can only be achieved if and when one is informed about green economy. The knowledge of environmental problems impacts pro-environmental behavior (López & Cuervo-arango, 2014). One can only take pro-environmental actions if they know what they can or cannot do. Thus, action related knowledge translates to behavior.

2.4. The relationship between Ascribed Responsibility and environmental citizenship behavior with the moderating role of Environmental knowledge.

Independent and Dependent variables can be perfectly described where there is a moderator. The current study proposes EK to moderate the relationship between AR and ECB. (Steg, 2007) that personal norms positive to the environment mediated the relationship between environmentally significant behavior and the ascription of responsibility. The authors did an experiment on the pricing policy for transport and its acceptance. The nexus between the ascription of responsibility, environmental knowledge (EK) and ECB is yet to be examined. The current study assumes that EK will moderate the effect of AR on ECB positively. For this reason, the hypothesis hereunder is proposed.

H5: Environmental Knowledge moderates Ascribed Responsibility positively

From the foregoing, the figurative model below is proposed.

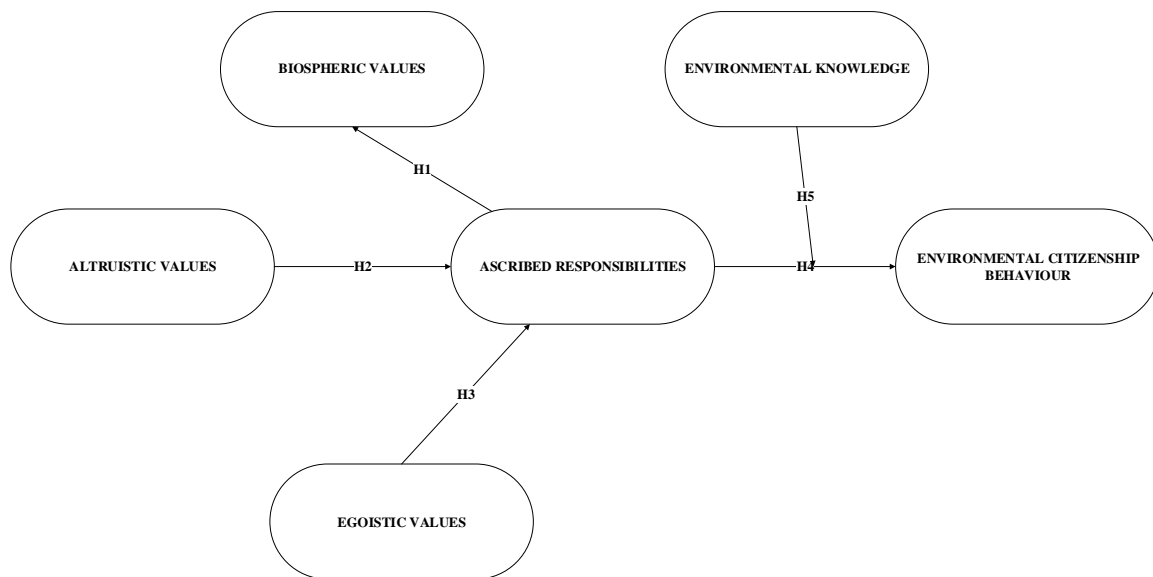


Fig.1: Conceptual Model

III. METHODOLOGY

3.1. The Study Area

Kenya's total area of 581,700 km² consists of ranges in natural ecosystems. There are the following areas; arid, semi-arid, savannah and forests. There is rapid and unending expansion of urban areas despite urbanization and of rural areas. Areas covered by water and the ocean environment which hosts marine and coastal ecosystems, fresh water lakes and rivers. Some of these rivers are periodic and may dry at different periods during climate variability. Some of the lakes are saline in nature while some are of fresh water. The aquatic environment includes 14,300 and 143,100 km² of territorial waters and exclusive economic zone (EEZ), respectively, in

the Indian Ocean (Services, Health, & Macro, 2010). Table 1 shows the different Agro ecological zones of the country. Kenya's economy is dependent on the environment. All the key sectors, rely on the environment. To achieve a sustainable economy and development, different sectors of development must take action. Agriculture has for a long time been the main contribution to the economy marking up for 25 percent of the gross domestic product (GDP) (Kabubo-Mariara & Karanja, 2007).

Table 1 Agro- ecological zones of Kenya

Zone	Approximate Area (km ²)	% Total

I. Agro-Alphine	800	0.1
II. High Potential	53,000	9.3
III. Medium Potential	53,000	9.3
IV. Semi-Arid	48,200	8.5
V. Arid	300,000	52.9
VI. Very arid	112,000	19.8
Rest (waters etc)	15,600	2.6

Source: Sombroek, et al., 1982.

3.2. Statistical Analysis

A scholar or researcher may use mediation analysis to realize the effect of X on Y (Hayes & Rockwood, 2017). The authors here use the example of the therapy and trauma. They explain that the initial cause X could be the kind of the therapy the patient receives or the kind of therapy or any other conceived actor that has some kind of cause which consequently has results.

Whilst mediation analysis focuses the cause and its consequences, moderation analysis deals with, time and conditions, or for the kind of individuals that effect exists or does not and to what extent. (Hayes & Rockwood, 2017). In this paper, the authors used the example of traditional therapy in comparison to a modern therapy which effects might be less effective to treating depression. The effect of the moderation might be small or even harmful.

In this paper Environmental knowledge will be the moderator on ascribed responsibility

In the collection of data, the research identified and assesses current and potential household-level Adaptation and Mitigation strategies available to farmers from 4 different Agro ecological zones (AEZs) was collected, cash crops, other crops, institutional backgrounds and policy were all considered. World Bank supported projects in the selected zones where agricultural mitigation and adaptation were practiced. They range from arid, semi-arid, temperate, and humid areas.

3.3. Data collection

Participants

The use of self-administered questionnaires was employed by distributing 350 questionnaires to those farmers who had basic knowledge on Climate smart agriculture. Around 300

were completed usably and handed back directly by the farmers after completion.

Table 2 study sites

district	Agro ecological zone	No of Households
Garissa	Arid	75
Njoro	Semi-arid	75
Othaya	Temperate	100
Siaya	Humid	100
Total		350

3.4. Study Design

The hypothetic-deductive approach was followed in this study, wherein hypotheses were tested. Each variable correlation is tested without much engagement of the researcher. Positive Environmental behavior was observed as it usually and normally occurs. The farmer being the unit of analysis. The data were collected in the year 2019 which has 2 main planting seasons however some plants especially vegetables have no particular season thus some grow throughout the year. The objective of this study being to confirm existing theory (Value Belief Norm) by developing new variables in this case, moderating Ascribed responsibility using Environmental knowledge; non-probability sampling technique, was applied (Boon et al., 2019). The thumb rule was used to reach the appropriate sample size (Cracraft, 1988).

IV. RESULTS AND ANALYSIS

A five-point Likert scale ranging from strongly disagree (never behave: 1) to strongly agree (always behave: 5) is employed. Six variables were investigated in this study: Biospheric value, Altruistic value, Egoistic value, environmental knowledge, Ascribed responsibility and Environmental Citizenship Behavior. The scale for the 3 value orientations were measured according to stern in (P. C. Stern et al., 1999). They were measured using 9 items such as; While farmers use the environment, the onus lies in them protecting it (e.g. "I only use environmentally friendly fertilizer", "I long for a war free world" and "I would like to have better harvest next time for more monetary returns). To

measure environmental knowledge ,reference was made to (Frick, Kaiser, & Wilson, 2004) who focused more on action-related knowledge to reveal the real knowledge about the impact of a specific action. Scales for Ascribed responsibility was constructed by adopting items used by (Paul C Stern, 1995) . “disposal of agricultural waste has contributed to increase of cancer deaths ” and “No one has the right to harm

the environment” . Environmental Citizenship Behavior was measured by adapting the items suggested by (Paul C Stern & Dietz, 1994) items measured were 3 (“I always watch out my elected leader’s contribution regarding environment issues related to irrigation methods and water conservation methods.)

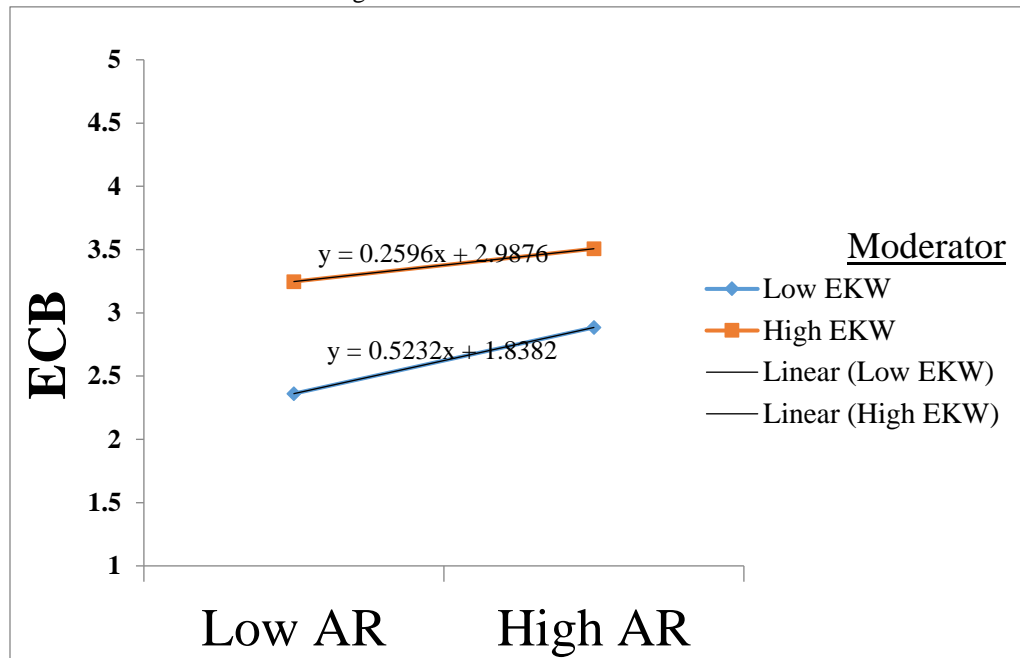


Fig 2: EKW dampens the positive relationship between AR and ECB

Table 3 ANOVA and Table 4. Regression Coefficient

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	56.285	1	56.285	176.183	.000 ^b
	Residual	104.787	328	.319		
	Total	161.072	329			
2	Regression	66.413	2	33.206	114.711	.000 ^c
	Residual	94.659	327	.289		
	Total	161.072	329			

a. Dependent Variable: ECB

b. Predictors: (Constant), EKW

c. Predictors: (Constant), EKW, AR

Model Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. Change
1	.591 ^a	.349	.347	.56522	.349	176.183	1	328	.000
2	.642 ^b	.412	.409	.53803	.063	34.985	1	327	.000

a. Predictors: (Constant), EKW

b. Predictors: (Constant), EKW, AR

Table 4 model of the regression coefficient shows $F(1, 328) = 176.183$ $p < 0.001$ and $F(2, 327) = 34.985$ $p < 0.001$. per this regression output shows potential significance. Table 3 ANOVA also further indicates that, the interaction of EKW accounted for the significant variance of AR and ECB with $R^2 = 0.063$ significance potential moderation between AR and ECB. The moderation interaction from Figure 2 also indicates dampen positive relationship between AR and ECB. Both model indicates significance of the variance, signifies moderation perceived in the hypothesis 5.

Table 4. Hayes' Process condition output of mediation. * $p < .01$, ** $p < .001$, *** $p < .005$.

OUTCOME of MEDIATION IN THE STUDY						
Model Summary	Exogenous construct predicts			significance predicts		
	R	R-sq	MSE	F	df1	df2
	.3627	.1315	.6759	16.4588	3.0000	326.0000
				p		
				.0000		
	coeff	se	t	p	LLCI	ULCI
constant	2.1904	.3947	5.5494	.0000	1.4139	2.9669
EV	-.1260	.0592	-2.1265	.0342	-.2425	-.0094
AV	.2207	.0552	4.0012	.0001	.1122	.3292
BV	.3251	.0670	4.8523	.0000	.1933	.4569
Model Mediation/exogenous construct						
	R	R-sq	MSE	F	df1	df2
	.5981	.3577	.3183	45.2440	4.0000	325.0000
				p		
				.0000		
Model						
	coeff	se	t	p	LLCI	ULCI
constant	1.4483	.2834	5.1106	.0000	.8908	2.0058
EV	-.0870	.0409	-2.1252	.0343	-.1675	-.0065

AR	.2548	.0380	6.7050	.0000	.1801	.3296
AV	.1960	.0388	5.0553	.0000	.1197	.2723
BV	.2973	.0476	6.2438	.0000	.2036	.3910

Test(s) of X by M interaction:

F	df1	df2	p
7.5082	1.0000	324.0000	.0065

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
AR	-.0321	.0169	-.0682	-.0020

exogenous significant predicts endogenous constructs

Partially standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
AR	-.0459	.0232	-.0940	-.0028

Completely standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
AR	-.0361	.0182	-.0741	-.0023

Table 4 indicates mediation of exogenous variables of (EV, AV and BV) to AR with indirect effect on ECB significant of ($\beta = .0592$, $t = -2.1265$, $p < .0342$), ($\beta = .0552$, $t = 4.0012$, $p < .001$), and ($\beta = .0670$, $t = 4.8523$, $p < .000$) respectively. The regression model shows all exogenous variables significance predictor of AR except EV. In the same vein, the indirect effect of (EV, AV, BV) significantly predicts the ECB shows table 4 EV ($\beta = .0409$, $t = -2.1252$, $p < .0343$), AR ($\beta = .0380$, $t = 6.7050$, $p < .000$), AV ($\beta = .0388$, $t = 5.0553$, $p < .000$), BV ($\beta = .0476$, $t = 6.2438$, $p < .000$). The effect size is $-.0361$ with 95% confidence level thus less than zero in negative interval $z = -.002$ (Preacher & Hayes, 2008). Therefore, the H4 of the indirect effects of all the exogenous constructs significantly satisfied the model constructs in this study. Table 5 shows very good significance relationship

among constructs, though, on negative weak relationship but significant. Therefore, all the constructs have showed good effects from H1, H2, and H3 (Chua et al., 2019)

The hypotheses in the study all supported, while the mediation and moderation also justified from table 4 and 3 above. From table 6 items loading from each construct indicated above or within the benchmark of 0.7. These loading are indication of good measurement effects of the exogenous variables and the endogenous constructs based on the conceptual model of the study. The variance explanatory power of ECB is $R^2 = 0.650$ represents 66% of the dependent variable strength. Also, the mediator $R^2 = 0.363$ thus 36% of the variance of all the exogenous directly to the mediator.

Table 5: Means, standard deviations (SD) and Pearson correlations (r)

Variables	EV	AV	BV	ECB	AR	EKW	@	Mean	SD
EV	1						0.706	3.5733	0.7859
AV	-0.166**	1					0.706	3.9356	0.83896
BV	0.140*	0.09	1				0.891	4.1642	0.68788
ECB	-0.132*	0.358**	0.382**	1			0.905	4.1508	0.6997
AR	-0.112*	0.253**	0.258**	0.466**	1		0.857	3.9629	0.87819
EKW	-0.174**	0.411**	0.327**	0.591**	0.398**		0.891	4.1568	0.79189

Correlation is significant at the * = $P \leq 0.05$, ** = $P \leq 0.01$, Note: @ = Cronbach's Alpha, SD = standard deviation, EGV = egoistic values, ALV = altruistic values, BPV = biospheric values, AR = ascribe responsibilities, ECB = environmental citizenship behavior, EKW = environmental knowledge.

Table 6 of factor loading

Loading of the constructs on the measured items						
ITEMS	1	2	3	4	5	6
AV3	0.866	0.088	0.154	0.123	0.015	-0.019
AV2	0.860	0.050	0.212	0.092	-0.003	-0.083
AV4	0.820	0.127	0.084	0.175	0.048	-0.065
AV1	0.800	0.090	0.110	0.097	0.004	-0.094
AR3	0.064	0.881	0.164	0.145	0.072	0.003
AR1	0.048	0.816	0.158	0.172	0.118	-0.082
AR2	0.144	0.814	0.050	0.195	0.106	-0.093
AR4	0.111	0.809	0.152	0.137	0.080	0.010
EKW3	0.160	0.136	0.861	0.235	0.122	-0.052
EKW4	0.101	0.211	0.821	0.144	0.123	-0.120
EKW2	0.218	0.089	0.775	0.320	0.105	-0.091
EKW1	0.236	0.194	0.707	0.285	0.192	-0.041
ECB3	0.152	0.192	0.238	0.812	0.147	-0.009
ECB2	0.188	0.180	0.287	0.787	0.131	-0.048
ECB1	0.205	0.214	0.178	0.783	0.195	0.012
ECB4	0.055	0.210	0.259	0.715	0.220	-0.168
BV2	0.030	0.036	0.053	0.163	0.831	0.082
BV4	0.011	0.083	0.154	0.093	0.815	0.067
BV3	0.076	0.175	0.143	0.086	0.813	0.140
BV1	-0.049	0.078	0.074	0.188	0.777	-0.030
EV2	-0.137	-0.003	-0.038	-0.010	0.029	0.834

EV4	-0.020	-0.014	-0.148	-0.032	0.072	0.754
EV1	-0.231	-0.076	-0.179	0.038	-0.026	0.748
EV3	0.155	-0.067	0.168	-0.189	0.203	0.538

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

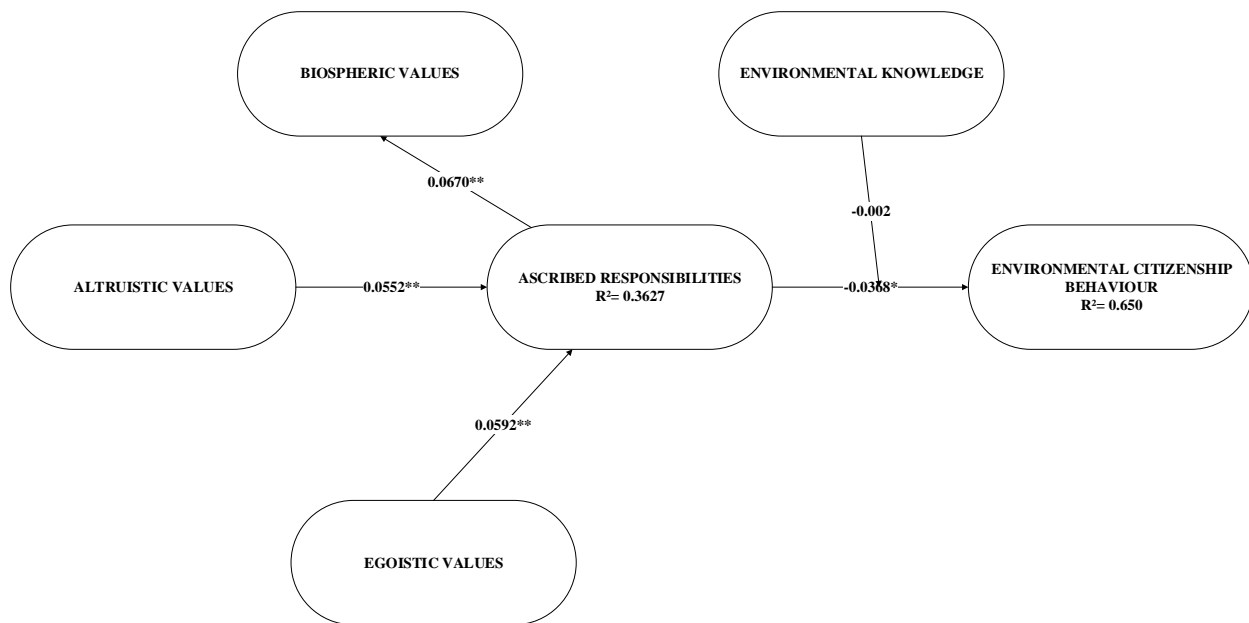


Fig.3: Regression path coefficient of the conceptual model

V. DISCUSSIONS

The current study looks into the nexus between Value Orientation and Environmental Citizenship Behavior while testing the mediating effect of Ascribed Responsibility and Moderating effect of Environmental Knowledge. On the ground of VBN theory, hypotheses were developed and thereafter tested using the advanced statistical technique, i.e., PLS-SEM. The results confirmed all hypotheses context of Kenyan farmers. It was important to examine different Agro ecological zones because of the varying temperatures and soil humidity. The synergy between value orientation and Ascribed responsibility in this study, VO in terms of BV and AV positively and significantly affected AR. EV on the other hand yields negative results. VBN theory therefore confirmed, which argued hypothesis of values are formed to prove a direct effect on how form and articulate AR (Paul C Stern, 2000) , Thus, a farmer with strong BV and AV is expected to accept AR and speedily welcome initiatives. The farmers consider their environment while using fertilizer, they are

concerned about the wellbeing of their fellow citizens and they focus on their harvest. When the farmers are egoistic though, they don't seem to care much about the impacts of their action. These value orientations affect Ascribed responsibility, and show how much they can do for environmental protection.

4.1. The relationship between Ascribed Responsibility and Environmental citizenship Behavior

Data obtained confirms the connection between AR and the ECB as is the case in the VBN theory. Individuals aware of what their actions might cause and capable of exercising caution refrain from harmful actions to the environment. The current research context, Kenyan farmers are more knowledgeable and employ the use of using Climate Smart methods in farming and consequently intimated the will to carry out their responsibility to take care of the environment. Therefore, Responsibility is confirmed. On Environmental knowledge, the current study revealed that EK enhances a farmer's responsibility to be more aware and as such have the

final effect in decision making. The results are true to the VBN theory, which assumes a nexus between variables and action taken, i.e. values, responsibility, norm and positive environmental behavior (Paul C Stern, 2000) Farmers who are aware of action related consequences and know their commitment to the environment, have their sense of moral obligation activated, and eventually influences their Environmental Citizenship Behavior.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

This study analyzes behavior of farmers towards adaptation and mitigation regarding climate change showing their knowledge of effects of climate change and show that some farmers have employed various adaptation methods. There is also a difference in effects in the different Agro Ecological Zones. Climate Smart Agriculture such as Crop rotation is mostly used in high potential zones, while irrigation and water harvesting are more common in dryer regions. If Kenyan farmers intend to counter the hard long term effects of climate change, more environmental knowledge on climate change must be instilled.

Provision of Environmental knowledge to farmers by the government should be a key policy issue. Monitoring and evaluation of practices on the knowledge to farmers should also be a key factor for adaptation to climate change. The gap in different disciplines such as scientists, climate experts and policy makers should be filled to disseminate knowledge. Scientists may spend all the time in the lab and have results but if not implemented into policy then it's a waste of government resources especially if the scientists are government funded.

Access to credit by farmers may be used as a key tool to attain adaptation measures. The same should not attract high interest rates so as not to discourage farmers.

Action-based knowledge does not predict public sphere behavior but Public behavior pretty much determines private sphere behavior. Suffice to say, if behavior is determined by public law, it streams down to private individual behavior. This means that Environmental citizenship behavior impacts values which may be changed because of awareness. Knowledge and motivation encourage Environmental Citizenship Behavior and the same acts backwards. Therefore, environmental education should provide information as well as nature-based experiences to make it eco centric.

Livestock farming has not been considered in this paper yet most Kenyan farmers combine both crop and livestock

farming. The arid and semi-arid farmers mainly concentrate on livestock rearing and this may be good for future research.

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Handle Assembler Validation

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Abstract— The present study was carried out in a company that manufactures 1-liter jugs, the daily production to be covered is at least 9500 1-liter bottles per shift, during the last months the production quota was not being met, since in the area handle assembly was lost about 12 seconds.

The objective of this project is to solve the problem presented in the production, reducing the time in the placement of the handle, the minimum production quantity per shift can be met. To provide a solution, an Ishikawa diagram was used using the 6 M's methodology where it was obtained and it was decided to solve the lack of an electro-pneumatic handle setting equipment, since, in the production area, there is no such system for so it was decided to build one so that it cannot affect the workspaces.

When building the assembler, the handle can be installed in 3 seconds under a single operator, that is, the installation time improved and a salary was reduced, also avoiding problems caused by insufficient personnel. In this way, the purpose for which the assembler was developed is fulfilled; the validation of it through ANOVA is presented below.

Keywords— ANOVA, validation, assembler.

I. INTRODUCTION

To raise production rates it is vital that all the components that make up a process are in their best state and synchronicity, this avoids delays, stoppages, waste and any factor that means losses for the company.

Within the company case study, the objective was defined to reduce the time the placement of handles, the handle assembler that is tested in this study works with an electro pneumatic system, which applies force and displacement on the handle in the neck of the bottle for placement.

With the use of the prototype, a production per shift of 9500 bottles is achieved, while approximately 7,200 are obtained manually, which reflects a deficit of 25%, causing that for each hour 288 more bottles should be placed, therefore, it is necessary the transfer of personnel.

THE ASSEMBLER CAN only attach one handle to a single bottle at a time, limiting the amount of final product. The

assembler shortens the time from 12 to just 3 seconds, streamlining the process.

The present invention aims to validate a device for placing a handle on a bottle or carafe, a machine that integrates the device for placing a handle on a bottle or carafe, a procedure for placing the handle on a bottle or carafe, and a handle that can be placed on a bottle or carafe. . The device for placing a handle on a bottle or carafe has a series of arms that allow the handle to be picked up from a handle feeder means and placed in a bottle or carafe.

The machine that integrates the above device has handle feeder means that position each of the handles in such an arrangement that allows the device for placing the handle on the bottle or carafe to pick up the handles from said handle feeder means.

Likewise, the machine that integrates the device for placing a handle on a bottle or carafe has feeding means for bottles or carafes that allow them to be directed

towards the device for placing the handle. The procedure for placing the handle on the bottle or carafe picks up the handle from the handle feeder device and places it on the bottle or carafe. (Ruiz, 2010)

OBJECTIVE

Validate the prototype that reduces the time for placing handles on the one-liter bottles, using ANOVA.

HYPOTHESIS

With the jointer, the time in placing the handle on the bottle will be reduced from 12 to 3 seconds, this for only one person.

JUSTIFICATION

With this project, the workers of the company will be able to place a greater number of handles in a shorter time, the profits will increase, since it will not be invested in more personnel or they will have to change the area; The production time will be reduced and at the same time, the machine will not stop due to bottle accumulation.

II. ANALYSIS OF VARIANCE (ANOVA)

To evaluate the experimental conditions of the machine we will use a statistical method known as analysis of variance or ANOVA (for its acronym in English Analysis of variance), which is in charge of analyzing the means, to evaluate whether an event or characteristic influences or not the operating results.

As in any experimental study of a phenomenon, a hypothesis is raised, this case is not the exception, known as the null hypothesis or also called H_0 , when making a change in some characteristic it is thought that this will not affect the performance of what is studying and we call this H_0 , in order to predict the behavior and verify if it changes or not.

To run the ANOVA, a continuous response variable is needed, which is the one we want to measure and observe how it reacts with the established changes, for this case it will be the time of placement of the handle and a categorical factor, which are the changes in the study, in this case it will be the different methods of placing the handle.

A series of samples will be selected at random, considering the operating characteristics and the factors to be evaluated; the time it takes to place the handle the different methods was taken.

III. TECHNOLOGICAL EVALUATION.

After defining the factor to be modified, we propose to create an automatic handle jointer. For this, the study of materials to be used is carried out.

PNEUMATIC CYLINDER

For the development of the jointer is necessary to have the technical data of the pneumatic cylinder, whose function is to place the handle.

Table 1 is shown below with data from the pneumatic cylinder.

Table 1 Technical data of the pneumatic cylinder

Attribute	Value
Action	Double
Maximum pressure	10 bar
Damping type	Padded
Body dimensions	20 mm diameter x 145mm
Maximum operating temperature	80°C
Length	145 mm
Minimum operating temperature	-20 °C
Diameter	20 mm

With the information in table 1 the plunger area is calculated.

$$\text{Equation 1} \quad F = \frac{P}{A}$$

Where:

P = pressure (Pa)

F = force (N)

A = area (m²)

To carry out the tests at different pressure values, the areas of the cylinder are calculated with equation 1.

At the end of the tests we could see that the force was not enough to place the handle.

Therefore, it was carried out at different pressures and the results are presented below. See table 2.

Table 2 Tests with different values

Kg/cm ²	Pressure		Strength (N)		Strength
	bar	Pa	Extension	Retraction	
1	0.980665	98066.5	11.11	8.33	No
2	1.96133	196433	22.25	16.69	No
3	2.941995	294199.5	33.33	25	No
4	3.92266	392266	44.44	33.34	OK
5	4.903325	490332.5	55.55	41.67	OK
6	5.88399	588399	66.66	50	OK
7	6.864655	686465.5	77.77	58.34	OK
8	7.84532	784532	88.88	66.68	OK
9	8.825985	882598.5	99.99	75.02	OK
10	9.80665	980665	111.1	83.35	OK

The pressure is shown in three different measurement units, kg / cm² which is the pressure with which the tests were carried out, in bar to identify its value in this measure and avoid exceeding the limit of the cylinder; also in Pa which is the measure of the international measurement system (SI) and in which the mathematical calculations were carried out.

Pulleys

4 pulleys were used for the transition of movement from the motor to the belt, as well as a gear motor from 20 to 1.

IV. RESULTS AND DISCUSSION

According to the figures in time and number of handles placed during a shift, it was stipulated that there is a deficit of 25% in production.

Table 3 and table 4 are shown below with the time and production values manually and with the assembler.

Table 3 Evaluation of the manual method

	Experienced staff	Inexperienced staff	Production	Expected production
Laying time	9	12		
Production per shift	3200	2400	7200	9500

Table 4 Evaluation of the automatic method

	Staff	Production n	Production n	Expected production n
Laying time	3			
Production n per shift	960	9600	9500	9500

Obviously, by automating the placement of the handle on the bottle, it is possible to reduce the placement time, in addition to meeting the objective of daily production.

To validate the efficiency of the proposed method, analysis of variance between the assembly methods is performed.

Where:

- H0: the assembly time does not depend on the method used.
- Continuous response variable which is time (in seconds).
- The categorical factor are the handle assembly methods.

RESUMEN						
Grupos	Cuenta	Suma	Promedio	Varianza		
Columna 1	10	81	8.1	3.65555556		
Columna 2	10	64	6.4	1.6		
Columna 3	10	41	4.1	0.76666667		
ANÁLISIS DE VARIANZA						
Origen de las variaciones	Suma de cuadrados	Grados de libertad	Promedio de los cuadrados	F	Probabilidad	Valor critico para F
Entre grupos	80.6	2	40.3	20.0756458	4.55173E-06	3.354130829
Dentro de los grupos	54.2	27	2.00740707			
Total	134.8	29				

In the image 1 and 2 the value of the variance of each of the methods is observed, while in the second sample F calculated which is 20.0756458 and F critical, when comparing the data it can be observed that the F calculated is greater than Critical F, therefore it is known that the hypothesis H0 is rejected and it is concluded that the assembly time does depend on the method used.

The assembler fulfills the main purpose of reducing the time in the placement of handles on the bottles, covering the amount of production per shift and in turn, avoiding transfers of personnel due to bottle accumulation

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Information Abusing of Rating Agency in “Beauty Contest”

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Abstract— This paper studies imitation behavior by subjects in information structure, for example rating agencies. We consider agencies make their rating based on knowledge of prior distribution, public signal, and private signal. They focus on two goals: accurately estimate the risk of the target, avoid giving rate far away from others. We find that agencies will overreact to the prior belief, public signal and underreact to the private signal. And we analyze the welfare the social welfare loss caused by this behavior and the impact on private information acquiring of this behavior.

Keywords— beauty contest, rating agency, signal, information acquaintance, welfare.

I. INTRODUCTION

Before making an estimation, many subjects seek to not only give an accurate estimation, but also predict other subjects' estimation. Because estimating far away from the majority make himself dubious. And the real value of the objective can only be disclosed after a while or gradually, so being different from others makes his estimation seem inaccurate and impacts his reputation temporarily. Even the real value is disclosed and prove the minority is right finally, the damage has happened. Thus, when making estimation, the subject will not only try to make accurate estimation but also predict what others will estimate.

In beauty contest game, people are asked to choose the most beautiful girl in the list non-publicly. The girl with

highest vote will be the winner. And who choose the winner will be rewarded. However, the outcome of the contest does not go along with the designer's mind. Because voters are not only trying to pick up the most beautiful girl but also trying to predict what others will choose in order to be rewarded. The “beauty contest” terminology is drawn from a well-known parable told by Keynes (1936, Chapter 12). Keynes described newspaper-based competitions whose entrants were invited to choose the prettiest faces from a set of photographs, but where it is optimal to nominate the most popular faces but not the prettiest faces. John Duffy and Rosemarie Nagel (1997) study the reference point is not only mean, but also median or maximum. In Potamites and Schotter (2007), they considered the influence of information, all players in a

beauty-contest game receive either public or private advice which is not directly influence the players' payoff. They find that meaningful public advice shifts the observed rationality levels toward higher rationality, indicating that public but not private advice influences the beliefs about other players. The difference in this paper is that the information is stochastic and given objectively. Celen, Kariv, and Schotter (2010) study the impact of naive advice and observational learning on the processing of information in an information cascade experiment. They find that subjects tend to follow the advice of others, but mostly ignore the past behavior of others (even though both types of information are equally informative in their setup). Morris and Shin (2002) say if there is no socially valuable private information, greater provision of public information always increases welfare. Myatt and Wallace (2012) say decision-makers seek actions that are both matched to some unknown underlying feature of the world (a "fundamental" motive) and also matched to the actions taken by others (a "coordination" motive). The participants may welcome any information that helps them to resolve uncertainty about the state of the world and the likely actions of others.

In a political party, members wish to choose the best action of the policy while conforming as closely as possible to the actions of others. Although they would like to make the right policy and make it together, everyone has different opinion on different policies. They learn from the environment to get their own opinion and listen to the leader. Dewan and Myatt (2008) study that in political party leadership is important as public information to guide political members to move. In Dewan and Myatt's model, the leader speaking is likely to public information, and their opinions are their private information. They balance between making the right policy and not being far away from others' proposition. Such games also have been applied to investment games (Angeletos and Pavan, 2004), to monopolistic competition (Hellwig, 2005), to financial markets (Allen, Morris and Shin, 2006), to a range of other economic problems (Angeletos and Pavan, 2007), and many other papers report to variants of the beauty-contest specification.

In reality, there are many phenomena reflecting beauty contest problem. Except policy making, rating agencies also

have over-intimidating problem. When rating agency estimate credit risk of government or company, it uses several factors: historical behavior, fundamental analysis, and private investigation. In order to build or keep its reputation among investors, it will try to accurately estimate the risk of a company, a bond, or a stock. However, if it gets some negative or positive signal in private investigation, it may be worry about using this signal in full trust. Because if other agencies do not receive such signal, making absolutely objective based on his own information set may lead to being quietly different from other agencies. The real performance of the bond or stock can only be seen in the future. Nothing can prove whether rating agency is doing a good job or bad job temporarily. So, if an agency rates some bond or stock quietly different from other agencies, its reputation may be dubious which is bad for it. Therefore, when making rating decision, an agency will predict what other agencies rate, and give a rate between his objective estimation and others' rating but not the objective estimation. Angeletos Pavan (2007) say that to measure the efficiency of using information, we should compare the equilibrium to the strategy mapping from primitive information to actions that maximizes ex ante utility. As a benchmark, this strategy identifies the best society could do under the sole constraint that information cannot be centralized or otherwise communicated among the players. Comparing equilibrium to this benchmark we use the difference between private and social incentives in the use of available information to measure the information using efficiency.

In our model, we consider agencies use prior distribution information, public information, and private information in estimation. How agencies will react to the signal they get. The efficiency and objectivity of the estimation agencies making. And how the relativity of private information influences the efficiency and objectivity. The target to estimate we name event value to be general.

In section 2, we reintroduce the beauty contest game to describe the imitation phenomenon hindering objective adjustment simply. In section 3, we introduce the model setting. In section 4, we analyze the equilibrium strategies of agencies, the efficiency loss, and the influence of relativity of private information on strategies and efficiency. In section 5, we assume the private information is

endogenous and analyze what factors are in relation with information acquaintance. In section 6, we analyze the factors influencing social welfare loss. In section 7, we give our conclusion.

II. BEAUTY CONTEST MODEL

In a beauty-contest game n players $i = 1, \dots, n$ simultaneously choose a real number $x_i \in X = [0, 100]$, x^* is the most beautiful girl in $[0, 100]$. The pay-offs depend on the quadratic distance of actions from an unobserved state variable and from the average action, that is $-(x_i - x^*)^2 - (x_i - \bar{x})^2$, for player i , where $\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$. The winner is the participant who gets the highest core. Through the pointing principle, we can see that players have two targets:

1. Accurately figure out the most beautiful girl x^* in the list.
2. Choose the girl close as possible as he can to the average choice of all players.

When n is large enough, if every player knows exactly the most beautiful girl x^* , then the unique Nash Equilibrium is that all players choose x^* . If all players do not know x^* , then $\forall a \in X$, $x_i = a$ for all i is a Nash Equilibrium. If only one of players assumed to be j knows x^* , the best choice for him is not x^* , but letting $x_j = \frac{x^* + \bar{x}}{2}$.

If $\bar{x} \neq x^*$, then the sophisticated player j will not choose the most beautiful girl. Because he faces the problem to not only choose the most beautiful girl but also predict what others will choose.

III. THE MODEL

We examine a three-date model that contains continuum rating agencies, indexed by the unit interval $[0, 1]$. At date 0, each agency chooses the precision of private signal. At date 1, each agency observes a public signal and his private signal. Agencies choose their estimation based on their public information and private information. At date 2, every agencies' rating is disclosed and the loss of deviation from average estimation are realized. At date 3, the real rate of target is disclosed and the loss of deviation from real rate of

target is realized. We assume the real rate of target is disclosed later than average rating. That is because the real risks of the target take more time to be known by public, so does the real rate of target. It is long enough for public to compare the rating made by all players and utility loss of deviation from average rating to be realized.

3.1 Date 0

Each agency is facing the problem of accurately predicting the real risk of target and being close to other agencies' rating. The two targets can be contradictory to some extent. So, agencies must balance them two. Let the real rate of target be θ . According to the history information, agencies know the ex-ante probability distribution about θ and θ is normally distributed with mean $\bar{\theta}$ and precision τ_θ . Let t_i be the rating made by agency i . And \bar{t} is the average rating of all agencies, that is $\bar{t} = \int_0^1 t_i di$. We assume the utility function of agency i is

$$u_i = -c_1(t_i - \theta)^2 - c_2(t_i - \bar{t})^2 \quad (1)$$

, where $i \in [0, 1]$. The first term represents utility loss of deviation from real rate. And second term represents utility loss of deviation from average rating. c_1, c_2 represent relative importance between two utility loss described above. The discount effect between date 2 and date 3 is contained in c_1, c_2 .

The society wish that the estimation of rating agency as close as possible to the real rate reflecting all kinds of risks of the target. Imitating other rating agency cannot bring benefit to the society. We assume social welfare function is

$$W = -(c_1 + c_2) \int_0^1 (t_i - \theta)^2 di \quad (2)$$

In section 5, we analyze endogenous private information acquaintance. But firstly, we assume that the precision of private information is exogenous.

3.2 Date 1

Each agency observes a public information S . And agency i observes a private information $k_i, i \in [0, 1]$, where

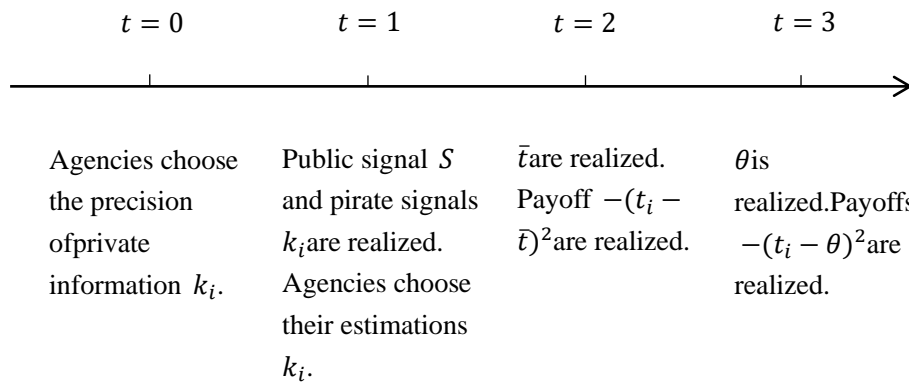
$$S = \theta + \varepsilon$$

$$k_i = \theta + \delta_i.$$

ε is normally distributed with mean zero and precision τ_ε . δ_i is also normally distributed with mean zero and precision τ_δ . ε and δ_i are pure noise and independent to other random variables. Agency i 's information set is $\{S, k_i\}$. Base on public information S and private information k_i agency i choose his rating t_i to maximize his

3.4 Date 3

The real rate of target is disclosed. Agency i 's loss of deviation from real value of event $-c_1(t_i - \theta)^2$ is realized.



IV. THE ANALYSIS

In this section, we firstly analyze social welfare maximization. Secondly, we study the equilibrium strategy when private information $k_i, i \in [0,1]$ are independent across the Agencies. Then, we assume that the private information is relevant.

4.1 Social welfare maximization

To accurately estimate the rating, the social optimum problem is

$$\max_{\{t_i\}} E(W|S, k) = -(c_1 + c_2)E\left[\int_0^1 (t_i - \theta)^2 di | S, k\right], \quad (3)$$

where $k = \{k_i\}, i \in [0,1]$.

By the property of integration and expectation, the social optimum problem equals to

$$\max_{t_i} E[(t_i - \theta)^2 | S, k_i]. \quad (4)$$

conditional expectation utility $E(u_i | S, k_i)$. We know conditional probability distribution $\theta |_{S, k_i}$ complies with normal distribution $N\left(\frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta}, \frac{1}{\tau_\theta + \tau_\varepsilon + \tau_\delta}\right)$.

3.3 Date 2

All ratings are disclosed. Agency i 's loss of deviation from average rating $-c_2(t_i - \bar{t})^2$ is realized.

Therefore, the optimal rating given by rating agency is

$$t_i^* = \frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta}, i \in [0,1], \text{ which is exactly the}$$

conditional expectation base on public information S and private information k_i . It is exactly the objective estimation of the rate because $t_i^* = E(\theta | S, k_i)$. It is also the most efficient estimation because it maximizes the social welfare.

4.2 Independent private information

When agencies acquire information from different aspects, the randomness can only depend on the way they acquire the information. The noises of private information are i.i.d. At this condition, private information is independent, that is $Cov(k_i, k_j) = 0, \forall i \neq j$.

Proposition 1. When the noises of private signal are independent, there exists a unique equilibrium in which agencies choose estimation

$$= \alpha S + \beta k_i + \gamma \quad (5) \quad t_i$$

with

$$\alpha = \frac{(c_1 + c_2)\tau_\varepsilon}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta},$$

$$\beta = \frac{c_1\tau_\delta}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta},$$

and

$$\gamma = \frac{(c_1 + c_2)\tau_\theta\bar{\theta}}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta}.$$

Note that $\alpha + \beta + \frac{\gamma}{\bar{\theta}} = 1$.

Proposition 1 characterized how agencies give their rating using information. The strategy they give is different from efficient strategy. This is because when agencies give their rating of the target, they estimate both real rate of the target and other players' rate of target. So, compare to the objective rating, ex-ante information about the rate distribution and public signal are more important, private signal is less important. In proposition 2, we describe this wrong information using.

Proposition 2. In order to maximize agencies' own utility, agencies will overreact to the prior distribution of the real rate and public signal, but underreact to the private signal.

Proof. We have stated that each agency's efficient rate should equal to conditional expectation of the event value θ given his information set, that is t^* . But they act by strategy proved in proposition 1, that is

$$t_i = \alpha S + \beta k_i + \gamma.$$

$$\begin{aligned} \alpha &= \frac{(c_1 + c_2)\tau_\varepsilon}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta} \\ &= \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta - \frac{c_2}{c_1 + c_2}\tau_\delta} \\ &> \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta}, \end{aligned}$$

$$\begin{aligned} \beta &= \frac{c_1\tau_\delta}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta} \\ &= \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta + \frac{c_2}{c_1}(\tau_\theta + \tau_\varepsilon)} \\ &< \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}, \end{aligned}$$

$$\begin{aligned} \frac{\gamma}{\bar{\theta}} &= \frac{(c_1 + c_2)\tau_\theta}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta} \\ &= \frac{\tau_\theta}{\tau_\theta + \tau_\varepsilon + \tau_\delta - \frac{c_2}{c_1 + c_2}\tau_\delta} \\ &> \frac{\tau_\theta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}. \end{aligned}$$

Thus, we have proved that agency overreact to the prior distribution of the real rate and public signal, but underreact to the private signal.

Proposition 2 says, when rating agencies put more weight on prior distribution of real rate and public signal comparing to the conditional expectation given his information set. At the meantime, agencies put less weight on their private signals comparing to the conditional expectation given his information set accordingly. It is because that when make estimations, agencies not only consider to accurately estimate the real rate of target, but also try to not deviate from average rating made by all agencies. Prior distribution and public signal are known to all players, they are beneficial to accurately estimate both event value and other agencies' estimation. However, even private signal gives some information of predicting the real rate of target, only if it is not certain, it may lead agency's estimation far away from other agencies' rating. We analyze the influence of private information precision on strategy later. Thus, prior distribution and public signal are more important for players than private signal.

4.2 Relevant private information

When agencies acquire information in a similar way, there may be relativity in the noises of information they acquiring. At this condition, private signals is relevant. We assume that the covariances between noises of private signals are same, that is $Cov(\delta_i, \delta_j) = \frac{\xi}{\tau_\delta}, \forall i \neq j$.

Proposition 3. When the noises of private signals are

relevant, there exists a unique equilibrium in which agencies choose to rate

$$\tilde{t}_i = \tilde{\alpha}S + \tilde{\beta}k_i + \tilde{\gamma} \quad (6)$$

with

$$\tilde{\alpha} = \frac{(c_1 + c_2)\tau_\varepsilon - c_2\tau_\varepsilon\xi}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2((\tau_\theta + \tau_\varepsilon)\xi + \tau_\delta)},$$

$$\tilde{\beta} = \frac{c_1\tau_\delta}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2((\tau_\theta + \tau_\varepsilon)\xi + \tau_\delta)},$$

and

$$\tilde{\gamma} = \frac{(c_1 + c_2)\tau_\theta\bar{\theta} - c_2\tau_\theta\bar{\theta}\xi}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2((\tau_\theta + \tau_\varepsilon)\xi + \tau_\delta)}$$

Note that $\tilde{\alpha} + \tilde{\beta} + \frac{\tilde{\gamma}}{\bar{\theta}} = 1$.

We can see when $\xi = 0$, the strategy in proposition 2 is as same as in proposition 1, noises of private signals are independent. When $\xi = 1$, private signals are completely relevant, that means all private information become public information. The weights agency place on signal S , signals k_i , and prior distribution of event value are $\tilde{\alpha} =$

$$\frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta}, \tilde{\beta} = \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}, \tilde{\gamma} = \frac{\tau_\theta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}, \text{ which is exactly}$$

objective efficient estimation that should be made based on information S, k_i , and prior distribution of event value. So next proposition we analyze how relativity of private signals affect the objectivity and efficiency of rating made by players.

Proposition 4. More relativity between private noises, more efficient the rating is by players' optimal strategies.

Proof. Take derivative of $\tilde{\alpha}, \tilde{\beta}$, and $\frac{\tilde{\gamma}}{\bar{\theta}}$ with respect to

ξ respectively, we have

$$\frac{\partial \tilde{\alpha}}{\partial \xi}$$

$$= -\frac{c_1c_2\tau_\varepsilon\tau_\delta}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2(\tau_\delta + (\tau_\theta + \tau_\varepsilon)\xi)]^2} < 0$$

$$\frac{\partial \tilde{\beta}}{\partial \xi} = \frac{c_2(\tau_\theta + \tau_\varepsilon)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2(\tau_\delta + (\tau_\theta + \tau_\varepsilon)\xi)]^2} > 0$$

$$\frac{\partial(\frac{\tilde{\gamma}}{\bar{\theta}})}{\partial \xi}$$

$$= -\frac{c_1c_2\tau_\theta\tau_\delta}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2(\tau_\delta + (\tau_\theta + \tau_\varepsilon)\xi)]^2} < 0.$$

In proposition 2, we have proved that $\alpha > \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta}, \beta <$

$\frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}$, and $\frac{\gamma}{\bar{\theta}} > \frac{\tau_\theta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}$, which are $\tilde{\alpha}, \tilde{\beta}$, and $\frac{\tilde{\gamma}}{\bar{\theta}}$ with $\xi =$

0. Thus as ξ increases from 0 to 1, $\tilde{\alpha}$, $\tilde{\beta}$, and $\frac{\tilde{\gamma}}{\bar{\theta}}$ are getting

close to $\frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta}, \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}$, and $\frac{\tau_\theta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}$. So, the rating is

more efficient as ξ increases. □

As the relativity of private noises increases, the private signals become more relevant. The signals agencies get from private signal is more similar. Thus, agency can make their rating base more on private signals because they worry less about being different from other agencies. In other words, as the relativity of private noises increase, the private information becomes more public. Using this information to rate will cause less balance problem between accurately rate the target and closing to average rating.

V. WELFARE ANALYSIS

In this section, we consider social welfare loss. Substitute efficient strategy and strategy proved by proposition 1 into unconditional expected social welfare function respectively, we have

$$\begin{aligned} E(W^*) &= -(c_1 + c_2)E \int_0^1 \left(\frac{\tau_\theta\bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} - \theta \right)^2 di \\ &= -(c_1 + c_2)E \left(\frac{\tau_\theta\bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} - \theta \right)^2 \end{aligned}$$

$$= -\frac{c_1 + c_2}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \quad (7)$$

$$\begin{aligned} E(W) &= -(c_1 + c_2)E \int_0^1 (\alpha S + \beta k_i + \gamma - \theta)^2 di \\ &= -(c_1 + c_2)E(\alpha S + \beta k_i + \gamma - \theta)^2 \\ &= -(c_1 + c_2) \frac{(c_1 + c_2)^2(\tau_\theta + \tau_\varepsilon + \tau_\delta) - (2c_1c_2 + c_2^2)\tau_\delta}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} \end{aligned} \quad (8)$$

Divide (8) by(7), we get

$$\begin{aligned} \frac{E(W^*)}{E(W)} &= \frac{1}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \frac{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2}{(c_1 + c_2)^2(\tau_\theta + \tau_\varepsilon + \tau_\delta) - (2c_1c_2 + c_2^2)\tau_\delta} \\ &= \frac{(c_1 + c_2)^2(\tau_\theta + \tau_\varepsilon + \tau_\delta)^2 - 2(c_1 + c_2)c_2(\tau_\theta + \tau_\varepsilon + \tau_\delta)\tau_\delta + c_2^2\tau_\delta^2}{(c_1 + c_2)^2(\tau_\theta + \tau_\varepsilon + \tau_\delta)^2 - 2(c_1 + c_2)c_2(\tau_\theta + \tau_\varepsilon + \tau_\delta)\tau_\delta + c_2^2\tau_\delta^2 + c_2^2\tau_\delta(\tau_\theta + \tau_\varepsilon)} \\ &= \frac{1}{1 + \frac{c_2^2\tau_\delta(\tau_\theta + \tau_\varepsilon)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2}} < 1 \end{aligned}$$

Without loss of generality, we normalize $c_1 + c_2 = 1, c_1, c_2 > 0$, and define welfare loss rate function as

$$f(c_2, \tau_\theta, \tau_\varepsilon, \tau_\delta) = \frac{c_2^2\tau_\delta(\tau_\theta + \tau_\varepsilon)}{[\tau_\theta + \tau_\varepsilon + \tau_\delta - c_2\tau_\delta]^2}. \quad (9)$$

The larger f is, the more proportion of social welfare is lost. In order to analyze the influence of $c_2, \tau_\theta, \tau_\varepsilon, \tau_\delta$ on social welfare loss rate. We take derivative of f with respect to $c_2, \tau_\theta, \tau_\varepsilon, \tau_\delta$ respectively. Clearly

$$\frac{\partial f}{\partial c_2} > 0,$$

that is the more agencies care about rating close to average rating, the more social welfare loss. It is intuitive, if agency cares more about their temporary reputation rather than estimate the risk of target the social welfare will decrease.

$$\frac{\partial f}{\partial \tau_\theta} = \frac{c_2^2\tau_\delta[(1 - c_2)\tau_\delta - \tau_\theta - \tau_\varepsilon]}{[\tau_\theta + \tau_\varepsilon + \tau_\delta - c_2\tau_\delta]^3} = 0$$

We have $\tau_\theta = \max\{0, (1 - c_2)\tau_\delta - \tau_\varepsilon\}$, if $(1 - c_2)\tau_\delta - \tau_\varepsilon < 0, \frac{\partial f}{\partial \tau_\theta} < 0$ for $\tau_\theta > 0$. The social welfare loss rate decreases with precision of prior distribution. If $(1 - c_2)\tau_\delta - \tau_\varepsilon > 0$, the loss proportion of social welfare increases on $\tau_\theta \in [0, (1 - c_2)\tau_\delta - \tau_\varepsilon]$ and decreases on $[(1 - c_2)\tau_\delta - \tau_\varepsilon, \infty)$. As $\tau_\theta \rightarrow \infty, f \rightarrow 0$. When the precision of public signal is enough higher than private signal, the loss proportion decreases as τ_θ increases. Otherwise, the loss proportion increases first and then decreases. When prior distribution is perfectly accurate, it is best for agencies to focus on unconditional expectation. It is because when the precision of prior distribution is low, the relative importance of private signal is large. This leads to a increasing proportion loss of social welfare. When the precision of prior distribution is high, agencies will focus more on this prior information and the relative importance of private signal is small. This leads the strategy of agencies being closer to social optimum strategy. Thus, the loss proportion decreases as τ_θ increases.

For $\frac{\partial f}{\partial \tau_\varepsilon} = \frac{\partial f}{\partial \tau_\theta}$, the analysis of the precision of public signal is similar. And

$$\frac{\partial f}{\partial \tau_\delta} = \frac{c_2^2(\tau_\theta + \tau_\varepsilon)(\tau_\theta + \tau_\varepsilon - (1 - c_2)\tau_\delta)}{[\tau_\theta + \tau_\varepsilon + \tau_\delta - c_2\tau_\delta]^3} = 0.$$

We have $\tau_\delta = \frac{\tau_\theta + \tau_\varepsilon}{1 - c_2} > 0$. If $\tau_\delta \in [0, \frac{\tau_\theta + \tau_\varepsilon}{1 - c_2}]$, $\frac{\partial f}{\partial \tau_\delta} > 0$, the loss proportion increase as τ_δ increases. If $\tau_\delta \in [\frac{\tau_\theta + \tau_\varepsilon}{1 - c_2}, \infty)$, $\frac{\partial f}{\partial \tau_\delta} < 0$, the loss proportion decreases as τ_δ increases. When τ_δ is low, agencies are cautious to use private signals. This leads to more difference between agency's strategy and efficient strategy. Thus, the loss proportion increases. When τ_δ is high, agencies can trust their private signals because others also rely on private signal more than before. It helps agency to rate accurately and be close to other's rating.

VI. ENDOGENOUS INFORMATION ACQUAINTANCE

In this section, we assume the private signal noises are independent for simplicity. We first analyze the impact of precision of private information on how agencies use prior information, public signals, and private signals, and the impact on the efficiency of rating. Then we assume that agencies can increase the precision of private signal at some cost and do some comparative static analysis.

In proposition 1, we prove that the optimal estimation strategy for player is

$$t_i = \alpha S + \beta k_i + \gamma$$

with

$$\alpha = \frac{(c_1 + c_2)\tau_\varepsilon}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta},$$

$$\beta = \frac{c_1\tau_\delta}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta},$$

and

$$\gamma = \frac{(c_1 + c_2)\tau_\theta\bar{\theta}}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta}.$$

Take derivative of $\alpha - \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta}$ with respect to τ_δ ,

$$\frac{\partial(\alpha - \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta})}{\partial \tau_\delta} = \frac{c_2(c_1 + c_2)(\tau_\theta + \tau_\varepsilon)^2 - c_1c_2\tau_\delta^2}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2(\tau_\theta + \tau_\varepsilon + \tau_\delta)^2} \tau_\varepsilon = 0,$$

we have $\tau_\delta = \sqrt{\frac{c_1 + c_2}{c_1}}(\tau_\theta + \tau_\varepsilon)$. When $\tau_\delta < \sqrt{\frac{c_1 + c_2}{c_1}}(\tau_\theta + \tau_\varepsilon)$, $\frac{\partial(\alpha - \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta})}{\partial \tau_\delta} > 0$. When $\tau_\delta > \sqrt{\frac{c_1 + c_2}{c_1}}(\tau_\theta + \tau_\varepsilon)$, $\frac{\partial(\alpha - \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta})}{\partial \tau_\delta} < 0$. The difference of weight put on public signal firstly decreases and then increases. Because as precision of private signal τ_δ increases, both optimal strategy and efficient strategy put less weight on public information. The speed of weight decreasing of optimal strategy is slower than it of efficient strategy when τ_δ is small. As τ_δ exceeds $\sqrt{\frac{c_1 + c_2}{c_1}}(\tau_\theta + \tau_\varepsilon)$, the speed of weight decreasing of optimal strategy is faster than it of efficient strategy. As τ_δ becomes infinite, the optimal strategy becomes also efficient. That is

$$\lim_{\tau_\delta \rightarrow \infty} \alpha - \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta} = 0.$$

Take derivative of $\beta - \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}$ with respect to τ_δ ,

$$\frac{\partial(\beta - \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta})}{\partial \tau_\delta} = \frac{c_1 c_2 \tau_\delta^2 - c_2 (c_1 + c_2) (\tau_\theta + \tau_\varepsilon)^2}{[(c_1 + c_2) (\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2 \tau_\delta]^2 (\tau_\theta + \tau_\varepsilon + \tau_\delta)^2} (\tau_\theta + \tau_\varepsilon) = 0,$$

we have $\tau_\delta = \sqrt{\frac{c_1 + c_2}{c_1}} (\tau_\theta + \tau_\varepsilon)$. When $\tau_\delta < \sqrt{\frac{c_1 + c_2}{c_1}} (\tau_\theta + \tau_\varepsilon)$, $\frac{\partial(\beta - \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta})}{\partial \tau_\delta} < 0$. When $\tau_\delta > \sqrt{\frac{c_1 + c_2}{c_1}} (\tau_\theta + \tau_\varepsilon)$, $\frac{\partial(\beta - \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta})}{\partial \tau_\delta} > 0$. The difference of weight put on private signals firstly decreases and then increases. Because as precision of private information τ_δ increases, both optimal strategy and efficient strategy put more weight on public information. The speed of weight increasing of optimal strategy is slower than it of efficient strategy when τ_δ is small. As τ_δ exceeds $\sqrt{\frac{c_1 + c_2}{c_1}} (\tau_\theta + \tau_\varepsilon)$, the speed of weight increasing of optimal strategy is faster than it of efficient strategy. As τ_δ becomes infinite, the optimal strategy becomes also efficient. That is

$$\lim_{\tau_\delta \rightarrow \infty} \beta - \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta} = 0.$$

Take derivative of $\frac{\gamma}{\theta} - \frac{\tau_\theta}{\tau_\theta + \tau_\varepsilon + \tau_\delta}$ with respect to τ_δ ,

$$\frac{\partial(\frac{\gamma}{\theta} - \frac{\tau_\theta}{\tau_\theta + \tau_\varepsilon + \tau_\delta})}{\partial \tau_\delta} = \frac{c_2 (c_1 + c_2) (\tau_\theta + \tau_\varepsilon)^2 - c_1 c_2 \tau_\delta^2}{[(c_1 + c_2) (\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2 \tau_\delta]^2 (\tau_\theta + \tau_\varepsilon + \tau_\delta)^2} \tau_\theta = 0,$$

we have $\tau_\delta = \sqrt{\frac{c_1 + c_2}{c_1}} (\tau_\theta + \tau_\varepsilon)$. The difference of weight put on prior distribution firstly decreases and then increases. Because as precision of private information τ_δ increases, both optimal strategy and efficient strategy put less weight on prior expectation. The speed of weight decreasing of optimal strategy is slower than it of efficient strategy when τ_δ is small. As τ_δ exceeds $\sqrt{\frac{c_1 + c_2}{c_1}} (\tau_\theta + \tau_\varepsilon)$, the speed of weight decreasing of optimal strategy is faster than it of efficient strategy. As τ_δ becomes infinite, the optimal strategy becomes also efficient. That is

$$\lim_{\tau_\delta \rightarrow \infty} \frac{\gamma}{\theta} - \frac{\tau_\theta}{\tau_\theta + \tau_\varepsilon + \tau_\delta} = 0.$$

The differences of weight put on prior distribution, public information, and private information all decrease on $[0, \sqrt{\frac{c_1 + c_2}{c_1}} (\tau_\theta + \tau_\varepsilon)]$ and increase on $[\sqrt{\frac{c_1 + c_2}{c_1}} (\tau_\theta + \tau_\varepsilon), +\infty)$. The difference between two strategies become maximal when

$\tau_\delta = \sqrt{\frac{c_1 + c_2}{c_1}} (\tau_\theta + \tau_\varepsilon)$. The optimal strategy $t_{\tau_\delta}(S, k_i)$ converges to efficient strategy t^* as τ_δ becomes infinite.

From the analysis above, we know that as each agency's private information becomes more accurate, the rating they give will be closer to efficient strategy if τ_δ is sufficiently large. Next, we want to find out if only one agency's private information becomes more accurate and other players' precision of private information is unchanged, will this agency give more efficient estimation? Even when his private information becomes perfectly accurate, will he against the pressure of peers and make objective and efficient estimation?

Proposition 5. Given other agencies' precision of private signal τ_{δ} same and unchanged, agency i 's rating will be more efficient as his precision of private signal τ_{δ_i} increases. Specially, when agency i 's private signal is perfectly accurate, he will give efficient rating, that is $t_i^* = k_i$.

Proof. Given all other agencies' precision of private signals is $\tau_{\delta}, \bar{t}_{i|S, k_i} \sim N(\alpha S + \beta \frac{\tau_{\theta} \bar{\theta} + \tau_{\varepsilon} S + \tau_{\delta_i} k_i}{\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}} + \gamma, \frac{1}{\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}} + \frac{1}{\tau_{\delta}})$. The optimal problem in section 3 becomes

$$\max -c_1 \left[t_i^2 - 2 \frac{\tau_{\theta} \bar{\theta} + \tau_{\varepsilon} S + \tau_{\delta_i} k_i}{\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}} t_i + \frac{1}{\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}} + \left(\frac{\tau_{\theta} \bar{\theta} + \tau_{\varepsilon} S + \tau_{\delta_i} k_i}{\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}} \right)^2 \right] \\ -c_2 \left[\beta^2 \left(\frac{1}{\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}} + \frac{1}{\tau_{\delta}} \right) + \left(t_i - \alpha S - \beta \frac{\tau_{\theta} \bar{\theta} + \tau_{\varepsilon} S + \tau_{\delta_i} k_i}{\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}} - \gamma \right)^2 \right].$$

The first order condition with respect to t_i is same to section 3. Thus the optimal rating for agency i is still $t_i = \alpha S + \beta k_i + \gamma$,

$$\text{where } \alpha = \frac{(c_1 + c_2) \tau_{\varepsilon}}{(c_1 + c_2)(\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}) - c_2 \tau_{\delta_i}}, \beta = \frac{c_1 \tau_{\delta}}{(c_1 + c_2)(\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}) - c_2 \tau_{\delta_i}}, \text{ and } \gamma = \frac{(c_1 + c_2) \tau_{\theta} \bar{\theta}}{(c_1 + c_2)(\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta_i}) - c_2 \tau_{\delta_i}}.$$

Take limitation of $\alpha, \beta, \frac{\gamma}{\bar{\theta}}$, we have $\lim_{\tau_i \rightarrow \infty} \alpha = 0, \lim_{\tau_i \rightarrow \infty} \beta = 1$, and $\lim_{\tau_i \rightarrow \infty} \frac{\gamma}{\bar{\theta}} = 0$. \square

From proposition 5, we know that when agency has absolute confidence in his private information, no matter what optimal estimation other agencies will give for any precision of others' private signals, this agency will give his real rate estimation of target. It is like keeping the truth in minority.

In the next, we assume agencies can do some research at some cost to increase the precision of his private signal. The cost of research is

$$c(\tau_{\delta}) = \frac{1}{2} \lambda \tau_{\delta}^2.$$

At the date 0 before get public signal and private signal, agencies must choose the precision of his private signal. Thus, the unconditional expectation utility maximizing problem is

$$\max Eu = -c_1 [Var(\alpha S + \beta k_i + \gamma - \theta) + [(\alpha + \beta - 1) \bar{\theta} + \gamma]^2] - c_2 \beta^2 Var(\delta_i) - \frac{1}{2} \lambda \tau_{\delta}^2$$

Simplify first order condition with respect to τ_{δ} , we have

$$c_1 + c_2 = \lambda \tau_{\delta} \left[\tau_{\theta} + \tau_{\varepsilon} + \tau_{\delta} + \frac{c_2}{c_1} (\tau_{\theta} + \tau_{\varepsilon}) \right]^2. \quad (*)$$

The proof of first order condition is presented in appendix.

Through (*) we can easily see that the precision of prior distribution and public information are substitutes of private information. If the precisions of prior distribution and public signal decrease, player will tend to do more research to increase the precision of private signal. And if the cost of research λ increases, agencies will do less research which is compatible to our intuitive.

Proposition 6. If the agency cares less about estimating closely to other agencies' and cares more about rating the risk of target accurately, he will expense more to do research.

Proof. c_1, c_2 represent the relative importance between accurately rating the target and estimating closely to other agencies' estimation. Thus, we can normalize c_1, c_2 by letting $c_1 + c_2 = 1$, then we have

$$\lambda \tau_\delta \left[\tau_\theta + \tau_\varepsilon + \tau_\delta + \frac{1 - c_1}{c_1} (\tau_\theta + \tau_\varepsilon) \right]^2 = 1$$

It is obvious that τ_δ increases as c_1 increases. \square

VII. SUMMARY

In this paper, we examine beauty contest model with information structure to describe a phenomenon that in order to keep reputation rating agency are going to miss use the information they get to rate. We consider three kinds of information: prior distribution, public information, and private information. And prove the unique equilibrium strategy of agency. We find that agencies use the signals in a way that is not efficient and objective.

The prior distribution and public signal have two parts of effect: first, it informs agency of the real risk rate of the target; second, it informs the agency of the likely action of other agencies. However, the private signal only has the first effect. Thus, agency overreacts to the prior distribution and public information but underreacts to private information which have same valuable information. This kind of imitation leads to inaccurate estimation. To be further, we consider what will happen if private signals of agencies are relative. When private signals are relative, private signal has two parts of effect too like prior distribution and public information. We find that more relative private signals are, the estimation they give will be closer to efficiency and objectivity. That is because as the relativity of private information increases the private information of agencies become more "public", and the second effect increases. When an agency gets a private signal, other agencies are likely to get same private signal. If private signals become perfectly relative, the private

signals become totally public, then the estimation is efficient and objective. In social welfare analysis, we find that the proportion of social welfare loss decreases as the precision of prior distribution and public signal increase if agencies care more about deviation from average rating. The proportion of social welfare loss decreases as the precisions of prior distribution and public signal are sufficiently large respectively. And the proportion of social welfare loss increases firstly and then decrease as the precision of private signals increases. Lastly, we analyze endogenous information acquaintance. As the precision of private information increases, the efficiency of estimation decreases at first and then increases. Keep precision of private signals of other agencies unchanged, if just one agency's precision of private signal increase he will make more efficient and objective estimation. Specially, when the private signal of the agency is perfectly accurate, that is the agency has full knowledge of the event value, he will make efficient and objective rating estimation no matter what others do. It explains the phenomenon that the truth is generally held by the minority. In analyze what research agencies will do to increase the precision of private signal, we find that when precision of prior distribution and public signal is high agencies do less research to increase precision of private information. When agencies care more about the loss of deviation from others than the loss of deviation from the truth, they do less research.

Appendix

The proof of proposition 1.

Suppose that each agency forms a linear conjecture on equilibrium estimation

$$t_i = \alpha S + \beta k_i + \gamma.$$

According to the law of large numbers, the average estimation become

$$\bar{t} = \alpha S + \beta \theta + \gamma.$$

$\bar{t}|_{S,k_i}$ complies with normal distribution $N(\alpha S + \beta \bar{\theta} + \gamma, \frac{\beta^2}{\tau_\theta + \tau_\varepsilon + \tau_\delta})$.

Conditional expectations utility of agencyi are

$$E(u_i|S, k_i) = E[-c_1(t_i - \theta)^2 - c_2(t_i - \bar{t})^2|S, k_i]$$

$$\begin{aligned} &= -c_1 \left(t_i^2 - 2t_i \frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \frac{1}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \left(\frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \right)^2 \right) \\ &- c_2 \left(\frac{\beta^2}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \left(t_i - \alpha S - \beta \frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} - \gamma \right)^2 \right) \end{aligned}$$

To maximize $E(u_i|S, k_i)$, we get first order condition with respect to t_i

$$c_1 \frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + c_2 \left(\alpha S + \beta \frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \gamma \right) = (c_1 + c_2)(\alpha S + \beta k_i + \gamma).$$

This equation satisfies with all S and k_i . Thus, we get

$$\begin{aligned} c_1 \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + c_2 \alpha + c_2 \frac{\beta \tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta} &= (c_1 + c_2) \alpha, \\ c_1 \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + c_2 \frac{\beta \tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta} &= (c_1 + c_2) \beta, \end{aligned}$$

and

$$c_1 \frac{\tau_\theta \bar{\theta}}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + c_2 \left(\frac{\beta \tau_\theta \bar{\theta}}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \gamma \right) = (c_1 + c_2) \gamma.$$

Solve the equations, we get

$$\begin{aligned} \alpha &= \frac{(c_1 + c_2) \tau_\varepsilon}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2 \tau_\delta}, \\ \beta &= \frac{c_1 \tau_\delta}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2 \tau_\delta}, \\ \gamma &= \frac{(c_1 + c_2) \tau_\theta \bar{\theta}}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2 \tau_\delta}. \end{aligned}$$

□

The proof of proposition 3.

Suppose that each agency forms a linear conjecture on equilibrium estimation

$$\tilde{t}_i = \tilde{\alpha}S + \tilde{\beta}k_i + \tilde{\gamma}.$$

The average estimation becomes

$$\bar{t} = \tilde{\alpha}S + \tilde{\beta} \int_0^1 k_i di + \tilde{\gamma}.$$

According to the law of large numbers, we have

$$E\left(\int_0^1 k_i di \middle| S, k_i\right) = E(\theta|S, k_i) + E(\delta_j|S, k_i) = \frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \frac{(\tau_\theta + \tau_\varepsilon)k_i - \tau_\theta \bar{\theta} - \tau_\varepsilon S}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \xi$$

$$Var\left(\int_0^1 k_i di \middle| S, k_i\right) = \lim_{n \rightarrow \infty} Var\left(\frac{\sum_{m=1}^n k_m}{n}\right) = \frac{\xi}{\tau_\delta}$$

Thus, $\bar{t}|_{S, k_i}$ complies with normal distribution $N(\tilde{\alpha}S + \tilde{\beta}(\frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \frac{(\tau_\theta + \tau_\varepsilon)k_i - \tau_\theta \bar{\theta} - \tau_\varepsilon S}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \xi) + \tilde{\gamma}, \frac{\tilde{\beta}^2 \xi}{\tau_\delta})$.

Conditional expectations utility of agencyiare

$$E(u_i|S, k_i) = E[-c_1(\tilde{t}_i - \theta)^2 - c_2(\tilde{t}_i - \bar{t})^2|S, k_i]$$

$$\begin{aligned} &= -c_1 \left(\tilde{t}_i^2 - 2\tilde{t}_i \frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \frac{1}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \left(\frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \right)^2 \right) \\ &- c_2 \left(\tilde{\beta}^2 \left(\frac{1}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \frac{\xi}{\tau_\delta} \right) + \left(\tilde{t}_i - \tilde{\alpha}S - \tilde{\beta} \left(\frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \frac{(\tau_\theta + \tau_\varepsilon)k_i - \tau_\theta \bar{\theta} - \tau_\varepsilon S}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \xi \right) - \tilde{\gamma} \right)^2 \right) \end{aligned}$$

To maximize $E(u_i|S, k_i)$, we get first order condition with respect to \tilde{t}_i

$$c_1 \frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + c_2 \left(\tilde{\alpha}S + \tilde{\beta} \left(\frac{\tau_\theta \bar{\theta} + \tau_\varepsilon S + \tau_\delta k_i}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \frac{(\tau_\theta + \tau_\varepsilon)k_i - \tau_\theta \bar{\theta} - \tau_\varepsilon S}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \xi \right) + \tilde{\gamma} \right) = (c_1 + c_2)(\tilde{\alpha}S + \tilde{\beta}k_i + \tilde{\gamma}).$$

This equation satisfies with all S and k_i . Thus, we get

$$\begin{aligned} c_1 \frac{\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + c_2 \tilde{\alpha} + c_2 \frac{\tilde{\beta}(1 - \xi)\tau_\varepsilon}{\tau_\theta + \tau_\varepsilon + \tau_\delta} &= (c_1 + c_2)\tilde{\alpha}, \\ c_1 \frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + c_2 \tilde{\beta} \left(\frac{\tau_\delta}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + \frac{(\tau_\theta + \tau_\varepsilon)\xi}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \right) &= (c_1 + c_2)\tilde{\beta}, \end{aligned}$$

and

$$c_1 \frac{\tau_\theta \bar{\theta}}{\tau_\theta + \tau_\varepsilon + \tau_\delta} + c_2 \left(\tilde{\beta} \left(\frac{\tau_\theta \bar{\theta}}{\tau_\theta + \tau_\varepsilon + \tau_\delta} - \frac{\tau_\theta \bar{\theta} \xi}{\tau_\theta + \tau_\varepsilon + \tau_\delta} \right) + \tilde{\gamma} \right) = (c_1 + c_2)\tilde{\gamma}.$$

Solve the equations, we get

$$\begin{aligned} \tilde{\alpha} &= \frac{(c_1 + c_2)\tau_\varepsilon - c_2\tau_\varepsilon\xi}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2(\tau_\delta + (\tau_\theta + \tau_\varepsilon)\xi)}, \\ \tilde{\beta} &= \frac{c_1\tau_\delta}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2(\tau_\delta + (\tau_\theta + \tau_\varepsilon)\xi)}, \\ \tilde{\gamma} &= \frac{(c_1 + c_2)\tau_\theta \bar{\theta} - c_2\tau_\theta \bar{\theta} \xi}{(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2(\tau_\delta + (\tau_\theta + \tau_\varepsilon)\xi)}. \quad \square \end{aligned}$$

The proof of first order condition in section 5.

$$Eu = -c_1[Var(\alpha S + \beta k_i + \gamma - \theta) + [(\alpha + \beta - 1)\bar{\theta} + \gamma]^2] - c_2\beta^2 Var(\delta_i) - \frac{1}{2}\lambda\tau_\delta^2$$

$$\text{Let } f_1 = -c_1[Var(\alpha S + \beta k_i + \gamma - \theta) + [(\alpha + \beta - 1)\bar{\theta} + \gamma]^2]$$

$$= -c_1 \left[\alpha^2 \left(\frac{1}{\tau_\theta} + \frac{1}{\tau_\varepsilon} \right) + \beta^2 \left(\frac{1}{\tau_\theta} + \frac{1}{\tau_\delta} \right) + \frac{1}{\tau_\theta} + \frac{2\alpha\beta}{\tau_\theta} - \frac{2\alpha}{\tau_\theta} - \frac{2\beta}{\tau_\theta} + [(\alpha + \beta - 1)\bar{\theta} + \gamma]^2 \right],$$

$$f_2 = -c_2\beta^2 Var(\delta_i) - \frac{1}{2}\lambda\tau_\delta^2$$

$$= -c_2 \frac{\beta^2}{\tau_\delta} - \frac{1}{2}\lambda\tau_\delta^2.$$

Take derivative with respect to τ_δ respectively.

$$\begin{aligned} \frac{\partial f_1}{\partial \tau_\delta} &= -c_1 \left[-2 \frac{\tau_\theta + \tau_\varepsilon}{\tau_\theta \tau_\varepsilon} \frac{c_1(c_1 + c_2)^2 \tau_\varepsilon^2}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} + 2 \frac{\tau_\theta + \tau_\delta}{\tau_\theta \tau_\delta} \frac{c_1^2(c_1 + c_2)(\tau_\theta + \tau_\varepsilon)\tau_\delta}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} \right. \\ &\quad - \frac{c_1^2}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} \\ &\quad + \frac{2}{\tau_\theta} \left(\frac{-c_1^2(c_1 + c_2)\tau_\varepsilon\tau_\delta}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} + \frac{c_1(c_1 + c_2)^2\tau_\varepsilon(\tau_\theta + \tau_\varepsilon)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} \right. \\ &\quad \left. \left. + \frac{c_1(c_1 + c_2)\tau_\varepsilon}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} - \frac{c_1(c_1 + c_2)(\tau_\theta + \tau_\varepsilon)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} \right) \right] \\ &= -c_1 \left[2 \frac{c_1(c_1 + c_2)[-(c_1 + c_2)(\tau_\theta + \tau_\varepsilon)\tau_\varepsilon + c_1(\tau_\theta + \tau_\delta)(\tau_\theta + \tau_\varepsilon) - c_1\tau_\varepsilon\tau_\delta + (c_1 + c_2)\tau_\varepsilon(\tau_\theta + \tau_\varepsilon)]}{\tau_\theta[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} \right. \\ &\quad \left. + \frac{c_1[-c_1\tau_\theta + 2(c_1 + c_2)\tau_\varepsilon - 2(c_1 + c_2)(\tau_\theta + \tau_\varepsilon)]}{\tau_\theta[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} \right] \\ &= -c_1 \left[\frac{2c_1^2(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta)\tau_\theta}{\tau_\theta[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} + \frac{c_1[-c_1\tau_\theta - 2(c_1 + c_2)\tau_\theta]}{\tau_\theta[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} \right] \\ &= -c_1 \left[\frac{2c_1^2(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} - \frac{c_1^2 + 2c_1(c_1 + c_2)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} \right] \end{aligned}$$

$$\frac{\partial f_2}{\partial \tau_\delta} = -2 \frac{c_1^2 c_2 (c_1 + c_2) (\tau_\theta + \tau_\varepsilon)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} + \frac{c_1^2 c_2}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} - \lambda\tau_\delta$$

Sum $\frac{\partial f_1}{\partial \tau_\delta}$ and $\frac{\partial f_2}{\partial \tau_\delta}$, we have

$$\begin{aligned} &\frac{\partial f_1}{\partial \tau_\delta} + \frac{\partial f_2}{\partial \tau_\delta} \\ &= \frac{-2c_1^3(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - 2c_1^2 c_2 (c_1 + c_2) (\tau_\theta + \tau_\varepsilon)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} + \frac{c_1^2 c_2 + c_1^3 + 2c_1^2(c_1 + c_2)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} - \lambda\tau_\delta \\ &= \frac{-2c_1^2(c_1 + c_2)^2(\tau_\theta + \tau_\varepsilon) - 2c_1^3(c_1 + c_2)\tau_\delta}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} + \frac{3c_1^2(c_1 + c_2)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} - \lambda\tau_\delta \\ &= \frac{-2c_1^2(c_1 + c_2)^2(\tau_\theta + \tau_\varepsilon) - 2c_1^3(c_1 + c_2)\tau_\delta + 3c_1^2(c_1 + c_2)[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} - \lambda\tau_\delta \end{aligned}$$

$$\begin{aligned}
 &= \frac{c_1^2(c_1 + c_2)^2(\tau_\theta + \tau_\varepsilon) + c_1^3(c_1 + c_2)\tau_\delta}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} - \lambda\tau_\delta \\
 &= \frac{c_1^2(c_1 + c_2)[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^3} - \lambda\tau_\delta \\
 &= \frac{c_1^2(c_1 + c_2)}{[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2} - \lambda\tau_\delta = 0.
 \end{aligned}$$

We get $c_1^2(c_1 + c_2) = \lambda\tau_\delta[(c_1 + c_2)(\tau_\theta + \tau_\varepsilon + \tau_\delta) - c_2\tau_\delta]^2$ or $c_1 + c_2 = \lambda\tau_\delta \left[\tau_\theta + \tau_\varepsilon + \tau_\delta - \frac{c_2}{c_1}(\tau_\theta + \tau_\varepsilon) \right]^2 \square$

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Correlates of Transformational and Transactional Leadership Styles of Entrepreneurs

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Abstract— This study was conducted in the first semester of AY 2018-2019 in Cabanatuan City, Philippines which included describing the personal profile and leadership styles of the participants in the Kapatid Mentor Me Program of the Department of Trade and Industry. This Kapatid Mentor Me Program helps micro, small and medium entrepreneurs the business-know-how in sustaining and expanding their enterprise thru coaching and mentoring. The profile variables considered were sex, age, marital status, educational attainment and length of experience in entrepreneurship; while the management styles and motivation considered were the leadership theories categorized as transformational and transactional leaders. The questionnaire consisted of 24 statements related to the components of transformational leadership based on the study of Xiao, et al. in 2006 such as idealized influence, inspirational motivation, intellectual stimulation and individualized consideration and transactional leadership such as contingent reward, management-by-exception and laissez-faire leadership. It was based on a modified version of the Multi-factor Leadership Questionnaire (MLQ). The study revealed that the entrepreneurs involved in the program were mostly in their middle age, women, married, college graduate and has already earned a relatively long experience in their respective businesses. Pearson r statistics shows that the profile variables did not significantly relate to any construct of either transactional and transformational leadership styles, except for age that negatively, but significantly correlated to transformational leadership. This means that the higher the age of the respondent, the lower his/her transformational leadership tendencies. This further implies that young entrepreneurs tend to be more transformational than their older counterparts.

Keywords— *transactional and transformational leadership, multi-factor leadership questionnaire, Kapatid Mentor Me Program Go Negosyo.*

I. INTRODUCTION

Leadership plays a very significant role in the success of businesses. It enables the entrepreneurs and managers to provide guidance and direction for employees. Businesses will get stagnant and can put the business in jeopardy without leadership. Every firm must therefore strive to have strong leadership to achieve its objectives and to maximize productivity because such leadership can motivate employees, initiate action, delegate responsibilities, build morale and improve the satisfaction that may later redound to success in any business endeavor.

There are two types of leadership hypothesized to have such an effect: transactional and transformational leadership. The concept of transformational leadership was initially introduced by leadership expert and presidential biographer, James MacGregor Burns, who explained that transactional leaders exchange tangible rewards for the work and loyalty of followers while transformational leaders engage with followers, focus on higher-order intrinsic needs, and raise consciousness about the significance of specific outcomes and new ways in which those outcomes might be achieved.

Bass (1998) extended the concept of transformational leadership to describe those who motivate followers to do more than they originally intended to do by presenting followers with a compelling vision and encouraging them to transcend their own interests for those of the group or unit. In fact, a defining characteristic of transformational leadership is the enormous personal impact it has on followers' values, aspirations, ways of thinking about work and interpreting events. Transformational leaders transform followers by transforming followers' values and beliefs.

Bass and Avolio (1998) later developed a "full range of leadership" model as illustrated in Figure 1. In the model, he presented three components that are characteristic

of transactional leadership, namely: (1) Contingent Reward (CR); (2) Management-By-Exception (MBE); (3) Laissez-Faire Leadership (LF), and five components which are characteristics of transformational leadership classified as 1) Idealized Influence (II), 2) Inspirational Motivation (IM), (3) Intellectual Stimulation (IS)(4) Individualized Consideration (IC) and Risk Acceptance (RA). The latter is characterized by an exchange relationship in which leaders motivate followers by providing them with rewards (or punishments) in return for follower effort (or lack of effort).

In this study, the transformational and transactional leadership styles of the entrepreneurs involved in *Kapatid Mentor Me Program* – Batch 1 and 2 of the Department of Trade and Industry – Cabanatuan City-were investigated.

The framework of the study lies on the assumption that transformational and transactional leadership influence the success of any business and that certain profile variables such as age, sex, civil status, highest educational attainment and length of service, on the other hand, influence one's leadership style.

The main objective of the study was to investigate the leadership styles of entrepreneurs involved in *Kapatid Mentor Me Program* – Batch 1 and 2 of the Department of Trade and Industry – Cabanatuan City. Specifically, it sought to 1) describe the entrepreneurs in terms of age, sex, civil status, highest educational attainment and length of service in entrepreneurship; 2) describe their transformational leadership tendencies in terms of Idealized Influence (II), Inspirational Motivation (IM), Intellectual Stimulation (IS), Individualized Consideration (IC), and Risk Acceptance (RA); 3) describe their transactional leadership tendencies in terms of Contingent Reward (CR), Management-By-Exception (MBE), and Laissez-Faire Leadership (LF); and 4) determine the relationship between the profile of entrepreneurs and their transformational as well as transactional leadership tendencies.

II. METHODOLOGY

The study employed a descriptive method of research which, according to Dr. Y.P. Aggarwal (2008), is devoted to the gathering of information about prevailing conditions or situations for the purpose of description and interpretation. It aims to assess the leadership styles of entrepreneurs.

The respondents of this study were the entrepreneurs of *Kapatid Mentor Me* Program Batch 1 and 2 of the Department of Trade and Industry – Cabanatuan City. There were a total of forty (40) business entrepreneurs involved in the program; however, only thirty-three (33) of them were utilized as respondents in this study.

A survey questionnaire consisting of two parts was the primary tool used to gather data about the respondents' leadership styles. The first part of the questionnaire was used to gather information about the respondents' profile; while the second part, consisting of 24 items, was used to gather information about their leadership styles. The items which were based on a modified version of the Multi-factor Leadership Questionnaire (MLQ) developed by Bass and Avolio (1998), were adopted from a dissertation entitled *Transformational Leadership VS. Transactional Leadership: The Influence of Gender and Culture on Leadership Styles of SMEs in China and Sweden* by Pan Xiaoxia (2006).

A 7-point Likert scale is shown in Table 1 which the respondents chose the option on the extent of their views they agree or disagree on a particular question or statement.

Table 1. Point, Range, and Equivalent Verbal Analogy

Point	Range	Verbal Analogy
7	6.22-7.00	Strongly Agree
6	5.35-6.21	Agree
5	4.48-5.34	Somewhat Agree
4	3.61-4.47	Neither Agree nor Disagree
3	2.74-3.60	Somewhat Disagree
2	1.87-2.73	Disagree
1	1.00-1.86	Strongly Disagree

III. RESULTS AND DISCUSSION

Profile of Entrepreneurs

The study revealed that the majority of the respondents were of age ranging from 40 to 49, mostly female (20 or 60.6%), married (28 or 84%), college graduate (22 or 66.7%), and into entrepreneurship for about 5 to nine years already (13 or 39.4%).

The figures further imply that married women take active participation in business entrepreneurship and that these women were not only educated but would also tend to be mature enough to handle the risks and pressures of business. Their relatively lengthy experience in the world of entrepreneurship would also tend to provide them with the opportunity to develop a style of leadership that would encourage successful dealings with clients and employees, which may later redound to successful business endeavors.

Transformational Leadership of Entrepreneurs

In terms of transformational leadership, the study revealed that the respondents were highest in Inspirational Motivation (WM = 5.28) and Lowest in Risk Acceptance (WM = 4.44)

The finding is an indication that the respondents tend to encourage employees to make the most of their skills and capabilities, help them find meaning in their work and articulate with them a compelling vision for the future. They talk about what needs to be accomplished but express confidence that those goals will be achieved.

Bass, Bernard M., and Ruth Bass (2008) wrote that a person who uses inspirational motivation creates an exciting image of what is essential to consider. This type of motivational behavior encourages a sense of team spirit, creating general enthusiasm—especially towards difficult challenges, where enthusiasm and motivation are needed in order to maintain optimism throughout all levels of the organization. Considering all these, it is believed that the entrepreneurs involved in the *Kapatid Mentor Me* Program knew how to inspire their employees towards the success of their business endeavors.

Table 2. Transformational Leadership Rating of Entrepreneurs

Transformational	Weighted Mean	Verbal Description
Idealized Influence		
I make others feel good working with me.	5.27	Somewhat Agree
I believe that others are proud to be associated with me.	4.94	Somewhat Agree
I talk about my life's important values and beliefs to my employees.	5.09	Somewhat Agree
Weighted Mean	5.10	Somewhat Agree
Inspirational Motivation		
I encourage employees to make the most of their skills and capabilities in doing their jobs.	5.52	Agree
I help others find meaning in their work.	5.27	Somewhat Agree
I articulate a compelling vision for the future.	5.06	Somewhat Agree
Weighted Mean	5.28	Somewhat Agree
Intellectual Stimulation		
I enable others to think about old problems in new ways.	5.00	Somewhat Agree
I provide others with new ways of looking at things.	5.00	Somewhat Agree
I get others to rethink ideas that they had never done before.	4.82	Somewhat Agree
Weighted Mean	4.94	Somewhat Agree
Individualized Consideration		
I let others know I am aware of the job well done.	5.06	Somewhat Agree
I give personal attention to others who seem confused in work.	4.85	Somewhat Agree
I give careful attention to the working conditions of my employees.	5.24	Somewhat Agree
Weighted Mean	5.09	Somewhat Agree
Risk Acceptance		
I think making risky decisions alone does not bother me at all.	3.97	Neither Agree nor Disagree
I think intuition can be one of the best guides in making decisions.	4.30	Neither Agree nor Disagree
I make quick decisions whenever necessary.	5.06	Somewhat Agree
Weighted Mean	4.44	Neither Agree nor Disagree
Overall Weighted Mean	4.97	Somewhat Agree

On the other hand, the average weighted mean obtained in Risk Acceptance was an indication that they were a little wary of taking the risk and would tend not to make a decision alone, nor to trust their intuition too much. It would likely take them sometime before coming up with a decision, which may delay operations if not moderated.

Transactional Leadership of Entrepreneurs

In terms of transformational leadership, the study revealed that the respondents were highest in Contingent

Reward (WM = 5.20) and lowest in Laissez-Faire Leadership (WM=4.85). This means that the respondents tend to tell others what to do if they want to be rewarded for their work, and sincerely reward them if they reach their goal/s. Likewise, they tend to care what their employees do particularly when the work is absolutely essential and are not contented with letting others act on their own.

Table 3. Transactional Leadership Ratings of Entrepreneurs

Transactional	Weighted Mean	Verbal Description
Contingent Reward		
I tell others what to do if they want to be rewarded for their work.	4.94	Somewhat Agree
I provide recognition or reward them when they reach their goals.	5.36	Agree
I expect employees to meet and adhere to company policy and recognize them for their achievement.	5.30	Somewhat Agree
I provide recognition/rewards when others reach their goals.		
Weighted Mean	5.20	Somewhat Agree
Management-By-Exception		
I am satisfied when others meet the agreed-upon standards.	5.48	Agree
As long as things are working well, I do not try to change anything.	4.70	Somewhat Agree
I tell others the standards they have to know in carrying out their work.	5.24	Agree
Weighted Mean	5.18	Somewhat Agree
Laissez-Faire Leadership		
I am contented to let others act on their own.	4.42	Somewhat Agree
Whatever others want to do is fine with me.	3.06	Somewhat Disagree
I don't care much what others do unless the work is absolutely essential.	4.45	Neither Agree nor Disagree
Weighted Mean	4.85	Somewhat Agree
Overall Weighted Mean	4.77	Somewhat Agree

The result of the study implies that the entrepreneurs involved in the study tend not to relax in their supervision of their employees. In fact, they would make sure that their employees know that their accomplishments are important and that they are willing to reward the anticipated accomplishments. Evidently, they are not the trusting types.

Relationship between the Profile of the Entrepreneurs and their Leadership Styles

Table 4. Computed r-value and p-value

Profile	Transactional		Transformational	
	(r-value)	p-value	(r-value)	p-value
Age	-.186	.308	-.432*	0.014
Sex	.265	.136	0.186	0.3
Civil Status	-.037	.839	-0.131	0.467
Highest Educational Attainment	-.215	.229	-0.135	0.453
Length of Service	-.022	.905	-0.078	0.666

*correlation is significant @ 0.05 level

Statistics show that the profile variables did not significantly relate to any construct of either transactional and transformational leadership styles, except for age that negatively but significantly correlated with transformational leadership with a computed *r-value* of *-.43*. This means that the higher the age of the respondent, the lower his/her transformational leadership tendencies get. This implies that young entrepreneurs tend to be more transformational than their older counterparts.

IV. CONCLUSIONS AND RECOMMENDATIONS

This study purported to determine the transactional and transformational leadership styles of the entrepreneurs involved in the *Kapatid Mentor Me* Program consisted of Batches 1 and 2 of the Department of Trade and Industry in Cabanatuan City and relate the entrepreneurs' tendencies correlated to age, sex, civil status, educational attainment and length of experience as entrepreneur/s.

Using descriptive research design with 33 entrepreneurs involved in the program as respondents, and using as data gathering instrument a validated questionnaire adapted from previous research, the study was conducted with the assumption that leadership styles in some ways define success in any business undertaking.

The study found out that the majority of the respondents were of age ranging from 40 to 49, female (20 or 60.6%); married (28 or 84%); college graduates ((22 or 66.7%); and into entrepreneurship for about five (5) to nine (9) years (13 OR 39.4%) already. They were more transformational than transactional leaders as indicated by their higher overall mean in the said leadership style (WM = 4.97) than in the other (WM = 4.77).

It was further found out that among the profile variables, only age was found to be significantly but negatively correlated with transactional leadership styles (Ramos, et al., 2019).

Based on the findings, the study recommends the following: 1) that the *Kapatid Mentor Me* Program be continuously improved and implemented such that

participants would be more aware and understand the different leadership styles that may be used to guide them in the management of their business; 2) that the respondents be mentored in terms of Risk Acceptance and Laissez-Faire approaches. Lastly, further study must be conducted to determine the other significant correlates of business success, such as organizational culture (Subia, Mones & Alfonso, 2017) & corporate social responsibilities (Mina, et al, 2019) to improve work motivation and job satisfaction of employees (Bautista & Balaria, 2018).

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Research Design of Grounding System for Substation, Using Soil Enhancement Material

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Abstract— This paper presents the steps of calculating a safety grounding system of substations as recommended by the IEEE Std standard, 80-2013 with ground grid configuration combined mesh and earth rods, using ground soil enhancement material to reduce ground resistance. A program for automatic design of substation grounding system has been developed, allowing quick calculations to be applied to Electricity companies, Electrical Design Consultants, etc. in Vietnam, for the sample grounding calculation example is applied to the 220/110/22kV Long Thanh substation.

Keywords— IEEE 80-2013 standard, grounding system, Soil Enhancement Material, Grounding system design program.

I. INTRODUCTION

The effect of grounding in the substation is to facilitate the rapid dissipation of fault currents into the ground in order to minimize local damage as well as avoid their undesirable propagation to other elements of the system while keeping the potentials on the grounding elements at acceptable levels [2, 3, 5, 6, 8].

II. GROUNDING CALCULATION ACCORDING TO IEEE STD. 80-2013

The IEEE Std 80 - 2013 [1, 4, 7] standard is used for guiding and designing the grounding systems for high-voltage substations meeting safety conditions of grounding resistance as well as step and contact voltages. However, this standard does not cover the soil enhancement material used for reducing grounding resistance when building grounding systems for substations.

Step 1: Determine the grounding area and soil resistivity

The grounding area, in which a is the length and b is the width:

$$A = a \cdot b \text{ (m}^2\text{)} \quad (1)$$

Determine soil resistivity at the site where the grounding system is deployed, $\rho(\Omega\text{m})$.

Step 2: Determine the grounding wire section

The grounding wire section:

$$A_{kcmil} = I_f \cdot K_f \cdot \sqrt{t_c} \quad (2)$$

Where: A_{kcmil} is the grounding wire section (kcmil); If is the RMS value of grounding fault current (kA); t_c is the time of grounding fault (s); K_f is the material coefficient.

Convert cross section of conductor from A_{kcmil} to A_{mm} :

$$A_{mm} = K_c \cdot A_{kcmil} \quad (3)$$

Where: K_c is the convert coefficient.

Step 3: Determine the step and the contact voltages

-Determine the limit step voltage:

+ For people weighing 50 kg:

$$E_{\text{step}50} = (1000 + 6 C_s \rho_s) \frac{0,116}{\sqrt{t_s}} \quad (4)$$

+ For people weighing 70 kg:

$$E_{\text{step}70} = (1000 + 6 C_s \rho_s) \frac{0,157}{\sqrt{t_s}} \quad (5)$$

-Determine the limit contact voltage:

+ For people weighing 50 kg:

$$E_{\text{touch}50} = (1000 + 1,5 C_s \rho_s) \frac{0,116}{\sqrt{t_s}} \quad (6)$$

+ For people weighing 70 kg:

$$E_{\text{touch}70} = (1000 + 1,5 C_s \rho_s) \frac{0,157}{\sqrt{t_s}} \quad (7)$$

Where: C_s is load reduction factor of the surface layer; ρ_s is resistivity of surface macadam layer (Ωm), t_s is the short circuit duration (s).

Step 4: First design

At this step, the initial values depend on the type of grounding mesh:

- + Distance between grounding rods D (m);
- + Number of vertical and horizontal bars of the mesh;
- + Total length of the grounding conductors L_c (m);
- + Total length of the grounding rods LR (m);
- + Total length of the grounding conductors and grounding rods LT (m);
- + Perimeter of grounding mesh LP (m);
- + The depth of the grounding mesh h (m).

Step 5: Determine the resistance of the grounding system

Determine the resistance of the grounding system:

$$R_g = \rho \left[\left(\frac{1}{L_r} \right) + \left(\frac{1}{\sqrt{20 \cdot A}} \right) \cdot \left(1 + \frac{1}{\left(1 + h \cdot \left(\sqrt{\frac{20}{A}} \right) \right)} \right) \right] \quad (8)$$

Where: R_g is the resistance of the grounding system (Ω); h is the depth of the grounding mesh (m); ρ is the soil resistivity (Ωm); A is the grounding area (m^2).

Step 6: Determine the maximum mesh current

$$I_G = D_f \cdot S_f \cdot 3I_0 \quad (9)$$

Where: I_G is the largest dissipation current to the ground (A); I_0 is the zero component of the grounding fault current (A); D_f is attenuation coefficient; S_f is segmentation factor of fault current; I_g is the grounding fault current (A).

Step 7: Determine the increment of soil potential GPR

The increment of soil potential GPR:

$$\text{GPR} = I_G \cdot R_g \quad (10)$$

Where: I_G (A) is the grounding fault current; R_g is the grounding resistance (Ω).

+ If the GPR value is less than the limited contact voltage, then goes to step 12, which is the detailed design for the grounding system.

+ If the GPR value is greater than limited contact voltage.

Step 8: Determine the mesh voltage and step voltage

Determine the distance factor for the mesh voltage K_m :

$$K_m = \frac{1}{2\pi} \cdot \left[\ln \left[\frac{D^2}{16 \cdot h \cdot d} + \frac{(D+2h)^2}{8 \cdot D \cdot d} - \frac{h}{4 \cdot d} \right] + \frac{K_{ii}}{K_h} \cdot \ln \left[\frac{8}{\pi(2n-1)} \right] \right] \quad (11)$$

Where: D is the distance between the ground wires (m); h (m) is the depth of the grounding mesh; d (m) is the grounding wire diameter; K_{ii} is adjusting coefficient according to the layout of the grounding mesh; K_h is the correction factor for the buried depth of the grounding mesh; n is geometric coefficient.

For the grounding mesh with ground rods, the mesh voltage E_m :

$$E_m = \frac{(\rho \cdot I_G \cdot K_m \cdot K_i)}{L_c + \left[1,55 + 1,22 \cdot \left(\frac{L_r}{\sqrt{L_x^2 + L_y^2}} \right) \right] \cdot L_r} \quad (12)$$

Where: ρ (Ωm) is the earth resistivity; I_G is the maximum earth fault current; K_m is the distance factor for mesh voltage; K_i is the correction factor for the shape of the grounding mesh; L_c is the total length of the mesh conductors; L_r is the length of earth rod; L_x is the mesh length in the x-direction; L_y is the grid length in the y-direction.

Distance factor for step voltage K_s :

$$K_s = \frac{1}{\pi} \cdot \left[\frac{1}{2h} + \frac{1}{D+h} + \frac{1}{D} (1-0,5^{n-2}) \right] \quad (13)$$

Step voltage E_s :

$$E_m = \frac{\rho \cdot I_G \cdot K_m \cdot K_i}{0,75 \cdot L_c + 0,85 \cdot L_r} \quad (14)$$

Where: $L_R(m)$ is total length of the earth rods.

Step 9: Compare the mesh voltage E_m and the allowable contact voltage E_{touch}

+ If $E_m \leq E_{touch}$ then goes to Step 10;

+ If $E_m > E_{touch}$ then goes to Step 11 to change the original design.

Step 10: Compare the step voltage E_s and the allowable step voltage E_{step}

+ If $E_s \leq E_{step}$ then goes to Step 12. This is the detailed design step;

+ If $E_s > E_{step}$ then goes to Step 11 to change the original design.

Step 11: Change the original design

If either of the two steps: Step 9 and Step 10 are not satisfied, the original design needs to be changed. Especially, it is possible to change the distance between the grounding conductors (D), the number of earth rods in the grounding mesh (N), the length of each earth rod (L_r), the length of the ground conductors to increase the total value of grounding conductor length (LC), total earth rod length (LR), mesh area ... with the aim of reducing the calculated values of E_m and E_s .

Step 12: Mesh detailed design

Once all the above steps have been calculated and satisfied, the detailed design of the grounding mesh will be carried out.

III. CALCULATE GROUNDING RESISTANCE IN CASE OF USING THE GROUND SOIL ENHANCEMENT MATERIAL

+ Consider a single horizontal electrode with ground soil enhancement material (Fig.1) with the ground resistivity $\rho(\Omega m)$, the grounding resistance R :

$$R = \frac{\rho}{2,73.L} \log_{10} \frac{2.L^2}{W.D} \quad (15)$$

Where: L is the length of horizontal electrode (m); W is the wide of the ground soil enhancement material (m); D is the deep of the groove (m).

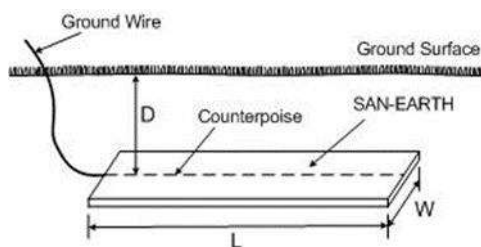


Fig 1. A single horizontal electrode with ground soil enhancement material.

+ Consider two horizontal electrodes with length L (m); deep of electrodes D (m); Distance between 2 electrodes a (m) in Fig. 2, the grounding resistance R :

$$R = \frac{\rho}{2,73.L} \cdot \frac{1}{2} (\log_{10} \frac{2.L^2}{W.D} + \log_{10} \frac{2.L}{a}) \quad (16)$$

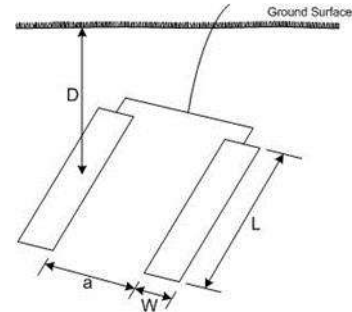


Fig. 2. Two horizontal electrodes with ground soil enhancement material

Consider two strips of ground electrodes placed in an L shape, each strip has a length $L/2$ (m); wide of strip W (m); Strip deep D (m) in Fig. 3, the grounding resistance R :

$$R = 1,03 \cdot \frac{\rho}{2,73.L} \cdot \log_{10} \frac{2.L^2}{W.D} \quad (17)$$

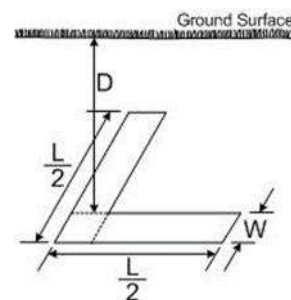


Fig.3. Two strips of ground electrodes placed in an L shape with ground soil enhancement material.

Consider the circumferential ground electrode for 4 square electrode strips with length $L/4$ (m) (Fig. 4); the grounding resistance R :

$$R = 1,12 \cdot \frac{\rho}{2,73.L} \cdot \log_{10} \left(\frac{2.L^2}{W.D} \right) \quad (18)$$

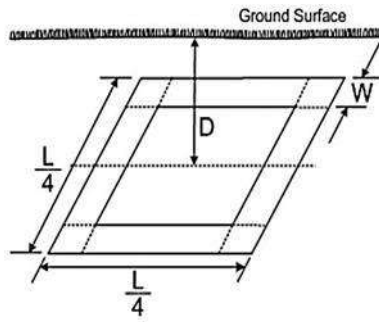


Fig. 4. The circumferential ground electrode.

IV. THE GROUNDING SUBSTATION CALCULATION PROGRAM (GSCP)

The main functions of the GSCP program include:

- + Automatically design safety grounding mesh for substations whose contact and step voltages are within permissible limits according to IEEE Std 80-2013 in case of using ground soil enhancement material;

- + The grounding mesh configuration uses the horizontal conductors in combination with the vertical grounding rods;

- + Calculate the annual cost function of the proposed grounding mesh in case of using ground soil enhancement material.

a. The initial parameters

The initial parameters include:

- + t_f is the grounding fault time (s);
- + Z_1 is the forward equivalent impedance of the primary side (Ω);
- + $Z_2 = Z_1$ is the inverse equivalent impedance of the primary side (Ω);
- + Z_0 is the zero-equivalent impedance of the primary (Ω);
- + S_f is the division current factor;
- + V_{ll} is the phase-to-phase voltage at fault position (kV);
- + ρ is the earth resistivity ($\Omega.m$);
- + ρ_s is the resistivity of the surface material layer ($\Omega.m$);
- + h_s is thickness of the rock layer (m);
- + h is the deep of grounding mesh (m);
- + h_0 is the deep of referrer grounding mesh (m);
- + Z_{T1} is the forward transformer impedance of secondary side (Ω);

- + $Z_{T2} = Z_{T1}$ is the inverse transformer impedance of secondary side (Ω);

- + $Z_{T0} = Z_{T1}$ is the zero-transformer impedance of secondary side (Ω);

- + S_T is the transformer power (MVA);

- + Z_T is the transformer impedance (%);

- + $V_{T_pri_ll}$ is the primary voltage of transformer (kV);

- + $V_{T_sec_ll}$ is the secondary voltage of transformer (kV);

- + D_r is the grounding mesh wide (m);

- + D_l is the grounding mesh length (m);

- + W is the soil enhancement material groove width (m);

- + b is soil enhancement material groove thickness (m);

- + L_r is the grounding rod length (m);

- + T_{mt} is the ambient temperature ($^{\circ}C$);

- + T_m is the maximum permissible temperature ($^{\circ}C$);

- + K_f is the material constant;

- + C_c is the cost of 1m cooper cable (VND);

- + Γ is the cost of a Cadweld connector (VND);

- + g_r is the cost of a grounding rod (VND);

- + g_h is the cost of a soil enhancement material bag (VND);

- + a_{vh} is the operating factor;

- + T_{hv} is payback time (Year).

b. Calculation results

Calculation results include:

- + N_r is the number of bars according to the width;
- + D_1 is the distance between 2 bars according to width (m);

- + N_{ll} is the number of bars according to the length (m);

- + D_2 is the distance between 2 bars according to length (m);

- + A_m is the section of grounding cable (mm^2);

- + L_T is the total length of grounding cable (m);

- + N_{rod} is the number of grounding rod;

- + L_r is the length of grounding rod (m);

- + MH is the total number of Cadweld connector;

- + B_h is the total number of used soil enhancement material bags (bag);

- + K is the total investment (VND);

- + Z is the calculation annual cost (VND/year).

V. GROUNDING CALCULATION FOR 250MVA 220/110KV LONG THANH TRANSFORMER STATION

Results of the calculation the grounding mesh for the 250MVA 220 / 110kV Long Thanh substation, according to 2 plans: Option 1 - No using soil enhancement material to reduce the grounding resistance and option 2- Using soil enhancement material to reduce the grounding resistance, the results of both plans are presented in Table 1. From analysis the results, it can be found that the two options are similar in terms of economic indicators because the calculation annual cost does not differ by more than 5%.

However, compared to option 1, option 2 has the following advantages:

- + Lower investment;
- + The amount of copper cable and the number of Cadweld welds is lower, which facilitates the installation in the field.

Table. 1. Results of Grounding calculation for Long Thanh 250MVA 220kV/110kV Substaion.

Calculation results	Option 1 No using soil enhancement material	Option 2 Using soil enhancement material
The number of bars according to the width	16	11
The distance between 2 bars according to width (m)	6,67	10
The number of bars according to the length	16	11
The distance between 2 bars according to length (m)	6.67	10
The section of grounding cable (mm ²)	70	70
The total length of grounding cable (m)	3000	2000
The number of grounding rod	56	36
The length of	3	3

grounding rod (m)		
Total number of Cadweld connector	256	121
The total number of used soil enhancement material bags (bag)	0	111
The total investment (VND)	862,400,000	703,500,000
The calculation annual cost (VND/year)	194,040,000	193,460,000

VI. CONCLUSION

+ The paper presents the method of calculation and designing the grounding system of substation in two cases, which are not using soil enhancement material and using soil enhancement material, applying the IEEE Std.80-2013.

+ The research team has developed a GSCP program to calculate and automatically design the safety grounding mesh of the substation to meet technical requirements, and at the same time define a calculated annual cost to selected grounding option plan in both cases with and without using of soil enhancement material.

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