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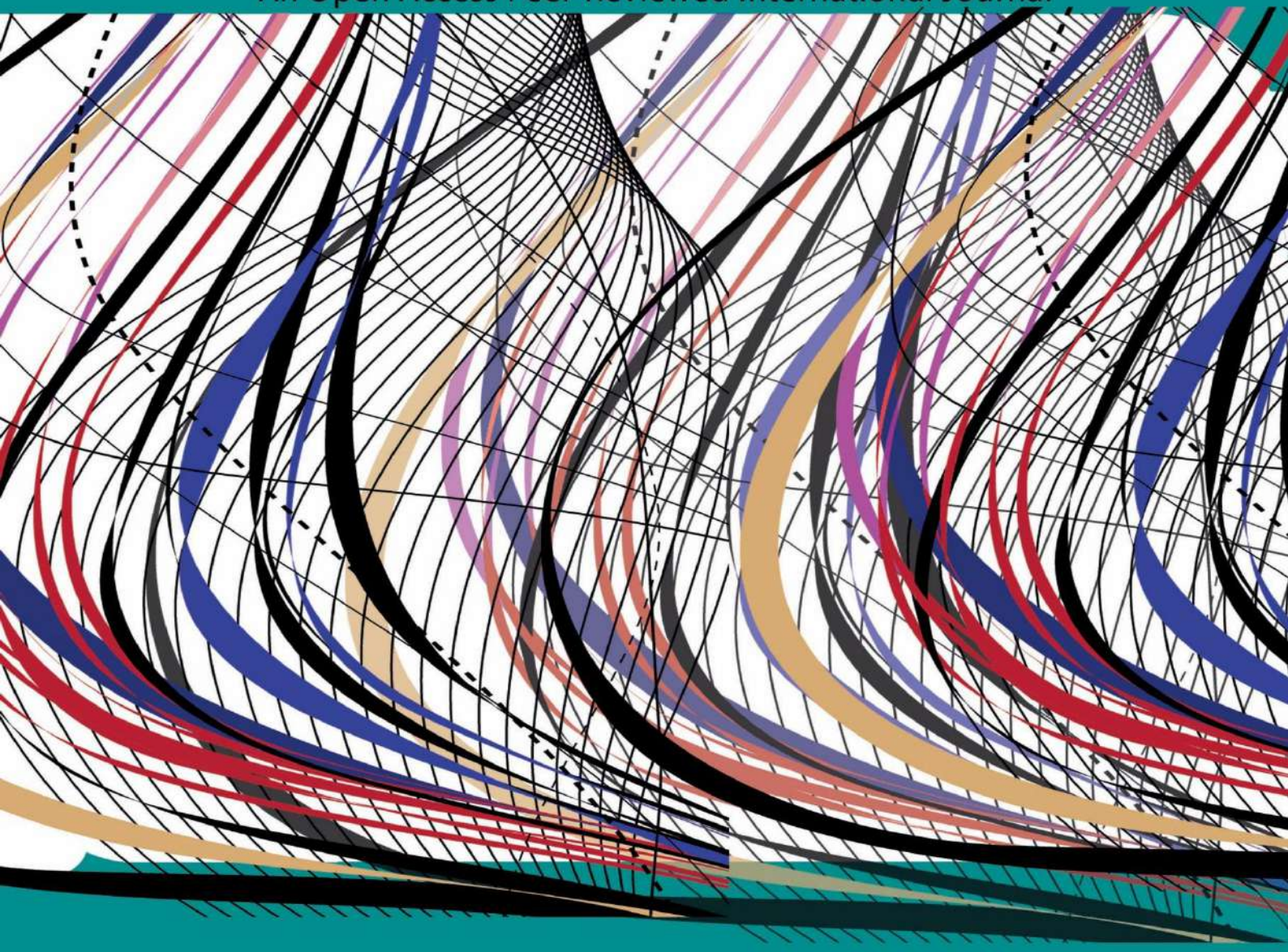

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FOREWORD

I am pleased to put into the hands of readers Volume-7; Issue-3: March, 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.

Dr. Dinh Tran Ngoc Huy
Editor-in-Chief
April, 2021

Editorial Board/ Reviewer Board

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Effect of COVID-19 outbreak towards banking and finance industry

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Abstract— *The coronavirus disease COVID-19 spreading throughout the worldwide with the total confirmed affected cases is 96,658,420, including 2,092,062 deaths, reported to WHO on 23rd January 2021. These numbers proved that COVID-19 become most affected virus in year of 2021. This virus affected all market segments of economic activities including banking and finance industry. The objective of this study is to evaluate the economic impact of COVID-19 outbreak towards banking and finance industry. This study selected two market indices (S&P500 and KLCI) for analyzing economic condition in equity market. Then, this study selected three banking institution for validating the finding for economic condition during outbreak of COVID-19. Result shows outbreak of COVID-19 give negative impact towards economic condition for banking and finance industry. The findings of this study will help practitioners and government body in developing finance policy to combating the current economic situation. Further study can be extending to analyzing the effectiveness monetary policy towards recovery of finance situation after COVID-19 outbreak. Furthermore, the finding of this study also will help banking institutions to develop more customer-friendly interest rate in overcoming this economic situation of COVID-19.*

Keywords— ***COVID-19, Banking, Finance, Market index, Coronavirus disease.***

I. INTRODUCTION

Financial intermediary is important body in the relationship between savers and borrowers. The example of financial intermediary is banking institution, insurance company and other institutions. The main function of financial intermediary is to channel savings into investments activities for generate a profit. The main objective of investments is to generate a high return and reduce a risk. Therefore, Bursa Malaysia must show a good reputation in managing portfolio investments in order to achieve the objective of investment.

Investment is the complex process involving decision making regarding the possible expected rate of return (Abu Bakar and Rosbi, 2018a). Many studies investigate the performance of investment portfolio (Abu Bakar and Rosbi, 2017a; Abu Bakar and Rosbi, 2019a) indicated the good performance of investment portfolio in Malaysia market. Kighir, et al., (2015) examines the Malaysia non-financial firms consider current earnings more important than current cash flow while making dividends payout decisions. In Malaysia, Bursa Malaysia is the stock exchange market that led the portfolio investment in Malaysia and globally. Bursa Malaysia comprise two types of market known as main market and ACE market. The index used in Bursa Malaysia known as KLCI index (Kuala Lumpur Composite Index) that comprise 30 largest companies listed on the Main Board of Bursa Malaysia. Several studies that focuses on the performance of companies listed on the Bursa Malaysia show that this stock market is a good platform for capital growth in short-

term and long-term investment (Abu Bakar and Rosbi, 2019b).

Even there are many studies indicated a good performance of Bursa Malaysia, but the problem nowadays is due to the COVID-19 pandemic happened since year 2019. Many industries were affected by COVID-19 pandemic such as tourism industry, manufacturing industry and others sector. Therefore, this study was investigated the effect of COVID-19 outbreak toward banking and finance industry by selected two market indices that are S&P500 and KLCI index. Furthermore, this study was analyzed three banks in Malaysia that are CIMB Bank Berhad, Malayan Banking Berhad and Public Bank Berhad.

II. LITERATURE REVIEW

The rapid growth of investment portfolio in Malaysia was driven by efficiency of Bursa Malaysia as a platform of capital market growth. Many studies examine the performance of Malaysian exchange market (Abu Bakar and Rosbi, 2017b). As suggested by Abu Bakar and Rosbi (2018b) stock market is one of the most important indicators on how the economic are moving up. Positive increment of dynamic movement for the share price indicates a good performance of stock market in Malaysia. Thus, the stability of economic is depending on the good performance of companies listed on the stock market. Besides that, the diversification of investment is one of the strategic in generating a maximum return and minimize a risk (Abu Bakar and Rosbi, 2019d).

Others study like Tee (2017) suggested that regulators should increase their surveillance and monitoring effort into Malaysian companies. In addition, Malaysian companies should be transparent in their corporate dealings and auditors should strengthen their audit efforts in order to provide more reliable financial information.

While, Zainudin, et al., (2018), analyses the relationship between stock price volatility and dividend policy companies listed on Bursa Malaysia indicate that dividend policy is a strong predictor of stock price volatility of industrial products companies in Malaysia. Michelfelder and Pandya (2005) found that emerging markets have higher volatility yet lower persistence of shocks than in mature markets. Study by Abu Bakar and Rosbi (2019c) regarding the performance of Bursa Malaysia suggested that the KLCI can be a good indicator in developing a new insight of Malaysian capital market growth globally.

Moreover, Abu Bakar and Rosbi (2020) highlight that the COVID-19 give a bad impact on the performance of equity market in Malaysia and suggested to develop a solution in stabilizing economic situation in COVID-19 outbreak. In the same time, investors need to monitor the equity market in order to develop a good combination of investment portfolio to gain better return and reducing loss.

III. IMPACT OF CORONAVIRUS DISEASE TOWARDS MARKET INDEX OF S&P 500 AND KLCI

This paper evaluated the economic condition during outbreak of coronavirus disease COVID-19. The COVID-19 disease spreading easily between humans through close contact. The virus that causes COVID-19 most commonly spreads between people who are in close contact with one another within about one meter. It spreads through respiratory droplets or small particles, such as those in aerosols, produced when an infected person coughs, sneezes, sings, talks, or breathes. The coronavirus that causes COVID-19 is primarily transmitted through droplets containing virus, or through viral particles that float in the air.

The COVID-19 pandemic represents an unprecedented disruption to the global economy and world trade. This study evaluated two market indexes to analyze the impact of COVID-19 towards economic situation. Figure 1 shows the dynamic behavior of market index for S&P500. The observation periods selected from trading days in February 2020 until April 2020. This period selected because this time frame shows the significant effect of COVID-19 outbreak towards economic activities.

First observation of market value S&P 500 is 3248.92 on 3rd February 2020. The maximum value of market index S&P 500 is 3386.15 on 12th observation period (19th February 2020). The minimum value of S&P 500 is 2237.40 on 35th observation period (23rd March 2020). The significant drop in S&P 500 market index indicates COVID-19 outbreak give negative effect towards economic development.

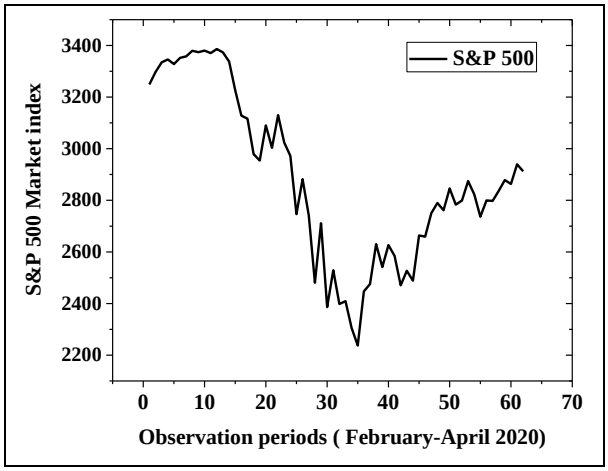

Fig. 1: Dynamic behavior of S&P 500 market index

Next, this study evaluated the dynamic behavior of Kuala Lumpur Composite Index (KLCI) as shown in Figure 2. The observation periods involving three months starting from February 2020 until April 2020. This period is important to analyze in evaluating the effect of COVID-19 outbreak toward economy activities because this is the period where the first wave of infection in global level.

Figure 2 shows the price movement of Kuala Lumpur Composite Index for 64 daily trading of observation periods. The maximum value of KLCI is 1554.49 on 5th observation (7th February 2020). The minimum value of KLCI is 1219.72 on 34th observation period (19th March 2020).

The difference between maximum value and minimum value of KLCI is -21.54%. Therefore, significant negative value indicates COVID-19 outbreak affected KLCI market price. The economic activity in KLCI market experienced negative effect that slowed down all economic activities during outbreak of COVID-19 pandemic.

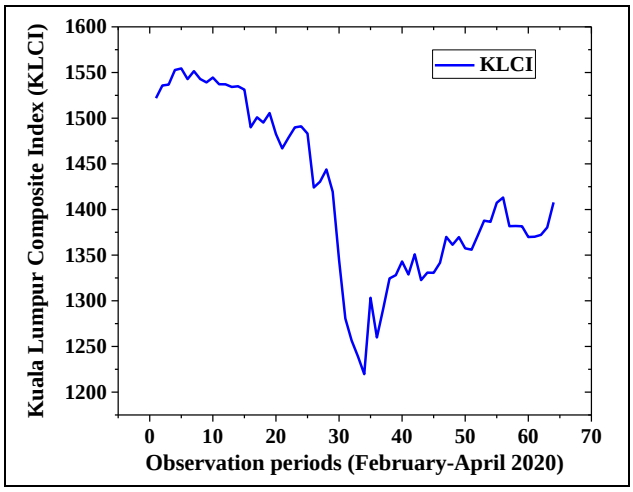

Fig. 2: KLCI movement during COVID-19 outbreak

IV. EFFECT OF COVID-19 TO BANKING SECTOR

In analyzing the impact of COVID-19 towards banking sectors, this study selected three share prices of banking institutions that listed on FTSE Bursa Malaysia KLCI. Based on the market capitalization, this study selected three main banking companies in Malaysia as the indicator for performance during COVID-19 outbreak.

Figure 3 shows the share price movement for CIMB Bank Berhad. The observation periods started form 3rd February 2020 until 30th April 2020. The total number of daily observations are 64 trading days. The first value of share price is value at MYR 4.85 for one unit of share. The value of share price for last observation is MYR 3.45 for one unit of share. The maximum value of share price is MYR 5.15 on 5th observation (7th February 2020). The minimum value of share price is MYR 3.14 on 34th observation (19th March 2020). The percentages between maximum and minimum value was calculate using Equation (1).

$$\Delta P = \frac{3.14 - 5.15}{5.15} \times 100\% = -39.03\% \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Equation (1) shows there is significant changes of share price with value of -39.03%. Therefore, the outbreak of COVID-19 gives impact towards CIMB Bank Berhad.

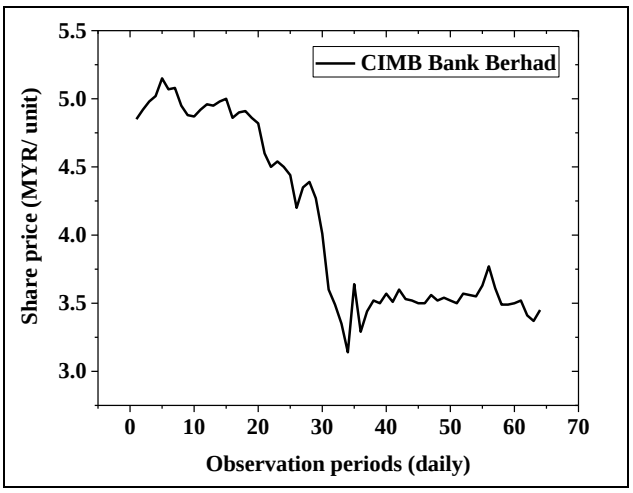

Fig. 3: Share price movement for CIMB Bank Berhad

Next, Figure 4 shows the share price movement for Malayan Banking Berhad. The observation periods started form 3rd February 2020 until 30th April 2020. The total number of daily observations are 64 trading days. The first value of share price is value at MYR 8.36 for one unit of share. The value of share price for last observation is MYR 7.57 for one unit of share. The maximum value of share price is MYR 8.54 on 7th observation (11th February 2020). The minimum value of share price is MYR 7.08 on 34th observation (19th March 2020).

The percentages between maximum and minimum value was calculate using Equation (2).

$$\Delta P = \frac{7.08 - 8.54}{8.54} \times 100\% = -17.10\% \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Equation (2) shows there is significant changes of share price with value of -17.10%. Therefore, the outbreak of COVID-19 gives impact towards Malayan Banking Berhad.

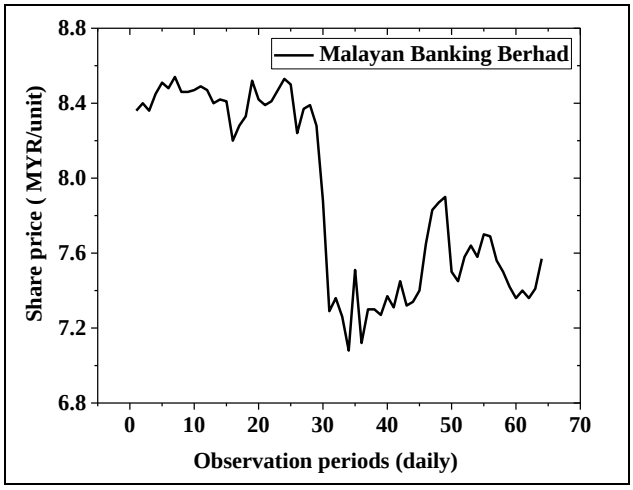

Fig. 4: Share price movement for Malayan Banking Berhad

Then, Figure 5 shows the share price movement for Public Bank Berhad. The observation periods started form 3rd February 2020 until 30th April 2020. The total number of daily observations are 64 trading days. The first value of share price is value at MYR 3.712 for one unit of share. The value of share price for last observation is MYR 3.276 for one unit of share. The maximum value of share price is MYR 3.712 on 1st observation (1st February 2020). The minimum value of share price is MYR 2.532 on 25th observation (6th March 2020).

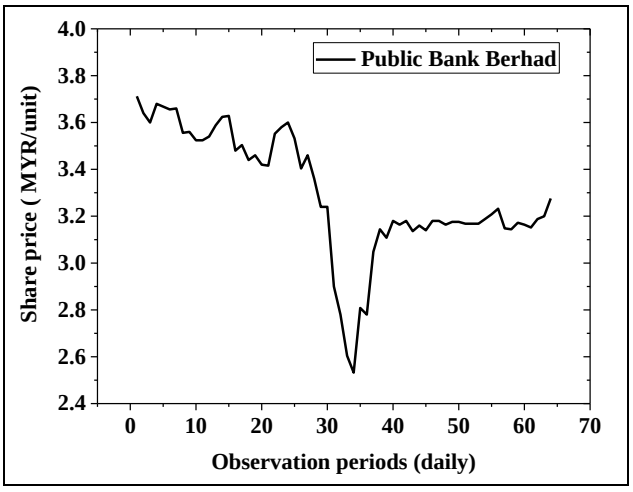

Fig. 5: Share price movement for Public Bank Berhad

The percentages between maximum and minimum value was calculate using Equation (3).

$$\Delta P = \frac{2.532 - 3.712}{3.712} \times 100\% = -31.79\% \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Equation (3) shows there is significant changes of share price with value of -31.79%. Therefore, the outbreak of COVID-19 gives impact towards Public Bank Berhad.

V. CONCLUSION

The objective of this research is to evaluate the economic impact of COVID-19 outbreak towards finance and banking industry. This study selected two main market for stock prices namely S&P 500 and KLCI as market index analysis for assessing economic impact because of COVID-19 outbreak. Meanwhile, for analyzing banking industries, three banking institution in Malaysia were selected to examined the effect of Covid-19 towards finance and banking industry. Main findings of this study are:

(a) First observation of market value S&P 500 is 3248.92 on 3rd February 2020. The maximum value of market index S&P 500 is 3386.15 on 12th observation period (19th February 2020). The minimum value of S&P 500 is 2237.40 on 35th observation period (23rd March 2020). The significant drop in S&P 500 market index indicates COVID-19 outbreak give negative effect towards economic development.

(b) The calculated difference between maximum value and minimum value of market index for KLCI changes is -21.54%. Therefore, significant negative value indicates COVID-19 outbreak affected KLCI market price. The economic activity in KLCI market experienced negative effect that slowed down all economic activities during outbreak of COVID-19.

(c) First banking institution selected for this study is CIMB Bank Berhad. The maximum value of share price is MYR 5.15 on 5th observation (7th February 2020). The minimum value of share price is MYR 3.14 on 34th observation (19th March 2020). There is significant change of calculated share price with value of -39.03%. Therefore, the outbreak of COVID-19 gives significant impact towards CIMB Bank Berhad.

(d) The second banking institution that evaluated in this study is Malayan Banking Berhad. There is significant change of dynamic share price with value of -17.10%. Therefore, the outbreak of COVID-19 gives significant impact towards Malayan Banking Berhad.

(e) The third banking institution that selected in this study is Public Bank Berhad. The maximum value of share price is MYR 3.712 on 1st observation (1st February 2020). The minimum value of share price is MYR 2.532 on 25th observation (6th March 2020). There is significant change of share price with value of -31.79%. Therefore, the outbreak of COVID-19 gives impact towards Public Bank Berhad.

The findings of this study give accurate information to

investors regarding the economic impact because of COVID-19. In the same time, this study gives information for policy makers in designing the optimal interest rate in improving the current economic situation of finance and banking industry during the COVID-19 outbreak. This study also helps society to alert regarding the impact of COVID-19 to their finance and economic activities.

For further study, it is suggested to develop questionnaires in evaluating the customer awareness and perception towards finance and banking industry during the outbreak of COVID-19 pandemic.

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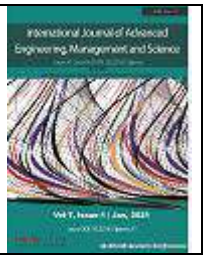

Preferred Essential Entrepreneurial Skills of Employees in the Hospitality Industry

Anna Margarita T. de Leon, Hannah Kaziel A. Gaya, Crispin B. Catle, Alan Joyce DD. Oracion, Lizelle C. Rodriguez

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Abstract— *This research study aimed to establish and discover the various entrepreneurial skills of an employee preferred in the hospitality industry. Through this evaluation, the researchers would become more aware of the necessary traits an employee should possess, hence preferred by employers. Entrepreneurial skills as used in this study were associated with the variables: personal characteristics, interpersonal skills, critical and creative thinking skills, and practical skills. The researchers used the descriptive method of research through a survey questionnaire administered to the heads in the hospitality industry. Based on the findings, the preferred entrepreneurial skills desired in an employee were being hospitable, ethical, knowledgeable, and pro-activeness in work.*

Keywords— ***Ethical, entrepreneurial skills, hospitable, hospitality industry, preferred employee traits.***

I. INTRODUCTION

Business is a major contributor to the world economy. It is the most important in capitalist economies. All business entities are formed to earn a profit that will increase the asset of its owners and the business itself. As the basic needs and wants of the people increases, the number of people who are eager to gain profit also increases thus leads to the existence of the business. At present, a lot of business ventures can be found in the country and one of the most common forms of this profit-oriented activity is the management of hotels and restaurants, which satisfies the needs of guests and diners.

As the hospitality and tourism industry moves into the next century, its future success depends on whether each country can upgrade the level of training for those already engaged in this field, and design new training approaches for those entering this employment sector. Education has become more highly valued. Therefore, hospitality and tourism programs throughout the world are racing to keep pace with the demands of a rapidly changing and highly dynamic industry.

Entrepreneurial skills encompass skills that target personal, interpersonal, creative, and practical aspects. It seeks out change, it embraces development and innovation and continuously pursues improvement and opportunities. Entrepreneurial activities are immensely significant for economic growth and national development in both formal and informal sectors (Al-Mamun et al., 2016). Having the right set of skills and characteristics can greatly contribute to the efficiency and effectiveness of an organization or enterprise. Personal characteristics, interpersonal skills, critical and creative thinking skills, and practical skills all have their own bearing on individual success. An individual's capabilities can boost one's personal strength in efficiently managing an enterprise (Man et al., 2002). Gerli et al. (2011) emphasized that it is important for entrepreneurs to hone certain competencies to enable firm performance. This is also particularly true for employees as they are the greatest asset of an organization. Mitchelmore and Rowley claimed that entrepreneurial competencies can advance enterprise performance, growth, and economic development.

Good management is a result of a smooth operation. The flow of management starts with the people who have the skills and capabilities of running the operations. People associate requiring entrepreneurial skills with those who only intend to set up their own

business. However, employers nowadays look for an entrepreneurial mindset in their employees. The European Council (2006) labeled entrepreneurship as one of the eight key competencies that all individuals should have in order to facilitate business creation and innovation (Landström et al., 2012) and to have a successful professional life (Daniel et al., 2017); the entrepreneur is seen not only as a person who is capable of assuming risks and starting a business but also as an individual who uses his/her skills and characteristics in order to create value in a company (Gundry, Ofstein & Kickul, 2014).

The researchers chose to explore this kind of study to determine the entrepreneurial skills of an employee most desired in the hospitality industry. This research study sought to describe the entrepreneurial skills of employees preferred (Subia, Mones & Alfonso, 2017) in the hospitality industry, and recommend a plan for human resource management and development.

II. METHODOLOGY

The study used the descriptive research design. The process of descriptive research goes beyond mere gathering and tabulation of data. It involves the understanding of the meaning or significance of what is described. Thus, the description is often a combination with comparison- and-contrast that comprise organizations, classifications, measurements, interpretation, and evaluation.

This study consisted of 6 hotels with 6 immediate supervisors as respondents situated within the city using purposive sampling in data gathering. A 5-point Likert scale was used in the responses of the informants to allow their level of preference; agreement or disagreement on the matter being described where 5 has an equivalent verbal analogy of Highly Preferred to be the highest and 1 as the lowest denoted by Least Preferred, hence

Table 1. The point, Range and Verbal Analogy on the Preference of the Respondents

Point	Range	Verbal Analogy
5	4.21 – 5.00	Highly Preferred
4	3.41 – 4.20	Preferred
3	2.61 – 3.40	Moderately Preferred
2	1.81 – 2.60	Less Preferred
1	1.00 – 1.80	Least Preferred

III. RESULTS AND DISCUSSION

Entrepreneurial skills of an employee preferred in the hospitality industry as rated by their immediate supervisor. This was rated from the numerical value of 5 as being Highly Preferred to 1 being Not Preferred.

The succeeding tables would show the entrepreneurial skills considered in this study labeled as Table 2. Personal Characteristics, Table 3. Interpersonal Skills, Table 4. Critical and Creative Thinking Skills, and Table 5. Practical Skills.

Shown in Table 2 are the results of the survey in the Item Personal Characteristics. This trait as a whole makes up one's personality so that employers will try to be assertive to look for these qualities in an employee; hence

Table 2. Personal Characteristics

Personal characteristics	Weighted Mean	Verbal Description	Rank
Optimism	4.13	Preferred	7
Initiative	4.43	Highly Preferred	5.5
Resilience	4.43	Highly Preferred	5.5
Adaptability	4.47	Highly Preferred	4
Cooperation	4.63	Highly Preferred	2
Efficiency	4.53	Highly Preferred	3
Hospitable	4.80	Highly Preferred	1
Overall Weighted Mean	4.49	Highly Preferred	

It can be noted that being hospitable the highest weighted mean of 4.80. It is followed by cooperation with a weighted mean of 4.63, then by the efficiency with a weighted mean of 4.53, adaptability with the weighted mean of 4.47, initiative and resilience with both having a weighted mean of 4.43, and lastly by optimism with a weighted average of 4.13. While the respondents agree that their employees should possess all these characteristics, being hospitable is of significant importance to them as this should be portrayed by most, if not all, hospitality industry members. Being hospitable to others, and particularly outsiders requires both certain skills and certain mindsets. Without the proper mindsets, one will be unable to give off the friendly vibe that hospitality requires. And without the right skills, one will also struggle to provide the proper help. It takes some practice to develop, but being hospitable to other people is a valuable character trait.

Table 3 tackled interpersonal skills as a necessary trait in the hospitality industry as it helps to develop

relationships with people. It is also known as social skills or an individual's capacity or tolerance in interacting with others.

Table 3. Interpersonal Skills

Interpersonal Skills	Weighted Mean	Verbal Description	Rank
Leadership	4.43	Highly Preferred	6
Motivation	4.47	Highly Preferred	2.5
Communication Skills	4.37	Highly Preferred	4.5
Listening Capabilities	4.37	Highly Preferred	4.5
Personal Relations	4.47	Highly Preferred	2.5
Negotiation	4.33	Highly Preferred	7
Ethics	4.63	Highly Preferred	1
Overall Weighted Mean	4.44	Highly Preferred	

The data suggest that ethics has the highest weighted mean of 4.63 followed by personal relations and motivation where both got a weighted mean of 4.47, then by leadership (Ramos, et al, 2019) with a weighted mean of 4.43, and by communication skills and listening capabilities with a weighted mean of 4.37, and lastly by negotiation with a weighted mean of 4.33. The respondents believe that when their employees possess the traits of being highly ethical, the rest of the cited characteristics will follow. If their employees possess the right moral values, they will most likely be effective and efficient in whatever undertaking they make. Establishing a healthy organizational environment is by fostering ethical awareness, practices, and behavior enhances employee satisfaction, reduces employee turnover intentions, improves visitor experience, and increases the organization's profit (Cheng et al., 2013).

Table 4 covers the area of an employee's critical and creative thinking skills as they evaluate knowledge in the workplace, interpret ideas, seek possibilities, consider alternatives, being resourceful, and solve problems in a logical manner.

Table 4. Critical and Creative Thinking Skills

Critical and Creative Thinking Skills	Weighted Mean	Verbal Description	Rank
Goal Setting	4.47	Highly Preferred	2
Planning	4.43	Highly Preferred	3
Organizing	4.30	Highly Preferred	4
Decision Making	4.20	Preferred	5
Knowledge	4.63	Highly Preferred	1
Overall Weighted Mean	4.41	Highly Preferred	

Critical thinking involves logical thinking (Subia, 2020; Subia, et al, 2020) and reasoning. It encompasses generating something new to the point of being innovative. This is what the respondents need in their employees. The highest weighted mean falls under the Item knowledge with 4.63, followed by goal setting with a weighted average of 4.47, then by planning with a weighted average of 4.43, and organizing with a weighted mean of 4.30, respectively, and lastly in decision making with a weighted average of 4.20. 'Knowledge is power' may sound like an over-used cliché, but it really is true when it comes to staying relevant in the extremely competitive hospitality industry. The respondents agree that when their employees are knowledgeable, they will be able to do anything to succeed and excel in their work. They further opined that an employee should have the ability and knowledge in order to have skill.

Table 5 is the fourth domain considered in this study that includes the employee's ability to analyze and creatively solve practical problems while integrating skills learned from previous experiences, which can also be a window to excel while advancing career opportunities.

Table 5. Practical Skills

Practical Skills	Weighted Mean	Verbal Description	Rank
Knowledgeable	4.47	Highly Preferred	2
Manual dexterity	4.00	Preferred	5
Flexibility and modularity	4.40	Highly Preferred	3
Mobility	4.30	Highly	4

		Preferred	
Proactiveness	4.60	Highly Preferred	1
Overall Weighted Mean	4.35	Highly Preferred	

It can be noted that being proactive has the highest weighted mean of 4.60 followed by knowledgeable with a weighted mean of 4.47, then by flexibility and modularity with a weighted mean of 4.40, and mobility with a weighted mean of 4.30, and lastly by manual dexterity with a weighted mean of 4.00. Being proactive is somewhat different than being prepared. The respondents know that being prepared in any task or endeavor is important, it is knowing what to do when the customers or the guests need something. Being proactive is knowing the needs of the customers or guests before they even have to ask, and this is what the respondents want to instill in their employees. This is a desirable trait because this is overcoming any obstacles while being in control of the situation.

Proactivity is not only conducive to the personal development of employees such as improving employee performance, promoting career success, obtaining clear role positioning, better job satisfaction, and enhancing employee creativity (Parker & Collins, 2010; Saks, Gruman, & Cooper-Thomas, 2011; Kim, Hon, & Crant, 2009; Kim, Hon, & Lee, 2010) and also key factors that determine the success of an organization and its competitive advantage (Crant, 2000; Grif-fin, Neal, & Parker, 2007, Frese, Kring, Soose, & Zempel, 1996; Parker, 2000).

IV. CONCLUSION AND RECOMMENDATIONS

This study was conducted to explore the various entrepreneurial skills in an employee preferred in the hospitality industry. This consisted of personal characteristics, interpersonal skills, critical and creative thinking skills, and practical skills.

Based on the researchers' findings, the following conclusions were drawn:

1. Most of the respondents were in their productive age and experienced in the field of hospitality management, female, college graduates, and holding supervisory positions.
2. In terms of personal characteristics, it can be noted that being hospitable is the highest.
3. As to interpersonal skills, it can be seen that ethics is the highest.
4. As to critical and creative thinking skills, the highest belongs to the variable knowledge.
5. As to practical skills, it can be noted that being proactive is the highest.

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

1. Since an employee's entrepreneurial skills can be honed over time, interaction with people can improve a person's values and attitudes.
2. More personality development subjects should be offered in the school's curriculum.
3. The organization's Human Resource Office can initiate a plan for employee development for their personal and professional growth.
4. An organization may institutionalize a system in developing employee competencies, recruitment, performance management, and rewards and recognition.

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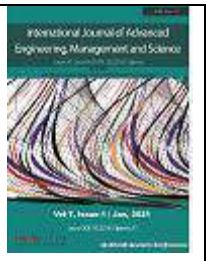

Social Media Exposure of Students in Relation to Academic Performance

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Abstract—*This study aimed to determine the level of academic performance of college students in relation to their level of social media exposure. The descriptive-correlational research design was used. The study was conducted during the First Semester of 2018-2019 in CapSU Dayao Satellite College utilizing the 186 randomly selected 4th-year college students from the four curricular (4) programs. A researcher-made questionnaire was utilized. Gathered data were analyzed and interpreted using mean, standard deviation, t-test, One-way ANOVA, and Pearson r. Results revealed that the respondents were 18-20 years old age, females, and with family income below the poverty threshold level. Respondents' level of social media exposure is "sometimes" and their academic performance is "good." Further, no significant difference was found in the level of social media exposure when grouped according to sex and monthly income, however, a significant difference was found when grouped according to age. On the other hand, no significant difference was found in the respondents' academic performance when grouped according to age, sex, and monthly family income. Further, no significant association or relationship was found between the level of social media exposure and the academic performance of the respondents. This implies that even though the respondents were exposed to social media they were able to maintain a good academic performance. Therefore, the time spent by students on the different social media platforms or the number of gadgets used is not indicative and determinant of how they will perform in their academics as a whole.*

Keywords— ***academic performance, social media exposure, social media platforms.***

I. INTRODUCTION

The popularity gained by social media reflects significant technological breakthroughs highlighting the efficient way of creating and digital exchanging of information. It enabled people to be connected in a borderless world providing social interaction across cultures. In like manner, social media plays a significant role in the paradigm shift of educational practices, attitudes, and performance of students as it became an apparent part of day-to-day activities.

The unprecedented use of students of the different social networking sites such as Facebook, Twitter, Instagram, YouTube, gaming sites, and other blogging sites has increased exponentially as evidenced by the presence of growing consumption of smartphones, laptops, iPods, and other gadgets. The number of users of social media sites attests to how students respond to technology as it is the fastest way to share photos, videos, and statuses as well as maintaining connections and relationships.

Students keep themselves updated on the top trending issues, entertainments, games, Tik Toks, fashion icons, celebrities, and other trendsetters. Social media paved opportunities for finding a job, meeting new friends virtually, and strengthening relationships. This contemplated an increased time staying engaged in social media as they actively maintain one or more accounts in the different platforms.

Academic performance on the other hand had undergone a massive change with social media becoming an instructional tool as its usability and accessibility among students had increased. It had also enhanced how lessons are prepared and how students respond and create their school works, activities, and performances as they have more mediums to explore and utilize.

The advantages and disadvantages of optimizing the use of social media outweigh one another as it somehow affects students' performance. According to Kuppuswamy and Shankar (2010), social network websites grab the attention of the students and then divert it towards non-educational and inappropriate actions including useless chatting. Trusov, Bucklin, & Pauwels (2009) also noted that the Internet is no doubt an evolution of technology but specifically social networks are extremely unsafe for teenagers, social networks have become hugely common and well-known in the past few years.

Likely, Rithhika & Sara (2013) concluded that students are very fond of using Facebook, Twitter, YouTube, and Orkut. Paying attention to their academic progress and addressing any issues will go a long way towards keeping the negative aspects of social media from influencing their studies.

Further, Kulidtud (2017) implied that the main purpose of the students in using the internet is different from their actual activity whenever they already accessed the sites. While their common main objective of accessing the networks was for academic purposes (i.e., to communicate with people who are away from them) but in practice, they were using their internet time for social purposes (i.e., to like the post of their friends, topics and etc.). Also, Liccardi, Pau, Ounnas, & Massey (2007) reviewed that the students are socially connected by sharing their daily learning experiences and do conversation on several topics.

Progressively, social media became a constant engagement among students. However, some students become very poor academically (Egedegbe, 2014). As ascertained by Brubaker (2013), that the current generation of college students has been exposed to a technology that led them to rely on social media such as Facebook and Twitter. It has an impact on academic performance when students overuse or multitask while doing their school work.

The Philippines being coined as the social media capital of the world where millions of Filipinos stay online for hours a day scrolling and chatting as a form of social interaction, students have become accustomed to having information at their fingertips. However, how they use their time and how they prioritize what information to access in relation to their academic performance while considering the poor internet connectivity, lack of gadgets and financial limitations of the students may be examined further. Likewise, on a personal note, diverted and unfocused attention of the students due to having gadgets and very active social media which deters them from doing assignments, studying for exams, and showing improvements in their performance was observed. Thus, interest in this study was pursued.

1.1 Statement of the Problem

Thus, the researcher decided to conduct this study to see if indeed the level of social media exposure of the students affects their academic performance. This study aimed to determine the level of academic performance of college students in relation to their level of social media exposure.

Specifically, it answered the following:

1. What is the socio-demographic profile of the respondents?
2. What is the level of social media exposure of the respondents?
3. What is the level of academic performance of the respondents?
4. Is there a significant difference in the level of social media exposure considering the respondent's sex, age, and monthly family income?
5. Is there a significant difference in the level of academic performance considering the respondent's sex, age, and monthly family income? and
6. Is the level of academic performance significantly related to the level of social media exposure?

1.2 Hypotheses of the Study

Based on the given problem, the following hypotheses were forwarded:

1. There is no significant difference in the level of social media exposure considering the respondent's sex, age, and monthly family income.
2. There is no significant difference in the level of academic performance considering the respondent's sex, age, and monthly family income.
3. The level of academic performance is not significantly related to the level of social media exposure.

II. METHOD

This study utilized the descriptive-correlation research design. The dependent variable in the study was the level of academic performance while the independent variables

are sex, age, monthly family income, and level of social media exposure. The study was conducted in Capiz State University, Dayao Satellite College for the Academic Year 2018-2019.

The respondents of the study were the 186 randomly selected fourth-year college students of Capiz State University, Dayao Satellite College from the four (4) offered programs of the college namely: Bachelor of Science in Criminology, Bachelor of Elementary Education, Bachelor of Science in Fisheries and Bachelor of Science in Computer Science.

A researcher-made research instrument was used in the conduct of the study. It is composed of two parts. Part I dealt with information regarding the socio-demographic profile of the respondents including a) sex, (b) age, and (c) monthly family income. Part II was on the level of social media exposure. The responses of the respondents on the level of social media exposure was scored and interpreted using the following scoring guide:

Score	Mean Interval	Verbal Interpretation
5	4.20 - 5.0	Always
4	3.40 – 4.19	Often
3	2.60 – 3.39	Sometimes
2	1.80 – 2.59	Rarely
1	1.0 – 1.79	Never

Secondary data was used for the General Weighted Average of the respondents. The source was the Transcript of Records requested by students and their Grade Online System accessible to students through their individualized passwords. The academic performance was scored based on the Revised Student Handbook (2018) of the university:

Numerical Grade	Percent Equivalent	Qualitative Rating
1.0	99-100	Excellent
1.25	96-98	Highly Outstanding
1.5	93-95	Outstanding
1.75	90-92	Very Good
2.0	87-89	Good
2.25	84-86	Very Satisfactory
2.5	81-83	Satisfactory
2.75	78-80	Unsatisfactory
3.0	75-77	Passed
5.0	Below 70	Failure

The questionnaire was subjected to face validity or content validity by a panel composed of three members considered as experts (Stoner et al., 2011) Their suggestions and recommendations were observed in the modification of the test. Once the content was validated, the instrument was pilot tested (Daud, Khidzir, Ismail, and Abdullahto, 2018) to 30 students who are not included in the identified population. Data from the pre-test was tabulated and the reliability coefficient was computed to assure stability and consistency of the instrument (Creswell, 2010). Using Cronbach's Alpha Pallant (2001) states value above 0.6 is considered high reliability and acceptable index (Nunnally and Bernstein, 1994). Whereas, the value of Cronbach's Alpha less than 0.6 considered low. Cronbach's values in the range of 0.60 - 0.80 are considered moderate, but acceptable. While Cronbach's Alpha in the ranges of 0.8 and up to 1.00 is considered very good. Results were then tabulated, analyzed, and interpreted using the appropriate test statistic: mean, standard deviation, t-test, One-Way ANOVA, and Pearson r.

III. RESULTS AND DISCUSSION

This section presents the results of the study. Corresponding discussion, analysis, and interpretations of the data given were also discussed.

Table 1: Socio-demographic profile of the respondents

Category	f	%
Age		
18-20	137	73.7
21-23	40	21.5
24-26	8	4.3
33-35	1	.5
Total	186	100.0
Sex		
Male	80	43.0
Female	106	57.0
Total	186	100.0
Monthly Family Income		
Php 5,000 & below	110	59.1
Php 5,001 – Php 10,000	38	20.4
Php 10,001 - Php 15,000	25	13.4
Php 15,001 - Php 20,000	8	4.3
Php 20,001 & above	5	2.7
Total	186	100.0
Preferred Social Media Platforms		
Facebook	165	88.7

Twitter	44	23.7
Instagram	14	7.5
Youtube	51	27.4
Viber	10	5.4
Skype	10	5.4
LinkedIn	9	4.8
LOL	14	7.5
Crossfire	4	2.2
Gadgets Used		
Cellphone	183	98.4
Tablet	9	4.8
Laptop	18	9.7
Desktop	6	3.2
I-pod	3	1.6

Table 1 shows that 137 or 73% of the respondents were 18-20 years old, 106 or 57% were females, 110 or 59.1 were earning Php 5000 and below.

Further, 165 or 88% uses Facebook as their most preferred social media platform and 183 or 98.4% use a cellphone in accessing their social media.

Table 2: Social media exposure of students

Level of Media Exposure	SD	Mean	Verbal Interpretation
• Social media allows me to do research for my lessons / assignments.	0.98	3.76	Often
• I use social media for uploading pictures and videos.	1.01	3.65	Often
• I check my social media account every day.	1.13	3.64	Often
• Social media updates me of my friends and family's activities.	1.01	3.59	Often
• Social media increases my ability to communicate.	1.00	3.50	Often
• Social media allows me to make more friends.	0.96	3.45	Often
• I spend more than three hours using/accessing my social media account.	0.86	3.39	Sometimes
• Social media is a distraction to release boredom	1.04	3.32	Sometimes
• I use social media because it allows me to reinvent myself	0.92	3.24	Sometimes
• Social media is a venue for interactive discussion.	1.01	3.22	Sometimes
• Social media enriches my vocabulary.	0.96	3.19	Sometimes
• I see my social media account as a venue for releasing my school pressure and stress.	1.05	3.10	Sometimes
• Social media affects my spelling proficiency.	1.09	3.10	Sometimes
• I use social media to express myself in any way I want.	1.04	3.09	Sometimes
• Social media affects my communication skills.	1.07	3.05	Sometimes
• I see to it that each account is updated daily.	1.15	3.04	Sometimes
• Social media eliminates the need for the physical presence of a friend.	0.99	2.97	Sometimes
• Because of social medias I sometimes forgot/missed making assignments and other school tasks.	1.05	2.95	Sometimes
• I do not update my social media account/s regularly.	1.04	2.95	Sometimes

• I stay awake late at night updating, watching videos, and responding to the newsfeeds of my account.	1.13	2.92	Sometimes
• I update my profile once in a while.	1.04	2.90	Sometimes
• I see social media as the reason for the increase or decrease in my grades in school.	4.03	2.87	Sometimes
• I feel delighted spending most of my time using social media apps.	1.09	2.84	Sometimes
• I spend more time browsing my account than reading.	1.08	2.82	Sometimes
• I make sure that I react and / or comment on every feed I receive in my account.	1.04	2.70	Sometimes
• I feel irritated if I cannot check my social media account.	1.12	2.67	Sometimes
• I maintain 2 -3 social media accounts.	1.25	2.64	Sometimes
• I feel the need to update my status on my social media account rather than reading my book.	1.03	2.57	Rarely
• I unconsciously use short words (abbreviations, acronyms, jijimon) usually used in social media in my school writing activities.	1.19	2.52	Rarely
• I came late to school once in a while because I slept late accessing my social media account/s.	1.14	2.46	Rarely
Overall Mean	**1.07**	**3.07**	**Sometimes**

Table 2 reflects the overall mean of the social media exposure of students. It has a grand mean of 3.07 verbally interpreted as “sometimes.” The highest statement with a mean of 3.75 was on “Social media allows me to do research for my lessons/assignments.”

The results reveal that students exhibit a sense of discipline and awareness of how access to social media can enhance their capability to cope with their school works. It fortifies the belief that students have developed a conscious decision making on optimizing the advantages gained through social media access to make their academic performance better.

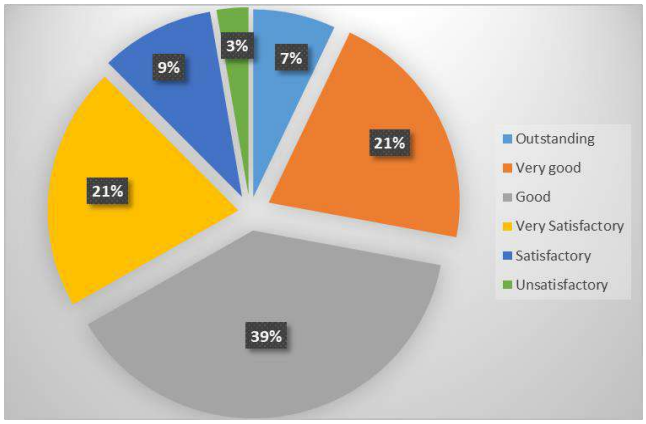

Fig.1: Level of Academic Performance

Fig. 1 discloses that the level of academic performance is Good with 78 or 39% of the respondents garnering a grade of 2 with a percent equivalent of 87-89.

The results imply that students were performing favorably towards their academics with only a handful hitting the unsatisfactory range. This suggests that students are informed of their academic responsibilities and have purposely responded towards a positive outcome in their study. However, it could also be highlighted that none were able to hit the Excellent and Highly Outstanding marks which suggest that a more intensive intervention to increase academic performance is needed.

Table 3: Difference in the social media exposure grouped according to sex

Category	Mean	t-value	df	Significance (2-tailed)
Sex				
Male	3.12	0.90	181	0.37
Female	3.04			

Table 3 reveals that when respondents were grouped according to sex, the significant t-value of 1.37 on the academic performance considering respondents' sex had a significant value of 0.37 which was higher than 0.5 alpha. This implies that regardless of sex, male and female have the same level of social media exposure. It further connotes that students have been exposed to the same type of social media and probably share the same kind of interest and follow the same trends and practices as they access and use the different sites.

Table 4: Difference in the social media exposure grouped according to age and monthly family income.

Variable	Source of Variation	Sum of Squares	Df	Mean Squares	F	Sig.
Age	Between Groups	6.478	9	0.720	2.100	0.032
	Within Groups	60.327	176	0.343		
	Total	66.805	185			
Monthly Family Income	Between Groups	0.555	4	0.139	0.379	0.824
	Within Groups	66.25	181	0.366		
	Total	66.805	185			

*** p < .05

Table 4 shows that there was a significant difference in the level of social media exposure when classified according to age (F = 2.100, p = 0.032) because the significant value was lower than 0.05 alpha. Meanwhile, no significant difference was found when respondents were grouped according to monthly family income (F = 0.379, p = 0.824) since the significant value was higher than 0.05 alpha. Thus, the null hypothesis was accepted.

The data implies that age affects social media exposure as younger students in the age range of 18-20 access social media more than the higher age brackets. The result is supported by Lennon, Rentfro, and Curran (2012) as cited by Kulidtud (2017) presented that young adults whose ages range from 18 – 20 oftentimes use social networking sites compared to those belonging to the higher age brackets.

Table 5: Difference in the academic performance grouped according to sex.

Category	Mean	t-value	df	Significance (2-tailed)
Sex				
Male	2.13	1.37	181	0.17
Female	2.08			

Table 5 shows that when respondents were grouped according to sex, the significant t-value of 1.37 on the academic performance considering respondents' sex had a significant value of 0.17 which was higher than 0.5 alpha. Thus, the null hypothesis was accepted. This implies regardless of sex, male and female students gave out the same level of academic performance.

Table 6: Difference in the academic performance grouped according to age and monthly family income.

Variable	Source of Variation	Sum of Squares	Df	Mean Squares	F	Sig.
Age	Between Groups	0.481	9	0.053	0.673	0.733
	Within Groups	13.99	176	0.079		
	Total	14.472	185			
Monthly Family Income	Between Groups	0.134	4	0.033	0.422	0.793
	Within Groups	14.338	181	0.079		
	Total	14.472	185			

Table 6 discloses that no significant difference was found when respondents were grouped according to age (F = 0.673, p = 0.733) and monthly family income (F = 0.422, p = 0.793) since the significant value was higher than 0.05 alpha. Thus, the null hypothesis was accepted. Results signify that regardless of the age and monthly family income of the students, the academic performance generally is the same.

Further, results may imply that students have developed a sense of understanding of what good academic records could do to land them good jobs regardless of their age.

Also, the family income or finances of the students may have not presented a difference in the academic performance may be due to the initiatives of the school and government in extending financial support through scholarships and allowances for qualified indigents, academic, and sports achievers, and student leaders.

Table 7: Relationship between the level of social media exposure and academic performance

Pearson Correlation	R	r^2	Significance
Level of Social Media Exposure and Level of Academic Performance	0.03	0.0009	0.68

Looking at the Pearson r value, no significant association between level of social media exposure and academic performance (r = 0.03; p = 0.68) was found because the significant value was higher than 0.05 alpha. The result shows that there is a very weak positive correlation but this correlation is not significant. Thus, the null hypothesis was accepted.

Students were performing academically despite accessing social media sites. It is relevant to note that in the face of social media's popularity, students can prioritize and multi-task between academic-related researches and social interactions. Correspondingly, students have learned to manage their time and were able to maximize the advantages of using social media.

Indeed, social media has contributed greatly to facilitating learning in the 21st century.

IV. CONCLUSIONS

Facebook is the most highly utilized and preferred social media platform as it is the most accessible and popular among students. The cellphone is the widely available gadget used in accessing social media platforms most likely it fits the financial limitations of students.

The level of social media exposure of students is not alarmingly high and within control which led to contemplate that students are mindful of their time and reasons for accessing social media.

Academic performance reflects good performance. However, the goal for excellence is not yet addressed. Thus, an intervention plan may be designed to help increase performance, especially for board courses.

Generation Z, for ages 18-22, demonstrates adeptness and familiarity with social media's uses and applications which allowed them to navigate sites and determine relevant information for academic and social purposes.

Provisions for social media as an educational tool for teachers and students may be explored. Advantages and disadvantages maybe weighed so countermeasures and guidelines may be established for the improvement of academic performance.

To further enhance academic performance, the administration may address the following implications:

7. The conduct of seminars or conferences in media and information literacy may be included to strengthen student's capability and knowledge in the responsible use of digital information, assert their rights and protect them from cyberbullying.
8. Considerations for an Enhanced Faculty Development Plan may be given prior attention. Send faculty to seminars and training, fellowships, and scholarship grants with a focus on internationalization for continuous development and upgrading of their pedagogical skills based on the newest trends in teaching.

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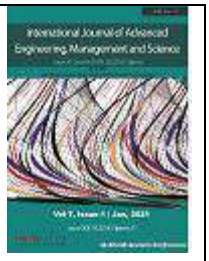

Mathematical Ability, Level of Science Misconceptions, and Science Performance of First-Year College Students

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Abstract— *This survey-correlational research aimed to ascertain the mathematical ability, level of science misconceptions, and science performance of 71 first- year college students of Capiz State University, Dayao Satellite College during the first semester of the academic year 2016–2017. Researcher-made test questionnaires and the revised American Association for the Advancement of Science Assessment Questionnaire instrument were used. In general, the respondents are mathematical "fairly able" (M=29.15, SD=4.087). In particular, out of 71 respondents, 73% are "fairly able", 24% are "able" and only 3% are "highly able". Respondents level of science misconceptions are "moderately high/low" (M=28.83, SD=3.179) with 35% are with a "low" level of misconceptions and 65% are with a "moderately high or low" level of science misconceptions. As a whole, respondents have "satisfactory" performance in science (M=26.68, SD=3.179). Particularly, 89% have "satisfactory" performance, 7% with "very satisfactory" performance and only 4% have "poor" performance in science. Inferential data analysis revealed that there is a significant difference in the science performance of the respondents when grouped according to their mathematical ability ($F(2,68) = 111.463$, $p<0.05$). The science performance differed significantly among the mathematical "highly able", "able", and the mathematical "fairly able" students. Also, results showed that there is a significant difference in the science performance when grouped by the level of science misconceptions. Furthermore, data revealed that students' performance in science is significantly related to their mathematical ability ($r=0.334$, $p<0.01$) and level of science misconceptions ($r=1.000$, $p<0.01$). Respondents' mathematical ability and level of science misconceptions are factors affecting science performance.*

Keywords— ***mathematical ability, science misconceptions, science performance***

I. INTRODUCTION

The development of human capacity in science and technology has been on the agenda of almost all developing countries over the past few decades including the Philippines. The education system is on track in revising and improving the current science education program to meet the highly competitive demand of society. Since the growth of science and technology contributes to the progress of a certain country particularly in socio-economic development. Science education of the Philippines aims to develop scientific literacy among students that will prepare them to be informed and participative citizens of the country who can make judgments and decisions regarding applications of science and technology as a form of human knowledge in different aspects of the society such as in health and in our environment (K to 12 Curriculum Guide Science, 2012).

It is being said that mathematics is the language of science and is considered as the training ground for analytical, systematic, and critical thinking. The understanding of Mathematics is vital in reporting results, experimental data, and explanation behind the concept of nature.

Another interesting part of the science teaching and learning process is the beliefs of students on certain scientific principles and concepts. Concepts include the ideas, objects, or events that help us understand and interpret the world around us (Eggen and Kauchak, 2004 as cited by Thompson and Louge, 2006) while misconception can be described as ideas that may be rooted from a personal experience, preconceived notions, nonscientific beliefs, mixed conceptions, conceptual misunderstanding and a result of an incorrect or insufficient explanation (Hanuscin, 2007). It was observed that many students may have science misconceptions about the concepts of weight and mass, heat and temperature, endothermic and exothermic reactions, objects' motion specifically the free falling bodies, photosynthesis and respiration. What is more critical in addressing science misconceptions is that students' conceptions do not change after instruction and may be developed through time. It seems obvious to Robelen (2013) that teachers need to understand the lesson content that they are trying to convey to students. However, study finds that what is critical to improved science learning is that teachers are unaware of the common misconceptions students have.

As observed, what may hinder students to fully understand science concepts is their poor idea or background of mathematics from elementary and secondary years. They may lack the ability to interpret science problems into equations and solve them using accurate mathematical principles. Thus, students should have strong scientific concepts and mathematical backgrounds to develop the problem- solving and analytical skills in science learning.

II. OBJECTIVES OF THE STUDY

This study aimed to ascertain the mathematical ability, level of science misconceptions and science performance of first-year college students of Capiz State University, Dayao, Satellite College of academic year 2016- 2017.

Specifically, the study sought to answer the following:

1. What is the mathematical ability of first-year college students?

2. What is the level of science misconception of first-year college students?

3. What is the science performance of first-year college students?

4. Is there a significant difference in the science performance of first-year college students when they are grouped according to their mathematical ability?

5. Is there a significant difference in the science performance of first-year college students when they are grouped according to their level of science misconceptions?

6. Are there significant relationships among mathematical ability, level of science misconceptions and performance?

In view of the aforementioned stated problems, the following hypotheses were forwarded:

1. There is no significant difference in science performance of first-year college students when they are grouped according to their mathematical ability.

2. There is no significant difference in science performance of first-year college students when they are grouped according to their level of science misconceptions.

3. There are no significant relationships among mathematical ability, level of science misconceptions, and performance.

III. THEORETICAL BACKGROUND AND MODEL

This study was anchored on the Theory of Constructivism of Piaget (1940) and Bruner (1960). Piaget suggests that children search for meaning as they interact with the world around them and use such experiences to test and modify existing schemas (Eggen and Kauchak, 2004 as cited by Chavan, Rajendra and Patankar, 2016) while Bruner as influenced by Piaget holds that learning is an active and knowledge building process that includes the facets of selection, transformation, decision making, generating hypotheses, and making meaning from information and experiences. Thus, Bruner emphasized that this process provides students the avenue to construct new concepts based on existing knowledge most likely when there is an absence of complete and accurate schema.

In this study, mathematical ability and level of science misconceptions are considered as the independent variables while science performance as the dependent variable.

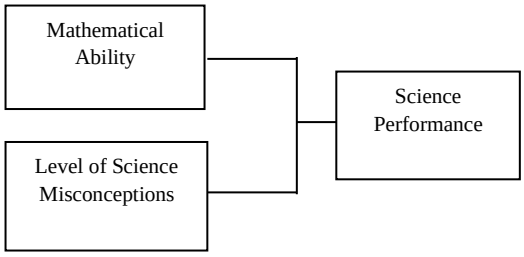

Fig.1: Conceptual Map

IV. METHODOLOGY

This survey-correlational research was conducted to determine the science performance of First-Year College Students of Capiz State University, Dayao Satellite College based on their mathematical ability and level of science misconceptions.

The participants of this study were the seventy-one (71) first-year college students randomly selected from BS Criminology (46) and BS Fishery (25) of the academic year 2016-2017. The Cochran formula was used in the computation of the sample size.

Researcher-made tests for mathematical ability and science performance, and the revised American Association for the Advancement of Science (AAAS) Assessment Questionnaire 2013 for the level of science misconceptions instruments were used. Prior to the conduct of the study, the Mathematical Ability and Science Performance Test had undergone face and content validation and was pilot tested among thirty (30) first-year students who are not part of the sample group and the results of was used for item analysis.

The statistical analyses used were mean, standard deviation, t-test for independent samples, Analysis of Variance (ANOVA), and Pearson r.

V. RESULTS AND DISCUSSION

This section presents the descriptive and inferential data and their respective analysis and interpretation.

5.1 Mathematical Ability

Table 1 presents the data on the mathematical ability of first-year college students. Data show that first-year students, in general are mathematical "fairly able" (M=29.15, SD=4.087). In particular, out of 71 respondents, 73% are "fairly able", 24% are "able" and only 3% are "highly able".

Table 1 Mathematical Ability of First-Year College Students

Mathematical Ability *Mean=29.15, SD= 4.087*	F	%
Highly Able (41.00 - 50.00)	2	3.0
Able (31.00 - 40.00)	17	24.0
Fairly Able (21.00 - 30.00)	52	73.0
Total	71	100.0

Scale	Description
41.0 – 50.0	Highly Able
31.0 – 40.0	Able
21.0 – 30.0	Fairly Able
11.0 – 20.0	Less Able
0.00 – 10.0	Least Able

Mathematically "able" students are competent in that they have learned and acquired the basic mathematical knowledge and skills necessary in understanding mathematical concepts.

The result indicates that students acquired basic skills in mathematics but others do not know how to apply these skills in problem solving and analysis. This is visible in the actual teaching-learning process in which students acquire the four basic arithmetic skills and may get the correct answer but when asked to solve word problems they tend to give an incorrect one.

Furthermore, results revealed that students are 'mathematically able' in identifying types of fraction but 'mathematically fairly able' in analyzing Venn diagrams. It shows that students are poor in mathematical analysis that involves building and applying abstract, and logically connected networks of mathematical ideas. The need for knowledge in mathematics is certainly inevitable because the trouble of students in mathematics may lie in their deficiency in mathematical background.

5.2 Level of Science Misconceptions

Table 2 Level of Science Misconceptions of First Year College Students

Science Misconceptions Mean=28.83, SD=3.291	f	%
Low (31.0 – 40.0)	25	35.0
Moderately High/Low (21.0-30)	46	65.0
Total	71	100.0

Table 2 presents the data on the level of science misconceptions of first-year college students. Data show that in general students' level of misconceptions are "moderately high/low" (M=28.83, SD=3.291). More particularly, of the 71 students, 35% are with a "low" level of misconceptions and 65% are with a "moderately high or low" level of science misconceptions.

Scale	Description
41.0 – 50.0	Very Low
31.0 – 40.0	Low
21.0 – 30.0	Moderately High/Low
11.0 – 20.0	High
0.00 – 10.0	Very High

In addition, students have a misconception on how the process of condensation works. However, results revealed that the students have 'low' misconception on the topic of temperature. The result of having a low level of misconceptions of students implies that they learned correct concepts but still have some incorrect beliefs or ideas in science on different states of matter, plant cells, zoology, motion and weather, and climate. Also, results indicate that some students acquired prior knowledge about the lesson or others may have an incorrect notion on how things work or having doubt, inappropriate ideas, misunderstanding and misinterpretations of facts. The result indicates that there is an obvious connotation of wrong ideas or incorrectly assimilated conceptions. Students hold still with their erroneous ideas that may lead to confusion and conflict. But the researcher believed that this could be corrected by providing appropriate schema in the learning process.

5.3 Science Performance

Presented in Table 3 is the data collected on the science performance test of first-year college students. Data revealed that the respondents have "satisfactory" performance in science (M=26.68, SD=3.179). Particularly, 89% of 71 students have "satisfactory" performance, 7% with "very satisfactory" performance and only 4% have "poor" performance in science, implying that respondents are knowledgeable about the different areas in science incorporated from the secondary science curriculum.

Table 3 Science Performance of First Year College Students

Science Performance Mean=26.68, SD=3.179	f	%
Very satisfactory (31.0.-40.0)	5	7.0
Satisfactory (21.0-30.0)	63	89.0
Poor (11.0-20.0)	3	4.0
Total	71	100.0

Furthermore, results revealed that students perform 'satisfactorily' in distinguishing plant cells from animal cells but perform 'poorly' in the topic of the process of human reproduction. Results signify that students perform satisfactorily in science but not very satisfactorily, indicating that students only knew the basic concepts and they have difficulty in answering complex questions and problems.

5.4 Difference in the Science Performance Among Mathematical Abilities

The disciplines of mathematics and science are very different. However, science depends upon the certainty of mathematics to lend validity to its results, while mathematics relies upon science to provide real-life scenarios or events due to its abstract concepts to concrete applications. One needs to learn and possess good mathematical skills to perform well in science in which problem-solving, analysis of results, and interpreting numerical values are all incorporated. The students' lack of understanding of necessary mathematical concepts and representation may be the basic hindrance why some students cannot perform well in a related subject such as science.

Table 4 ANOVA of Science Performance Among Mathematical Ability

Source of Variance	SS	df	MS	F	Sig.
Between Groups	895.988	2	447.994	111.463	.000*
Within Groups	273.308	68	4.019		
Total	1169.296	70			

*Significant @ 5% level of significance

Table 4 presents the ANOVA results on the science performance of first year college students among their different mathematical abilities. Results show that students' science performance significantly differed [F (2,68) = 111.463, $p<0.05$] with their mathematical abilities. In addition, the post hoc Tukey HSD results also revealed that the science performance of students differed significantly among the mathematically "highly able", "able" and the mathematically "fairly able" students.

Consequently, the null hypothesis which states that there is no significant difference in science performance of students when they are grouped according to their mathematical ability is hereby rejected.

5.5 Difference in the Science Performance Considering Levels of Science Misconceptions

Table 5 presents the t-Test of Science Performance of first-year college students considering the levels of science misconceptions. Results showed that there is a significant difference in students' level of misconception in relation to their science performance. This implies that students' understanding either preconceived notion or ideas gained from observation and experience greatly affect their

performance. It is evident that if students learned incorrect information, or did not fully understand a lesson in previous classes, they may have trouble learning new topics. On the other hand, students who learned and understand correct information have a better chance of success learning new lessons.

Table 5 t-Test of Science Performance Considering Levels of Science Misconceptions

		Mathematical Ability	Science Misconceptions
Science Performance	r	.556*	-.488*
	Sig	.000	.000
	N	146	146
Mathematical Ability	r		-.545*
	Sig		.000
	N		146

*Significant @ 5% level of significance

Therefore, the null hypothesis which states that there is no significant difference in science performance of first-year college students when grouped according to their level of science misconceptions is hereby rejected.

5.6 Relationship of Science Performance, Mathematical Ability and Level of Science Misconceptions

Mathematical ability and science misconceptions are factors affecting students' science performance. Results show that mathematical ability and level of science misconceptions are also significantly related ($r=0.334$, $p<0.01$). Since they are significantly related to one another it is noted that with the right science concepts and ideas together with strong mathematical background students will perform very satisfactorily in science. Results show that the two variables are factors affecting science performance.

Table 6 shows the correlation matrix between the students' science performance, mathematical ability and level of science misconceptions. Considering students' science performance, data revealed that their performance in science is significantly related to their mathematical ability ($r=0.334$, $p<0.01$) and level of science misconceptions ($r=1.000$, $p<0.01$).

Table 6 Correlation Matrix among Mathematical Ability, Level of Science Misconceptions and Science Performance

Level of Science Misconceptions	N	Mean	SD	T	df	Sig
Low (31.0- 40.0)	25	30.08	1.115	9.162	69	0.000*
Moderately High/Low (21.0-30.0)	46	25.04	2.616			

*Correlation is significant at the 0.01 level (2-tailed).

Therefore, the null hypothesis which states that there are no significant relationships among mathematical ability, level science misconceptions and performance, is hereby rejected.

VI. CONCLUSIONS AND RECOMMENDATIONS

This study focused on the mathematical ability, level of science misconceptions and science performance of first-year college students. Respondents of the study are mathematical "fairly able". It appears that the mathematical skills of students need improvement in analyzing problem information effectively. Some students are mathematical "highly able" problem solvers who can use a variety of techniques or strategies as they comprehend and represent a certain problem before they proceed to a solution. However, students who are "able" are well within the average level indicating that they acquire the basic skills in mathematics.

As found out, students have "low" science misconceptions indicating they have perceived some right notion, ideas, theories, and concepts in some areas of science but are still having some difficulty in assigning meaning to scientific concepts when applied to a certain situation.

Students have a "satisfactory" performance in science based on the secondary science curriculum. Students understood and applied the science concepts, performed scientific processes and skills, and demonstrated scientific attitudes and values.

Though science and mathematics are two related subjects, results show that they are significantly different. When students perform satisfactorily they can apply mathematical skills and concepts in science. But this is not a guarantee that students who perform well in mathematics will likely the same in science. As observed, some students are fast learners in mathematics but slow in understanding

concepts in science. On the other hand, good mathematical skills may be an indicator of science performance.

The result that there is a significant difference in science performance of students when grouped according to their level of science misconceptions imply that identifying students' misconception gave teachers the basis for an instructional plan that could fit students' prior knowledge. Correcting science misconceptions may produce concrete and organized schemas and may lead to a better understanding of abstract science concepts.

As found out that there are significant relationships among science performance, mathematical ability, and level of science misconceptions, it appears that mathematical ability and level of science misconceptions are factors affecting science performance. If one possesses good mathematical skills together with a very low level of science misconceptions these may result in very satisfactory science performance. The connections of the three variables are related to one another. It is observed that mathematically able students are those with high success in pursuing science. If students acquired the correct ideas or concepts they may not only able to identify scientific concepts but able to relate, interpret and analyze scientific laws, principles and theories and apply these skills to daily living. Students will perform better in science if they are fully equipped with all the necessary competence and skills needed.

The students' mathematical ability was just 'fairly able'. For students to be mathematical 'highly able', teachers are encouraged to develop differentiated strategies or activities inside the classroom that can combat students' weaknesses in mathematics. Mathematics teachers should also encourage and develop the student's competence in the use of logical procedures in problem-solving, critical thinking, algebraic, and logical reasoning.

For students to eradicate their science misconceptions, they must be judicious in learning new concepts from different information sources. Students are encouraged to conduct scientific projects and investigations to challenge their scientific beliefs. Teachers should assess or identify students' common science misconceptions and specific strategies for changing them. To bridge the gaps from students' prior knowledge, teachers can assist learners by providing the kinds of information and experiences to cope up students' science misconceptions.

The 'satisfactory' science performance of the students may be improved to a 'very satisfactory' performance in science if the mathematical procedure in problem-solving is practiced with accuracy and precision. Problems of different variety and units should be practiced frequently. The science concepts behind the problems should be marked. Teachers, on the other hand, may formulate appropriate learning strategies for students who have difficulty in learning science, maintain students' attention, participation, and dynamic atmosphere in the class.

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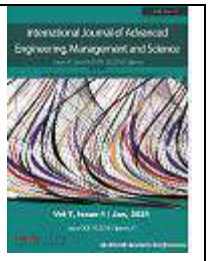

Model Predictive Control for Three-phase Grid-Connected Inverters

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Abstract— *Demands of renewable energy are increasing due to its effectiveness and sustainability. However, this energy source depends much on the weather and is unstable. Therefore, it needs to be connected to the power network via grid-connected inverters using power electronics devices. The power quality of inverter outputs depends much on the control strategy and modulation. The conventional control methods such as the proportional-integral (PI) and proportional resonance (PR) use the control loops and depend on the controller coefficients. The hysteresis current control method offers the best dynamic response. However, its switching frequency is very difficult to control. This paper presents a method basing on the model predictive control. In the proposed method, the inverter switching states are optimally chosen to minimize the cost function. This helps inverters reduce the switching counts while ensuring the low output harmonics. Thus, this can help inverters decrease the switching loss. The simulation results on Matlab/Simulink have validated the effectiveness of the proposed control method compared with that of the hysteresis current one.*

Keywords— ***Grid-connected inverters, current harmonics, PR control, hysteresis control, model predictive control.***

I. INTRODUCTION

The electric systems using renewable energy through the three-phase grid-connected inverters are increasing [1]. The power quality of inverter outputs depends much on the control strategies. There are many types of current controllers used for the three-phase grid-connected inverters such as PI, PR, and hysteresis current (HC). The PI and PR controllers are often used very popular in the control of grid-connected inverters due to their simplicity. However, the quality of these controllers depends much on the controller coefficients. In addition, the controller coefficients adjusted to increasing the dynamic response of these controllers make the overshoot increase. This can cause overcurrent and damage power electronic devices. Meanwhile, the HC controller offers the fast response and low overshoot [2]–[7]. However, this HC controller has the switching frequency to vary in a wide range and difficult to control. Therefore, in order to keep the switching frequency constant, the HC controller needs to apply the adaptive hysteresis band as proposed in [6], [8]. This leads to the complex calculation of digital signal processors. In addition, the use of the three independent HC controllers for the three phases makes the switching states difficult to be optimal. This leads the number of switching commutations of the HC controller to increase high. When increasing the hysteresis bandwidth to reduce the switching frequency, the inverter output harmonics increase significantly. The current harmonics of the inverters cause negative effects for the power quality of the power network [9]. In order to ensure the electric energy operation and transmission are safe and stable, the grid codes are promulgated by the electric system operators such as IEEE-929 (2000) [10], IEEE-1547 (2009) [11]-[9] of the United States, IEC 62116 (2005),

IEC 61727 (2007), EN 50160 in Europe, and VDE 0126 (2006) in Germany. In addition, the harmonic limits 519 (2014) in [12] are also applied for grid-connected inverters. Then, the conventional control methods can cause overcurrent for IGBTs due to the high overshoot.

Moreover, the digital control platforms basing on DSPs become very popular due to the semiconductor technology development and suitable for the discrete control. This helps the digital control methods increase advantages. In which, a method basing on the model prediction will promote these benefits. The method of model predictive control (MPC) can completely reject the control loops. However, the MPC in [13] has not been used popularly in the field of grid-connected inverters because of the dependence of the system parameters [14]–[16]. Therefore, this paper proposes a control method of three-phase grid-connected inverters using the model predictive control. Due to its good dynamic response, the HC control method will be described in Section II to make the fundamentals compare with the MPC method. The MPC method is also presented in detail in Section III. The results and discussion in Section IV will show the effectiveness of the MPC method compared with that of the HC one. The harmonics and switching counts are also considered quantitively. In addition, a strategy for decreasing the number of switching commutations is also proposed in this section. This strategy will help inverters reduce the switching loss. Section V will include the advantages of the MPC method.

II. HYSTERESIS CURRENT CONTROL

A common grid-connected inverter has a structure as Fig. 1. The required active and reactive powers of the system needed to inject into the grid will be calculated according to the reference currents $I_{d\text{-}ref}$ and $I_{q\text{-}ref}$ respectively. A phase-locked loop (PLL) is used to extract the grid voltage angle θ. This angle is used to convert the currents $I_{d\text{-}ref}$ and $I_{q\text{-}ref}$ in the synchronous frame dq into the three phase currents as Fig. 2. In the HC control method, three reference phase currents are compared with three output phase currents of inverter [6], [8] respectively. Thus, there are three HC controllers used in this method.

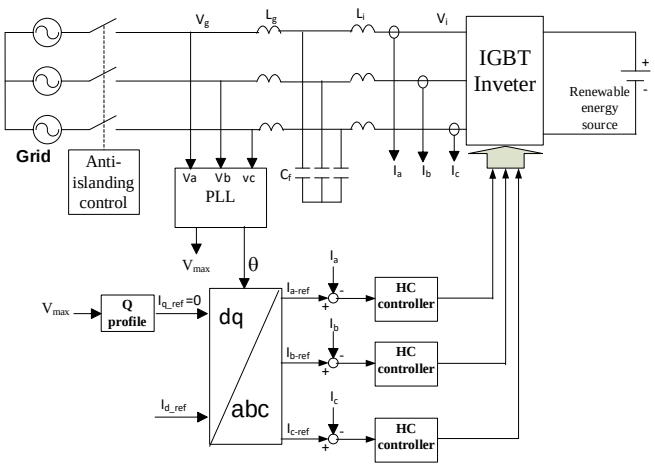

Fig. 1: Three-phase grid-connected inverter system using the HC controller.

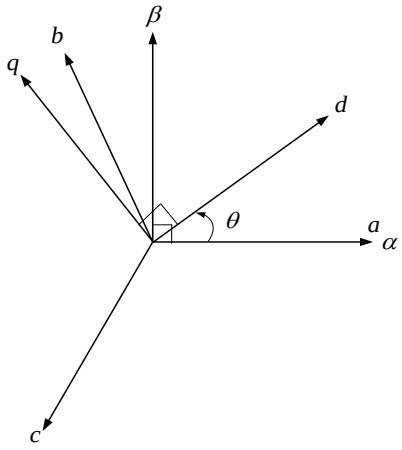

Fig. 2: Coordinate transformation

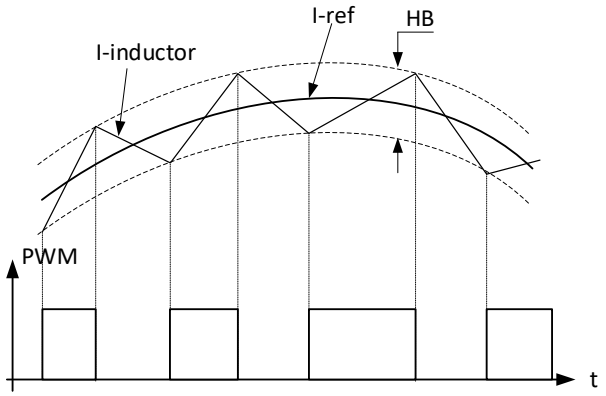

Fig. 3: The switching principle of the HC controller

The switching principle of each phase current is showed in Fig. 3. Then, the pulse-width modulation (PWM) depends on the hysteresis bandwidth (HB). The switching frequency is difficult to control. Especially, in the regions of small current value, the switching frequency can

increase highly. To solve this issue, an adaptive hysteresis bandwidth can be used [8], [17]. However, the calculation will be more complex. So, in reality, the fixed HB is often used [7]. A principle model on Matlab/Simulink in Fig. 4, using the HC control method, has a 2-level 3-phase inverter with 6 IGBTs as Fig. 5. The outputs consist eight switching states of 3 phases, Sa, Sb, and Sc.

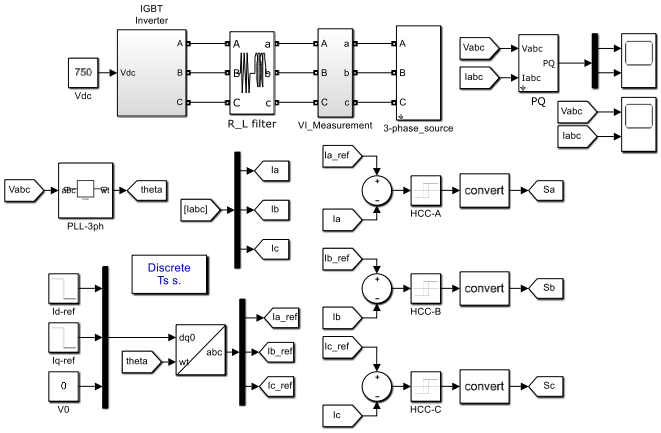

Fig. 4: Simulink model using the HC controller

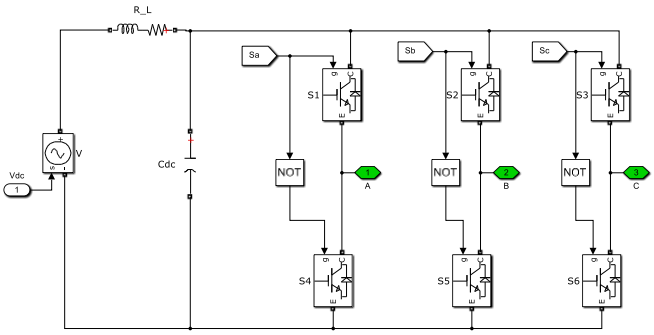

Fig. 5: 3-phase inverter model

III. MODEL PREDICTIVE CONTROL

The space vector modulation and development of DSP help the MPC be popularly applied [18]. Moreover, the control concepts in the MPC are also very intuitive. The principle diagram of the MPC method is showed in Fig. 6 and its operational principle is also showed in Fig. 7. The state space model is described as (1).

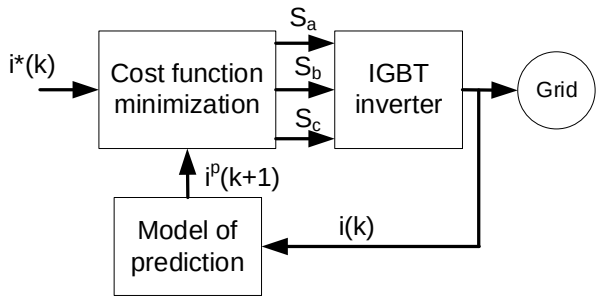

Fig. 6: The principle model of MPC

$$\begin{aligned} x(k+1) &= Ax(k) + Bu(k) \\ y(k) &= Cx(k) + Du(k) \end{aligned} \quad (1)$$

Where k is the sample instant. Then, the cost function is described as (2) and represents the expected response of the system. In the 2-level 3-phase inverter, the number of states is defined as (3) and showed in Fig. 8.

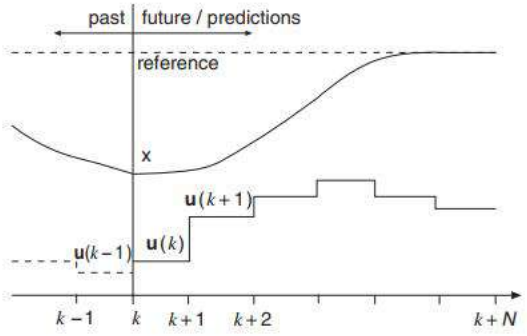

Fig. 7: The operational principle of MPC

$$g = f\left(x(k), u(k), ..., u(k+N)\right) \quad (2)$$

$$N = x^y = 2^3 = 8 \quad (3)$$

Then, the cost function of the current control using the MPC will be defined as follows.

$$g = \left|i_\alpha^*(k+1) - i_\alpha^p(k+1)\right| + \left|i_\beta^*(k+1) - i_\beta^p(k+1)\right| \quad (4)$$

Where $i_\alpha^*(k+1)$ and $i_\beta^*(k+1)$ are the real and image of the reference current vector $i^*(k+1)$ to inject into the grid. $i_\alpha^p(k+1)$ and $i_\beta^p(k+1)$ are the real and image of the predictive current $i^p(k+1)$ to inject into the grid at the instant k+1. In order for simplicity, we assume the reference current is unchanged in the sampling cycle Ts. Then, $i^*(k+1)$ is as $i^*(k)$.

The switching states of IGBTs are defined as follows.

$$Sa = \begin{cases} 1 & if \quad S1 \quad ON \quad and \quad S4 \quad OFF \\ 0 & if \quad S1 \quad OFF \quad and \quad S4 \quad ON \end{cases} \quad (5)$$

$$Sb = \begin{cases} 1 & if \quad S2 \quad ON \quad and \quad S5 \quad OFF \\ 0 & if \quad S2 \quad OFF \quad and \quad S5 \quad ON \end{cases} \quad (6)$$

$$Sc = \begin{cases} 1 & if \quad S3 \quad ON \quad and \quad S6 \quad OFF \\ 0 & if \quad S3 \quad OFF \quad and \quad S6 \quad ON \end{cases} \quad (7)$$

The phase voltage equations will be defined as

$$V_{aN} = L\frac{di_a}{dt} + Ri_a + V_{ga} + V_{nN}$$
$$V_{bN} = L\frac{di_b}{dt} + Ri_b + V_{gb} + V_{nN}$$
$$V_{cN} = L\frac{di_c}{dt} + Ri_c + V_{gc} + V_{nN} \quad (8)$$

Then, the voltage vector V can be inferred as

$$V = \frac{2L}{3}\frac{d\left(i_a + pi_b + p^2 i_c\right)}{dt} + \frac{2R}{3}\left(i_a + pi_b + p^2 i_c\right) + \frac{2}{3}\left(V_{ga} + pV_{gb} + p^2 V_{gc}\right) + \frac{2}{3}\left(V_{nN} + pV_{nN} + p^2 V_{nN}\right) \quad (9)$$

Where p is as $e^{j2\pi/3}$. According to the definite of space vector, the grid current and voltage will be defined as follows.

$$i = \frac{2}{3}\left(i_a + pi_b + p^2 i_c\right) \quad (10)$$

$$e = \frac{2}{3}\left(V_{ga} + pV_{gb} + p^2 V_{gc}\right) \quad (11)$$

And assume that

$$\left(V_{nN} + pV_{nN} + p^2 V_{nN}\right) = V_{nN}\left(1 + p + p^2\right) = 0 \quad (12)$$

Then, the inverter output voltage will be as follows.

$$V = Ri + L\frac{di}{dt} + e \quad (13)$$

The derivative of the current in the discrete domain with the sampling cycle T_s according to the forward Euler method will be as follows.

$$\frac{di}{dt} \approx \frac{i(k+1) - i(k)}{T_s} \quad (14)$$

The predictive current at the time k+1 will be as.

$$i^p(k+1) = \left(1 - \frac{RT_s}{L}\right)i(k) + \frac{T_s}{L}\left(V(k) - \hat{e}(k)\right) \quad (15)$$

Where ê(k) is the estimated grid voltage. The algorithm of the MPC is showed in Fig. 9. Where the weight factor Lamda (λ) is used to consider the reduction of the number of switching commutations. S is calculated as (16) and is the sum of switching commutations and x is the phases A, B, and C respectively.

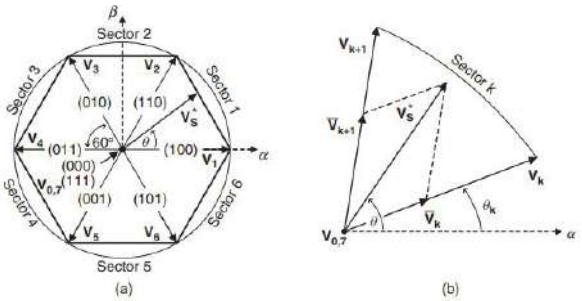

Fig. 8: The states and principle of space vector

$$S = \sum_{x=1}^{3}\left|S_x(k+1) - S_x(k)\right| \quad (16)$$

A simulation model on Matlab/Simulink using the MPC is showed in Fig. 9. The dynamic circuit parameters are the same as those of the Fig. 4. In the MPC model, the controller uses the block Matlab function in Simulink.

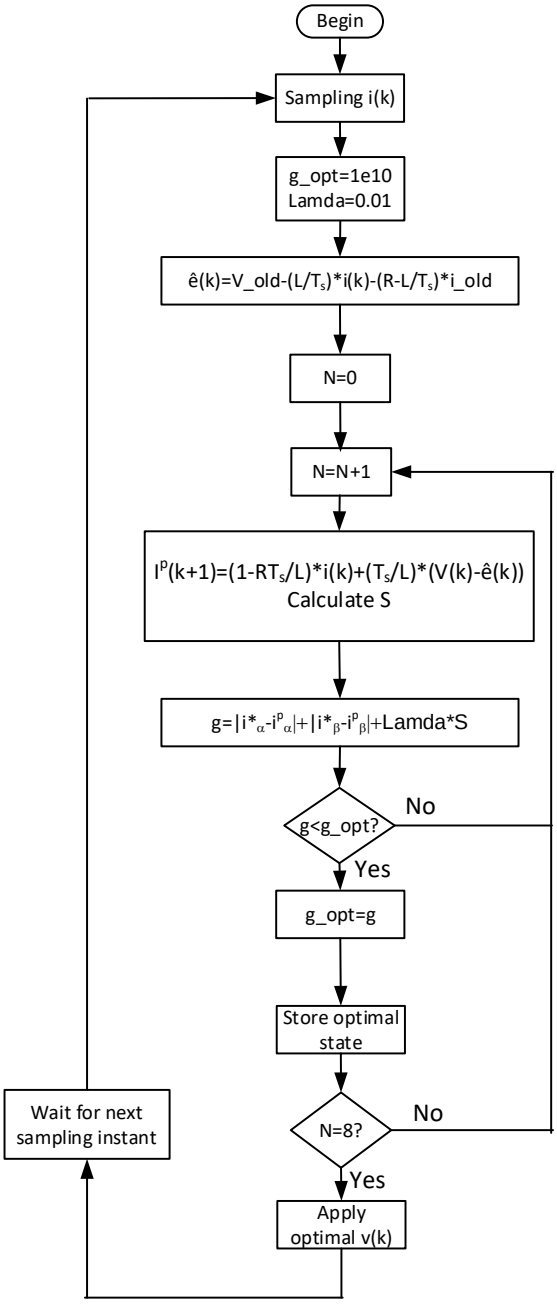

Fig. 9: Algorithm of the MPC

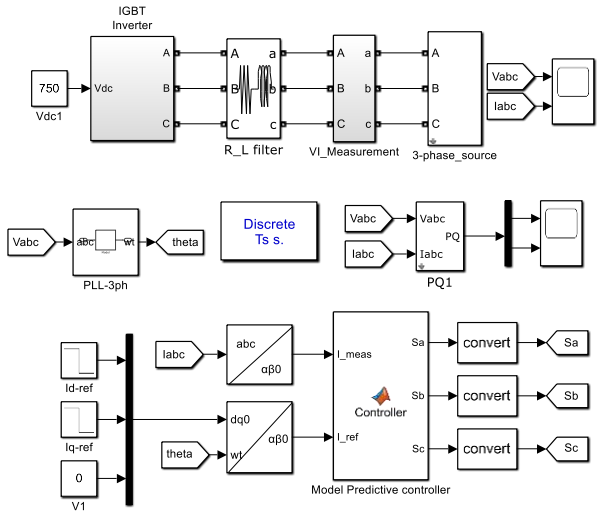

Fig. 10: Simulink model of the MPC

IV. RESULTS AND DISCUSSION

Table 1. The system parameters

Symbol	Description	Value
V_g	Grid voltage	3*380 V
f_g	Grid frequency	50 Hz
R_f	Filter resistor	0.001 Ohm
L_f	Filter inductor	7.5 mH
V_{dc}	DC voltage	750 V
T_s	Sampling time	1e-5 s
T_{sd}	MPC sampling time	4e-5 s
λ	Weight factor	1e-2

The system parameters are showed in Table 1. There are two intervals for survey in this paper. In the first interval, 0-0.4 s, the reference current is changed in the step, $I_{d\text{-}ref}$ as 40 A, and in the final interval, 0.4 0.6 s, $I_{d\text{-}ref}$ as 20 A.

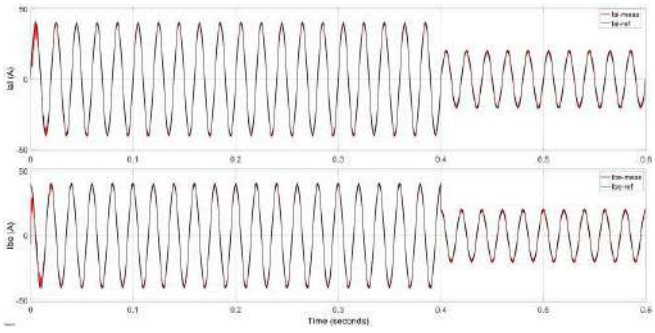

Fig. 11: Current responses of the HC

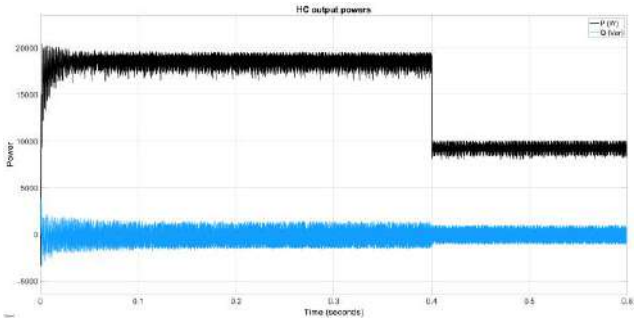

Fig. 12: Power response of the HC

The reference current $I_{q\text{-}ref}$ is always as 0. This means that the only active power is injected into the grid.

The simulation results in Figs. 11-14 have showed the current and power responses of the HC method. These results also showed the settling time and overshoot are very small.

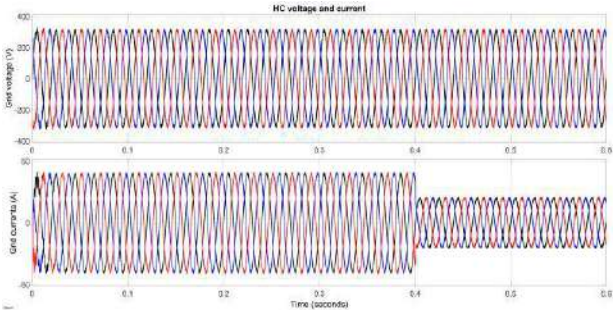

Fig. 13: Voltage and current response of the HC

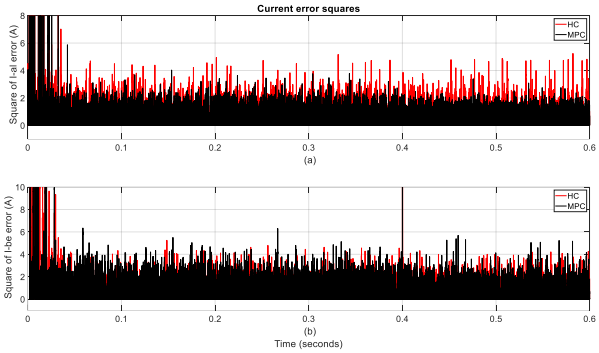

Fig. 14: Squares of current errors of the HC and MPC

However, the current steady state error of the HC method is significantly high. This is showed clearly in Fig. 14(a), in which the squares of the current errors of the HC method in the red are higher than 5 A. While those of the MPC one in the black are always lower than 4 A. The phase A current harmonics of the two methods are also measured at the final fundamental period of each interval and showed in Table 2.

Table 2. Comparison of methods

Time (s)	0-0.04		0.4-0.6	
Method	THD_I (%)	I_{peak_fund} (A)	THD_I (%)	I_{peak_fund} (A)
HC	2.42	39.72	4.79	19.76
MPC	**2.26**	**39.96**	**4.55**	**20**

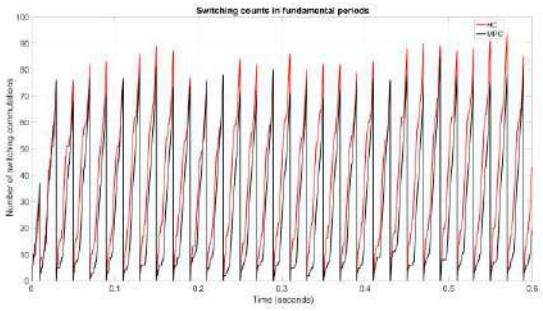

Fig. 15: Switching counts of the HC and MPC with λ=0

The current total harmonic distortions of the HC control are 2.42 % and 4.79 %. These values are higher than those of the MPC one, 2.26 % and 4.55 % respectively. Moreover, the fundamental current magnitude of the MPC, as 39.96 A and 20 A, are higher than those of the HC one, as 39.72 A and 19.76 A respectively. This helps increase the generation efficiency of the inverters.

In addition, the number of switching commutations in each fundamental period in Fig. 15, with λ=0, has showed that the switching counts of the MPC in the black are lower than 80. While those of the HC method in the red are always higher than 80.

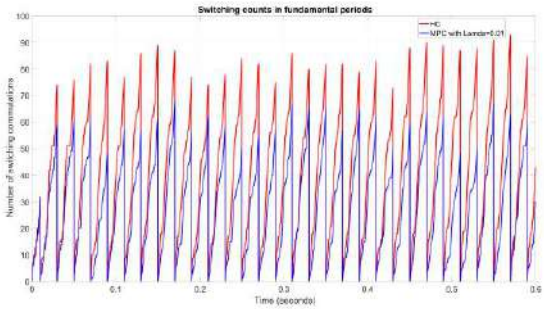

Fig. 16: Switching counts of the HC and MPC with λ=0.01

When considering the reduction of switching count with the weight factor λ=0.01, the number of switching commutations of the MPC, in the blue in Fig. 16, is always lower than 65. Although the number of switching commutations of the MPC is lower than those of the HC, the current THD of the MPC is still lower than that of the HC in Fig. 17.

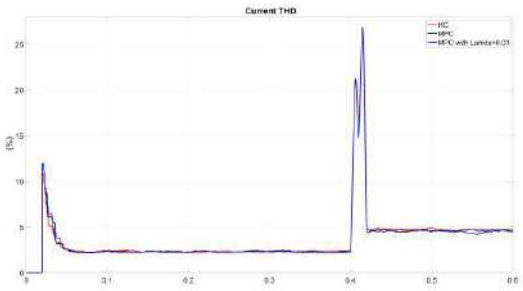

Fig. 17: Current THD of HC and MPC

V. CONCLUSION

This paper has presented a method using the model predictive control for three-phase grid-connected inverters. An algorithm for reducing the number of switching commutations is also proposed by including the weight factor in the cost function of the MPC. The simulation models of the MPC and HC methods built on Matlab/Simulink are used for verifying the proposed algorithm.

The performance of the proposed MPC method has also been validated when comparing the simulation results of the MPC with those of the HC one. The current harmonics, the number of switching commutations, overshoot, and settling time are also considered quantitively.

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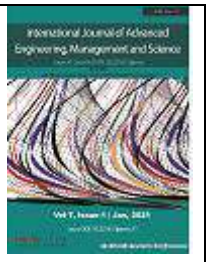

Fake News Detection using Machine Learning: A Review

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Abstract— *This paper examines the implementation of natural Techniques of language recognition for 'false news' identification, that is, false news storeys that stem from unreputable storeys from sources. Using a data set and list obtained from Signal Media for OpenSources.co sources, we use the expression frequency-inverse-inverse Detection of bi-grams and probabilistic meaning free grammar (PCFG) document frequency (TF-IDF) in a corpus of articles.[1] Fast Access and Exponential Growth Social networking network data has been made available. It is difficult to analyze between false and true facts. The simple dissemination of data by sharing has contributed to a rapid rise in its falsifying. The credibility of social media networks is also at stake if there is a proliferation of the dissemination of false information. It has now become a study activity to check the data automatically so that it is classified as false or accurate by its source, content and publisher. Machine learning, along with some pitfalls, has played a critical role in the classification of results. This paper explores various approaches to machine learning to distinguish fake and fabricated news. The restriction of such methods and improvisation by the use of deep learning is also explored. [2]*

Keywords— ***Machine learning, Classification algorithms, Fake-news detection, Text classification, online social network security, social network.***

I. INTRODUCTION

Fake news is now seen as one of the major problems of democracy, Journalism, the economy, guy. It has weakened the general confidence in the government and has a potential influence on life today. [3] The notion of misleading news is not a revolutionary one. Notably, even before the invention of the Internet, the idea existed when newspapers used imprecise and distorted information to promote their purposes. More and more consumers have continued to forsake traditional media channels used to disseminate data on Internet networks through the introduction of the Internet. Not only does the above approach encourage users to browse a variety of publications in one session, it is is more usable and faster. However, the development came with a redefined notion of fake news as content publishers began to use what was commonly referred to as click bait. Click baits are phrases that are intended to capture the attention of a customer who is brought to a web page whose content is significantly below their expectations by clicking on a link. Many users find clickbaits to be an annoyance, and the result is that most of these tourists will only end up visiting certain sites for a very short time.[4] A few decades ago, the term "Fake News" was much less unheard of and not popular, but it has exploded as a big monster in this digital era of social media. In our society, fake reporting, clouds of knowledge, manipulation of news and loss of confidence in the media are increasing problems. However, an in-depth understanding of false news and its origins is required in order to begin to address this problem. Only then can we look at the different strategies and fields of machine learning (ML), natural language processing (NLP) and artificial intelligence (AI) that might enable us to resolve this situation. In the last half-

year, "fake news" has been used in a multitude of ways and various interpretations have been given.[5] A considerable number of pre-existing false news models are context-specific in nature. The mechanism to identify the categories of disappointments that may arise in the handling of textual material is missing. This paper explores a variety of strategies and kinds of dissatisfaction that can be faced in managing online news and measures their benefits and advantages. Mathematical formulas inconvenience. The solution of the problem in question offers an algorithmic approach. The article discusses the following features of fake news in order to discriminate between the different current models:[10]

(a) Describes the content, forms and features of fake news.

(b) false news outlets are detected.

(c) an overview of the different entities (data collections) which can be used for classifying false news.

(d) Developing a data model to identify the related news information

(e) Evidential retrieval, setting up false news criteria.

(f) for the purposes of predicting the classification, control, collection and use of data.[10]

II. OUTLINE

Text, or natural language, is a type that is difficult to process due to different linguistic characteristics and forms, such as sarcasm, metaphors, etc. In addition, thousands of languages are spoken and each language has its own grammar, script and syntax. The processing of natural language is a branch of artificial intelligence that involves techniques that can use text, create models and make predictions. The aim of this work is to establish a system or model that can use data from past news reports to assess whether or not a news store is likely to be false.[5]

2.1 MOTIVATION:

Fake news spreads mainly across social networking networks such as Facebook, Twitter and many others. In order to hurt a person, and/or benefit financially or politically, fake news is written and released with the intent to deceive. Currently, the vertical litany spanning national security, education and social media is seeking to find better ways to tag and describe misleading news in order to defend the public from disinformation. Our goal is to create a clear model that classifies the news store as either inaccurate or true. Following media attention, Facebook has recently been at the forefront of much criticism. They have now released a tool to review false news on the website itself for their users, and it is apparent from their recent announcements that they are actively researching their ability to automatically recognize those tweets. It is not, however, a clear task. As fake news exists at all ends of the spectrum, the algorithm can be ideologically impartial to offer an equal balance of reputable news sources at either end of the spectrum. We should decide what makes it 'legitimate' for a digital medium and an empirical instrument to evaluate this.[8]

2.2 CLEANING TEXT DATA:

Data cleaning has been carried out at different stages in this process. Next the data was checked for null values and redundant columns, and as there were columns that did not add value to the project, they were discarded. The next step was to delete the stop words from the results. The explanation for the deletion of stop words is that the model causes dimensionality. Elimination of the stop terms will also further limit the dimensionality of the model. The WordNetLemmatiser package was then used to lemmatize the data. Lemmating is a means of replacing words with general sense, e.g. buy, supermarket, store. Only the word "Store" can be omitted from the other two words if the lemma is ended. In this way, they will not be taken as three distinct words when the text matrix is created, thereby reducing time and complexity. Finally, by converting data into lower cases the data is unified. This is the key step, since the duplication of the data can be reduced.[9]

III. METHODOLOGY

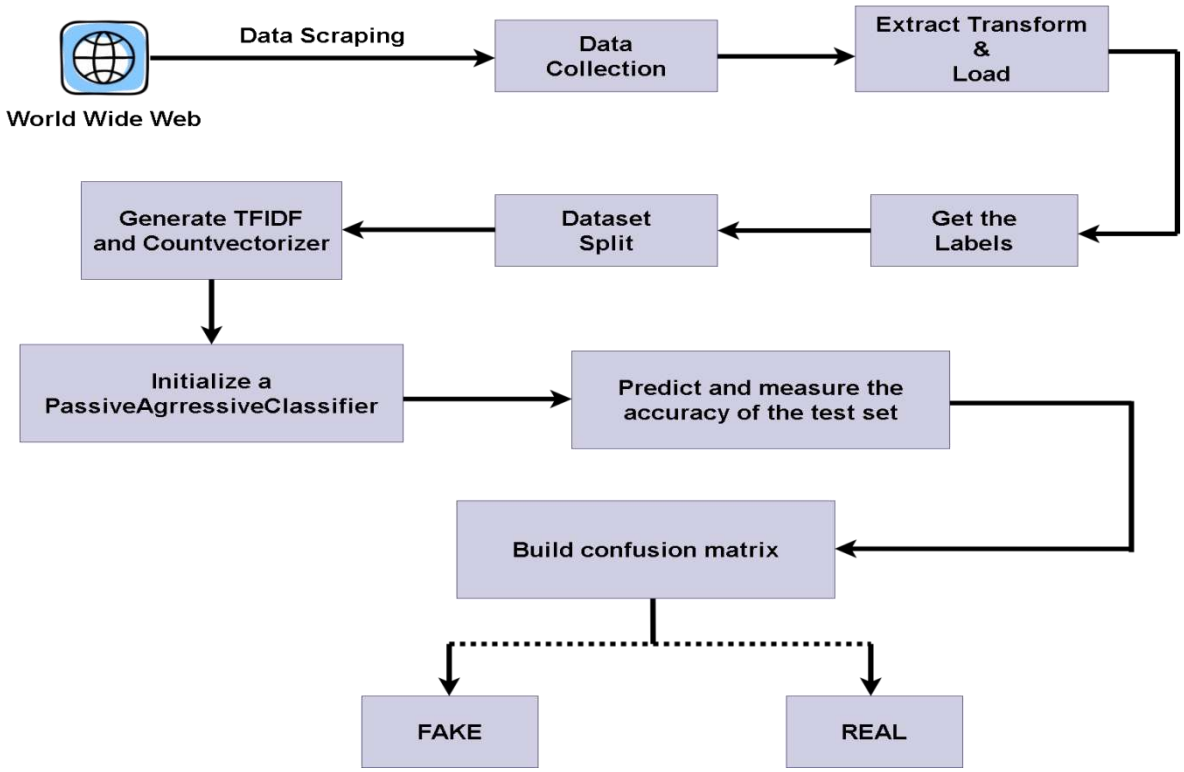

Fig.1: Classifier prediction model

Depending on the size and consistency of the text data (or corpus) and also the characteristics of the text vectors, the output of the classifier can differ. As it comes to extracting text attributes, the usual noisy terms called 'stop words' are less relevant words, they do not add to the true sense of the expression and they only contribute to the dimensionality of the function and can be omitted for better performance.[5] This helps to minimize the size / dimensionality of the text corpus and apply text history to isolate the function. Lemmatization is also used to transform terms into their central context, resulting in the conversion of several words into a single, distinct representation.

IV. MODEL

The detail is never evenly distributed in the data collection. In such cases, however, the performance of the classifier may be calculated. The accurate predictions of the classifier are truth positive, and the incorrect predictions are false positive. The role of calculating precision, recall and f1 scores is made straightforward by the use of these figures.

		Forecast Class		
		Classified Positive/Negative		
Real Class	Labeled Positive/Negative		Class = Real	**Class = Fake**
		Class = Real	True Positive	**False Negative**
		Class = Fake	False Positive	**True Negative**

Fig 2: Confusion matrix model

V. FAKE NEWS CLASSIFICATION:

The various forms of fake news of this paper are summarized below in their latest paper.

1. Visual based: Visual fake news uses content that incorporates multiple media forms including graphic display such as Photo-shopped images and videos. Visual news is mainly available on platforms such as Social Media and Media websites, attracting the attention of the public. For many other users, Facebook, Instagram and Twitter are common examples of social media used to publish and share content online.

2. User based: Fake accounts produce this kind of fabricated news and reach particular demographics that could reflect those age groups, ethnicity, community, political affiliations.[6]

3. Fake headlines: Headlines for attracting publicity that represent fictitious reality. They are also used for less credible journals, such as tabloid newspapers. Readers also quickly note that the content of the storey does not match the headline. Their names are referred to as "Clickbait Headlines."

4. Target misinformation: Fictitious piece of information shared for self-serving purposes. Targeted disinformation is frequently aimed at audiences most vulnerable to obtaining this sort of material without checking its validity and quickly embracing and distributing polarizing news.

VI. COMPARISON

A main aspect of the grouping of findings is the correlations between intra-class and inter-class clusters. The cluster intra-class indicates the distance between the data point and the cluster centre, while the cluster between the cluster and the data point displays the distance between the cluster.The distance between the cluster data point and the cluster data point.

Various characteristics were selected for performance observation using the various methods of supervision and deep learning mentioned above. There are essentially four attribute vectors derived from our text dataset.

* Vector number *

* Phrase-level vectors

* N-gram vectors

* Vectors of character type[7]

VII. LITERATURE SURVEY

7.1 PREVIOUSLY USED TECHNIQUES:

Social media may also act as an inconsistent platform for false news and inaccurate facts, a popular source of news for newspapers and TV. According to recent estimates, Facebook has 1,2 billion users on the most popular social media site. Thus, blogs such as this are certainly one way in which many people share counterfeit news widely. But to find misleading news on social media sites is very difficult. Psychological and social theories for appraisal from a data review point of view should be considered. The reasons for reading news on these websites can differ. Few will take less time, share and comment on the topic of the post, debate on the issue, etc. There are a few steps to take, from characterizing these news outlets to recognizing them.[10]

7.2 SOME FREQUENTLY OCCURRING FAKE NEWS FORMS:

It is important to recognize the same thing and to observe the various types that may constitute it before dwelling on the topic of false news. Fake news is a type of sensational reporting or purposeful advertising that includes the propagation of intentional disinformation or hoax by conventional print, communicative news media or online social media. Periodically, the news is however, sometimes it also finds its way into the mass press through the deceit of social media. Fake news is published and disseminated strategically with the goal of deluding or destroying an office, a substance, a person or raising money through frequently leveraging nostalgic or deceptive features with a relentless effort to expand consumer flow.[10]

VIII. RESULT

Our research started with the extraction of real-time tweets using keywords, and after the pre-processing of these tweets, important features were extracted from the dataset. These characteristics are important because they have valuable features that define the data collection.

We research the predictive consistency and device variability. We rely only on higher performance models for the assessment of models in terms of coherence and heterogeneity. We cluster the model space and carry out an inquiry to explain the function of the characteristics of the model choices depending on the characteristics present in every model[9].By analyzing all the templates used to accomplish the purpose, we calculate the functionality's predictive precision. More precisely than the average AUC values of all models in which the feature was used, is predictive precision of the function. Similarly, the system variability is the Insane average value of all the models used by the function. How functions are achieved is mathematical precision and ambiguity. A few features

obviously exhibit a significantly higher precision in the measurement.[9].It is also clear how much precision and quantity of training results are affected by the false news identification paradigm. If the model is trained with a complex data set with news from various domains, it is not too far-reaching to achieve a much more stable and reliable classification. More technological innovations, including hyperparameter tuning and improved feature range, can also be used in this guide.[5]

IX. CONCLUSION

In recent years the issue of fake news and its impact on culture has been highly concerned. In the issue of false news identification, the subject of data prediction and classification should been controlled using training data. Since most falsified news databases have many features, most are useless and obsolete, decreasing the amount of falsified news detection algorithm can improve its accuracy. Therefore a method of false news identification should be used in this article to gather features. The key characteristics in the function selection system are clustered into separate clusters, depending on the comparability of the characteristics. From each cluster, the final feature set is then selected depending on the necessary characteristics. [12] Finally, our results suggest that models with odd combinations of features appear to recognise these kinds of false news. As a result different models are based on a very different logic, distinguishing false stores from real ones. This shows the scale of the problem and helps us to understand how impossible it is for a single approach to fix all kinds of false news reports. We expect fake news stores to be classified as a technique for creating solid and accurate classifier sets as a potential task. For example, we've seen a number of cluster models that are made up of random variations of features in this work. This means that the Ensemble Integrating Models strategies from different clusters are in place. This is a fruitful line of inquiry.[10] Fake news has been steadily detected in recent years.However an item of news has also been found to be false. In our study, Explanatory False News Identification is a novel challenge, which seeks to: 1) dramatically boost detection efficiency; and 2) use news phrase describing why news stores are deemed false; and customer knowledge. In order to research counterfacts and to detect causal statements/comments, we suggest a strong hierarchical joint attention network. Real-world data set tests show the feasibility of the proposed system.[13]

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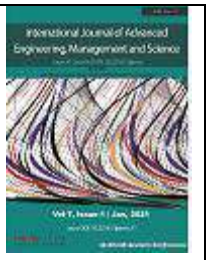

Modelling and Optimal Viscometry Formulation Evaluation of a Modified Green Based Self-Healing Automotive Paint

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Abstract**—** *This research successfully converted periwinkle shells, an agrowaste of regenerative resource, to an additive for the formulation of a self-healing car paint. The periwinkle shell was deproteinized, demineralised and deacetylyzed to produce chitosan. The parent chitosan sample in a series of reactions was modified by graft copolymerization with maleic anhydride and methyl methacrylate to yield a chitosan derivate (chitosan-g-maleic anhydride-g-(methyl methacrylate) copolymer (modified chitosan). A 2^4 full factorial central composite rotatable experimental design and a three-layered (4:n:1) feed-forward architecture of artificial neural network trained by the Levenberg-Marquardt backpropagation algorithm was employed to model and predict the process variables. The physicochemical properties of the paint formulations were studied using standard methods. Fourier Transform Infrared was used to identify the functional groups of the samples under investigation. Grafting efficiency (GE %) of 75.3% and grafting yield (G %) of 76.25% indicates effective graft copolymerization of methyl methacrylate on to the maleilated chitosan. The functional groups revealed by the FTIR spectra confirmed the graft copolymerization of maleilated chitosan with methyl methacrylate to yield a chitosan derivate (chitosan-g-maleic anhydride-g-(methyl methacrylate) copolymer and also identified the presence of the modified chitosan in the self healing paint. The drying time, adhesion and chemical resistance properties measured were within acceptable limits. ANOVA results show that quadratic equation best describes the viscometry behaviour of the paint formulation. The binder and solvent showed significant effect on the response. The AAD (%) and coefficient of determination values obtained for RSM and ANN show that the two techniques predicted to a great extent the viscometry behaviour of the system, however, ANN model marginally outperformed the RSM model. An optimal response of 99.85mPa.s was recorded at 70.24g binder, 79.99g solvent, 15.72g pigment and 3g additives.*

Keywords**— viscosity, graft co-polymerization, self-healing paint, RSM, ANN.**

I. INTRODUCTION

A coating is a covering that is applied to the surface of an object, the purpose of application may be to improve surface appearance, adhesion, corrosion resistance, wear resistance and scratch resistance. An industrial coating is a paint or coating defined by its protective, rather than its aesthetic properties, although it can provide both. Paint is basically composed of four materials: resin (binder), solvent, pigment(s) and additives, homogeneously mixed together which when applied on a surface as a thin layer forms a solid dry adherent film after oxidation/ evaporation/ polymerization. According to Rodger (2008), the basis for paint classification is usually based on its purpose and area of application. A water base paint is term

as an emulsion paint which can be applied for architectural building (Michael, 2005; Rodger, 2008) while a paint whose diluent of formulation and medium of cleanliness is solvent is referred to as gloss paint. This type of paint can be formulated for refinery equipment coating, road marking purposes, varnishes, car surface coating and so on. (Rodger, 2008; Alireza*et al*., 2009).

At the beginning of the automotive industry about 100 years ago, cars were painted with a varnish-like product that was brushed onto the vehicle surfaces; this coating was sanded and smoothed, and then the varnish was reapplied and refinished to establish several layers of the coating (Akafuah *et al.,* 2016). The durability of enamel finishes was improved considerably by the 1960s with the introduction of acrylic stoving enamels (Learner, 2000). To further improve coatings' appearance and durability, a new type of wet-on-wet finish was developed and introduced in the late 1970s, consisting of a thin basecoat and a thicker clearcoat (Fettis, 2008). Another significant enhancement in paint technology was the development of "alkyd" enamel paints that were introduced on some car models in the early 1930s (Standeven, 2006). Automotive coatings continue to evolve as they either satisfy or are anticipated to meet customer expectations and environmental regulations while also lowering manufacturing and ownership costs. One of these evolutions is in the use of smart coatings because they offer the potential to significantly improve surface durability while adding additional functionalities or properties like super-hydrophobicity, self-stratifying, self-sensing, sound proofing, vibration damping and self-healing (Akafuah *et al.,* 2016).

Self-healing materials offer a new route toward safer, longer-lasting products and components (Gianluca and Salvatore, 2016). Self-healing effect is generally defined as the recovery of coating integrity after some kind of damage occurs (Carneiro *et al.,* 2012) using the resources inherently available to them (Jamil *et al.,* 2015). Self-healing materials address this degradation through the inclusion of an active phase that responds to the micro damage by initiating a repair mechanism. One of the self-healing materials which has been investigated in polymer technology is chitosan(Husnugul *et al.,* 2013). The chitosan structure is presented in plate 1 (Younes and Rinaudo, 2015).

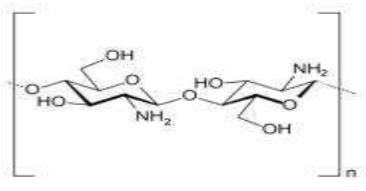

Plate 1: Chitosan Structure

Chitosan is one of the most promising polysaccharides due to its unique physicochemical properties namely biocompatibility, biodegradability (Ahmed and Ikram, 2016), antimicrobial activity and excellent film-forming ability, which have attracted scientific and industrial interest. Chitosan is very economical and can be generated almost from nothing. The parent chitosan sample produced has limited solubility in organic solvents (Chen *et al.,* 2011), therefore, for best performance in the paint matrix there is need for chemical modification. Chitosan was modified by graft co-polymerization process to yield chitosan-g-maleic anhydride-g-(methyl methacrylate). The used of maleic anhydride (MA) gives notable importance in the drying properties, hardness and colour of the resin (Lohbeck and Haferkorn, 2000). It is often used to effectively increase the viscosity of a resin which will then require a large volume of dilution solvent, thus reducing the cost of the alkyd.

Nigeria is one of the countries blessed with innumerable untapped materials of regenerative resources which could be transformed into useful materials thus possibly contributing toward waste minimization. There is a clarion call for a paradigm shift on re-processing of residuals and wastes for sustainability and improvement on the aesthetics of our environments. In line with this, periwinkle shell, an agrowaste of regenerative resources was utilized in generating a modified biopolymeric material which acts as an additive for the formulation of self healing car paint.

Painting process for automotive industries is very important to give a more attractive appearance to the vehicles and to provide a layer of protection for the body against corrosion and weathering. It is one of the major costs in car manufacturing, it may cost more expensive than the body itself. Maybe the high costs are in terms of the processes that occur in painting process and not the price of the machines that are used in the paint shop (Jamaluddin, 2015).

Viscosity is an important parameter to be considered in paint application on surfaces. Spray guns will not atomize effectively when used with highly viscous paints. At extreme cases, the paint will not be ejected from the spray gun's orifice. Poorly atomized coatings result in a rough surface, poor appearance and significantly reduced coverage. However, proper viscosity of paint will atomize a fine mist and leave tiny droplets on the desired spraying surface. These tiny droplets will then flow together and make a smooth and level film (Jamaluddin, 2015). Experimental process design is key to establishing experimental conditions to achieve target viscosity for effective paint application.

Experimental process design is a systematic method to determine the relationship between factors affecting a process and the output of that process (Asfaram et al., 2017). The overall influence of the combined possible interactions of the significant factors: binder, solvent, pigment and additives on the viscosity of the self healing paint will be investigated using a 2^4 full factorial experimental process design. Based on the experimental results, a mathematical model will be developed using the Response surface methodology (RSM) to describe the viscometry behaviour of the paint formation within the design space. Also an artificial intelligence method, the artificial neural network, which has gained prominence in many disciplines including engineering will be adopted as an effective tool to predict the process parameters. ANN has universal approximation capability, i.e. it can approximate almost all kinds of non-linear functions including quadratic functions, whereas RSM is useful only for quadratic approximations (Desai *et al.*, 2008).

The effective application (spraying and brushing) of all types of paint greatly depends on viscosity thus this research aims at modeling the viscometry response for a self-healing car paint formulation. To the best of our knowledge, there is no published optimal factor evaluation data for a modified biopolymeric material developed from periwinkle, an agrowaste, as an additive for the production of a self healing car paint. Results obtained from error analyses (absolute average deviation (AAD (%) and R^2) computations were used to compare the predictive capability of the RSM and ANN generated models in capturing the viscometry responses for interaction of the input controllable variables.

II. MATERIALS AND METHODS

Materials

The precursor for the modified biopolymeric material preparation was sourced from an agrowaste, periwinkle shells indiscriminately disposed in our environment. Binder (alkyd resin (BN 2814520)) and additives (mix-drier and anti-skin) were sourced from Intecil industries Ltd, Enugu and Hazel Chemical Company, Enugu respectively, solvent (white spirit) and pigment (titanium (IV) oxide) were purchased from a chemical vendor at Bridge Head Chemical market Onitsha, Nigeria. All chemicals used for the experimental procedures were of analytical grade and used without further purification.

Methods

Preparation of Chitin and Chitosan

Deproteinization

The periwinkle shells were pulverised into powder using a dry grinder and sieved with 2 mm sieve. 50 g of the less than 2 mm size powdered periwinkle shell was weighed into a 500 ml beaker and 200 ml of 4% (w/v) KOH was added with constant stirring for 6 h at 80°C and filtered. The residue was washed with distilled water until it is free of base and then dried at 100°C for 2 h (Okoya *et al.*, 2014).

Demineralization

The deproteinized periwinkle shell residue was poured into a 250 ml conical flask and 100 ml of 3 % (v/v) 1 M HCl was added and placed on a magnetic stirrer for 3 h at 30°C to demineralise it. The content was filtered and the residue washed until it is free of acid. The acid free residue was then dried at 90°C for 1 h. A snow white residue called chitin was obtained (Okoya *et al.*, 2014).

Deacetylation

The chitin was poured into a 250 ml conical flask for deacetylation, 50% (w/v) NaOH solution was added, stirred at 30°C for 4 h and filtered. After filtration, the residue, chitosan was washed until the filtrate is neutral and dried at 90°C for 1 h, then store for studies (Okoya *et al.*, 2014).

Preparation of chitosan –g-maleic anhydride -g-(Methylmethacrylate) co-polymer

Preparation of chitosan- g- Maleic anhydride

Chitosan (2g) and maleic anhydride (6g) were dissolved in 100 ml of dimethyl formamide (DMF), and then the mixture was stirred at 130˚C for 3hrs under nitrogen atmosphere. The resultant solution was cooled to room temperature and poured in to ice water to precipitate the product. The product was collected by filtration, washed with diethyl ether for three times and then dried in vacuum at 40˚C. The grayish white powder of N-maleilated chitosan was obtained. (Hemalatha and Sudha, 2011).

Chitosan-g-maleic anhydride-g-(Methyl methacrylate)

The graft co-polymer was homogeneously synthesized in aqueous solution by using ceric ammonium sulphate as initiator. A mixture of 0.5g of maleilated chitosan and 1.6g CAS/10ml of HNO_3 was stirred followed by the addition of methacrylate (2g). The reaction was performed at 70˚C for 1hr. The contents of the flask were cooled to room temperature and poured into 10%NaOH solution to precipitate the graft co-polymer. The grafting efficiency (GE %) and grafting yield (G %) were calculated as follows (Hemalatha and Sudha, 2011):

$$GE\% = \frac{W_g}{W_g + W_i} \times 100 \quad (1)$$

$$G\% = \frac{W_g}{W_a} \times 100 \quad (2)$$

Where,

Wa = Weight of monomer.

Wi = Weight of chitosan – g-Maleic anhydride.

Wg= Weight of N-Maleilated chitosan-g-(Methyl methacrylate).

Characterization

FTIR

Buck scientific M530 USA FTIR was used for the analysis. This instrument was equipped with a detector of deuteratedtriglycinesulphate and beam splitter of potassium bromide. The software of the Gram A1 was used to obtain the spectra and to manipulate them. An approximately of 1.0g of samples, 0.5ml of nujol was added, they were mixed properly and placed on the salt pellet. During measurement, FTIR spectra was obtained at frequency regions of 4,000 – 600 cm^{-1} and co-added at 32 scans and at 4 cm-1 resolution. FTIR spectra were displayed as transmitter values (Van der *et al.,* 2004).

Drying time

A whatman filter paper was placed unto a panel under investigation after 4 hours of application. A rubber band was placed unto the filter paper with the smaller diameter downwards. A 50g brass was placed on the rubber band and left for 1 minute. The weight and rubber band were removed and then the panel inverted. The filter paper should fall off the test film (if necessary with a light tap) to obtain the tack free time (NIS 574: 2008).

Adhesion

A multi-blade cutting tool was used to cross-hash the substrate. A soft tissue was used to clean the surface to remove any detached flakes or ribbons of coating. An adhesive tape was then firmly placed on the cut area to ensure good contact. The adhesive tape was forcefully pulled out of the scratched area and examined whether the coated paint peeled off along with the tape.

Chemical resistance

A mixture of acetone, demineralized water and isopropyl alcohol were dropped randomly on the coated surfaces of the formulations and kept at room temperature for 24 hours according to ASTM D1308 test method. The samples were observed to determine if there are stains that can result to corrosion or reducing the life span of the coated substrates.

Viscosity

The viscosities of the paint formulations were measured with a Digital Viscometer (NDJ-5S) using spindle 3 with a speed of 60rpm at 29±1˚C. The viscometer spindle was dipped into the paint sample in a beaker, the minimum insertion point on the spindle was ensured which was followed by viscosity measurement.

Experimental design

The controllable input variables and the response variable was modeled using the response surface methodology (RSM) technique. A central composite design (CCD) was selected to determine the experimental conditions as the inclusion of axial experimental points allow for a larger spread of conditions to be examined, which is beneficial when the required complexity of model is not known for accurate predictions to be made (Box et al., 2005). The single, interactive and quadratic effects of the independent variables (Binder (A), Solvent (B), Pigment (C) and Additives (D) were evaluated to optimize the Viscosity of the formulation (Y).

The 2^4 CCD experimental matrix (Table 2) was developed by Design Expert Version 10, State Ease U.S.A with 30 runs (16 factorial points, 8 centre points and 6 axial points). The experiments were performed in random order to avoid systematic error. Table 1 displays experimental boundary of the independent variables for the optimal solution evaluation. A mathematical relationship between the dependent variable: viscosity (Y) and the independent variables: Binder (A), Solvent (B), Pigment (C) and Additives (D) may be described as:

$$Y = f(A, B, C, D) \quad (3)$$

Table 1: Experimental range of the independent variables

Independent variable	Symbol	Range and Levels				
		-α	-1	0	+1	+α
Binder (g)	A	10	70	130	190	250
Solvent (g)	B	5	30	55	80	105
Pigment (g)	C	5	15	25	35	45
Additives (g)	D	0	1	2	3	4

The relationship of the resultant response and the independent variables was approximated by the second-order polynomial (equation 4).

$$Y = \beta_0 + \sum_{i=1}^{K} \beta_i x_i + \sum_{i=1}^{K} \beta_{ii} x_i^2 + \sum_{i=1}^{K-1} \sum_{j=i+1}^{K} \beta_{ij} x_i x_j \quad (4)$$

Where Y is the predicted viscosity, β_0 is a constant, β_i, β_{ij}, β_{ii} are linear, interaction and squared coefficients respectively, x_i and x_j are independent variables, K is the number of factors. Analysis of Variance (ANOVA) was used to determine the statistical significance of each regression coefficient on the response (Y). According to Uzoh and Onukwuli (2014), the determination of unknown coefficient of equation (4) entails judicious transformation of the actual values of the four control variables at various levels over which the experiments were executed to their coded equivalents using -1 and +1 notations to designate low and high level factor setting and '±α' and '0' for axial and centre points, respectively. It has been shown that working with the coded variables enhances matrix transformation and helps in results analyses. Equation (4) was fitted to the experimental data to obtain the final predictive equation for the formulation in terms of the coded variables.

Artificial neural network

A three-layered feed-forward architecture of artificial neural network (Multilayer perceptron [MLP]) trained by the back-propagation algorithm was proposed to build a predictive model with the first layer of four neurons representing the independent variables (input layer), the second and third layers of neurons represent the hidden layer and output layer (viscosity) respectively (Okoye *et al.,* 2019). Each of the neurons in the first layer is connected to one or more layers of the hidden neurons that represent nonlinear activation functions. These neurons are in turn connected to a final level of output neurons and, through the use of learning algorithms, the relative influence of each input neuron and their complex interactions on the observed result can be discerned(Pilkington *et al.*, 2014).

Neurons are needed in the hidden layer in order to minimize the deviation of ANN predictions from experimental results. These neurons are connected by weights that are modified during the learning algorithms. Matlab 2015 (MathWorks) was used in developing the MLP. Fig 1 depicts the architecture of the developed ANN for the modeling of viscometry behavior of the paint formulations.

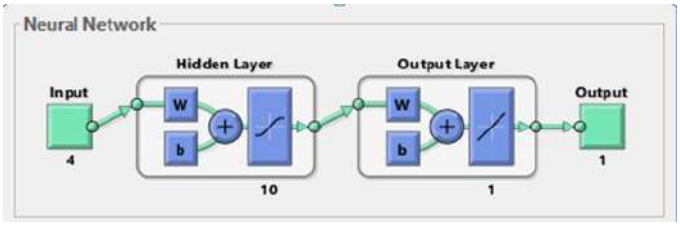

Fig 1: ANN architecture

Comparison of RSM and ANN models

The capability of the RSM and ANN models in capturing the experimental data was evaluated using the absolute average deviation (AAD%) error function (equation 5) and the coefficient of determination (R^2).

$$AAD(\%) = \left(\frac{1}{n} \sum_{i=1}^{n} \left\{ \frac{y_{i,pred} - y_{i,exp}}{y_{i,exp}} \right\} \right) \times 100 \quad (5)$$

where n, $y_{i,pred}$, and $y_{i,exp}$ represent the number of points, predicted and experimental values respectively. The lower the AAD(%) value and the higher the value of R^2, the better will be the goodness of fit. The range of R^2 is from 0 to 1. R^2 values closer to 1 indicate the model's superiority in predicting the behavior of the system (Yolmeh *et al.*, 2014).

III. RESULTS AND DISCUSSION

Grafting

The grafting efficiency (GE %) of 75.3% and grafting yield (G %) of 76.25% were calculated from equations 1 and 2 . These values calculated for GE% and G% suggest effective graft copolymerization of methyl methacrylate on to the maleilated chitosan.

FTIR

FTIR analysis was conducted to detect the presence of unknown substances present in the samples. The analysis revealed the vibrational origin of the amine, carbonyl and alcoholic groups of chitosan and the corresponding graft copolymers. Figure 2 represent the FTIR spectrum of the chitosan generated from periwinkle shell. Peaks 3424.36 cm^{-1}, 2933.83 cm^{-1} revealed the presence of N-H stretching and C-H stretch (IRChart, 2021) respectively. 1848.48 cm^{-1}, 1617.93 cm^{-1} and 1390.76 cm^{-1} were assigned to C-H bending, primary amine(Merc, 2021), NH bend (Coates, 2000) and O-H bending (Merc, 2021) respectively.

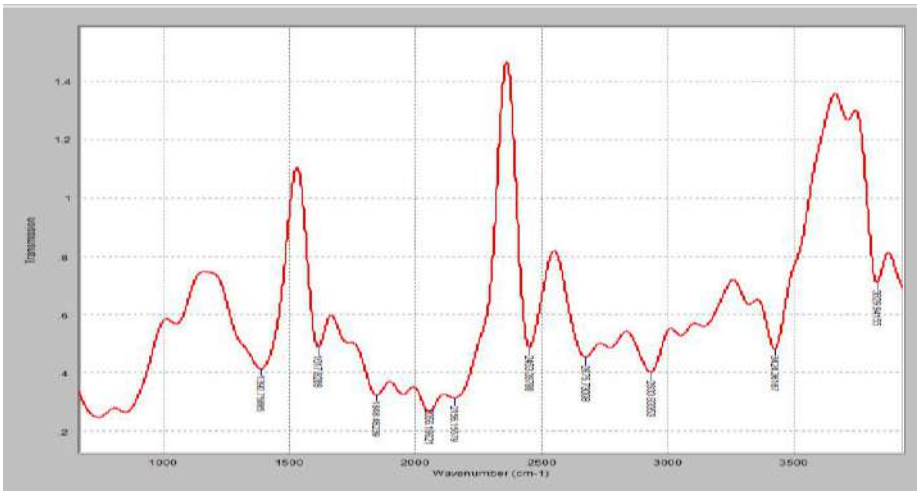

Fig. 2: FTIR Spectrum of Chitosan

Figure 3 is a graph of %Transmittance vs wave number for chitosan-g-maleic anhydride. The spectrum reveals a conspicuous peak at 1619.01cm^{-1} establishing the presence of C=C bond (Merc, 2021). This confirmed the grafting of maleic anhydride group on to chitosan (Hemalatha and Sudha, 2011).

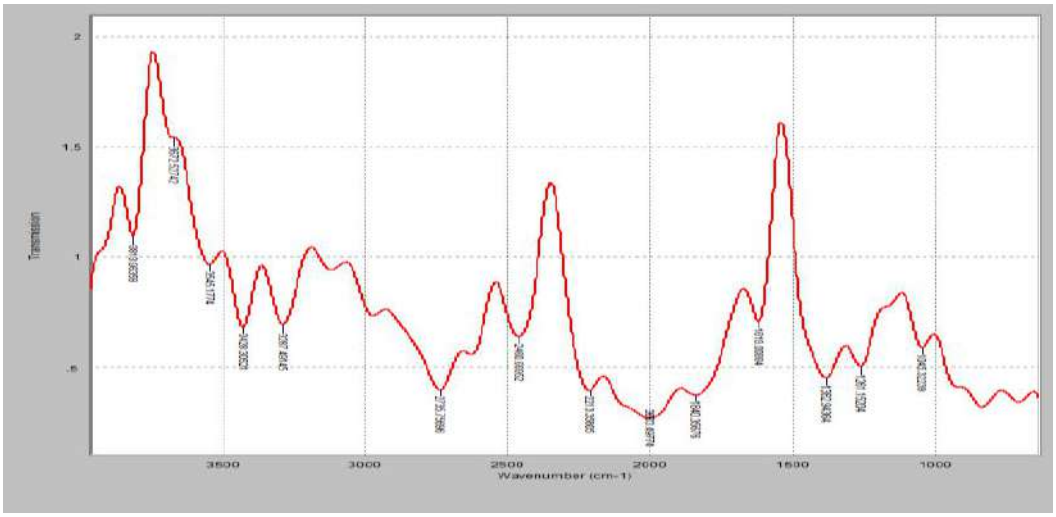

Fig. 3: FTIR Spectrum of Chitosan-g-maleic anhydride

Chitosan-g-maleic anhydride-g-(Methyl methacrylate) copolymer is a product of further grafting of maleilated chitosan with methyl methacrylate. From the FTIR spectrum (Figure 4) depicted additional sharp peaks at 1388.62cm^{-1}, 1625.44 cm^{-1} and 2805.33 cm^{-1} showing the presence of carbonyl compounds. Methyl C-H asym./sym. stretch of the methacrylate structure forms part of Chitosan-g-maleic anhydride-g-(Methyl methacrylate) copolymer are in infrared (IR) range of (2880-2860) cm^{-1} having peak positions close to 2854 cm^{-1} as depicted in Figure 4 (Coates, 2000). This substantially confirmed the grafting of methyl methacrylate to maleilated chitosan (Hemalatha and Sudha, 2011).

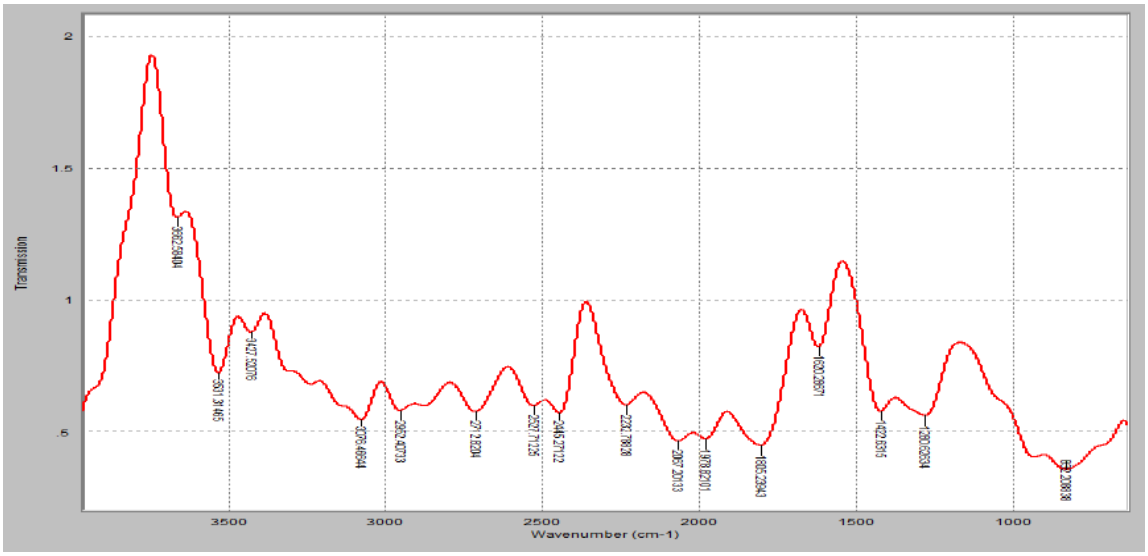

Fig. 4: FTIR Spectrum of Chitosan-g-maleic anhydride-g-(Methyl methacrylate)

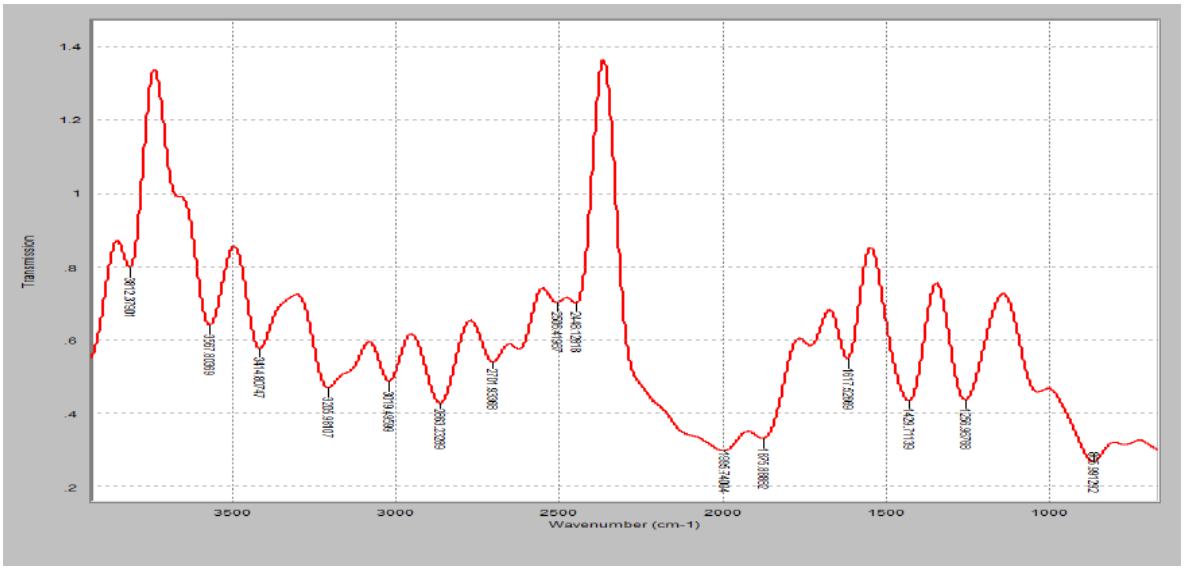

Fig. 5: FTIR Spectrum of formulated car paint

Figures 5 and 6 show the graph of FTIR spectra for the formulated car paint and modified car paint. The FTIR spectrum for the car paint identified peaks 1256.97cm^{-1}, 1617.53 cm^{-1}, 1995.74 cm^{-1} and 2863.23 cm^{-1} representing C-O stretch, C=O bonds (www.orgchemboulder.com), C-H bending (Coates, 2000), aromatic compound (Merck, 2021) and methylene C-H asym./sym. Stretch (Coates, 2000) as represented within the alkyd resin paint structure. Figure 6, had additional peaks at 1060.46cm^{-1}, 1344.09 cm^{-1}, 2718.03 cm^{-1}, 2827.56 cm^{-1}, 3386.70 cm^{-1} and 3446.89 cm^{-1} showing the presence of primary amine CN stretch, aromatic secondary amine CN stretch (Coates, 2000), O-H stretching (Merc, 2021), methyl ether O-CH_3, aliphatic primary amine NH stretch and hydroxyl group, H-bonded OH stretch. These show the presence of Chitosan-g-maleic anhydride-g-(Methyl methacrylate) copolymer used in the formulated self healing paint. The observed shifts in peaks of the functional groups may be as a result of interactions with other additives used in the paint formulation.

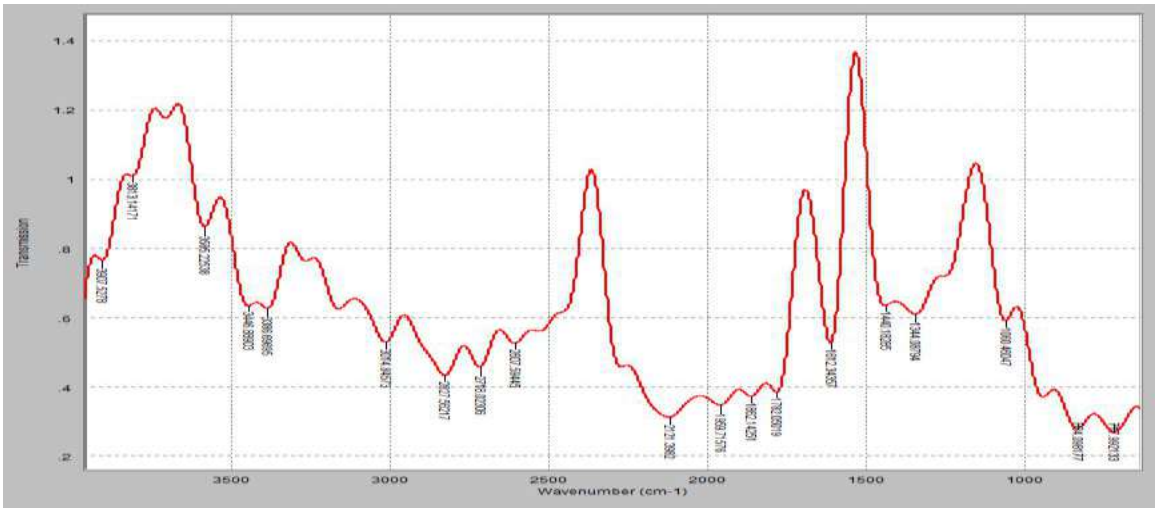

Fig. 6: FTIR Spectrum of the formulated self healing paint

Physic-chemical characterization

The drying time, adhesion and chemical resistance properties were measured. At the end of the drying time test period according to the method reported, the filter paper fell of the test film with a light tap. The resistance of the paint formulations was tested in a mixture of acetone, demineralized water and isopropyl alcohol medium after 24 hours. The morphology of the substrates did not change (no stains were recorded) after the medium's drops on them. This outcome shows that the paint formulations have high chemical resistance. The formulations sprayed on metal surface portrayed strong adherence characteristics as no flaking or ribboning was observed after making the cuts and applying the adhesive tape. It is reported that hydroxyl groups in the structure of the resin improved the adhesion to the substrates. The outcome of these characterization results fall within standard acceptable limit, therefore suggest that the product is a good paint.

Response surface methodology Model

A set of 30-experimental runs generated by a 2^4 central composite design were performed to examine the combined effect of the controllable input variables (binder, solvent, pigment and additives) on the response (viscosity). Experimental data was compared with RSM model's predictions (Table 2). The experimental data was fitted into linear, 2FI, quadratic and cubic models to test the adequacy of the models in describing the system.

As recorded in Table 3, the quadratic model presents the lowest prediction error sum of squares (PRESS) value of 1033950 compared to cubic (7816944), 2FI (6025394) and linear (8831846) models. Also, the quadratic model's predicted R-squared value (0.9494) can best be approximated to 1 when compared to 0.5678, 0.7051 and 0.6175 for linear, 2FI and cubic models. Model with the lowest PRESS value suggests highest predictability. From these findings, the quadratic model best correlates the predicted and the experimental response data for the investigated paint formulations, therefore, was selected for further computations on the experimental data. Quadratic model's predicted and adjusted R-squared values of 0.9494 and 0.9830 are considered to be in reasonable agreement having a difference less than 0.2. According to Jie (2014), the predicted R-square considers all effects and adjusted R-square considers only square effects and interaction effects between two input variables. The quadratic model's coefficient of determination, R^2, value of 0.9912 suggests that 99.12% of the total variation could be explained by the model.

ANOVA results for Response Surface Quadratic model is presented in Table 4. The F-value of 120.89 and the very low value (<0.0001) recorded for the model P-value confirms the significance of the model. Statistical significance of the model's terms can be measured using the P-value. It is seen on Table 4 that model terms C, D, AC, AD, BC, BD, CD, C^2 and D^2 are statistically insignificant ($P > 0.05$). According to Pilkington (2014), higher Fisher's F-test values and lower P values indicate the relative significance of each model term.

The resultant quadratic model equation generated after regression analyses is given by:

In coded values:

$$Y = 2208 + 567.42A - 527.58B + 40.08C - 33.08D + 409.88AB + 23.25AC - 38.25AD + 28.63BC - 36.37BD + 35.50CD - 273.23A^2 - 211.35B^2 - 11.48C^2 - 9.48D^2 \quad (6)$$

In actual values, equation 7 is written as:

Y = 1778.78 +14.47Binder – 19.38Solvent -8.69Pigment +78.98Additives + 0.27Binder*Solvent

+0.04Binder*Pigment -0.64Binder*Additives +0.11Solvent*Pigments -1.45Solvent*Additives +3.55Pigment*Additives -0.08Binder^2 – 0.34Solvent^2 – 0.11Pigment^2 – 9.48Additives^2. (7)

The unitless coefficients of the second order polynomial model design equations 6 and 7 were determined by multiple regression analysis. Positive sign in front of the terms indicates synergistic effect while negative sign indicates antagonistic effect of the factor. Statistically, the key contributory variables in viscosity variation are the binder (p-value < 0.0001) and solvent (p-value < 0.0001). By sign convention, increase in binder mass in the formulation is synergetic to the response (viscosity) while increase in solvent mass in the formulation is antagonistic to viscosity.

Table 2: Design Matrix for the paint formulation

No.	Independent factors				Viscosity (mPa.s)		
	Binder (g)	Solvent (g)	Pigment (g)	Additives (g)	Experimental	RSM Predicted	ANN predicted
1	70	80	15	3	143	85.42	132
2	190	80	15	3	1654	1917	1646.9
3	70	80	15	1	155	218.83	115.4
4	190	30	15	3	2359	2282.42	2308.2
5	10	55	25	2	20	-19.75	20.3
6	70	80	35	3	167	247.33	186.7
7	130	55	25	2	2208	2208	2208.3
8	70	30	35	3	2105	2137.75	2327.4
9	130	55	25	2	2208	2208	2208.3
10	190	30	15	1	2374	2423.33	2269.9
11	70	80	35	1	196	238.75	95.8
12	130	55	45	2	2225	2242.25	2243.7
13	190	80	15	1	2270	2203.42	2259.3
14	70	30	35	1	2117	1983.67	2018.1
15	130	55	25	0	2232	2236.25	2252
16	70	30	15	1	2016	2078.25	1987.7
17	130	55	25	2	2208	2208	2208.3
18	250	55	25	2	2306	2249.92	2273
19	130	105	25	2	397	307.42	368.4
20	190	80	35	1	2271	2316.33	2351.8
21	130	5	25	2	2424	2417.75	2434.2
22	70	30	15	3	2006	2090.33	2271.2
23	130	55	25	2	2208	2208	2208.3
24	190	30	35	1	2398	2421.75	2459.6
25	130	55	25	4	2204	2103.92	2210.2
26	130	55	5	2	2195	2081.92	2132.6
27	190	30	35	3	2357	2422.83	2343.6
28	130	55	25	2	2208	2208	2208.3
29	130	55	25	2	2208	2208	2208.3
30	190	80	35	3	2268	2171.92	2280.5

Table 3: Model Summary Statistics

Source	Std. Dev.	R-Squared	Adjusted R-Squared	Predicted R-Squared	PRESS	
Linear	488.33	0.7082	0.6616	0.5678	8831846	
2FI	409.57	0.8440	0.7619	0.7051	6025394	
Quadratic	109.39	0.9912	0.9830	0.9494	1033950	Suggested
Cubic	88.06	0.9973	0.9890	0.6175	7816944	Aliased

Table 4: ANOVA for Response Surface Quadratic model for paint formulation

Analysis of variance table [Partial sum of squares - Type III]						
Source	Sum of Squares	df	Mean Square	F Value	p-value Prob > F	
Model	20254284	14	1446735	120.8936	< 0.0001	Significant
A-Binder	7727080	1	7727080	645.6984	< 0.0001	
B-Solvent	6680260	1	6680260	558.2229	< 0.0001	
C-Pigment	38560.17	1	38560.17	3.222205	0.0928	
D-Additives	26268.17	1	26268.17	2.195048	0.1592	
AB	2687960	1	2687960	224.6142	< 0.0001	
AC	8649	1	8649	0.722737	0.4086	
AD	23409	1	23409	1.956128	0.1823	
BC	13110.25	1	13110.25	1.095533	0.3118	
BD	21170.25	1	21170.25	1.769051	0.2034	
CD	20164	1	20164	1.684965	0.2139	
A^2	2047657	1	2047657	171.1085	< 0.0001	
B^2	1225250	1	1225250	102.3857	< 0.0001	
C^2	3614.298	1	3614.298	0.302022	0.5907	
D^2	2464.583	1	2464.583	0.205948	0.6565	
Residual	179505.2	15	11967.01			
Lack of Fit	179505.2	10	17950.52			
Pure Error	0	5	0			
Cor Total	20433789	29				

The normality of residuals was investigated from the trend observed in Figure 7. The plots show the presence of influential values (outliers). The plotted points follow a straight line with very few outliers. The trend followed is an indication that the residuals are normally distributed.

Figure 8 reveals the extent of the model's predictability within the design space. It is expected that the plots should scatter around the 45° line. For robust correlation to be established between the actual and the predicted values. It can be seen from the predicted versus actual plot that the actual response values closely matched the predicted line.

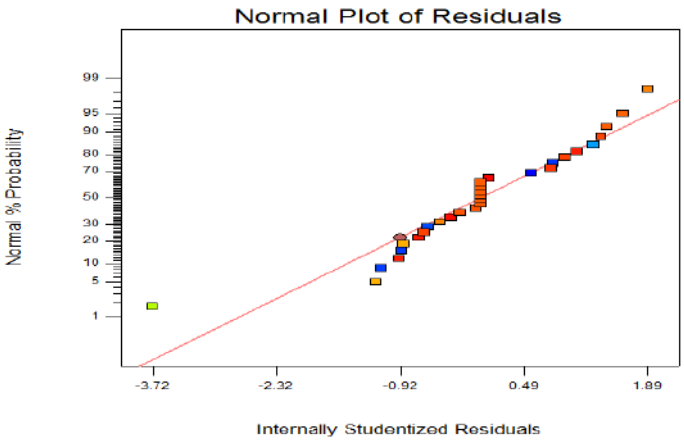

Fig 7: Normal probability plot of residuals for viscosity response on paint formulation

Fig 8: RSM predicted vs Actual plot for viscosity response on paint formulation

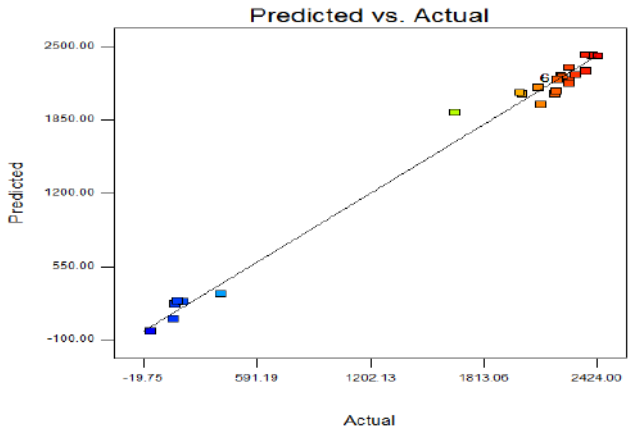

Fig 8: RSM predicted vs Actual plot for viscosity response on paint formulation

Figure 9 reveals the combined interactive effect of the binder and solvent on viscosity variation of the paint formulations with other variables held at their mid-points (pigment=25g; additives = 2g). As the mass of the binder was reviewed upwards, the synergetic effect on the response was clearly observed. Upward review of the mass of solvent introduced in the formulation displayed continuous negative effect on the response. The curved architecture displayed on the canopy is an indication that the model contains statistically significant model terms.

Examining the effect of binder and pigment on viscosity (Figure 10) having other variables kept at their midpoints (solvent = 55g; additives = 2g) also shows the positive effect of the binder on the response as it is reviewed upwards. The increase in the mass of pigment from 16 – 35g on the canopy did not significantly affect the value of the response variable. This is in line with the findings from the ANOVA table (Table 4).

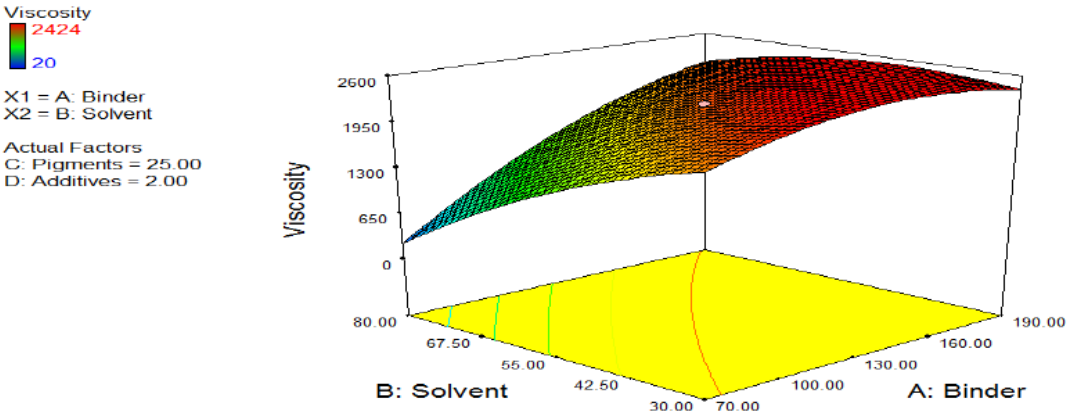

Fig 9: 3D Surface plot for combined effect of binder and solvent on viscosity

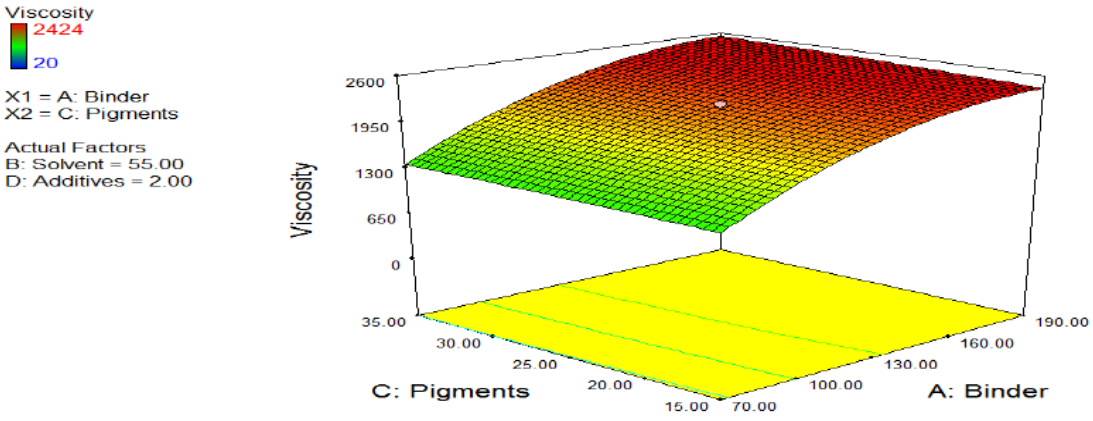

Fig 10: 3D Surface plot for combined effect of pigment and binder on viscosity

Artificial Neural Network

The data in the design matrix (Table 2) was used in training the neural network. The feed-forward ANN architecture was used in building the ANN model. Fig 11 reveals that the MLP network has three layers: input, hidden and output layer. The input layer consists of four neurons representing the process independent variables (binder, solvent, pigment and additives). The whole investigated data was partitioned into three: training, validation and testing. This was done to avoid over-training and over-paramaterization (Desai *et al.*, 2008). 70% of the data set (21 experimental runs) were used to train the network while the remaining results (30%) were split evenly between validation and testing. ANN's extent of prediction of the experimental data adjudged by the coefficient of determination (R^2) values was shown in Figure 11. The ANN model predicted data is presented on Table 2.

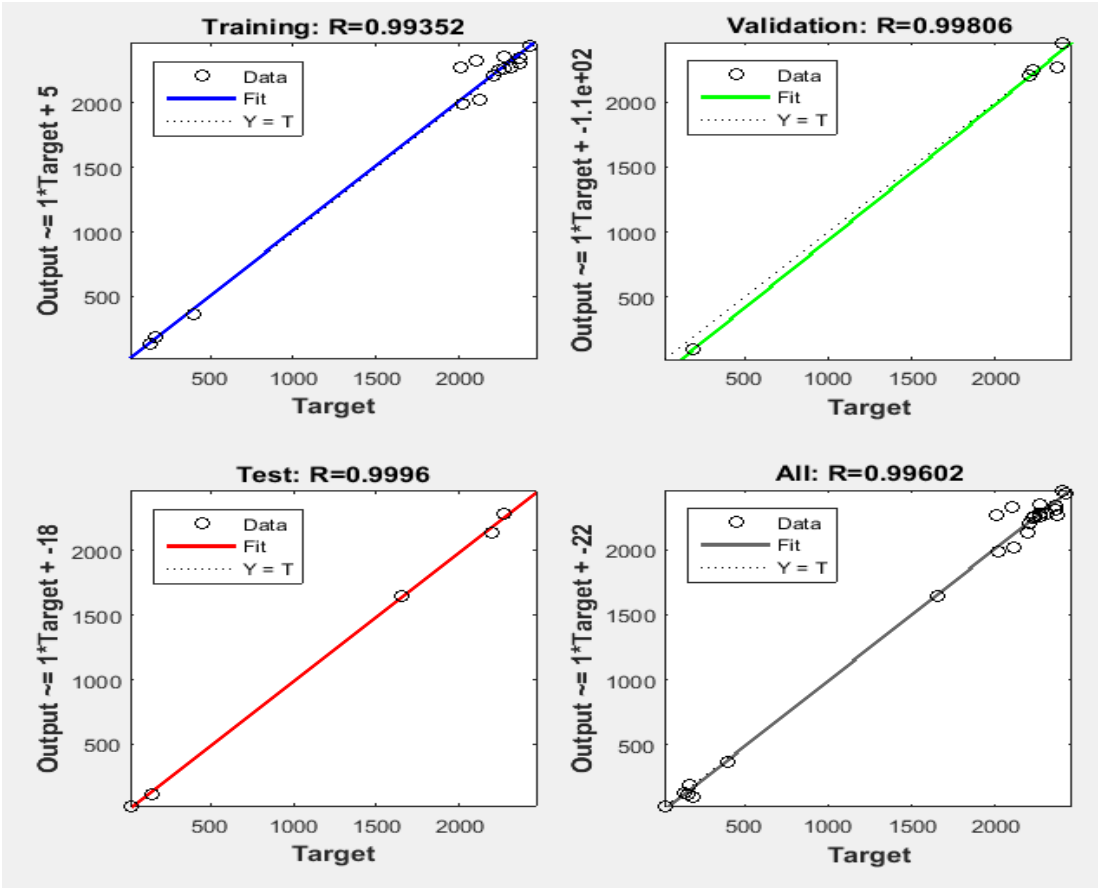

Fig 11: ANN model regression plots for training, validation, test and all prediction data

Comparison of RSM and ANN Models

The closeness of the RSM and ANN models' predictions to the experimental data was measured by fitting experimental and predicted values in equation 5. From the AAD(%) estimation, ANN and RSM gave 4.12% and 5.77% respectively. From Figure 12, 0.992 and 0.991 coefficient of determination values were presented for ANN and RSM respectively. The result indicates that both the ANN and RSM predicted the experimental values to a great extent, however, the ANN model marginally outperformed the RSM model.

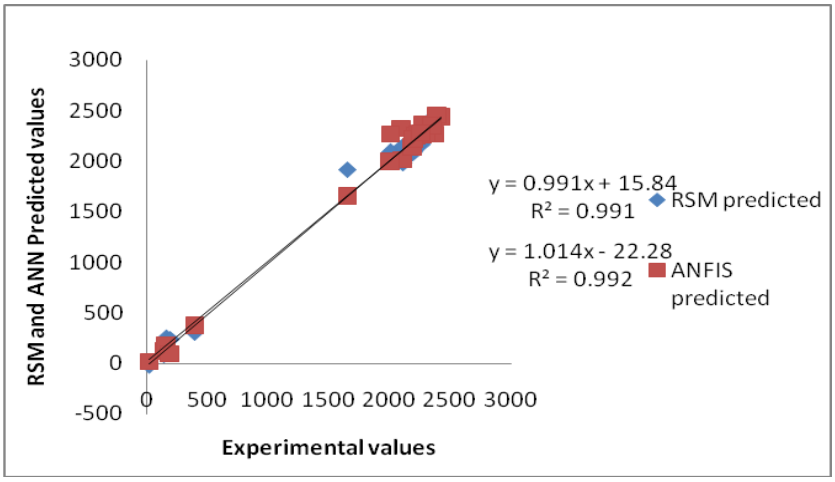

Fig.12: Plot for ANN and RSM models' comparison

Process optimization

The viscosity of paint is one of the vital quality control test that is necessary for product delivery and spray specifications. The data presented on Table 2 presents paint for high and low viscous formulations which can serve depending on the functionality. According to Schoff (2021), there is a rule of the thumb in the paint industry that a viscosity of approximately 100cps provides acceptable spraying, brushing or roll coating. In line with this objective, a systematic combination of the input variables in equation 6 aided by Design Expert Software version 10 was employed to generate optimal solutions. Table 5 shows CCD optimum predicted conditions and validation experimental result. It is seen that viscosity of the paint experimental formulation (102mPa.s) obtained at optimal controllable variable condition closely matches with the CCD predicted optimal response (99.85mPa.s).

Table 5: CCD optimum predicted/validation result

Binder	Solvent	Pigment	Additives	Viscosity	
				CCD Optimal Response	Experimental Validation
70.24	79.99	15.72	3	99.85	102

IV. CONCLUSION

Chitosan was extracted from periwinkle shells, modified effectively by graft copolymerization of methyl methacrylate on to the maleilated chitosan and incorporated into the paint samples; the calculated Grafting efficiency (GE %) of 75.3% and grafting yield (G %) of 76.25% were obtained respectively. The FTIR spectra were highly instrumental in highlighting all the stages of the processes. The quadratic model outperformed the linear, 2FI and cubic models in explaining the viscometry behaviour of the formulation. The derived quadratic model can be effectively used to navigate through the design space (high and low viscosity). The ANOVA results revealed that only the binder and solvent significantly affected the viscosity of the formulations. The RSM and ANN displayed high predictability of the response variable, however, ANN displayed higher superiority in capturing the experimental data.

V. FUNDING STATEMENT

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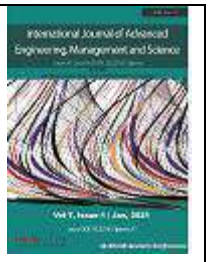

Sustainable Development Strategies of Restaurants in Cabanatuan City

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Abstract— *The study delved on determining the sustainable development strategies of restaurants in Cabanatuan City, Philippines. It covered certain areas of sustainable development more particularly in the aspects of Economic, Environmental, and Social. It used the descriptive research design that consisted of 8 randomly selected restaurants using a guided interview and observation to gather data. Findings showed that the restaurants have been adhering to certain areas of sustainable development more particularly in the area of Business Management which ranked first, while some components in the true sense of Corporate Social Responsibility may be lacking. Other noteworthy observations included the loose implementation of waste management, challenges on food supply chain management sustainability is in the offing, and subscription to the use of renewable energy be considered urgent. Overall score on the eight parameters measured in this study pointed to the sustainable development strategies to the verbal interpretation of "often" which has to be elevated to "always" for more sustainable development goals.*

Keywords— ***Sustainability, sustainable development, restaurants, hospitality, corporate social responsibility.***

I. INTRODUCTION

Restaurants are key parts of the hospitality industry, which has the ability to provide and affect the business sector. The Hospitality Industry is a broad category of different fields relating to customer service and satisfaction, as well as the production of goods whether tangible or intangible. These establishments operate on procurement, preparation and distribution or sale of food to their customers. As such, restaurants nowadays are not only focusing on profits but as well as maintaining sustainable development in their operations, thereby achieving sustainability.

According to Brundtland Commission (1987), sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The same way that Jones and Allen stated that sustainable development is the pathway to sustainability. Since the latter must be taken further and can only be attained when there is a balance among the three pillars namely environmental, economic and social factors (Purvis et al., 2019). However, sustainability cannot be defined simply as it may seem, likewise with sustainable development. These two elusive words that may require a deeper understanding must be addressed to fully achieve the industry's goal. Sustainable development is a process in which the natural resource base is not allowed to deteriorate (Myers, 1987). The second alternate definition was provided by environmentalist Paul Hawken, who has written about the realization (and the science behind it) that we are using and destroying the earth's resources faster than they can be regenerated and replenished.

In this study, Economic sustainable development was measured with two standards; Marketing and Business Management. The environmental aspects included four standards; Food and Beverage Management, Water Efficiency, Energy Conservation and Waste Management, while Social standards refer to communication and corporate social responsibility.

Cabanatuan City has now developed into a restaurant hub. New restaurants and food establishments sprung in and out of the city. Cabanatuan, being a progressive and characterized as a first-class city boasts business opportunities including the food and beverage industry. It is credited for its good access to different products and services, with a population of more than 300,000 (2015 census), the city remains to be a good market for food establishments. Present time indicates more than 82 food establishments registered in the city as of 2017 (Business Permit and License Division, Cabanatuan City) notwithstanding the kiosks and proliferation of ambulant food vendors. Since the Philippines is expected to have its population grow bigger than the present year in the next decades, it will entail further reliance on the more efficient and effective use of farmlands to feed the growing population. Such increase requires a second look as regards their practices on sustainable development.

In line with this, this research study aimed to describe the sustainability strategies of restaurants with regard to the triple bottom line approach of sustainability in terms of economic, environmental and social. The findings of the study served as the basis for proposed sustainable regulations and standards.

II. METHODOLOGY

The study used the descriptive research design. According to Cristobal and Cristobal (2013), this method of research accurately portrays a population that has been chosen because of some specific characteristics. It is also used to determine the extent or direction of attitudes and behavior. The purpose of this method is to provide a picture of the situation as it naturally happens. It may be used to develop theories, justify practices, aid in making professional judgments, or identify problems with them. The study delimited the respondents to eight restaurants only using purposive sampling based on their asset size which should be more than Php1 million in capitalization, not less than 10 years in operation, and whose number of employees are 15 and above. It further employed unstructured interviews and observation for validation purposes in data gathering. Likert scale was utilized in determining the degree to which the strategies were applied by the respondents of restaurants. The interpretation of the Likert scale is based on the degree of frequency where the option is Always, Often, Seldom, and Never, hence the scale in the responses is shown in Table 1.

Table 1. Point, Range and Verbal Analogy

Point	Range	Verbal Analogy
4	3.26 - 4.0	Always (applied every time)
3	2.51-3.3.25	Often (applied most of the time)
2	1.76 -2.50	Seldom (applied rarely)
1	1.00 -1.75	Never (not ever applied)

III. RESULTS AND DISCUSSION

1. Describe the sustainable development strategies of the restaurants

Tables 2 to 9 show the summary of the degree of practice or application of the sustainable development strategies of restaurants.

Table 2. Sustainable Development Strategies – Economic (Marketing)

No.	Item Statement	Weighted Mean	Verbal Interpretation
1	Makes use of social media sharing incentives (Facebook, Instagram, Twitter)	3.75	Always
2	Uses print as a marketing medium	3.12	Often
3	Adopts a loyalty program	3.12	Often
4	Rates are competitive with other restaurants	3.25	Often
5	Uses digital media in taking orders	2.25	Seldom
	Overall Weighted Mean	3.10	Often

Among all the items indicated in Table 2, the restaurants make use of social media sharing incentives such as Facebook, Instagram and Twitter constantly with a mean score of 3.75 and an interpretation of Always. On the other hand, it is safe to say that most of the establishments rarely use digital media in taking orders with a mean of 2.25. Note that this survey was conducted before the onset of the covid-19 pandemic the reason, too, that online platforms had a low score.

The use of any form of media makes efficient the business operation attuned with the times and widens the horizon particularly its customer base. It also boosts competition among the players to improve the product or services and breeds innovation of methods and processes. This in return would be beneficial to consumers and stakeholders and adds economic value to owners toward long-term business sustainability. This also promotes operative value-chain management.

Table 3. Sustainable Development Strategies – Economic (Business Management)

No.	Item Statement	Weighted Mean	Verbal Interpretation
1	Hires employees within the area of operation	3.75	Always
2	Pays employees on time	3.75	Always
3	Uses a Point-of-Sale system	3.37	Often
4	Accounts day to day finances of the business	3.62	Always
5	Allots sufficient budget for sustainability measures	3.50	Always
6	Employees are regularly given training on customer satisfaction	3.37	Often
	Overall Weighted Mean	3.56	Always

The data suggest that item numbers 1 and 2 have the highest mean of 3.75 and a verbal interpretation of Always. Overall weighted mean indicates 3.56 and interpreted as Always. This would mean that the Economic Sustainable Development Strategies in terms of Business Management specifies a degree of applicability and should therefore be considered as manageable and feasible. The data further implies that restaurant owners, who are leaders and managers (Zabala, et al., 2018), are subservient to a law which is an indication of good business practice, and are apparently working within the framework of the understanding of business ethics. Ethical behavior creates stability and positive effects and a respectable reputation for the company, good image in the community and the stakeholders as well. It also fosters a stronger bond among the employees in the company, hence making it a necessary component for the survival of the business and its sustainability.

Table 4. Sustainable Development Strategies – Environmental (Food and Beverage Management)

No.	Item Statement	Weighted Mean	Verbal Interpretation
1	Food ingredients used in the restaurant are sourced locally or within the region	3.12	Often
2	Beverages offered in the restaurant are sourced locally	3.25	Often
3	Has an accredited supplier of food and beverages	3.87	Always
4	Produces its own ingredients	2.25	Seldom
5	Changes or modifies the menu regularly	2.37	Seldom
	Overall Weighted Mean	2.97	Often

Table 4 reveals that in terms of Food and Beverage Management, the restaurants “always” have an accredited supplier with a mean score of 3.87, while on the area of producing its own ingredients have a mean score of 2.25 and verbally interpreted as “seldom”.

What the restaurants in Cabanatuan City lack are the production of their own materials and ingredients. "Growing your own ingredients has the potential to produce food in a sustainable way." This is according to an executive chef, Ben Kramer. As an own producer, it eliminates the uncertainty of availability or break in supply (Manitoba, 2013). The issue of supply-chain management also crops up as a concern here especially in the areas of the value chain and eventually the efficient and equitable use of resources.

Sustainable consumption and production in the UN's 2030 Agenda calls for changes in the patterns in the production and consumption of goods of countries to mitigate the effects of economic progress on the environment (Development Asia, 2020)

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Table 5. Sustainable Development Strategies – Environmental (Water Efficiency)

No.	Item Statement	Weighted Mean	Verbal Interpretation
1	There is a regular potability water test in the restaurant	3.12	Often
2	Has a self-service policy for drinking water or only upon request by customers	2.50	Seldom
3	Serves water upon guests have been seated	3.12	Often
4	The restroom uses waterless urinals or water-efficient toilets.	2.12	Seldom
5	Water conservation guidelines are implemented	3.75	Always
	Overall Weighted Mean	2.92	Often

The survey reveals that restrooms or toilets in these establishments are not water-efficient and do not have waterless urinals with a mean score of 2.12 and interpreted as seldom.

The findings confirm with a 2016 Manila Times report which stated the need for water conservation in the Philippines not only in the restaurant industry but as a whole. The country is likely to face shortages of water for drinking, sanitation, agriculture, and industry within the next ten years unless stronger management and conservation efforts are initiated.

Table 6. Sustainable Development Strategies – Environmental (Energy Conservation)

No.	Item Statement	Weighted Mean	Verbal Interpretation
1	Makes use of solar panels or other forms of alternative energy	1.37	Never
2	A light-emitting diode (LED) is used in all lighting system	3.12	Often
3	Uses inverter technology air conditioning units	2.87	Often
4	Uses inverter technology refrigerators	1.73	Seldom
5	Open dining area (al fresco)	2.37	Seldom
6	Energy-saving guidelines are strictly implemented	3.75	Always
	Overall Weighted Mean	2.54	Often

A mean of 1.37 or "never" was reflected in the use of solar panels as an alternative form or source of energy. The use of solar panels in the Philippines is in its initial stage. Moreover, the cost of installation can be prohibitive, too. As regard, the provision of an open dining area can be far from incorporating in building design because the Philippines has a hot climate, and people are seeking air-conditioned areas for their convenience.

Table 7. Sustainable Development Strategies – Environmental (Waste Management)

No.	Item Statement	Weighted Mean	Verbal Interpretation
1	Engages in garbage segregation	3.12	Often
2	The use of plastic materials is discouraged instead, it uses recyclable or biodegradable food containers	2.85	Often
3	Uses recyclable takeaway bags	3.00	Often
4	Conducts inventory in order to compare purchase and quantity of garbage	2.76	Often
5	The restaurant is engaged in the 3Rs: Reduce, Reuse and Recycle	3.00	Often
6	Waste management guidelines are strictly implemented	2.55	Often
	Overall Weighted Mean	2.88	Often

Of the item statements listed above, number 6 or waste management guidelines are strictly implemented in the restaurants studied. A mean score of 2.88 or "often" had been discovered. This confirms the law pertaining to the Solid Waste Management Act of 2000 or Republic Act (RA) 9003. The law declares the policy of the state in adopting systematic, comprehensive and ecological solid waste management program that ensures the protection of public health and the environment. Apparently, the restaurants are yet to apply recyclable takeaway bags as their primary food packaging and to engage in the 3Rs-Reduce, Re-use and Recycle. Both items have mean scores of 3.0 respectively and interpreted as "often".

However, based on the observation of the researchers, a few of them (3 or 38%) are remiss in waste segregation. These are the restaurants located outside the malls. More so, there are countless health hazards and damage to humans and the environment because of improper waste segregation and disposal. Although in the Philippines, there is enough law to address this problem, Local Government Units (LGUs) and other concerned agencies struggle to implement such.

Table 8. Sustainable Development Strategies – Social (Communication)

No.	Item Statement	Weighted Mean	Verbal Interpretation
1	Reminders to limit the use of water, conserve energy and minimize waste are posted conspicuously inside the restaurant for *employees* to see	3.5	Always
2	Reminders to limit the use of water, conserve energy and minimize waste are posted conspicuously inside the restaurant for *customers* to see	1.71	Seldom
3	Sustainability measures are posted on the restaurant's social media page	2.11	Seldom
4	No Leftover policy is adopted in the restaurant	1.75	Seldom
5	Food and beverage items are individually described on the menu	2.31	Seldom
	Overall Weighted Mean	2.28	Seldom

Of all the items stated, number 1 got the highest mean score of 3.50 and verbally interpreted as "always". This indicates that communication plays a vital role in promoting sustainability. The reminders to limit the use of water and energy as well as minimize waste are placed conspicuously for everyone to see, this is a good gauge of sustainability in communication among restaurants. Seemingly, a mean of 1.75 or "seldom" was gained by the No-left over the policy of restaurants. Food wastage is a major concern among industry practitioners and should be dealt with immediately.

Table 9. Sustainable Development Strategies – Social (Corporate Social Responsibility)

No.	Item Statement	Weighted Mean	Verbal Interpretation
1	Conducts social and community development activities like tree planting and gift-giving	2.00	Seldom
2	Actively supports/join Government and Non-Governmental Organizations' CSR programs and projects	1.75	Seldom
3	Supports charitable organization	2.00	Seldom
4	Supports local food suppliers by buying their goods	2.75	Often
5	Provides health benefits to employees	3.37	Often
6	Gives financial support for students' education	1.75	Seldom
	Overall Weighted Mean	2.27	Seldom

It is discouraging to note that the restaurants have not acquired a definitive social responsiveness program as other companies do. The findings also reveal that they are not actively supporting government and non-governmental organizations' CSR programs as well as giving financial support to student's education is not among the priorities of these establishments. Both items indicated a mean of 1.75, and interpreted as "seldom"

The findings run parallel to the study of Montalbo (2015) which resulted that Corporate Social Responsibility (CSR) related mission/vision is clearly not embedded in the institutional websites of fast food restaurants. On a good note, the personal/social proximity approach is highly evident in the health benefits provided to employees with a mean of 3.37 and interpreted as "often". The combined mean weight of 2.27 is interpreted as "seldom" which could mean that restaurants need to improve CSR strategies in their respective establishments.

Tong and Wong (2016) stressed that CSR can improve an organization's competitive edge and sustainability. In addition, CSR together with the concept of 3Rs (Reduce, Reuse and Recycle) can enhance the corporate image and its effect on the performance of fast-food restaurants.

IV. CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the findings of the study, the following conclusions were drawn and ranked accordingly based on their weighted mean:

Rank 1. As to Economic– Business Management. This aspect of sustainable development strategies got a verbal interpretation of "often" that indicates that restaurants regularly employ appropriate tools in their business activities.

Rank 2. As to Economic – Marketing. This aspect of sustainable development strategies got a verbal interpretation of "often" as many of them constantly practice innovative selling techniques attuned with the times.

Rank 3. As to Environmental – Food and Beverage Management. This aspect of sustainable development strategy got a verbal interpretation of "often". However, they seldom produce their own ingredients and rarely change their menus which may imply unsustainable in the long run.

Rank 4. As to Environmental – Water Efficiency. This aspect of sustainable development strategy got a verbal interpretation of "often". On the contrary, some areas need still to be achieved as not all of them use waterless urinals, and some policies in water conservation not fully implemented.

Rank 5. As to Environmental – Energy Conservation. This aspect of sustainable development strategy got a verbal interpretation of "often". Noticeable in the findings is that establishments are not yet inclined to use them more friendly (renewable) solar energy.

Rank 6. As to Environmental – Waste Management. This aspect of sustainable development strategy got a verbal interpretation of "often". The "often" WM suggests that this area may still lack comprehensive and all-encompassing policy as regard waste management.

Rank 7. As to Social – Communication. This aspect of sustainable development strategy got a verbal interpretation of "seldom". This further indicates that rarely do restaurants are aware to convey to employees and stakeholders the importance of communicating effectively environmental concerns.

Rank 8. As to Social – Corporate Social Responsibility. This aspect of sustainable development strategy got a verbal interpretation of "seldom". Under this aspect that restaurants still lack the spirit and meaning of true corporate social responsibility.

Recommendations

In the light of the conclusions derived therefrom, the following recommendations are hereby made:

1. The restaurants should adopt measures to be more environmentally conclusive; producing their own ingredients can promote farm-to-table as well as modifying the menu to adhere to seasonal crop changes.

2. Corporate Social Responsibility must be promoted and emphasized (Mina, et al., 2019 as cited by Balaria, et al, 2021) among the restaurants particularly in conducting social and community development activities, supporting government and non-governmental organizations' CSR programs, and giving financial assistance to students' education as practiced by some companies.

3. Regulations and standards must be set to provide guidance to restaurateurs and future owners to be sustainable in their operations.

4. An organized union of restaurant owners must be established to pioneer sustainability measures in their operations, as well as, promote camaraderie and bring about community togetherness in this area.

5. Lastly, further researches on sustainable development and sustainability could be expanded to include other measures which could provide greater insights to the restaurant industry. It can also be extended to hotels and accommodations and other forms of businesses.

Proposed Sustainable Regulations and Standards

The researcher proposed Regulations and Standards-based on the UNDP Sustainable Development Goals – Three Pillar Impacts. The following can be adopted.

1. Impact Management – provide tools to support investor and business contributions to the SDGs.

2. Impact Intelligence – data that provide insights where development is needed in cognitive intelligence and thinking skills (Subia, et al., 2020) of restaurant owners.

3. Impact Facilitation – connect businesses to provide insights and tools that translate opportunities to action.

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Effects of intangible assets such as Technology and assertive leadership on efficient systems in a Cuban institution

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Abstract— *In the work field, leaders develop assertiveness to establish their relationship with their employees. However, technology is increasingly opening up in Cuba and stimulates the use of systems platforms such as roads or channels of indirect communication of leaders with their employees. Assertiveness could be influenced by the use of technology and generate a new asset of intangible knowledge. To learn about this relationship, a descriptive non-experimental transactional empirical study was conducted at a Cuban financial institution. Questionnaires and expert judges' criteria were used to analyze the relationships of variables and to triangulate the results. Metrics revealed that there is a significant relationship between the assertive behavior of leaders and the use of technology. It was found that subjects with a high degree of use in technologies developed assertive behaviors in the exercise of their work.*

Keywords— ***Assertiveness, Technology, Leader's behaviors, intangible assets.***

I. INTRODUCTION

Since 2011, the Cuban business system has been going through a new stage of transformations that among other purposes, seek to unleash old ties, grant greater powers and achieve more efficiency and organization. Like any change process, it has not been without complexities, successes and misadventures. The government's top direction led to a diagnostic in the main organisms of the state in order to know the deficiencies, their causes and measures to solve them. Also, changes that consider organizational transformations to be complex processes and that need to be studied and implemented gradually were made.

In Cuba, the expanse of information science has achieved a development in the use of information technology spreading in the business world; this technology has become an inevitable part of working life. The studies associated with the influence of technology on the leaders appropriate the work contributed by various models and theories. Such is the case with the Unified Theory of Adoption and The use of technology (UTAUT) which is the latest model that has been designed to understand the nature of use of technology. Leaders in organizations are not exempt from this influence but on the contrary technology has been the most effective steering tool that they can use in the exercise of their profession.

The change of economic paradigm requires adopting a new strategic perspective, where it must identify and manage those resources and innovation capacities that make it sustainable over time (Borrás F. 2015). In the knowledge economy, these resources and capacities will be - basically - of an intangible nature, delimiting the potential of the organization (Piekola H. 2020). It is necessary to know the relationship of influence between the use of technology and assertive leadership Cuesta-Santos A., Fleitas-Triana S., García-Fenton., Hernández-Darias, Anchundia-Loor A., Mateus-Mateus L. (2018), because both variables constitute intangible assets that are

necessary to manage in the organization (Brookings A. 1996; Cuozzo B., Dumay J., Palmaccio M. (2017). If the institution is able to properly manage the technology and its relationship with the assertive behavior of the leaders, then the management of these intangible assets will provide greater efficiency and effectiveness in the management of the company (Alhabshi, S.M., Rashid, H.M.A., Khadijah Syed Agil, S. and Ahmed, M.U. 2017).

Intangible assets such as technology and leadership have been studied with the intention of knowing their effect on the productivity of companies' work. Roth F. (2020) found a significant relationship between labour productivity growth and the effect of intangible assets on ledgers. The company's added value increases and becomes a source of productivity growth (Vanderpal G., 2019, Cuesta A. 2014; Ferdaous, J. and Rahman, M.M. 2019; Shaper S., Nielsen Ch., & Roslender R. 2017).

Therefore, it is necessary to determine whether technology influences the assertive behaviors of leaders, and whether the style of indirect assertiveness is common in the behavior of leaders, with email, chat and the Internet being one of the main tools that make the results of the work more efficient. The objective of this study is to know whether the leaders of the Cuban financial institution whose purpose is to seek the greatest economic efficiency through the management of their intangible assets, are being influenced by technology, and whether they have developed styles of indirect assertiveness, or if they exert a direct assertiveness in their relationship with employees.

The growing progress of technology in the world has generated new ways of acting and perceiving human relations, and Cuba has not been exempt from it. Despite the emerging development of technology compared to highly developed countries, it can be said that yes, they are present in industrial relations.

The use of a mobile phone to receive and make calls, email and financial and accounting computer systems typical of the Cuban banking system, show the existence of a relationship by bank leaders regarding technology in the exercise of management. It is common to use email to give and receive guidance and cell phone to develop work issues, other actions such as video online conferences or meetings with leaders throughout the national territory take place today. From which the research question arises: How technology influences the assertiveness of leaders and their development. Taking into account international experiences, empirical research focuses on the diagnosis of the assertiveness of the leaders in their work.

The literature review shows that human factors are related to the use of technology, which is why the attitude to the use of technology is recognized as a factor to be studied in the labor organization. In behavioral science, assertiveness is conceived as a social skill that has a kind of attitude or willingness to express desires and defend rights. Indirect assertiveness is recognized by the ability to express desires and defend rights using other indirect channels such as traditional telephone, cell phone, email or postcard, chat, or other. The leader’s assertive behavior tends to be necessary for the exercise of direction and for the relationship with subordinates. Also, the use of technologies has become a daily and necessary activity for leaders in the labor organization.

The Cuban banking system has no scientific research to provide information on how technologies are influencing the behavior of leaders. In addition, what are the most common attitudes regarding the use of technologies? The relationship between the assertive behavior of leaders and the use of technologies is unknown. Both variables are intangible assets that deserve to be properly managed, because they create value in the organization.

The considerations referred to above demand an investigation that solves the following scientific problem: There is a lack of scientific evidence in the Cuban population demonstrating how assertive behavior is developing, based on the subject's interaction with new technologies. To do this, it is necessary to know: ¿How technologies are influencing the assertive behavior of leaders?

H1 The use of technology is positively related to assertive behavior

H1.2 The use of technology is positively related to indirect assertive behavior

H1.3 The use of technology is positively related to non-assertive behavior

H0 The use of technology is not positively related to assertive behavior

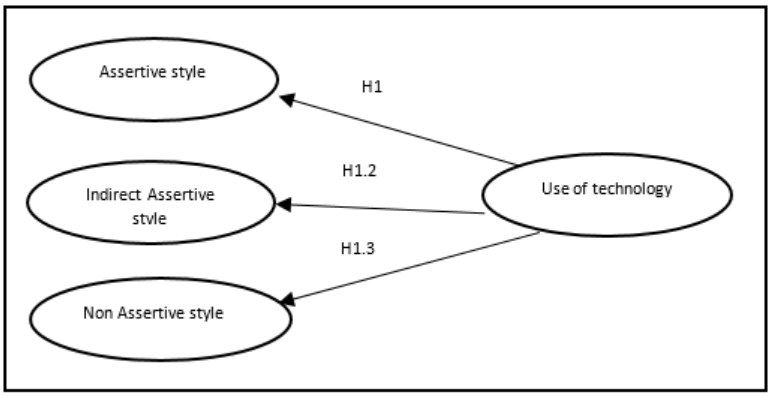


Fig.1: Research hypothesis.

source: own elaboration

1.1 Theoretical framework: Assertiveness in leaders

The changes that occur in the Cuban socioeconomic model at present have a significant impact on their labor organizations. This new scenario calls for a greater role of executives and workers in the sense of adopting different ways of acting and managing the processes of working life.

The conception of assertiveness from the perspective of labor organizations has as its premise the analysis of the labor organization as a system, characterized by its complexity, constant transformation and exchange with its variables and subsystems, that make it bear their own identity and which in turn guarantee their development and stability over time (Andrey D. 2019).

The professional role of the leader increasingly demands creative and proactive behavior in the interests of being more efficient in the search for solutions, hence assertiveness constitutes an essential social skill for performance in the organization (Manesh, R. S., Fallahzadeh, S., Panah, M. S. E., Koochehbiuki, N., Arabi, A., & Sahami, M. A. 2015). Being assertive, operating with emotional intelligence, having communication and leadership skills, is today a demand at work, not only for those who serve in management positions, but also for all workers (Allahyari1 B., Jenaabadi H., 2015).

Assertiveness begins to play an important role, recognized as one of the most outstanding and common skills to positions within the organization. The term assertiveness appears as an objective form of assessment of employment skills, becoming in many cases a form of unity of competence, which is necessary for the successful performance of a worker or manager, as well as for the selection of staff for their tangible character, within Human Capital Management (Manesh, R. S., Fallahzadeh, S., Panah, M. S. E., Koochehbiuki, N., Arabi, A., & Sahami, M. A. 2015; Shafer A. Ortiz R, Thompson B., Huemmer J. 2017).

It is then considered that the more complex the functions of a given position are, the greater the need to be assertive. For the organization, having assertive people ensures superior performance, not only from a human point of view but from its operation in general, so that the different systems that make up it achieve a better articulation, and impact positively in the quality of work. That is why it is essential to train assertive skills in the employees (Valliammal Sh.et al 2017).

Assertive behavior develops when there is an understanding or awareness of the need to change established standards in the organization, which can impair the success of the task and brings to affect efficiency and results (Maloney M., Moore P. 2020). Acting assertiveness provides the possibility to seek solutions and communicate it.

Assertiveness occupies an important place in teamwork, ensuring the achievement of common goals, an anxiety-free working climate in which its members can freely express their personal opinions, counter disagreements socialize and diminish complacency that reinforces a personal and individual stance, above the collective's decisions. The development of assertive behaviors when working in a group, exchange and development meetings, allows achieving better established objectives and better consolidated strategies (Manesh, R. S., Fallahzadeh, S., Panah, M. S. E., Koochehbiuki, N., Arabi, A., & Sahami, M. A. 2015; Ames D. Flynn F. 2007).

1.2. Theoretical approaches to the concept of assertiveness

The word assertiveness has its origins in the word Assert, which according to the dictionary of the Royal

Spanish Academy means: To declare or affirm positively, with certainty, with simplicity and force; the word assertiveness is derived from the Latin asserere, assertum; which still means affirming. So assertiveness means affirmation of one's personality, self-confidence, self-esteem, aplomb, safe and efficient communication. (Zaldivar D., 2002; Dinçyürek S., Güneyli A., Çağlar M. 2012).

The origins traditionally attributed to the study of social skills fall on the work of Salter (1949), related to the development of Conditioned Reflections Therapy, which was recognized for the development of techniques to increase expressiveness in the individual. (Alberti, R., & Emons, M., 1970; Zaldivar D., 2002; Ames D., Lee A. Wazlawek A. 2017).

The first researcher to use the term assertive behavior was Wolpe (1958). The studies carried out in this field were followed by the works of Lazarus (1966), both of which developed research on assertive behavior promoting the use of this word. But it wasn't until the publication of Alberti and Emmons' book "Your perfect right" that the term was popularized among the scientific community of the time (Alberti, R., & Emons, M. 1970).

The definition of assertiveness has been conceptualized by various authors: Wolpe (1977), Lazarus (1966), McFall y Lillesand (1971), Libet y Lewishon (1973), Lange y Jakubowaki (1976), Rich y Schroeder (1976), Mac Donald (1978), Carboles (1979), Walter Riso (1988), Rimm y Master (1990), Zaldivar D. (1994), Caballo (1995), L. Sánchez (2000), Flores, G. M. & Díaz-Loving, R. (2002), Pérez Pincheira R. (2007); have made their considerations based on a certain characteristic of assertiveness. The definition of assertiveness is related to behavior that allows decreased anxiety and defense of personal rights (Aktop A., Özçelik M., Kaplan E., Aeferoğlu F. 2015). Kim Y., Lee E. & Lee H. (2019) offers some light on the differences in assertiveness between men and women in unsafe situations. For the author the assertiveness is the personal capacity expressed through behavior, which guarantees the open expression of desires, intentions, it is the defense of personal rights and feelings without anxiety.

Assertive people tend to use of negotiation to achieve successful social interactions. That is why communication is one of the indispensable ways or tools for assertiveness to be expressed, so it is the type of communication that determines whether the individual managed to be assertive or not with his interlocutor (Andrey D. 2019). They are also characterized by the intention of achieving communication that satisfies the need to express ourselves (Guo, W., Li, T. and Wu, N. 2015).

Communicating effectively is a basic requirement to get the desired answer from our interlocutor, that is why it is necessary to improve communication as a mode of expression of assertiveness and stimulate or train it using positive thoughts (Hamidi F, Otaghi M, Paz FM. 2020). Assertive communication offers a broad opportunity for human well-being. Leaders can use it to visualize scenarios where the best job and personal performance is achieved (Manesh, R. S., Fallahzadeh, S., Panah, M. S. E., Koochehbiuki, N., Arabi, A., & Sahami, M. A. (2015).

Assertive communication is essential to develop a good exercise in leadership. The exercise of management involves structuring styles of behaviors that ensure the success of the fulfillment of the goals of the group, of the task for which it was designated and for which it is responsible (Guo, W., Li, T. and Wu, N. 2015); Oana, J., & Ionica Ona, A. 2019).

One of the ways that bring us closer to achieving this goal is the use of assertive styles in the direction and in trading in companies. If as leaders of organizations we do not defend our wishes, rights, work needs, the common objectives within the group will not be achieved, the guidance and direction of that group will be lacking. That's why one of the features a manager should have is assertiveness. The role of communication for the exercise of leadership in decision-making is recognized. Assertive communication is important to gain greater knowledge of subordinates and a better management exercise (Guo, W., Li, T. and Wu, N. 2015); Oana, J., & Ionica Ona, A. 2019).

Assertive leadership is based on the transformation of those behavioral styles that limit the development of skills and attitudes in the leader. It's about the leader being able to achieve greater capacity for change, greater flexibility to understand others and themselves, as required by the organization. As well as accepting and transforming institutional and own constraints (Guo, W., Li, T. and Wu, N. (2015).

It is necessary to catalyze the processes stagnant by the poor decision-making or immobility caused by the exercise of management. The leader must be able to express his mistakes, limitations and successes to others without fear. Maintain self-esteem and achieve their professional and personal realization (Zaldivar D. 2002; Ames D. 2009).

The studies carried out by Díaz-Guerrero (1972 - 2006), highlight that cognitive and personality development is obtained as a result of a constant dialectic between the bio-psychic individual and his sociocultural field. Other authors such as Flores M. (2002); Diaz-Loving

R. (2019); Henderson, M. and Furnham, A. (1983), take these postulates into consideration and analyze assertive behavior in different fields and cultures. In addition, they determine that some factors influence assertiveness, such as: sociodemographic variables, personality variables, the person in interaction, the situational context and the psychological context (Díaz-Loving R. 2019).

At this point Henderson, M. and Furnham, A. (1983), define that assertiveness is influenced by the culture in which the individual develops, by the situational and psychological context. In addition, by the people involved in social interaction and by personality. In addition, Flores Galaz, M., & Díaz-Loving, R. (2004) recognizes three types of assertive behavior styles.

The assertive style is when the person is able to express their limitations, feelings, opinions, desires, rights, is able to give and receive praise, make requests and handle criticism. He's a socially qualified individual. Indirect assertive style is the person who has no ability to say or express himself openly, it is difficult to have direct face-to-face confrontations with other people in everyday or work situations whether with family, friends, bosses and co-workers, so it is seen in the need to express their opinions, desires, feelings, requests, personal limitations, say no , give and receive praise, and handle reviews by indirect means such as letters, phone, cell phone, email, video calls, chat or others. The non-assertive person is one who does not have the ability to express his desires, opinions, feelings, or praise. Has limitations for initiating interaction with others, and for handling criticism (Flores Galaz, M., & Díaz-Loving, R. 2004, Cortés ML., Góngora E. 2009).

1.4. Technology UTAUT Model

Leaders make use of technologies to develop steering activity. In their performance, the leaders communicate with the subordinates through e-mail or through the mobile phones in order to speed up the communication processes and reduce the waiting times of the feedback (Dwivedi Y., Nripendra P., Jeyaraj A., Clement M., Michael D. 2017). This has become the last few times in a daily practice, as it is a common interest in labor organizations to achieve greater efficiency in work, and the use of technologies offers that opportunity for leaders (Sekyere A. 2016).

Recent research in the educational area has demonstrated the advantages of using technologies to achieve greater competitiveness and levels of management and performance (Yong Liu. 2015; Attuquayefio S. Addo H. 2014). They also recognize that expectations, social influence and willfulness or intention in the use of technology have a direct impact on student performance (Ukut, I.I.T. & Krairit, D. 2019; Arif M., Amen K. 2018). This idea can be easily extrapolated to the area of organizations, because phenomena develop with similar characteristics.

Technology can be seen as an effective driver for work. The fourth industrial revolution, eminently technological, is also a revolution of values expressed through the assertive conduct of leaders (Idorenyin T. 2019; Arif M., Amen K. 2018). What we need today are assertive leaders who not only understand the complexities of technology, but also use this technology assertively to promote further development within the organization (Sarfaraz J. 2015).

The UTAUT model explains the acceptance of the technology and is based on eight theories or models of acceptance. The UTAUT is based on the Theory of Reasoned Action (TRA), the Technological Acceptance Model (TAM), the Motivational Model, the Theory of (TPB), the combined TAM and TPB, the Personal Computer Utilization model, Theory of the dissemination of innovation and social cognitive theory. (Venkatesh, Viswanath, Michael G. Morris, Gordon B. Davis, and Fred D. Davis 2003; Kuciapski M. 2017; Thongsri N., Shen L., Bao Y. Alharbi I. 2018; Rahi S., Othman M., Alghizzawi M., Mi Alnaser F. 2019).

The model requires a socio-psychological analysis of the relationship between the user's perception of technology and the behavior of acceptance or rejection (Apostolos G., Costas A., Christos S. 2019). It is important to study the characteristics of the subject's performance expectations and the degree of social influence to which the subject is exposed and the conditions of the environment to facilitate access to technology. These variables in offer a gradient of acceptance or rejection of the use of technology that is valid for studying (Goswami A., Dutta S. 2016: p. 52; Troy Devon Thomas, Lenandlar Singh & Kemuel Gaffar. 2013).

Many authors have found significant relationships between performance expectation, resistance to innovation and social influence, with respect to the actual use of technologies (Moghavvemi S., Mohd N., Standing C. 2016). These variables are considered the main determinants of adoption intentions. However, other authors have analyzed other components associated with the individual and recognized the role of human attitudes in the process of adopting technologies (Dwivedi Y. et al 2017).

The factors that make up the model have been as follows:

Performance Expectation is understood as the percentage in which a subject considers the information system to be a key factor for successful performance.

Second, the expectation of effort is considered as the comfort or ease that information systems are associated with social influence relationships and or communication with people. Social influence represents the type of perception a subject manifest about the positive assessment of the use of the system in others and their positive attitude of use. On the other hand, the condition of facilitation is understood as the value of the subject about the existence of a logistical infrastructure to support the use of the system. And finally the behavioral intention based on the disposition or attitude of a subject to develop a type of motivated behavior (Goswami A., Dutta S. 2016; Troy D. et al 2013; Venkatesh, Viswanath, Michael G. Morris, Gordon B. Davis, and Fred D. Davis 2003; Lwoga, E.T. and Komba, M. 2015; Khatun F., Palas MU, Ray PK. 2017).

Recent research in this field has used the UTAUT model to learn about behavioral trends related to the use of technology. These studies have made significant inferences regarding the influence of perceived credibility with respect to the intent of the use of technology. Even, with its relationship with the female genus (Kriti Priya Gupta, Rishi Manrai & Utkarsh Goel. 2019; Goswami A. 2016). Others explain the relationship between Internet trust and performance expectations, as predicting indicators of the intent to use the technology (Mansoori K.A.A., Sarabdeen J., Tchantchane A. 2018). Psychological empowerment has also been found to influence the intent of electronic participation as a form of social interaction (Naranjo-Zolotov M. Oliveira T., Casteleyn S. 2019).

These studies show the autonomy of the subject with respect to the use of technologies, as well as the possibility of selecting applications that reveal a personal intention. Apparently the intent of use occurs more often in young people, so age is an aspect to consider (Kuciapski M. 2017; Sobti N. 2019). This provides lights that allow to establish relationships between indirect assertive behavior characterized by the expression and defense of rights and desires through indirect channels such as telephone, cell phone, email, postal letter or others. These indirect channels do not contain a face-to-face intent with the other subject, so the use or attitude to new technologies could open up a possibility to stimulate the emergence of indirect assertive behaviors in subjects.

The model has been studied by several authors and the results have not been coincidental in establishing the relationship between attitude towards technology and its impact on behavior (Isaias, P., Reis, F., Coutinho, C. and Lencastre, J.A. 2017). Positive influence has been shown between performance expectation and effort on attitudes. The influence of personal rules on the intent of actual behavior and behavior has also been demonstrated (Maity M., Bagchi K., Shah A., Misra A. 2019). The UTAUT model is useful for predicting the use of systems and making decisions related to technology adoption. The UTAUT model has had followers and detractors, and has received criticism about its effectiveness. However, it provides a possible scenario for studying the human behaviors associated with the use of technology, which is very useful and necessary (Serife Nur Yildiz, Alev Ates Cobanoglu, Tarik Kisla 2020; Troy D. et al 2013; Ayman A. 2014).

II. METHOD

The research methodology used for the determination of specific hypothesis and sub hypotheses was realized using the scientific inquiry scheme commonly used by authors studying assertiveness.

Non-experimental, descriptive transactional research is performed. We chose non-experimental research design because it allows us closer to hypothesized as real variables. The research that the program is based on a metal transactional design. It is a descriptive study as it establishes descriptive hypotheses. The universe for determining the size of the sample was composed of all the dependencies of the institution under study.

The population in our study was composed of leaders of the institution specifically of the middle managers. 258 leaders were selected. This population is chosen to know the degree of assertiveness and the predominant response styles in their interpersonal relationships, so that research contributes to the development of social skills applied to the exercise of leadership.

Probabilistic sampling was used to minimize the standard error. It has as advantages that all the elements of the studied population have identical possibilities to be selected. On the other hand, it should be noted that the values obtained in the sample are very similar to those of the population. For the selection of the probabilistic sample we use a simple random sampling; to calculate the size of the sample under study was proceeded as follows:

Calculation of sample size:

P= 99%

e= 0,01

N= 258

$$S^2 * p\,(1-p) = 0.9\,(1-0.9) = 0.09$$

$$V^2 * e^2 = (0.02)^2 = 0.0004$$

$$N^2 = \frac{0.09}{0.0001} = 900$$

$$n = \frac{n'}{1+n'/N} = \frac{900}{1+(900/258)} = \frac{900}{1+15,51} = \frac{900}{4.48} = 200.89 = \mathbf{201}$$

N: population size, n: subset of population, S: standard error, estimated by us, V2: population variance, its definition (Se) squared error.

The procedure for determining the sample is the systematic selection of sample elements. To apply the systematic selection procedure for sample elements, it is necessary to calculate the selection interval. The K value will depend on the size of the population and the sample. Two types of research sources were used to conduct research: Primary Data Source: Interview with institution leaders to classify the degree of assertiveness and build the groups: Assertive, Non-assertive, Indirect Assertive. Application of the EMA test, to diagnose the type of assertiveness of the subjects. Interview, to know the access that the leader has to the technology and what is the most used channel to communicate with subordinates: mobile, email, chat, video call or other.

Taking as a reference the UTAUT model, aspects of the original questionnaire were taken and an evaluation guide was prepared with the aim of knowing the degree to which leaders use technology in their work. The evaluation guide was provided by the experts who evaluated each of the leaders and ranked them into three groups. First, those who had a high degree in the use of technology, defined by a daily frequency. A second group that is classified as a middle degree. The frequency of use of the technology was at least three days a week. A third group classified as a low, with a frequency of use of technology to interact with subordinates, consisting of once or never a week. The degree of use of the technology was classified on an ordinal scale of 1 to 5, to determine whether the subjects possessed the attribute.

Experts analyzed the expectation of performance, understood as the degree to which a person believes that using the technology would help them achieve gains in job performance. They also assessed the expectation of effort, understood as the degree of ease associated with the use of technology and its social influence on workers. Three other traits were analyzed by judges as the degree to which leaders perceive other important people to believe they should use technology. Also, evaluate the condition of facilitation, which is only the degree to which a person believes that there is an organizational and technical infrastructure to support the use of technology. In addition, the behavioral intent of leaders known as an individual's willingness to perform particular behavior. All these aspects were evaluated by the expert judges according to the UTAUT questionnaire, Cronbach Alpha's Alpha was calculated to confirm the internal consistency of the question guide for each model factor.

Then the weight matrix was formed. Using Kendall W status, and the goodness of the W coefficient that allows to obtain the level of concordance of the judges between 0 and 1. Considering that the value 1 means a total criterion match and the value 0 means a total disagreement, concordance was obtained among the experts of 0.8.

After summarizing the responses from both data sources, the mean value was calculated and the hypothesis test determined using Spearman's Rho coefficient for non-normal data. Since, the answers in a questionnaire are not directly related to the average values of the evaluation carried out by the experts. To contrast the hypotheses a correlation coefficient of 0.195 was obtained and the significance of 0.015, that demonstrates a significant correlation according to the scale estimates. In addition, a significance level of 0.05% was taken as an acceptable value. The null hypothesis H0 is rejected, which explains that: The use of technology is not positively related to assertive behavior, so we can conclude that it is possible to work with the hypothesis H1: The use of technology is positively related to assertive behavior.

Subsequently, the correlation and relationships between the variables were determined by the contingency tables and the Coefficient Rho Spearman.

III. RESULTS

The sample under study was characterized by being predominantly female at 71% with an average age of 39 years. The ethnic composition had 69% belonging to the white race, 14% of the black race and 17% of the mestizos. 74% of the sample corresponds to the University school level, 24% is average technician and 9% is the Higher Middle level. The expert judges' approach was obtained from the application of the peer-to-peer comparison method.

Managers of the institution under study were interviewed, who had the responsibility to classify the leaders (subjects of the investigation), according to the criteria outlined in this work, in three groups: high degree in the use of technology to communicate with its employees, the average degree in the use of technology, up to three times per week, and the low degree of use of technology. The value of 1 was used to define low degree of use of the technology. Values of 2 and 3 were used to define the average degree of use of the Technology, and values of 4 and 5 to represent the high degree of use of the technology. The results obtained in the application of this method are detailed as follows.

A pair of expert judges were compared to see if leaders make use of technology in their relationship with their employees. An internal consistency analysis was carried out on the modified UTAUT questionnaire to determine whether the questions asked measure what they

are intended, and whether they are perfectly understood by the judges.

For each factor a high reliability Cronbach Alpha was obtained. The Performance Expectancy factor got a value of 0.910 for a total of 4 items evaluated. The Effort Expectancy factor obtained a coefficient of 0.918 through 4 items evaluated. The Social Influence factor reached a Cronbach Alpha of 0.745 and was evaluated by 3 items. The Facilitating Conditions factor was worth 0.792, and was evaluated by 2 items. The Behavioural Intention factor reached 0.731 and was evaluated by 3 items.

Out of a total of 201 subjects who made up the sample; 194 subjects were identified with a high degree of use of technology according to the judges. In the category average degree of use of the technology were cataloged 4 leaders and in the low degree only 3 leaders.

The reliability coefficient Alpha de Cronbach obtained 0.78 in the Multidimensional Scale of Assertiveness EMA test indicates that the test is reliable, corresponding to the default value as a high reliability indicator The internal coherence of the questionnaires is adequate, demonstrating that each question contributes significantly to the variable to be measured and that the questionnaire is consistent.

The diagnosis made with the Multidimensional Scale of Assertiveness, EMA, showed that the 98.5% of leaders develop styles of assertive behavior. Scale scores were found within normal in linear T-scores of 40 to 60 on average, set by Flores Galaz, M., & Díaz-Loving, R. (2004). Only 5 leaders scored on the scale within the average range, the rest of the scores were found above average. This diagnosis shows that leaders tend to behave assertively in their relationships with their employees.

An Indirect assertive behavior style diagnosis was obtained for 3.7% of leaders. The scores obtained by the leaders are within the average range. This shows that subjects with above-average scores 40-60 develop indirect assertive styles in the relationship with their employees through letters, emails, cell phone or other indirect means of communication. Below-average scores found in this style indicate that subjects are assertive and do not use indirect means to express feeling desires or defend personal rights.

The results of the diagnosis of indirect assertiveness correspond to the findings of Flores M. (2002) and Díaz-Loving R. (2019), assuming that indirect assertiveness is more common in Mexicans than in Cubans, where assertive style is the most common in the Cuban population.

With a non-assertive diagnosis only rated 1.8% and this result was within the average range of 40 - 60. This shows that leaders develop non-assertive styles in the relationship with their employees, although being scored on average, it indicates that this style of behavior is not fully accentuated.

In order to know if the variable, Use of technology is related to Assertiveness, Spearman's correlation coefficient was used and Contingency Tables were also used.

IV. DISCUSSION

The analysis of the contingency table carried out showed that there is a significant relationship between the two variables studied. The relationship between assertiveness and low degree of use of technology reached 9.3%. The relationship between assertiveness and the average degree of use of technology showed a percentage of 18.5. The relationship between the high degree of use of technology and assertiveness showed a percentage of 68.5%. It is confirmed that there is a positive relationship between assertiveness and high degree of use of technology. See Table 2

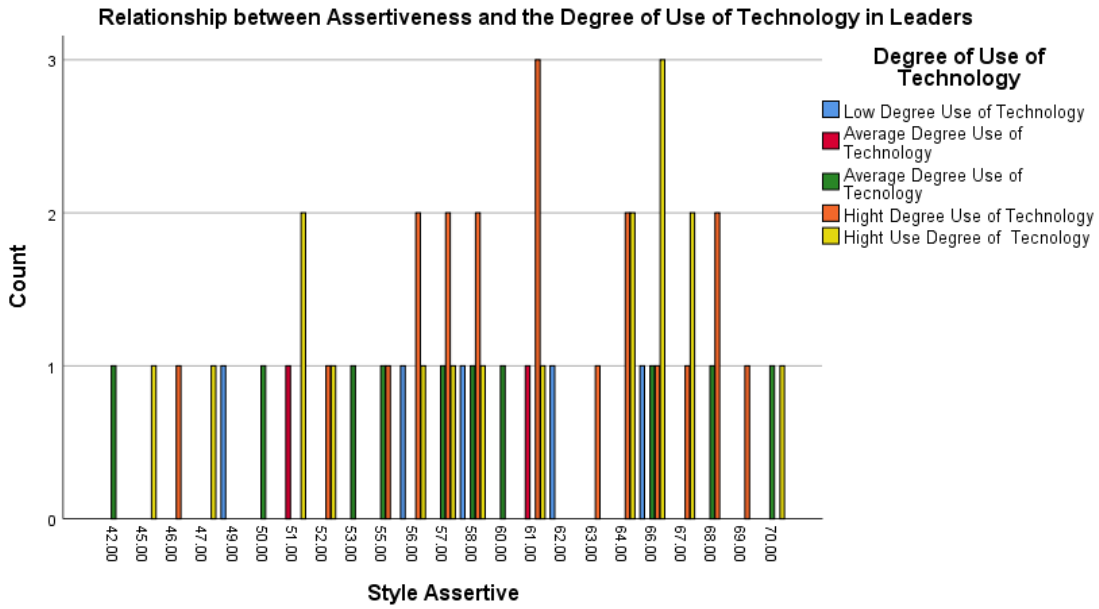
Table 2 Relationship between assertiveness in leaders and the Degree of Use of Technology
Contingency Table Assertiveness *Degree of Use of Technology

		Low Degree Use of Technology	Average Degree Use of Technology	Average Degree Use of Technology	High Degree Use of Technology	High Use Degree of Technology	Total
Assertiveness	Count	5	2	10	20	17	201
	% of the total	9.3%	3.7%	18.5%	37.0%	31.5%	100.0%

Graph 3 represents the relationship between the Technology Degree of Use variables and the Assertive style. It is clear that leaders who develop assertive behaviors tend to use technology to a high degree. It is also noted in the graph that the leaders studied have a medium and low degree of use, which means that they do not use technology as often for their working relationships with employees. It can be concluded that the three degrees of use

are present, although in greater percent the high degree of use of technology. See graph 3

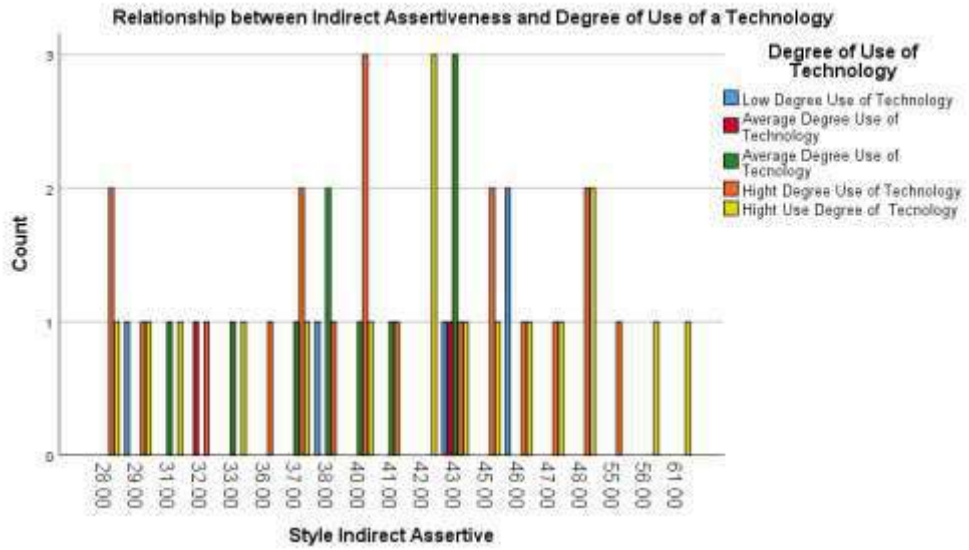
Graph 3. Contingence table result, Assertiveness variables and Degree of Use of Technology



In the case of Cuba, that the use of technology does not yet reach the levels of other countries in the region, we consider these findings to be interesting, since they allow to draw strategies that warn of the need to stimulate the use of technology in the leaders. The study found that technology, being related to assertive behavior, stimulates the expression of feeling desires, and defends personal rights in employee relations.

Graph 4 describes the behavior of the Indirect Assertive style with respect to the Degree of Use of Technology. In this respect, a higher percentage ratio of variables was found in the average degree of technology use. Although they are also present the high degree, and low use of technology. Indirect assertive leaders scored above the linear 40 T value of the scale, where it is reaffirmed that they possess the indirect assertive style. Leaders below this average do not possess this indirect style. Note that leaders below average 40 with assertive styles gained the highest percent in the High Degree of Technology Use. See graph 4

Graph 4. Contingence table result, Indirect Assertiveness variable and Degree of Use of Technology



Spearman's Rho coefficient was used to establish the positive and negative correlation between the variables studied. With the use of this coefficient, the correlation between the variable Degree of use of technology and Assertiveness style, Indirect Assertiveness style, and Non-Assertiveness style could be found.

Table 5 details the values obtained. Analyzing the significance level, the correlation is significant at level 0.05, bilateral. The values are below the estimated range, which shows that there is correlation between the variables. See table 5.

Table 5 Spearman correlation. Relationship between variables, assertiveness and degree of use of technology

Correlation

			Style Assertive	Style Indirect Assertive	Style Non Assertive	Degree of Use of Technology
Rho de Spearman	Style Assertive	Coefficient de correlation	1.000	-.293*	-.103	.195
		Sig. (bilateral)	.	.031	.045	.015
		N	201	201	201	201
	Style Indirect Assertive	Coefficient de correlation	-.293*	1.000	.032*	.141
		Sig. (bilateral)	.031	.	.016	.018
		N	201	201	201	201
	Style Non Assertive	Coefficient de correlation	-.103	.032*	1.000	.179
		Sig. (bilateral)	.045	.016	.	.017
		N	201	201	201	201
	Degree of Use of Technology	Coefficient de correlation	.195	.141	.179	1.000
		Sig. (bilateral)	.015	.018	.017	.
		N	201	201	201	201

*. The correlation is significant at level 0.05 (bilateral).

Low positive correlation was found between the Degree of Use of technology with respect to assertive style, as the correlation values obtained are 0.195. In addition, 0.141 of positive correlation was obtained between the Degree of Use of technology and the indirect assertiveness style and, 0.179 of correlation between the Degree of use of technology and the non-assertive style.

In relation to the assertive variable and assertive style, indirect assertive and non-assertive, significant correlation was found. For example, a negative correlation of -0.293 was obtained between indirect assertiveness style and assertive style. A negative correlation of -0.103 was also found between non-assertive style and assertive style.

Significant correlation was found in relation to assertive variable, assertive style, indirect assertive style, and non-assertive style. For example, a negative correlation of -0.293 was obtained between indirect assertiveness style and assertive style. A negative correlation of -0.103 was also found between non-assertive style and assertive style.

V. CONCLUSION

A low positive correlation was found between the Degree of Use of Technology and Assertiveness, with values close to zero 0.195 observed when Spearman's Rho correlation coefficient was applied. In addition, a significant correlation of the assertive variable and assertive style, indirect assertive style and non-assertive style was found. Indirect assertive style and assertive style showed a negative correlation of -0.293. The non-assertive style and assertive style showed a negative correlation of -0.103. The above confirms that the variables are correlated.

The study used as a reference the adapted questionnaire of UTAUT Model, confirms that there is a positive relationship between the Degree of use of technology and the assertive behavior of the leaders. The three degrees of use of High, Medium and Low technology are present in the leaders, although in greater percentage the high degree of use of the technology.

The objective of this study was to identify the influence of The Use of Technology on assertive behavior, very often used by leaders in the exercise of management. In applying the EMA Multidimensional Scale of Assertiveness, largest percent of leaders develop the style of assertive behavior.

Leaders working in work environments where the use of technology is high developing an assertive behavior in their relationship with subordinates, finding that social factors have a significant effect on the behavioral intent in terms of interaction.

For future research it is suggested to use other Cuban financial institutions as primary data sources with similar characteristics. As limitations of this study it is recognized that the number of managers of the financial institution studied is less than the total number of workers, so it is complex to expand the sample within the same institution, so it would be advisable for leaders of other Cuban financial institutions to participate in the study.

To deepen the relationship between the variables studied, factorial analysis can be used to analyze each factor of the UTAUT Model, and include the attitude variable studied by Troy D. et al (2013) and Dwivedi Y. et al (2017) as contributions of the model. Also, contrast it with the assertive behavior of leaders. This analysis might reveal which of the factors in the model directly affect assertive behavior. This would allow new inferences about the relationships between the Use of Technology and the Assertive behavior of leaders.

The study analyses the behavior of intangible assets in modern enterprise and the peculiar way in which they manifest themselves in practice. They are considered in their grouped form and in context. It confirms that the study of intangibles assets such as leadership and technology can be important management axes in the organization. At present, the relationship between assertiveness in leaders and their relationship to the use of technology has not been thoroughly studied, so the contributions of this work offer lights that may be interesting for the practical management of these intangibles' assets. By the nature of the numbers, which are used to respond to an ordinal scale, for the measurement and evaluation of these intangibles assets, the results become theoretical approximations which constitute research findings.

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Analysis Industrial Robot Arm with Matlab and RoboAnalyzer

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Abstract— *The industrial robot arm to be analyzed is the Motoman K10S, with configuration has 7 parts, namely Base, Rotary Head, Lower Arm, Upper Arm, Wrist Roll, Wrist Pitch Yaw, and Wrist Twist. The first joint connects the Base section with the Rotary Head (joint range of 340º or ± 170º). The second joint connects the Rotary Head section with the Lower Arm (joint range of 240º or ± 120º). The third joint connects the Lower Arm section with the Upper Arm (joint range of 275º or ± 137.5º). The fourth joint connects the Upper Arm section with the Wrist Roll (joint range of 360º or ± 180º). The fifth joint connects the Wrist Roll section with the Wrist Pitch Yaw (joint range of 270º or ± 135º). The sixth joint connects the Wrist Pitch Yaw section with the Wrist Twist (joint range of 400º or ± 200º). Based on the configuration of the industrial robot arm, further kinematic modeling of the six joints and the placement of the coordinate axis on each joint. Forward and inverse kinematic calculations are made in Matlab software. Then with RoboAnalyzer as a robot arm simulator to verify the results of the calculations.*

Keywords— ***industrial robot arm, forward kinematic, inverse kinematic, Matlab, RoboAnalyzer.***

I. INTRODUCTION

Definition of industrial robots is automatically controlled, reprogrammable, multipurpose manipulator, programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications [1]. An industrial robot is a multipurpose manipulator that is automatically controlled [2]: Three or more axes; (Re)programmable: Translations and Rotations, Movement pattern, and Possibly sensor guided; Can be equipped with different end-effectors for industrial applications: Gripper, Tools, Sensors, etc. Basically, the main components of an industrial arm robots are designed to refer to existing standards as shown in Figure 1 below. In the picture you can see the Base, Rotary Head, Lower Arm, Upper Arm, Wrist Roll, Wrist Pitch Yaw, and Wrist Twist sections. Base as a holder that will be mounted on the location where the robot is placed. The Rotary Head is a horizontal rotating part (S axis) above the Base, and above the Rotary Head there is a Lower Arm section connected to the joint - Waist (waist) that rotates vertically (L axis). Upper Arm is the part that is above the Lower Arm and is connected by a joint - Shoulder (shoulder) that rotates vertically (U axis).

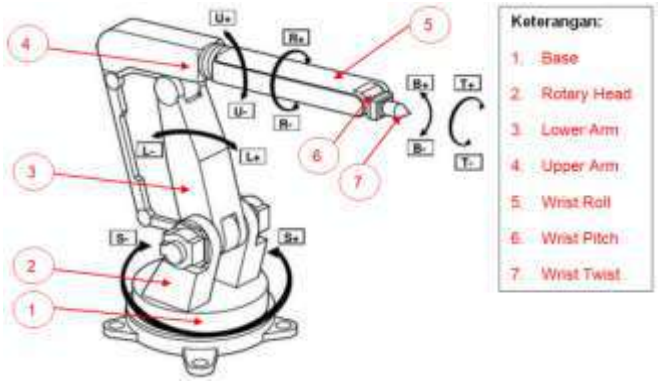

Fig. 1: Industrial Robot Arm Configuration [3]

After the Upper Arm there is the Wrist Roll and it is connected to the joint - Wrist (wrist) which rotates about the axis of the Upper Arm (R axis). After the Wrist Roll there is a part of the Wrist Pitch Yaw and it is connected to the joint - Wrist (wrist) that rotates to the perpendicular to the axis of the Upper Arm (axis B). Then at the very end after the Wrist Pitch Yaw there is a part of the Wrist Twist and it is connected with a joint - Wrist (wrist) that rotates about the upper arm axis of the arm (T axis).

The industrial robot configuration that is designed has 6 joints and the names of each joint and their maximum-minimum limits can be seen in Table 1 below:

Table 1 Joint Robot Arm Rotation Limitation and Direction

No	Joint i	Structur	Max.	Min.	Joint Range	Axis
1	1	Turning	170° (kekiri)	-170° (kekanan)	340°	S
2	2	Lower arm	120° (kebawah)	-120° (keatas)	240°	L
3	3	Upper arm	137,5° (kebawah)	-137,5° (keatas)	275°	U
4	4	Wrist roll	180° (CCW)	-180° (CW)	360°	R
5	5	Wrist pitch/ yaw	135° (kebawah)	-135° (keatas)	270°	B
6	6	Wrist twist	200° (CCW)	-200° (CW)	400°	T

And in Figure 2 and Figure 3 below, you can see the placement of the coordinate axis (frame) at each joint of the industrial robot arm that is designed, as follows:

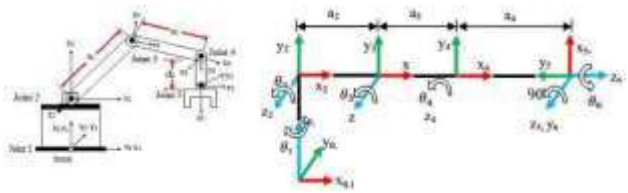

Fig. 2: Industrial Robot Arm Configuration [4]

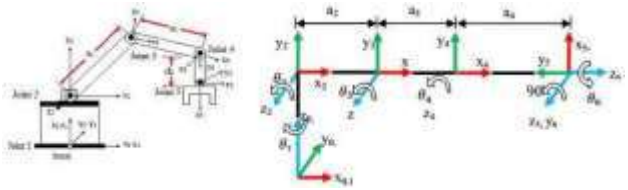

Fig. 3: Robot Arm Construction [4]

II. KINEMATICS MODELING OF INDUSTRIAL ARM ROBOT

To be able to determine the orientation and link position of the robot, kinematic modeling is needed. In robotics, kinematic modeling is a form of statement containing a mathematical description of the geometry of a moving robot structure without considering the force causing it. Based on the forward kinematic analysis, the input reference for each actuator can be determined in the form of an angle so that the robot can make movements to achieve the desired orientation and position. Figure 4 shows the placement of the coordinate axis (frame) on the joint simulator arm robot based on the right hand rule.

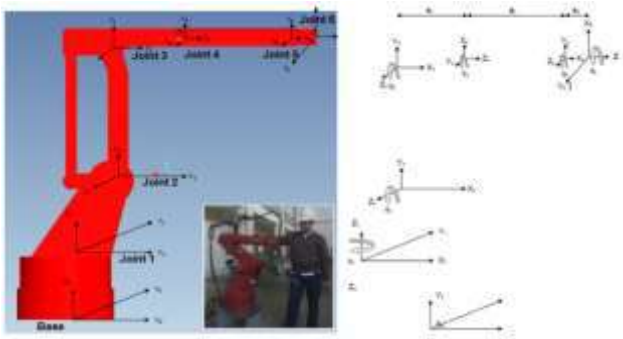

Fig. 4: Coordinate Frames for the Industrial Robot Arm

III. MATHEMATICAL FORMULATION

The robot arm simulator consists of several links and joints. Joints are used to connect any existing links where each joint represents one degree of freedom. To describe the translational and rotational relationships between adjacent links, the Denavit Hartenberg (DH) parameter method is used as a matrix method that systematically builds a coordinate system from each link. Table 2 shows the DH parameters of the robot arm simulator. Based on the DH parameter, then the matrix transformation of each frame coordinate can be determined from link i to i + 1 using the following equation:

$$ {}^{i-1}_{i}T = \begin{bmatrix} \cos\theta_i & -\sin\theta_i\cos\alpha_i & \sin\theta_i\sin\alpha_i & a_i\cos\theta_i \\ \sin\theta_i & \cos\theta_i\cos\alpha_i & -\cos\theta_i\sin\alpha_i & a_i\sin\theta_i \\ 0 & \sin\alpha_i & \cos\alpha_i & d_i \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (1) $$

Table 2 DH Parameters for the industrial Robot Arm

i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0°	0	0	θ_1
2	90°	0	0	θ_2
3	0°	a_1	0	θ_3
4	0°	a_2	0	θ_4
5	0°	a_3	0	θ_5
6	90°	0	0	θ_6

To calculate the forward kinematic, we determine the values a1 = 119 mm, a2 = 119 mm, a3 = 165 mm and a4 = 47.5 mm based on the link length of the robot arm designed, then determine the sampling angle value □i, for example θ1 = 60°, θ2 = 60°, θ3 = 60°, θ4 = 60°, θ5 = 90°, and θ6 = 60°. Furthermore, using the MATLAB software, a matrix transformation equation is obtained which states the orientation matrix and position vector from the base to the end effector as follows:

$$ {}^{0}T_5 = {}^{0}T_1.{}^{1}T_2.{}^{2}T_3.{}^{3}T_4.{}^{4}T_5.{}^{5}T_6 $$

Matriks orientasi | Vektor posisi

$$ {}^{0}T_6 = \left[\begin{array}{ccc:c} -0{,}0000 & 0{,}8660 & 0{,}5 & 28{,}1997 \\ 0{,}0000 & 0{,}5000 & -0{,}8660 & -48{,}8433 \\ -1{,}0000 & 0 & -0{,}0000 & 197{,}8006 \\ \hdashline 0 & 0 & 0 & 1{,}0000 \end{array}\right] \quad (2) $$

To verify the results of the forward kinematic calculation, the RoboAnalyzer software will be used. By entering the link dimensions and angles with the same value when using MATLAB, the following results will be obtained:

$$ {}^{0}T_6 = \begin{bmatrix} 1E-05 & 0{,}8660 & 0{,}4999 & 28{,}1979 \\ -1{,}8E-05 & 0{,}4999 & -0{,}8660 & -48{,}8419 \\ -1{,}0000 & 0 & 2{,}1E-05 & 197{,}8018 \\ 0 & 0 & 0 & 1{,}0000 \end{bmatrix} \quad (3) $$

IV. FORWARD KINEMATICS

The calculation of forward kinematics of the industrial robot arm is carried out either with the help of MATLAB software or with the RoboAnalyzer software for verification. In the early stages, modeling of the robot was carried out, then continued by compiling the DH Parameters (Denavit-Hatenberg parameter) of the modeled industrial robot arm. And the next step is to calculate forward kinematics based on the initial value or the angle of each joint. The steps from this stage are as follows:

The modeling of the industrial robot arm that is carried out is to determine the position of the X-Y-Z axis for each joint, namely from joint 1 to joint 6. And for more details, see Figure 3 above.

4.1. FORWARD KINEMATICS WITH MATLAB

Based on the industrial robot arm modeling that has been done, the dimensions of each robot link can be determined which can be written in Matlab program. Then enter the initial value or the amount of rotation of each joint in radians written in Matlab program. Then it can display the robot in an X-Y-Z graph and calculate forward kinematics written in Matlab program (Figure 5).

```
% Dimension robot
a1 = 0.119; a2 = a1; a3 = 0.165; a4 = 0.0475;

% Create Link using this code
% L = Link([Theta   d    a    alpha]);
L(1)=Link([0 0 0  0]);
L(2)=Link([0 0 0  pi/2]);
L(3)=Link([0 0 a1 0]);
L(4)=Link([0 0 a2 0]);
L(5)=Link([0 0 a3 0]);
L(6)=Link([0 0 a4 pi/2]);
robo=SerialLink(L, 'name', 'Motoman')

% Putaran (initial value) tiap joint [rad]
q1=-0.5137;
q2=-0.5137;
q3=1.7916;
q4=-0.5124;
q5=-1.9537;
q6=-0.8474;

% Tampilkan robot dalam grafik x-y-z berdasarkan inputan sudut tiap joint
robo.plot([q1 q2 q3 q4 q5 q6])

% Forward kinematik dengan inputan sudut tiap joint (q1 s/d q6)
% Tampilkan Homogenous Transformation Matrix
robo.fkine([q1 q2 q3 q4 q5 q6])
```

Fig. 5: Coordinate Frames for the Industrial Robot Arm

And the results in matlab can be seen in Figure 6:

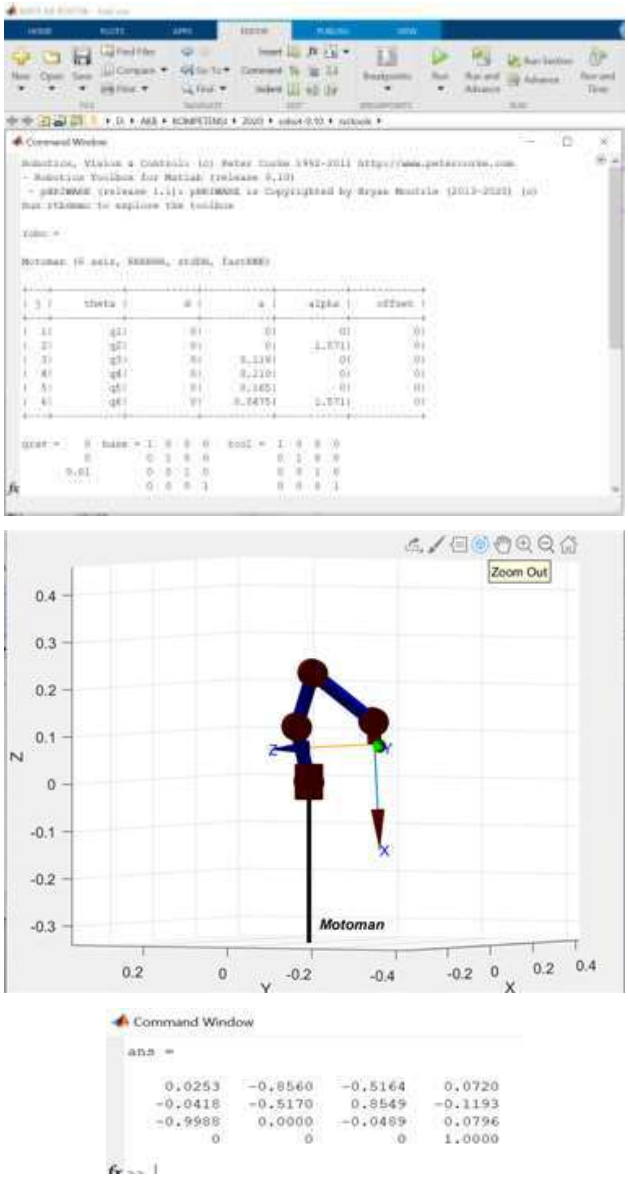

Fig. 6: Result of Forward Kinematics in Matlab

Based on the results obtained above is a homogenous transformation matrix, which contains rotation and translation as well as the position of the end-effector, as follows:

X = 0.0720; Y = -0.1193; dan Z = 0.0796.

4.2. FORWARD KINEMATICS WITH ROBOANALYZER

And in addition to matlab, forward kinematics calculations can be carried out with the help of RoboAnalyzer software for verification and the results can be seen in Figure 7:

Fig. 7: Simulation of Forward Kinematics in RoboAnalyzer

Based on the results of the calculation of forward kinematics using the RoboAnalyzer software above, it can be seen that the end-effector position is:

X = 0.072044; Y = -0.119267; and Z = 0.079601.

V. INVERSE KINEMATICS

In the inverse kinematics calculation of the industrial robot arm, it is carried out both with the help of MATLAB software and the RoboAnalyzer software for verification. In the early stages, modeling of the robot was carried out, then continued by compiling the DH Parameters (Denavit-Hatenberg parameter) of the modeled industrial robot arm. And the next step is to calculate inverse kinematics based on the initial value or the angle of each joint. The steps from this stage are as follows:

The modeling of the industrial robot arm that is carried out is to determine the position of the X-Y-Z axis for each joint, namely from joint 1 to joint 6. And for more details, see Figure 3 above.

5.1. INVERSE KINEMATICS WITH MATLAB

Based on the industrial robot arm modeling that has been done, the dimensions of each robot link can be determined which can be written in Matlab program. Then enter the position of the end effector, which is the translation on the X, Y, and Z axes in mm and the rotation on the X, Y, and Z axes in degrees written in Matlab program. Then the inverse kinematics calculation can be done and display the robot in an X-Y-Z graph written in Matlab program (Figure 8).

```
% Dimension robot
a1 = 0.119; a2 = a1; a3 = 0.165; a4 = 0.0475;

% Create Link using this code
% L = Link([Theta  d    a    alpha]);
L(1)=Link([0 0 0  0]);
L(2)=Link([0 0 0  pi/2]);
L(3)=Link([0 0 a1 0]);
L(4)=Link([0 0 a2 0]);
L(5)=Link([0 0 a3 0]);
L(6)=Link([0 0 a4 pi/2]);
robo=SerialLink(L, 'name', 'Motoman')

% Inverse kinematik dengan inputan posisi x,y,z end effector dan roll, pitch, yaw
qa = robo.ikine(Ta)

figure;
subplot(2,2,1);
% Tampilkan robot dalam grafik x-y-z berdasarkan inputan sudut tiap joint
robo.plot([q1 q2 q3 q4 q5 q6]);

subplot(2,2,2);
% Tampilkan robot dalam grafik x-y-z berdasarkan inputan posisi end efector
roboa.plot(qa);
```

Fig. 8: Matlab Program for Forward Kinematics

And the results in matlab can be seen in Figure 9:

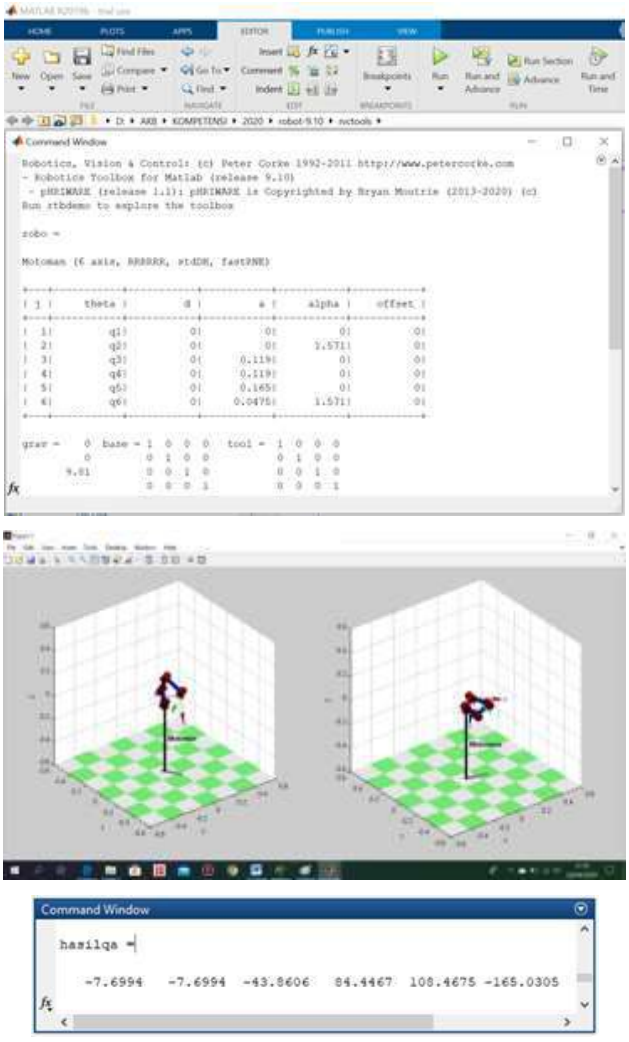

Fig. 9: Result of Inverse Kinematics in Matlab

Based on the results obtained above, the amount of rotation of each joint is in degrees, as follows:

q1 = -7.6994; q2 = -7.6994; q3 = -43.8606;

q4 = 84.4467; q5 = 108.4675; and q6 = -165.0305

V.1. INVERSE KINEMATICS WITH ROBOANALYZER

And in addition to matlab, inverse kinematics calculations can be done with the help of RoboAnalyzer software for verification and the results can be seen in Figure 10:

Fig. 10: Simulation of Inverse Kinematics in RoboAnalyzer

Based on the results of inverse kinematics calculations with the RoboAnalyzer software above, it can be seen that the rotation rate of each joint in radians is:

q1 = -7.6994; q2 = -7.6994; q3 = -43.8606;

q4 = 84.4467; q5 = 108.4675; and q6 = -165.0305

IV. RESULTS AND DISCUSSION

Based on the simulation results of forward and inverse kinematics in Matlab and RoboAnalyzer for industrial robot arm. The results of simulation forward kinematics in RoboAnalyzer is almost the same as that generated from the Matlab program, And the results of simulation inverse kinematics in RoboAnalyzer is almost the same as that generated from the matlab program.

V. CONCLUSION

Based on the paper results can be concluded as follows:

1. The forward kinematics calculations were successfully carried out in Matlab program and RoboAnalyzer software.
2. The inverse kinematics calculations were successfully carried out in Matlab program and RoboAnalyzer software.
3. The kinematic simulation that has been done can be

used as the basis for controlling the designed industrial arm robot.

ACKNOWLEDGEMENTS

For research on industrial arm robot theme in the world of manufacturing, the authors suggest the following research:

1. Industrial robotic arm modeling and the basics of kinematics can be developed into a program to control robots in the welding process.
2. The use of more than one industrial arm robot with the program algorithms to simulate a manufacturing process.
3. Combining the Matlab program with the C programming language in controlling industrial robot arms.An acknowledgement section may be presented after the conclusion, if desired.

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Current industrial applications of microbial transglutaminase: A review

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Abstract— *Transglutaminases are commonly used in a number of manufacturing operations, including the food and pharmaceutical industry, owing to their protein cross-linking properties. Transglutaminases derived from animal tissues and lungs, which were the first origins of this enzyme, are being substituted out in preference of microbial sources, which are less expensive and simpler to generate and purify. Following the identification of microbial transglutaminase (MTGase), the enzyme was formulated for industrial purposes using a conventional fermentation process based on the bacterium S. mobaraensis. Many trials have been conducted in this area in order to improve enzyme efficiency for commercial purposes. Several hosts microorganisms such as E. coli, Y. lipolytica, S. lividans, P. pastoris and C. glutamicum gene expression studies were conducted for transglutaminase production. This study reflects on the MTGase application in two broad industries: food and biotechnology. The usage of mTGase is presented for many food classes, highlighting implementation possibilities and obstacles to further enhance end-product efficiency. Few applications in the textile and leather industry, as well as applications in the PEGylation reaction, the development of antibody drug conjugates, and regenerative medicine, are also addressed.*

Keywords— ***Microbial Transglutaminase; Enzyme cross-linking; Streptomyces mobaraensis.***

I. INTRODUCTION

Microbial transglutaminases (mTGase) have been developed for industrial applications since 1989 using the *Streptomyces mobaraensis* bacterium in a conventional fermentation procedure. This microorganism produces MTGase as an extracellular enzyme with a molecular mass of approximately 38 kDa. MTGase functions in a broad pH and temperature spectrum (pH 5.0 to 8.0, and active temperatures of 40 to 70 °C). The MTGase of *S. mobaraensis* is independent of Ca2+, and it does not need any special cofactors to activate (Ando et al., 1989).

MTGase-mediated enzymatic modifications to proteins have long been used to enhance the properties of a specified target. These enzymatic reactions are extremely selective, take place under moderate reaction conditions, and contain no harmful byproducts (Fatima & Khare,

2018). Researchers have increased their quest for the applications of MTGase in recent years to obtain methods and products which may influence the technical and functional characteristics of end products, not only in the food industry but also in many biochemical reactions. In this study, we emphasize the significance of MTGase in different research areas with possible applications for this enzyme.

Fig. 1 Diagrammatical representation of MTGase application in different sectors.

II. FOOD APPLICATIONS

In the 1990s, studies on the use of transglutaminase in food technologies started after development of MTGases in microorganisms such as *Streptoverticilliummobaraense*(Ando et al., 1989), *Streptomyces cinnamoneum*(Duran et al., 1998) *and Bacillus subtilis* (Suzuki et al., 2000). In 1992, Gottmann and Sprössler announced the first use of MTGases in food area and claimed that MTGase may be a cost-effective food enzyme (*EP0492406B1.Pdf*, 1992). The mTGasses was used mostly in milk, beef, fish, and baker's production two decades later (Strop, 2014). By introducing crosslinking, deamidation, amines, and sticking to food surfaces, MTGase modifies the mechanical properties of food proteins. However, the protein involving food environment, the cross-linking process occurs before other reactions (Santhi et al., 2017). Based on the type of the protein substrate, the conditions of enzymatic reactions, and the volume of enzyme used, important details of certain investigations on the usage of MTGase for the alteration of properties in various foods are shown in Table 1. MTGas action mechanisms are of the utmost importance for the commercial usage of proteins and have not been completely explained (Gaspar & de Góes-Favoni, 2015).

2.1 DAIRY PRODUCTS

In order to further enhance people's understanding of a dynamic dairy industry, the consistency and versatility of dairy goods is deemed to be extremely important. Crosslinking milk proteins with transglutaminase is one of the most effective methods for promoting bio-functionality properties in dairy products. The usage of mTGase may be an effective method for improving the nutritional and technical features of dairy goods while also lowering manufacturing costs by reducing the volume of fat and stabilizer in the end product (Taghi Gharibzahedi et al., 2018). This enzyme can shape intramolecular and intermolecular covalent crosslinks between two amino-acid residues in milk proteins' structure. Whey α-lactalbumin, β-lactoglobulin and casein are the suitable acyl donor and/or acceptor substrates for transglutaminase but certain cross-linking reactions are distinct between them (Oner et al., 2008; Rodriguez-Nogales, 2006). The advantages of MTGases in milk products include enhanced gel resistance and improved viscosity and storage stability (Domagała et al., 2016). The addition of MTGase to the process improves the gel's heat tolerance and firmness. Yogurt, a milk gel made by acidic fermentation mediated by lactic-acid bacteria, has the drawback of serum isolation when exposed to changes in temperature or physical stress. This issue can be avoided by adding MTGase to yogurt, as MTGase increases the gel's water holding capability (Yokoyama et al., 2004). Ice creams that have been treated with MTGase have better aeration and foam consistency, resulting in more secure end-products. Low-fat ice cream and cheese with lower non-fat solids content may also be produced with the MTGase enzyme (Rossa et al., 2011). Adding MTGase to cheese can increase moisture content, affecting the palatability and yield of various cheese products (Wen-qiong et al., 2017).

2.2 MEAT AND SEAFOOD PRODUCTS

The potential of MTGases to shape minced meat into a solid steak initially piqued the attention of the food industry. Meat items are restructured to give them more firmness when frying, resulting in minimal quality loss (Lesiow et al., 2017). In terms of flavor, form, presentation, and taste, the mTGase generates a final product with organoleptic properties comparable to traditional beef (Qin et al., 2016). Several studies (Table 2.2) on the usage of MTGase in meat products have been reported that this enzyme can be used at temperatures ranging from 10 °C to 50 °C. MTGase supplementation has also been shown in several experiments to improve the gel intensity of meat products and have beneficial results on the performance of pork, beef, poultry, and fish proteins

(Akbari et al., 2021). Since meat products are strongly proteic, myofibrillar proteins have a direct effect on their textural consistency. The majority of myofibrillar proteins, actin and myosin, are essential substrates of mTGase and can also be polymerized by it, enhancing the textural properties of structured meat products (Mazzeo et al., 2013). Efforts to minimize the sodium level in meat products is a high priority affecting people's wellbeing, and the meat industry is working on the production of ways to avoid the usage of salt in processed meat products without reducing their quality in order to meet these demands. To prevent quality loss caused by the decrease of salt content, strategies such as the use of MTGase may be used in the manufacturing of meat products with low salt content. (Karaca & Kilic, 2017).

2.3 SOYBEAN PRODUCTS

Soy protein isolate (IPS) is widely used for its nutritional values and functional properties as an important component in Asian diets and general processed foods. Glycinin (11S) and β-conglycinine (7S), which make up about 70 percent of its total protein content, are compounded by IPS. These globulins are excellent MTGase substrates (Qin et al., 2016). The effects of MTGase on the properties and microstructures of IPS films molded with various plasticizers were investigated (glycerol and sorbitol mixture ratio of 1:1). The MTGase cross-linking treatment was found to be an effective method for improving the films cast properties of all plasticizers tested (Tang et al., 2005).

Tofu, a common soybean curd product, is made by coagulating soybean proteins with the addition of Ca2+ and Mg2+, as well as glucono-δ-lactone. The most significant stage in the processing of tofu is coagulation, or the gelation of soymilk. Tofu, a common food in several countries, has a limited shelf life due to its smooth and softness texture, which prevents sterilization. The emergence of mTGase in its processing generates an edge for texture control and improves its quality, giving a product more consistent, silky texture and withstand for fluctuations in temperature (Chang et al., 2011). Adding to this, proteins other than soy can be connected to soy protein by MTGases in a covalent manner to create combinations of new functions. The combined protein emulsifiers have been improved compared to both isolated protein, for example, by the conjugation of milk caseins or soybeans globulins with ovomucine (a white glycoprotein egg) (KATO et al., 1991).

2.4 CEREAL BASED PRODUCTS

Gottmann and Sprössler identified the first beneficial results of mTGase use in baking (*Europäisches Patentamt European Patent Office*, 1992). The use of mTGase in cereal proteins, especially wheat proteins (globulins, glutenins, gliadins, and prolamins), has piqued the bakery industry's interest (Mazzeo et al., 2013). The cross-links produced between wheat proteins by the action of mTGase, with proper pore size and sufficient dough thickness, greatly influenced the consistency, functional, and rheological properties of these structures, such as flexibility, elasticity, resistance, and water adsorption (Bonet et al., 2005). The first investigators to use MTGase in white bread were (GERRARD et al., 1998). These authors suggested that the enzyme may have a benefit during the production of bread compared to conventional oxidant enhancers. In the bakery area, a further use of MTGases is in the processing of pasta and instant noodles. Study by (SAKAMOTO et al., 1996) has shown that noody and pasta treatments with MTGases deterred texture degradation during cooking and enhanced product capacity, even though producing low-grade flour was used for the purpose of production costs.

2.5 FOOD COATING AND EDIBLE FILMS

Protein films have gained great interest in the food sector as an alternative to petroleum-based polymer products. Protein films may be used to protect fresh fruit and vegetables for improving their shelf life. These films are natural, not harmful, biodegradable, good for health, and are possible to eat. The cross-linking activity of MTGase creates protein edible films that are structurally homogeneous, mechanically stable, gas-permeable and have a smooth surface (Porta et al., 2016). According to (Rossi Marquez et al., 2017), when apples were covered with whey protein grafted film with pectin and transglutaminase, weight loses during storage were substantially decreased, by around 80%, after 10 days. Likewise, this grafted film prevented weight loss from samples of potatoes and carrot up to the 6th storage day.

Analysis conducted by (Fernandez-Bats et al., 2018) demonstrated that the usage of bitter vetch (Viciaervilia), which was crosslinked to MTGase, could obtain mesoporous silica nanocomposite bioplastics that displayed increased barrier effects on gas and water vapour. The prepared content displayed antimicrobial and antifungal properties, which were likely improved by the addition of nisin to the filmforming solutions, meaning that it could be used as an active bio-preservative packaging to prolong the shelf life of a number of foods.

III. BIOTECHNOLOGICAL APPLICATIONS OF MTGASE

One of the most rapidly expanding fields of mTGase science is transglutaminase biotechnological applications including antibody–drug conjugates, PEGylation, regenerative medicine, tissue engineering, and the production of microparticles for enteric delivery of substances of interest in the food and pharmaceutical industry.

3.1 ENZYMES IMMOBILIZATION MEDIATED BY MTGASE-CATALYZED BIOCONJUGATION

Protein immobilization has been used in solid subsidies as a biotechnological application technology for enzymes, which has various benefits over the usage of free types, such as facilitating isolation from the reaction medium and reuse (Duarte et al., 2017; Mateo et al., 2007). Generally, proteins linked to functional support groups are highly stable when protein degradation is limited to the medium. Protein immobilization by the forming of covalent bonds has been done routinely with chemically active supports or chemical link reagents (Mateo et al., 2007). However, when several functional groups are found on protein surfaces, the protein is typically spontaneously bound to the substrate and the overall enzyme activity has been decreased. Several strategies were established to maintain biomolecular activity during immobilization including immobilization using MTGase for site-specific usage (Tominaga et al., 2004). Increased selectivity and consistency with responsive biological systems with regard to conventional chemical methodologies can be achieved by immobilization by transglutaminase-catalyzed bioconjugation(Wang et al., 2019). (Synowiecki & Wołosowska, 2006) reported that a silica gel adjusted utilizing 3-aminopropyl-triethoxysilane using MTGase as a cross-linking factor has been impounded from β-glucosidase from *Sulfolobusshibatae* and the immobilization mechanism has not affected the optimum temp and pH of the substrate hydrolysis.

3.2 ANTIBODY DRUG CONJUGATES (ADCS)

The use of mTGase to bind antibodies to various substances in order to generate antibody–drug conjugates is another exciting technology (ADC). ADCs are new cancer therapeutics that use antibodies to administer a cytotoxic drug to tumor cells selectively, increasing the therapeutic index of chemotherapeutic agents while still showing improved protection than nontargetedcytotoxics(Anami et al., 2017). The application of appropriate linkers to conjugate drugs to antibodies is one of the major challenges in the production of ADC (Yao et al., 2016). Chemical conjugation methods have been commonly used to make ADC, resulting in heterogeneous mixtures of ADC of differing physical and pharmacokinetic properties (Dennler et al., 2014; Strop et al., 2013). The usage of mTGase as an alternative to chemical ADC alteration is because the enzyme prevents the production of certain heterogeneous mixtures. Furthermore, suitable amine-containing linkers may be added, enabling the mTGase to conjugate structurally complex drugs and probes (Ohtsuka et al., 2000). (Strop et al., 2013) studied how the conjugation site affects the stability, toxicity, and effectiveness of ADC generated by the mTGase reaction, and whether these distinctions can be due to the binding location directly. 90 sites were examined to bind many compounds using a "glutamine tag," and 12 sites with a large degree of conjugation were discovered. The extremely homogeneous trastuzumab-MMAE conjugate with DAR (Drug-Antibody Ratios) of 2 was developed using a two-step chemo-enzymatic method, in which mTGase attaches a spacer entity that is reactive to the antibody and then interacts with the antimitotic toxin monomethyl auristatin E (MMAE) (Dennler et al., 2014). Several other research on the development of monoclonal antibodies utilizing mTGases have been conducted recently and are well known (Farias et al., 2014; Jeger et al., 2010; Siegmund et al., 2015).

3.3 PEGYLATION

Davis introduced the concept of “PEGylating” a protein by conjugating PEG [poly (ethylene glycol)] to it at the end of the 1960s (Davis, 2002). Since then, PEGylation has been commonly used for the extension of therapeutic proteins distribution and the reduction of its immunogenicity in vivo among many other applications of pharmacology (Pasut & Veronese, 2012). PEG is the polymer of choice for bioconjugations since it is biocompatible, decreases immunogenicity and antigenicity, is easily cleared from the bloodstream, is soluble in water and other organic solvents, not poisonous and has a good mobility in solution. The FDA authorized the usage of PEGs in the early 1990s (Harris & Chess, 2003).

Protein PEGylation chemical strategies generate spontaneous lysine (Lys) derivatives, which contribute to variability and decreased bioactivity of the items. The use of MTGase instead demonstrates a strong substrate specificity for covalent binding of PEG molecules to pharmaceutical proteins, and a site specific alteration or PEGylation may be obtained for the residues of Gln attached with the proteins on the substrates (Fontana et al., 2008). Due to their partial selectivity to the carboxamide substrate, transglutaminases are interesting candidates for protein PEGylation. For the reaction to take place, the carboxamide must be in the dynamic region of the protein

molecule (Dozier & Distefano, 2015). As a consequence, mTGase has been widely used to add mPEG–NH2 to the reactive Gln residue of proteins in a site-specific manner (Freitas et al., 2013). The reactive Gln residues changed by mTGase must be located in disordered protein regions and must fulfill the sequence criteria of the enzyme. The usage of mTGase is restricted since certain target proteins lack reactive Gln residues that can meet the structural and sequence specifications of the enzyme (Freitas et al., 2013). To date, only a small number of studies have been undertaken on the Lys residue level of mTGase-media protein alteration. The work of (Zhou et al., 2016b) is one of those who have connected carboxybenzyl-glutaminylglycine (CBZ-QG) to mPEG amine to shape CBZ-QG-mPEG for cytochrome C PEGilation.

3.4 TISSUE ENGINEERING AND REGENERATIVE MEDICINE

Potential applications are being studied in tissue engineering fields such as cardiac system, vascular system, bone, pancreas and cartilage (Zhu & Tramper, 2008). The majority of this field's study has gone into developing biomaterials that can replicate the shape and composition of the extracellular matrix. These biomaterials must be biocompatible and biodegradable, as well as non-toxic. Furthermore, biomaterial manufacturing and processing must be simple and scalable. Hydrogels are the most widely used biomaterials in tissue engineering because of their high plasticity and moisture content (Polak, 2010). Gelatin, hyaluronic acid, collagen, sodium alginate and chitosan, as well as industrial products like polylactic-co-glycolic acid copolymer, polylactide, polycaprolactone, polyethylene glycol and polyacrylamide, can be used to make hydrogels (El-Sherbiny & Yacoub, 2013). Gelatin is a protein produced by collagen hydrolysis with biodegradability and cell adhesion capability. It is known as GRAS substance by the FDA and has a long history of healthy usage in pharmaceuticals, food, and cosmetics (Elzoghby et al., 2012). Unfortunately, gelatin's medicinal uses are restricted due to its lack of mechanical strength and susceptibility to in vivo enzymes. It is important to improve its functional efficiency and enhance its tolerance to enzyme hydrolyses (Zhao et al., 2016). In order to achieve this goal, crosslinks induced by mTGase are typically added in biomaterials such as collagen, replacing physical approaches such as dehydrothermal drying (DHT) and UV irradiation, among others, and chemical crosslinking mediated by glutaraldehyde, formaldehyde, and 1-ethyl-3-(3-dimethylaminopropyl)-carbodiimide (EDC). Chemical methods also use poisonous chemicals that must be separated from hydrogels before being added, whereas physical methods create fragile bonds with a large probability of degradation (Stachel et al., 2010). As a result, replacing these processes with the enzymatic application of mTGases to produce hydrogels is one of the most exciting developments for obtaining biomaterials, as the mTGase-mediated process has little chance of toxicity and is simple to prepare, with strong mechanical stabilities (Milczek, 2018).

3.5 TRANSGLUTAMINASE IN TEXTILE INDUSTRY

The textile finishing industry has come under criticism for using conventional chemical treatments in wool manufacturing, which are considered to be very harmful to the climate. Unfortunately, utilizing proteases as an alternate enzymatic mechanism may result in a significant loss of fabric weight and yarn capacity. As a result, transglutaminases have been thoroughly investigated in the processing of wool and leather fabrics in order to establish suitable technologies based on their application. It has been discovered that mTGase can restore properties of wool and silk that have been damaged by chemicals and enzymes used during various processing periods, including carding, combing, washing, bleaching, painting, twisting and spinning (Tesfaw, 2014). Streptomyces hygroscopicusmTGase-treated wool fabrics revealed restored fiber frameworks that had been weakened by protease treatments (Du et al., 2007). The use of Guinea pig liver transglutaminase or mTGase extracted from Streptoverticiliummobaraense in wool production reduced shrinkage and improved yarn resistance, implying that transglutaminases can counteract the harmful effects of proteolytic processing of wool (Cortez et al., 2004). Wool garments made with mTGase-treated fabrics are expected to be more prone to domestic washing. Protease-containing biological detergents may inflict permanent fiber harm, resulting in a loss of fabric power, form, and color fading (Cortez et al., 2004). However, by incorporating the benefits of utilizing both proteases and transglutaminases in a simultaneous enzymatic treatment of wool, a bioprocess for machine washable wool with minimal fiber damage was created (Hossain et al., 2009). Casein was introduced into wool using mTGase and used as a surface coating material to smooth the quality of the wool fiber by coating or filling the deteriorated scales in wool yarn (Cui et al., 2011).

3.6 TRANSGLUTAMINASE IN LEATHER INDUSTRY

The method of filling, is one of the most crucial phases in leather manufacturing, since it involves introducing materials into the voids within leather fibers in order to smooth out surface defects and improve material

consistency. Glucose, gum and starch, as well as enzyme-modified casein and gelatin, are widely used as fillers, with the latter two being cross-linked with leather proteins through the action of MTGase(Zhu & Tramper, 2008). The fillers incorporated by MTGase were found to be tightly attached to the leather and would not easily be separated through further processing (Taylor et al., 2006). Furthermore, the effects of mTGase-modified gelatin-sodium caseinate on subjective aspects of leather (visual aspects, touch, etc.) as well as mechanical and structural properties were studied. The use of mTGase increased subjective aspects thus leaving mechanical properties including tensile strength and elongation at break unchanged (Q. Liu, et al., 2011).

Table 1: Studies with mTGase applied to diferent protein sources

Group of food	Protein substrate	Microorganism of TGase	Treatment conditions (enzyme concentration, temperature, and incubation time)	References
Meat and seafood products	Pork myofibrillar protein	Activa® TI (*S. mobaraensis*)	0.5% (w/w); 4 °C; 24 h	(G.-P. Hong & Xiong, 2012)
	Pork myofibrillar protein	Activa® TI (*S. mobaraensis*)	0.2% (w/w); 4 °C; 24 h	(G.-P. Hong & Xiong, 2012)
	Pork myofibrillar protein	Activa® TI (*S. mobaraensis*)	0.6% (w/w); 4 °C; 24 h	(G. P. Hong & Chin, 2010)
	Pork leg to manufacture dry-cured ham	Activa® EB (*S. mobaraensis*)	0.1% (w/v); 7 °C; 24 h	(de Ávila, Ordóñez, De la Hoz, Herrero, & Cambero, 2010)
	Beef	Activa® TG-K (*S. mobaraensis*)	0.5% (w/w); 60 °C; 2 h	(Domagała et al., 2016)
	Steak—beef trimmings	Activa® TG-B (*S. mobaraensis*)	1% (w/w); 8 °C; 4 h	(Sorapukdee & Tangwatcharin, 2018)
	Chicken and beef myofibrillar proteins	Activa® (*S. mobaraensis*)	5–6.8% (w/w); 40 °C or 78 °C, 0.5 h	(Ahhmed et al., 2009)
	Tilapia fillets	Activa® WM (*S. mobaraensis*)	0.5% (w/w); 4 °C; 24 h	(Monteiro et al., 2015)
	Fish myofibrillar protein	NS	0.1%; 4 °C; 2 h	(Feng et al., 2018)
	White shrimp	Activa® TG-K (*S. mobaraensis*)	0.8 U/g of protein substrate; 25 °C; 2 h	(Tammatinna, Benjakul, Visessanguan, & Tanaka, 2007)
	Caiman steaks	Activa® WM (*S. mobaraensis*)	1% (w/w); 4 °C; 18 h	(Canto et al., 2014)
Dairy products	*α*-Lactalbumin concentrate	Activa® MP (*S. mobaraensis*)	10 U/g of protein substrate; 50 °C; 5 h; pH 5	(Sharma, Zakora, & Qvist, 2002)
	Na-caseinate, Ca-caseinate, skim milk powder, condensed milk, whole milk	Activa® (*S. mobaraensis*)	1 U/g of protein substrate; 40 °C, 2 h	(Oner, Karahan, Aydemir, & Aloglu, 2008)

	powder, whey, and milk			
	Paneer (traditional Indian milk product)	Activa® (*S. mobaraensis*)	1 U/g of protein substrate; 4 °C; 16 h	(Prakasan, Chawla, & Sharma, 2015)
	Milk	Activa® TI (*S. mobaraensis*)	0.3% (w/w); 84.5 °C; 1 h	(Rodriguez-Nogales, 2006)
	Milk	Activa® MP (*S. mobaraensis*)	3 U/g of protein substrate; 40 °C; 2 h	(Domagała et al., 2016)
	Milk	Activa® TG-B (*S. mobaraensis*)	7 U/mL of milk proteins; 30 °C; 3 h	(Chen & Hsieh, 2016)
	Cheese whey protein	NS	40 U/g of whey proteins; 40 °C; 1 h; pH 5	(Wen-Qiong, Lan-Wei, Xue, & Yi, 2017)
	Ice cream	Activa® (*S. mobaraensis*)	4 U/g of protein substrate; 57 °C; 1.5 h	(Rossa, de Sá, Burin, & Bordignon-Luiz, 2011)
Cereal based products	Noodle	NS	1% (w/w); 30 °C; 0.5 h	(Wang, Huang, Kim, Liu, & Tilley, 2011)
	Rice noodle	Activa® (*S. mobaraensis*)	1% (w/w); 40 °C; 2 h	(Kim, Kee, Lee, & Yoo, 2014)
	Rice flour	Activa® (*S. mobaraensis*)	1% (w/w); 30 °C; 1 h	(Gujral & Rosell, 2004)
	Wheat gluten hydrolysate	Activa® TI (*S. mobaraensis*)	0.05% (w/w); 55 °C; 1 h and 5 °C; 18 h	(Agyare, Addo, & Xiong, 2009)
	Bread wheat flour	Activa® WM (*S. mobaraensis*)	8 U/g of protein substrate; 30 °C; 2 h	(Mazzeo et al., 2013)
	Damaged wheat flour	Activa® (*S. mobaraensis*)	1.5 U/g of protein substrate; 37 °C; 0.5 h	(Bonet, Caballero, Gómez, & Rosell, 2005)
Leguminous products	Soy protein	TGase was purified from the culture medium of *Streptoverticilliumcinnamoneum subsp. cinnamoneum* IFO12852	0.05% (w/v); 55 °C; 1 h	(Babiker, 2000)
	Soy protein isolate	Activa® WM (*S. mobaraensis*)	0.08% (w/v); 50 °C; 0.4 h	(F. Song & Zhang, 2008)
	Legume protein isolate	NS	0.05% (w/v); 55 °C; 1 h; pH 7.5	(Elfadil, 2010)
	Black soybean packed tofu	Activa® (*S. mobaraensis*)	1% (w/w); 55 °C; 0.5 h	(Chang, Shiau, Chen, & Lin, 2011)
	Soy-based cream cheese	NS	2.6% (w/w); 50 °C; 24 h	(Lim, Easa, Karim, Bhat, & Liong,

				2011)
	Soy protein isolate	Activa® (*S. mobaraensis*)	0.5% (w/v); 50 °C; 1 h	(Jin, Kim, Seo, & Lee, 2013)
	Soybean protein	NS	10 U/g of protein substrate; 37 °C; 3 h; pH 7.5	(C.-L. Song & Zhao, 2014)

NS: not specified

IV. CONCLUSION

We explored how microbial transglutaminases are used in the dairy, medicinal, and biotechnology industries. The implementations of MTGase have significant consequences for the growth of these sectors, developing innovative materials at a low cost, enhancing the application and efficiency of food, pharmaceuticals, and other commodities such as wool and leather, all with the aim of sustainably supporting anthropogenic activities. MTGases have been important in the processing of refined fish and meat items, agricultural products, noodle, soybean products, pasta, as well as coating and edible films. MTGase has been essential in more advanced fields such as antibody drug conjugates, PEGylation, regenerative medicine, tissue engineering, and the development of microparticles for enteric distribution, all of which have a significant effect on health goods and services. Because of its usefulness and value addition to processed products, research on the applications of MTGases is constantly expanding, revealing numerous opportunities to create new materials and improve the efficiency of current ones. More and more investigations should work on bioprocess technologies in order to lower the manufacturing expenses of MTGases while improving their constructive features.

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Different Language Usage on Social Media

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Abstract— *The research presented the effects of Social Media on the formation of new words that are being used by the Social Media users that often includes in the formal use of language in the academe. The emergence of different Social Networking Sites (SNSs) such as Facebook, Twitter, and E-mail have driven a more advanced change in the way people communicate. The study aimed to assess how Social Media affects the formal English Language used in the academe. The result of the study also highlighted how often do Social Media users of the Central Luzon State University, College of Education use the proper abbreviations, exclamatory spelling of emoticons, use letter homophones, acronyms, commit misspelled words, use shortening of words, use numbers to represents words, and use combination of two different language in their papers. The qualitative method of research used the survey technique and was utilized for gathering data. The questionnaires serve as the instrument for collecting data. 50 students of the College of Education, English Majors of the said university are the respondents.*

Keywords— ***academe, language, new words, social media, usage.***

I. INTRODUCTION

A. BACKGROUND OF THE STUDY

English Language is said to be the universal language and learning it, means having access to the world, to other people, ideas, ways of thinking and literature. It is the medium for teaching different subjects in the academe and also a medium of knowledge in transferring and sharing certain ideas and feelings. English is one of the important way of communication used among people in different field such as in business, advertisements, engineering mechanics and so on and so forth. That is why English language proficiency is now a must in all aspects of everyday life for us to be able to engage in the globalization.

Nowadays, people make use of the Social Media that became the major form of communication wherein language use has stuck in various areas especially in the teaching and learning. The emergence of different Social Networking Sites (SNSs) such as Facebook, Twitter, e-mail have driven a more refined revolution in the way people communicate.

According to Simpson (2014), former chief editor of the Oxford English Dictionary said that the words that surround us every day influence the words we use. Since so much of the written language we see is now on the screens of our computers, tablets, and smartphones, language now evolves partly through our interaction with technology. And because the language we use to communicate with each other tends to be more malleable than formal writing, the combination of informal, personal communication and the mass audience afforded by social media is a recipe for rapid change.

The 21st century people has come wherein technologies are emerging so fast, and it is affecting the language tremendously. The number of SNSs users especially among students and teenagers have increased extremely over the years and created Internet slangs, new word and symbols or old words having a new meaning such as in Facebook; from unfriend to “selfie”, using Emoticons, acronyms like “ATM” which means at the moment, social media is clearly having an impact on language. In the long run people may tend to bind with

those words which can strengthen or weaken the student's English Language proficiency.

B. STATEMENT OF THE PROBLEM

This research aims to answer the central question "How Social Media Affects the Formal English Language used in the Academe?"

- What are the different Language Usage commonly used to communicate through the Social Networking Sites?
- How do people in 21st century aware of the evolution of language and formation of new words brought by the modern technology?
- How does frequent use of internet slang weaken or develop the English language?
- How often do Social Media Users use the proper abbreviations, exclamatory spelling of emoticons, use letter homophones, acronyms, commit misspelled words, use shortening of words, use numbers to represents words, and use combination of two different language?
- How the language of social media affects the formal language used in the academe?

C. OBJECTIVES OF THE STUDY

This study entitled "The Different Language Usage in Social Media" aims to meet the following objectives:

1. To determine the socio-demographic characteristics of the respondents from the Fourth year- English Majors of the College of Education, Central Luzon State University including the age, and gender while residing at the aforementioned school.

2. To determine the words that are usually used by the SNS's users.

3. To gain insights from the SNSs users on how often they commit misspelled words or use more than one language combined in conversations.

4. To distinguish how language used in Social media affects the formal language use in the academe.

D. SIGNIFICANCE OF THE STUDY

The Researcher

The importance of this study to the researchers is to determine the different language usage in Social Networking Sites and how they use this informal language that will affect the student's attitude to grammar and how they use the internet language in everyday life. This study has a huge impact to the researchers as a translator in the future to be aware on the new generated language used in Social Networking Sites when they will encounter variety of language that has need for translation.

The Students

This study aims to help the students to become aware that misspelling, incorrect use of words and other form of figurative language is not accepted when it comes to formalities and the proper usage of English language. However, students who are engaged in SNSs communication, leading to the creation of new phrases and words seems to be extremely worsening students' vocabulary.

To the Academe

This study is very essential in the academe because it gives awareness to teachers and students regarding on their English Language proficiency. The research may use by the academe in the awareness that language now evolves partly through our interaction with technology. Because the language we use to communicate with each other is the combination of informal, personal communication and the mass audience. In the long run people may tend to bind with those words which can lessen the English Language proficiency.

The Society

The communication styles thus become more informal and more open, and this connects into other aspects of life and culture as we reflect in society. This study in pertains to society that different Language usage in Social Networking Sites has an impact to those people who use in making messages, posting different stories that were placed due to the modernization of technology. Thus, in a society the people will adapt with their writing and speaking strategies as they apply in reality.

The Nation

The significance of this study in the nation will apprehend the evolution of language and the formation of different words that will create another standard or new writing and communication skills due to common use of abbreviations and unusual jargon, thereby damaging students' ability to employ formal literacy skills. English language proficiency is a need to become globally competent that will affect the growth of the economy of the nation.

E. SCOPE AND DELIMITATION

This study entitled "The Different Language Usage on Social Media" will focus only on the language being created by the social media users and how it affects the English Language. The data gathering will only limit to the students of Central Luzon State University specifically in College of Education and will meet 50 randomly selected students who are avid user of Social Networking Sites such as Facebook, Twitter and etc.

II. REVIEW OF RELATED LITERATURE

According to Thomson Wadsworth (2007) in the Article entitled Social Media Violated English Language he stated that, a language consists of symbols that convey meaning, also has rules for combining those symbols that can be used to create messages.

It means that language is a way of expressing ideas and emotions through symbols, it can be in the form of verbal or non- verbal consisting of the use of words in a structure and conventional way. Perhaps, language is dynamic, it can evolve or it can regress therefore language cannot confine in a box because it will be stagnant and will tend to die. Technology nowadays become one of the reasons of the evolution of language.

Language is influenced by many factors such as class, society, and developments in science and technology. But the major influence on English language is and has been the media. Language is influenced by many factors such as class, society, developments in science and technology etc. However the major influence on English language is and has been the media stated by Dr. Neha Sharma (2012) in her study entitled Impact of Social Media on English Language: A Review.

The development and changes of language can be the effect of some groups in the society that people encountered in everyday life. This days the group of LGBT (Lesbian, Gay, Bisexual, and Transgender) community especially the gay group has extreme influence in the language, their "gay language" were adapted by many people and become part of the vocabulary. Another factor is the modernization, the bloom of different gadgets and machineries can influence the language such as the use of the Social Media as a way of communication.

As defined by Andreas Kaplan and Micheal Haenlein(2010),in the book entitled Users of the World, Unite! The Challenges and Opportunities of Social media said that Social Media allows the creation and exchange of user- generated content because it is a group of internet-based applications that build on the ideological and technological foundations of Web 2.0.

Social Media has become one of the most powerful sources for information and news updates through platforms such as Facebook, Blogger, Twitter, Word Press, LinkedIn, Google+ Tumblr, MySpace and Instagram. On the other hand, from a linguistic point of view, the impact of social media reflects on the new words or expression like newsfeeds, viral, hashtag which do not make sense few years ago but meant something completely different than they do nowadays.

Perhaps, Schonfeld (2010) in an article entitled Discourse of Twitter and Social Media, pointed out that Social Networking Sites (SNS) are the most commonly used form of Social Media wherein millions of people around the world can create and produce also millions of different messages.

According to Aydin (2012) in a review of research on Facebook as an educational environment. Education Tech Research Development, the amount of SNS users has increased tremendously over the past five years, especially among teenagers and students. Many users have created Internet slang to communicate and express their thoughts on SNSs and mobile networks.

As the time pass by, technology became part of everyone's life. It is really emerging so fast and the new generation have been immediately adapt this change in our lifestyle. Most of the users are the students for their researches and there studies, and for teenagers who always communicate with their friends through the Social Medias.

In the study entitled Code-switching in E-distance learning education, Abdul Kadir & Zubir (2012 found that code-switching occurs intentionally and not through lack of competence in the base language. The students used code-switching functions for various purposes such as to capture attention, to show respect, to show empathy and to indicate a shift in topic.

Code switching is concurrent use of more than one language in a sentence. It occurs intentionally because in communicating, you have to relay the message properly and can only make it if you are able to express the thoughts. There are concepts that are present in one language that is not present on the other so through code switching you may able to make them understand the message you are sending.

An earlier study entitled Communicative Functions and Reasons for Code Switching: A Malaysian perspective, Muthusamy (2009) showed that undergraduates of a Malaysian public university had emphasised that lack of register proficiency was also another contributing factor for code switching. The study concluded that the ability of the speakers who were able to speak more than one language fluently played an important role during their interaction.

The interaction is effective if the sender relay the message to the receiver accurately. Using of one or more language in a sentence played an important role during interaction to express the thoughts and ideas that can't be expressed or does not have any translation in the concept of just one language.

According to Drouin (2011) in the journal entitled College Students' Text Messaging: Journal of Computer Assisted Learning, use of "texts" and literacy skills, he examined the frequency of text messaging, use of ''texts'' and literacy skills such as reading accuracy, spelling and reading fluency in a sample of college students in America. Co-relational analyses revealed significant positive relationships between text messaging frequency and literacy skills in spelling and reading fluency but significant, negative relationships between texts usage in certain contexts like emails to professors and literacy especially in reading accuracy. Those reportedly using more texts on SNSs and those using more texts in emails to professors had significantly lower reading accuracy scores.

This only means that in some cases texting trough Social Networking Sites can affect the literacy of the students. It may lower reading accuracy because there are internet slangs that may interrupt the vocabulary of the students and can lead to confusion.

In addition to that, Craig (2003) and David (2008) in the study entitled Reflections of Student's Language Usage in Social Networking Sites: Making or Marring Academic English. They said that the longer time that students are engage in texting through the Social Networking Sites the more they improve the student's literacy.

In some instance Social media has a positive effect on the student's learning because it has the potential for use in educational applications. Moreover, social media, enable students to share information, to learn about their classmates, to communicate with their classmates and professors, and to post and discuss relevant class information.

According to Thurairaj et al., (2012) in an article entitled Teachers' Emotions in ELT Material Design. International Journal of Social Science and Humanity, he indicated that the students do improve their language as well as their writing skills, because Facebook and Twitter provides activities preferred by the students and leads to positive language learning.

In using Social Networking Sites such as Facebook, the users may encounter different Linguistic items which they can read and use in posting thus enriches the individual's vocabulary but having different meaning from the standard meaning which is acceptable.

Drouin (2011) in a Journal entitled College students' text messaging, use of textese and literacy skills a Journal of Computer Assisted Learning specified that one should be guide and equipped with a variety of strategies and knowledge of different communication modes, which includes social networking and media platforms like Facebook.

In using the social media some people are not aware of some words that are being formed. The users are not able to differentiate formal language from informal language as more often than not, the students at tertiary level, are inclined to use improper formats and sentences that deaden Standard English.

Cummings (2011) in a study entitled An Experience with Language, ProQuest Dissertations & Theses: Literature & Language states that computer-assisted language learning will never be able to substitute for teachers because there could be issues of control in administrating relevant exercises in language teaching and learning.

There are some instances that words on Social Media have different meaning with regards to the Philippine Standard English language that was taught in the academe. And in that case teachers are responsible in clearing the meaning.

According to Plester et al., (2008) in a journal entitled Txt msg n school literacy: Does texting and knowledge of text abbreviations adversely affect children's literacy attainment? Literacy, stated that Internet slang and short message services have been shown to have an impact on the English language. It was estimated that 90% of school children owned a mobile phone, and 96% used text messaging. This shows that young people are active "texters". Internet slang was invented for the purpose of saving keystrokes. As typing is much slower than speaking, in order to counter this problem, people started shortening words and creating new words.

Social media users mostly teenagers are avid of chatting with their friends. In order for them to have a long and fast changing of messages they do shortening of words for example the word Please becomes pls. and it makes easier and faster to type.

According to Mphahlele & Mashamaite (2005), text messaging is deemed to be detrimental to students' language proficiency since students mix this "text language" with the standard language they learn at school. Consequently, students displayed numerous errors ranging from incorrect spellings to "ungrammatical" sentence constructions.

The words and symbols that people use in making messages were placed and adapt with their writing and speaking. The short term of words and some other text languages have been used and combined with the Standard English that is accepted and known by most of the people. They become unaware with the words they are using and

become a factor to decline the English language proficiency.

According to Craig (2003), in an article entitled Instant messaging: The language of youth literacy, The Boothe Prize Essays 2003, it is also found that texting also threatens students' literacy because it creates undesirable reading and writing habits due to common use of abbreviations and unusual jargon, thereby damaging students' ability to employ formal literacy skills.

Texting may affect the individual's reading and writing skills because of using language of the internet like exclamatory spelling of emoticon such as hahah, acronyms such as LOL and letter homophones such as U. Another thing is that if an individual is interacting with other people the language used might mix with the language of the other.

According to John Simpson (2014), Facebook has also done more than most platforms to offer up new meanings for common words such as friend, like, status, wall, page, and profile. Other new meanings which crop up on social media channels also reflect the dark side of social media: a troll is no longer just a character from Norse folklore, but someone who makes offensive or provocative comments online; a sock puppet is no longer solely a puppet made from an old sock, but a self-serving fake online persona; and astroturfing is no longer simply laying a plastic lawn but also a fake online grass-roots movement.

Furthermore, Scott (2010) in an article entitled Discourse of Twitter and Social Media, believed Emoticons are can pose a significant problem. Depending on the configuration of the concordance software used, some of the characters used in emoticons are not considered valid letters for that system, they may also be interpreted as marking word breaks. In addition some characters may have other special meanings to the system.

Through the use of social media channels like Facebook, Twitter etc. the old words are having a new meaning based on the usage of the words on the said channels. The language of the internet now becomes the language of the world wherein there's no grammar being followed.

According to Mphalele and Mashamaite (2005), in the book entitled The impact of short message service (sms) language on language proficiency of learners and the sms dictionaries: A challenge for educators and lexicographers stated that in order to save space, time, and money. Mobile phone users can communicate with others by using symbols or abbreviated forms of words and sentences.

These Social Networking Sites users utilize every second engaging in Social Networking Sites communication, leading to the creation of new phrases and words. The shortcut language used and created on instant messaging, on the offset, seems to be extremely worsening students' vocabulary.

Language usage is changing because of using different linguistic features in the social media such as Exclamatory Spelling of Emoticons, Letter Homophones, Acronyms, Misspelled Words, Shortening of Words, Numbers representing words, Combination of two different language.

III. INDENTATIONS AND EQUATIONS

METHODOLOGY

This chapter includes the methods and procedures made on gathering the data, research design of the study, the participants, data analysis, and instrument used in the paper.

A. DATA GATHERING PROCEDURES

The researchers will use a convenience sampling technique in conducting this research by distributing a survey questionnaire to the English Majors in the College of Education at Central Luzon State University to collect data necessary for the study.

B. RESEARCH DESIGN

This paper used qualitative- interview design because it aims to assess the experiences of the students from the College of Education on how they are affected by the Social Media in the formation of new words that they may use in the formal use of the language in the school.

C. DATA ANALYSIS

In analyzing the data, the researcher will get the percentage of the result of the given questionnaire and percentages were primary tools used in analysing and interpreting the data.

IV. RESULTS AND DISCUSSION

Table 1: Respondent's Socio-Demographic Characteristics

Respondents No.	Age	Gender
1	18	Female
2	18	Female
3	18	Female
4	18	Male

5	18	Male
6	18	Male
7	18	Female
8	18	Male
9	18	Female
10	18	Female
11	18	Male
12	18	Female
13	18	Male
14	18	Female
15	19	Male
16	19	Female
17	19	Female
18	19	Male
19	19	Male
20	19	Male
21	19	Female
22	19	Female
23	19	Male
24	19	Male
25	19	Female
26	19	Female
27	19	Female
28	19	Male
29	19	Female
30	19	Male
31	19	Female
32	19	Male
33	19	Female
34	19	Female
35	19	Female
36	20	Male
37	20	Male
38	20	Female
39	20	Female
40	20	Female
41	20	Female
42	20	Male
43	20	Female
44	21	Female
45	21	Male
46	21	Female
47	21	Male
48	21	Male
49	22	Female
50	22	Female

Illustrate the socio-demographic characteristics of the respondents.

The table above shows the demographic characteristics of the respondents wherein the age bracket is from 18-21 years old. 14 out of 50 are 18 years old, 21 of them are 19 years old, eight of the respondents are 20 years old while 5 respondents are 20 years old and the remaining two respondents are 21 years old. With regards to their gender almost all of them are female which has the sum of 29 whereas 21 of them are male.

As supported by (Aydin, 2012) said that the amount of SNS users has increased tremendously over the past five years, especially among teenagers and students.

Table. 2: Represent the answers to the given questions stated in the survey questionnaire

QUESTIONS	NEVER	ONCE
1	0	0
2	7	10
3	6	6
4	5	8
5	13	6
6	4	6
7	9	12
8	15	18
9	12	18
10	5	4
QUESTIONS	NEVER	ONCE
1	0	0
2	7	10
3	6	6
4	5	8
5	13	6
6	4	6
7	9	12
8	15	18
9	12	18
10	5	4
QUESTIONS	NEVER	ONCE
1	0	0
2	7	10
3	6	6

4	5	8
5	13	6
6	4	6
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6	4	6
7	9	12
8	15	18
9	12	18
10	5	4
QUESTIONS	NEVER	ONCE
1	0	0
2	7	10
3	6	6
4	5	8
5	13	6
6	4	6

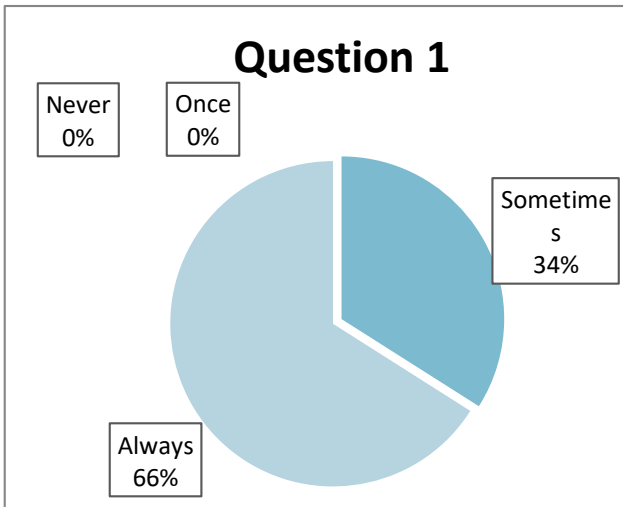

Fig.1: How often you use Social Networking Sites?

In question number one, 66% of the respondents **always** use SNSs while the remaining 34% **sometimes** use SNSs. None of the respondents had **never** or even **once** been logged in to SNSs. Due to the trends of today's generation teenagers are fond of using the different social media platforms, thus everyone already have their own mobile phones and have their own social; media accounts.

Schonfeld (2010) in an article entitled Discourse of Twitter and Social Media, pointed out that Social Networking Sites (SNS) are the most commonly used form of Social Media wherein millions of people around the world can create and produce also millions of different messages.

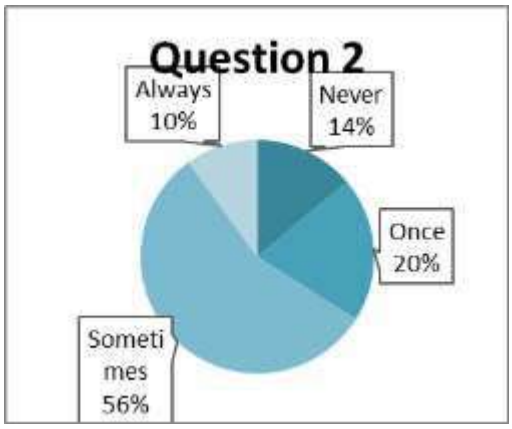

Fig.2: Do you use only one language in communicating with your friends via SNSs and mobile phone in each conversation?

In question number 2.62% of the respondents **sometimes** used one language in communicating with their friends via SNSs, while 5% of them used **once**, 9% belongs to **always** and the remaining 24% **never** used only one language in communicating via SNSs.

An earlier study (Muthusamy, 2009) showed that undergraduates of a Malaysian public university had emphasised habitual expression that was related to psychological aspect of behaviour as their main reason for code switching. Lack of register competence was also another contributing factor for code switching. The study concluded that the ability of the interlocutors who were able to speak more than one language fluently played an important role during their interaction.

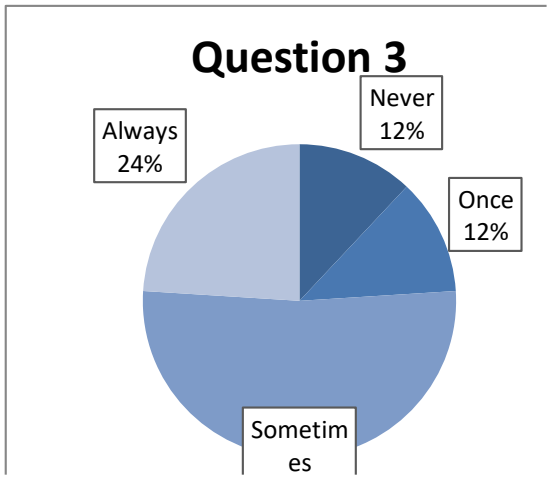

Fig.3:.How often you use proper abbreviations or short forms when communicating with your friends through SNSs?

In question number 3, 6% of the respondents **always** used abbreviations or short forms when communicating with friends through SNSs, **once and never used abbreviations** are with the same percent which is 5% and the remaining 84% are the respondents **sometimes** uses proper abbreviation and short forms of language.

According to Craig (2003), in an article entitled "Instant Messaging: The language of youth literacy, The Boothe Prize Essays 2003," it is also found that texting also threatens students' literacy because it creates undesirable reading and writing habits due to common use of abbreviations and unusual jargon, thereby damaging students' ability to employ formal literacy skills.

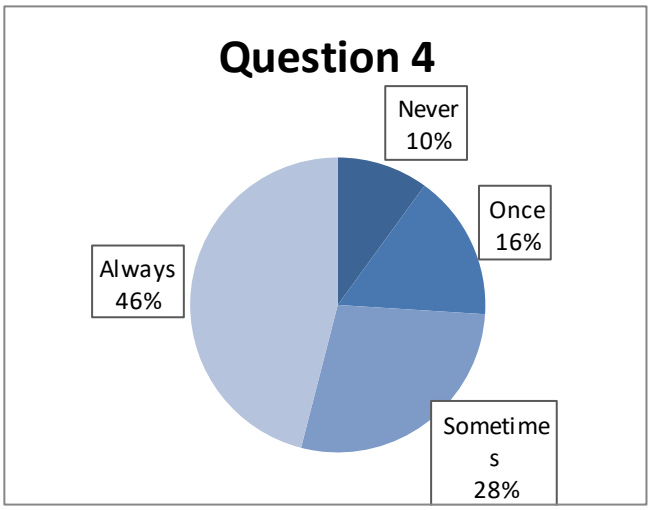

Fig.4: How often do you use language like Exclamatory spelling of emoticons. (For example hahaha, wah, wooh)

In a result of the table above, 46 % of the respondents **always** used language like exclamatory spelling of emoticons, 28 % for **sometimes,** 16% belongs to **once** and the rest which is 10% of the respondents **never** used the statement mentioned.

Scott (2010) in an article entitled Discourse of Twitter and Social Media, believed Emoticons are can pose a significant problem. Depending on the configuration of the concordance software used, some of the characters used in emoticons are not considered valid letters for that system, they may also be interpreted as marking word breaks. In addition some characters may have other special meanings to the system.

Through the use of social media channels like Facebook, Twitter etc. the old words are having a new meaning based on the usage of the words on the said channels. The language of the internet now becomes the language of the world wherein there's no grammar being followed.

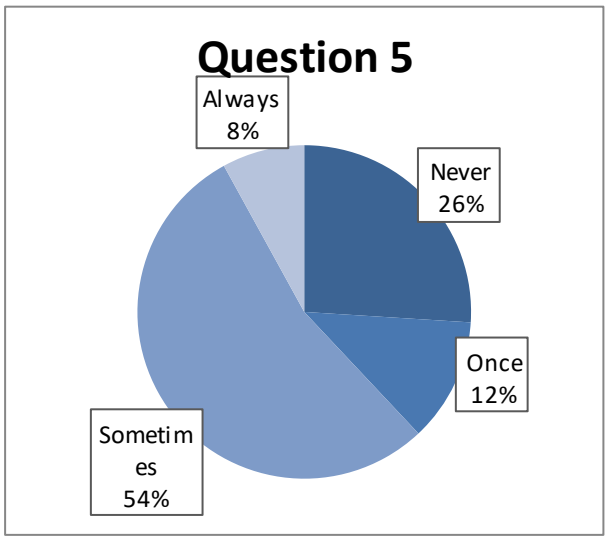

Fig.5: How often you use letter homophones (Example: U to represents the word" You"

In the given question above 26 % of the SNSs users have never been used letter homophones, 8 % of the respondents **always** used letter homophones, 54 % of them **sometimes** used homophones and the rest which is 12 % used homophones **once**.

According to Plester et al., (2008) in a journal entitled Txt msg n school literacy: Does texting and knowledge of text abbreviations adversely affect children's literacy attainment? Literacy, stated that Internet slang and short message services have been shown to have an impact on the English language. Internet slang was invented for the purpose of saving keystrokes. As typing is much slower than speaking, in order to counter this problem, people started shortening words and creating new words.

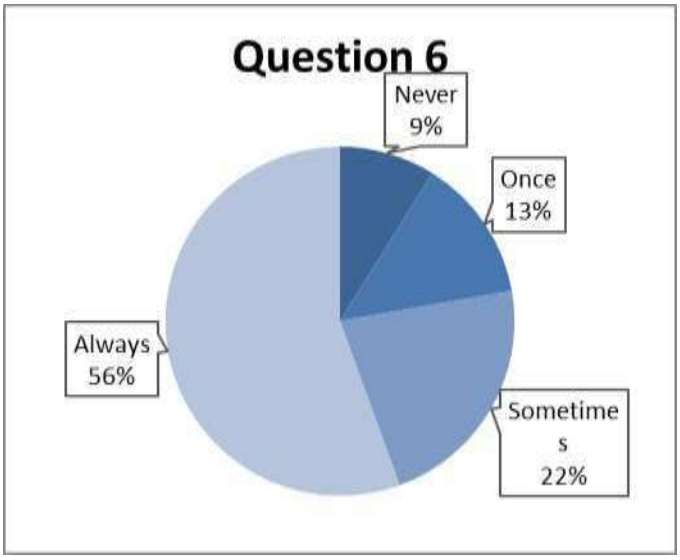

Fig.6: How often do you use Acronyms (Example: LOL, ATM, JGH, IDK, OTW, BRB)

As a result in the table 6 answered the question of how often they used Acronyms 9% always used, 53% used sometimes, 8% used once and the respondents whose never used Acronyms is 30%.

According to Mphalele and Mashamaite (2005), in the book entitled "The impact of short message service (sms) language on language proficiency of learners and the sms dictionaries: A challenge for educators and lexicographers" stated that in order to save space, time, and money. Mobile phone users can communicate with others by using symbols or abbreviated forms of words and sentences.

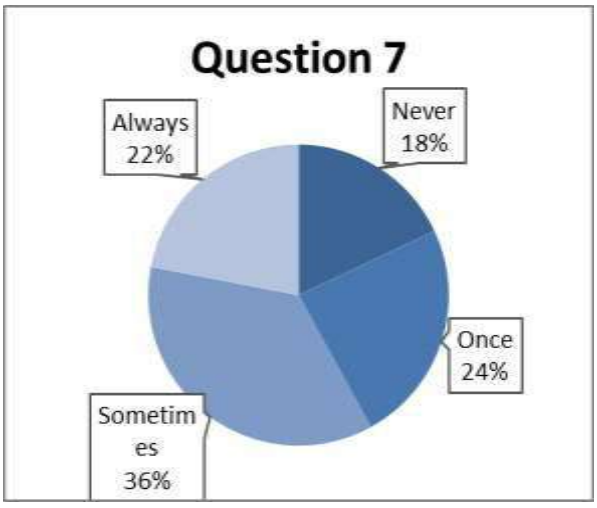

Fig.7: How often do you commit misspelled words?

In a result of question 7 the respondents admit that 15% of them **always** commit misspelled words, 70% commit **sometimes**, 10% for **once** and the remaining 5% **never** commit misspelled words.

According to Mphahlele & Mashamaite (2005), text messaging is deemed to be detrimental to students' language proficiency since students mix this "text language" with the standard language they learn at school. Consequently, students displayed numerous errors ranging from incorrect spellings to "ungrammatical" sentence constructions.

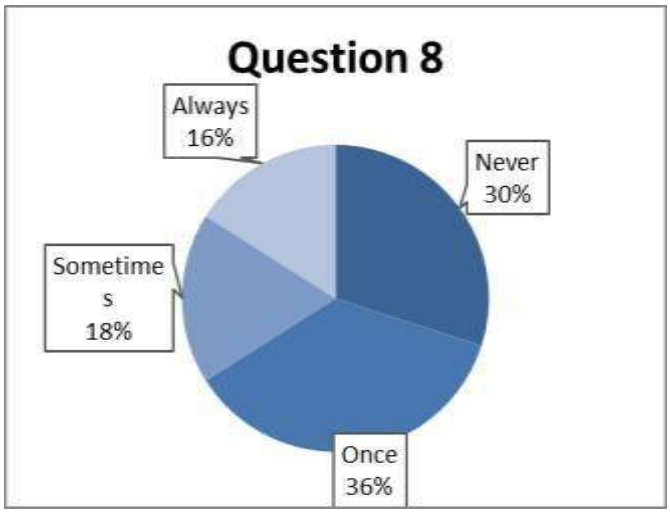

Fig.8: How often do you use shortening of words? (Examples: msg. instead of messages and tnx. Instead of thanks)

As a result in the given question above 15% of the respondents **always** used shortening of words, 20% of them used **sometimes** while 40% of them use **once** and the rest which is 25% **never** used shortening of words.

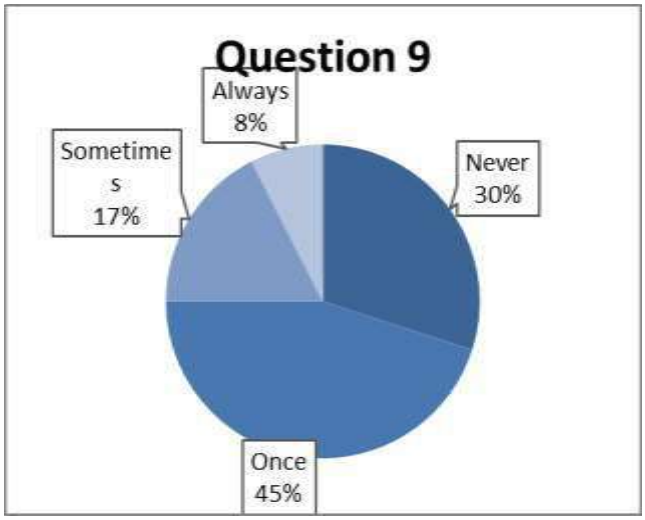

Fig.9: How often do you use numbers to represents words? (Example: 143 represents I love you.)

10% of the respondents **always** used numbers to represent words, 20% of this are the respondents who used **sometime, 10%** for used **once** and the remaining 60% are

those respondents who never used numbers to represents words.

According to Plester et al., (2008) in a journal entitled Txt msg n school literacy: Does texting and knowledge of text abbreviations adversely affect children's literacy attainment? Literacy, stated that Internet slang and short message services have been shown to have an impact on the English language. It was estimated that 90% of school children owned a mobile phone, and 96% used text messaging. This shows that young people are active "texters". Internet slang was invented for the purpose of saving keystrokes. As typing is much slower than speaking, in order to counter this problem, people started shortening words and creating new words.

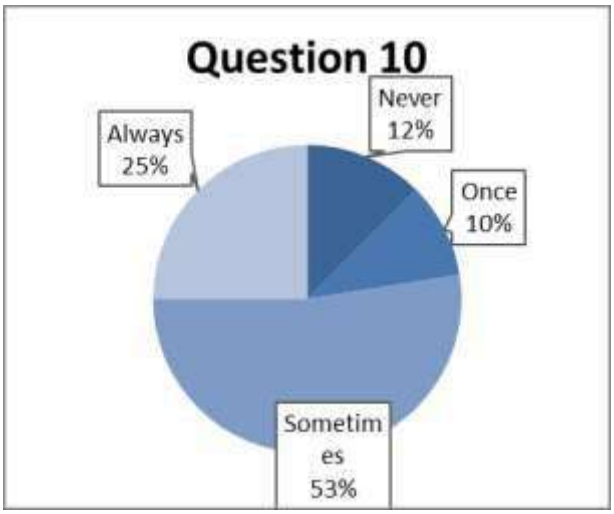

Fig.10: How often do you use combination of two different language? (Example: Taglish)

In question number 10, 33% of the respondents always used combination of two different language like Taglish, 52% of them sometimes used, while 5% of them used once and lastly the remaining 10% never used combination of different language.

Abdul Kadir & Zubir (2012) on e-distance learning students in a public university in Malaysia. The study found that code-switching occurs intentionally and not through lack of competence in the base language. The students used code-switching functions for various purposes such as to capture attention, to show respect, to show empathy and to indicate a shift in topic

General Question 1: *How does Social Media affects the formal English Language by using the following given questions above?*

Based on the answered of the respondents most of them stated that Social Media affects the formal English Language by using different language usage or the given questions above. First, of course the formality of language will vanish and according to them it is one of the problem of the "millennial" because nowadays our country is modernized by the use of modern technology and the Social Media. They create their own language and influence one another by using those kind of form of language.

According to John Simpson (2014), Facebook has also done more than most platforms to offer up new meanings for common words such as friend, like, status, wall, page, and profile. Other new meanings which crop up on social media channels also reflect the dark side of social media: a troll is no longer just a character from Norse folklore, but someone who makes offensive or provocative comments online; a sock puppet is no longer solely a puppet made from an old sock, but a self-serving fake online persona; and astrosurfing is no longer simply laying a plastic lawn but also a fake online grass-roots movement.

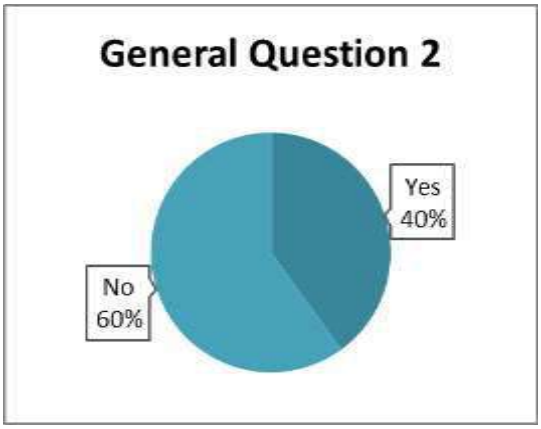

Fig.11: Are you in favor of using different language usage in Social Media with regards in the formal English Language in the academe?

In general question number 2, 40% of the respondents answered **yes** in favor of using different language usage in social media with regards in the formal English language in the academe, on the other hand 60% of the respondent disagree or answered no in the given question stated above.

Drouin (2011) examined the frequency of text messaging, use of ''textese'' and literacy skills (e.g., reading accuracy, spelling and reading fluency) in a sample of college students in America. Co-relational analyses revealed significant positive relationships between text messaging frequency and literacy skills (spelling and reading fluency) but significant, negative relationships between textese usage in certain contexts (e.g. emails to professors) and literacy (reading accuracy). Those reportedly using more textese on SNSs and those

using more textese in emails to professors had significantly lower reading accuracy scores.

V. CONCLUSION AND RECOMMENDATION

Conclusion

The result shows that most of the respondents are 18 years old and most of them are female. 90% of the respondents always use Social Networking Sites that they preferred such as Facebook and Twitter. In communicating with their friends via SNSs and mobile phone, 62% of them sometimes uses only one language. On the other hand, 84% of the respondents sometimes use proper abbreviations or short forms when communicating with friends through SNSs. Most of the respondents always use language like exclamatory spelling of emoticons for example Haha! Huhu! and Wooh! With the rate of 65%. While 60% of the SNSs users have never been used letter homophones like U for the word YOU and D for the word THE. According to the results 53% of the respondents use acronyms like LOL, ATM, JGH, IDK, FYI, and OTW. Most of the respondents commits misspelled words in their daily communication with friends. Out of 20 respondents, 40% of them once used shortening of words such as *msg.* instead of message, and *tnx* instead of the word thanks. Moreover, 60% of the respondents never used number to represent words for example 143 to represent I Love You. Most of the respondents sometimes uses the combination of two different language like Filipino and English in communicating through Social Media. Therefore Social Networking Sites like Facebook creates their own language and adapts and influence one another by using different language usage such as using Acronyms, Shortening of words, Letter homophones and Exclamatory spelling of Emoticons. They also disagree that the newly created words by the language usage they are using in Social Media in the Formal English Language used in the Academe.

Recommendation

Based on the findings and conclusions presented, the researchers' offers suggestions and the recommendations are suggested:

1. The researcher recommend to the future researchers to maximize the respondents in gathering of their data. They should become fair for choosing respondents either male or female to know their opinions in certain issues.
2. The researcher suggest to the future researchers to use Survey Questionnaire because it is one of the effective style in gathering of data in which you can use Convenience Sampling to minimize the time and you can efficiently proceed to the next chapter of you research.
3. The researcher offer to the future researchers to use topic about modernization in 21st century that can actually more understand by the respondents. It can be the development of language by generation to generation and how people deal with that kind of language.

Those statement mentioned above is an alternative formal recommendation for the future researcher that is best supported in conducting their study.

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