

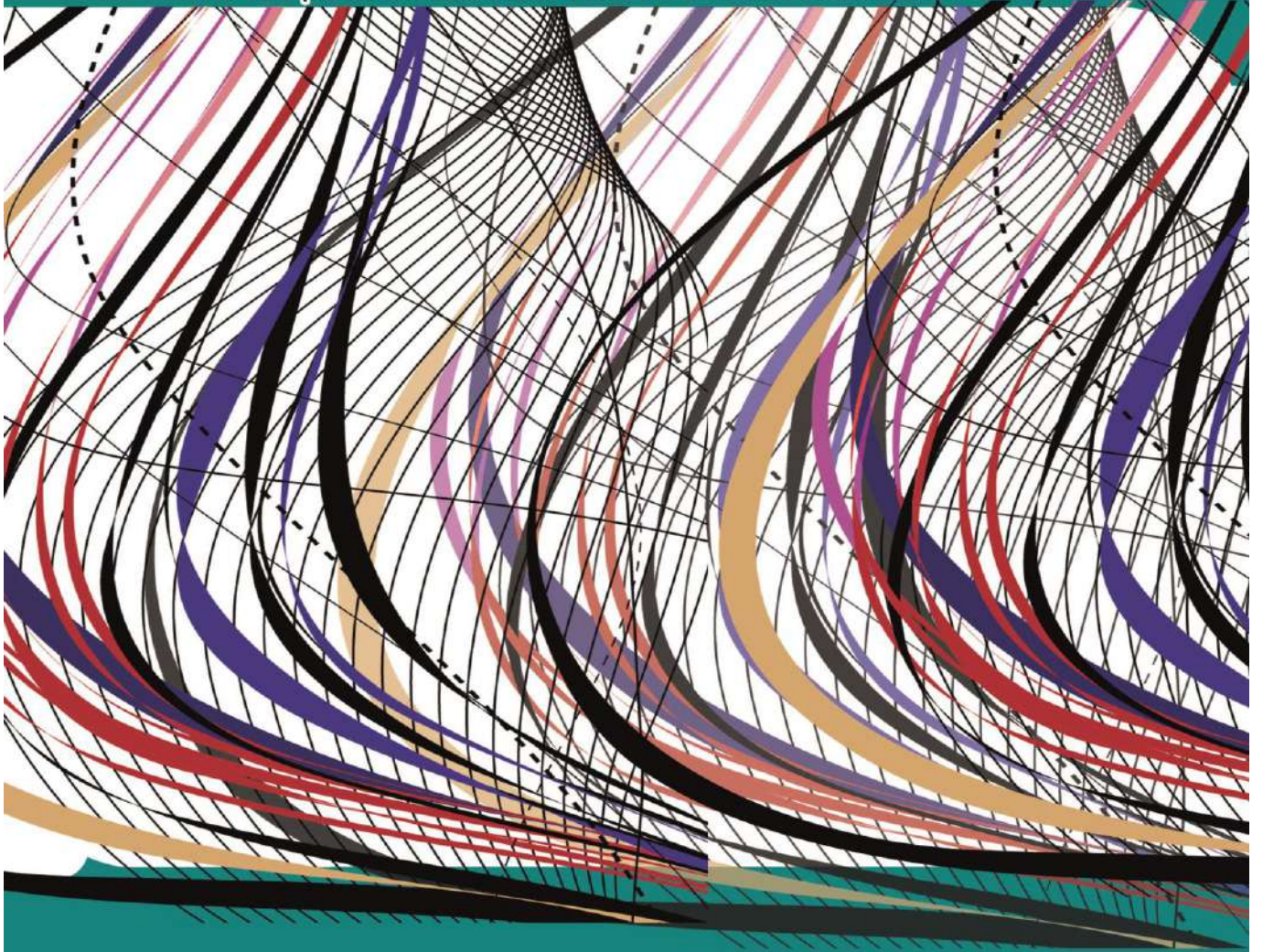
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*Editor in Chief*

Dr. Dinh Tran Ngoc Huy

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# FOREWORD

I am pleased to put into the hands of readers Volume-5; Issue-8: Aug, 2019 of “**International Journal of Advanced Engineering, Management and Science (IJAEMS)** (ISSN: 2354-1311)”, 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

Date: Sept, 2019

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# Factors of Job Satisfaction in Universities

Ana Gutiérrez-Banegas

**Abstract—Purpose:** To highlight the factors that make up the concept of job satisfaction in organizations and, especially, in universities in order to reduce turnover and increase productivity.

**Design / methodology / approach:** Bibliometric research in 34 selected articles, Scimago Journal Rank Q4 or higher.

**Findings:** The findings suggest that job satisfaction focused on universities, although it has been little studied in the academic literature, show that the factors are like other types of organizations.

**Limitations of research:** These results indicate the need for more studies to build a theory to raise job satisfaction in organizations and, especially, in universities.

**Practical implications:** This document allows to identify the multiple criteria that influence job satisfaction to create the necessary conditions to retain the best qualified and talented personnel.

**Type of academic publication:** Literature review.

**Originality / value:** This article makes three specific contributions to literature. First, identify the factors that influence job satisfaction within any type of organization; second, it focuses on job satisfaction within universities, and third, it shows some constructs that help raise the level of job satisfaction.

**Keywords—**job satisfaction, strategies, staff turnover, universities.

## I. INTRODUCTION

In a competitive business environment, the retention of qualified and talented employees is a major challenge for organizations. Many of them invest in the development of human capital and, however, fail to retain staff. Among the various factors that influence staff turnover, job satisfaction plays a vital role over the employee retention rate. Job satisfaction is a multidimensional construction and has been influenced by many variables (Nanjundeswaraswamy, 2019).

Scanlan and Still (2019) explain that it is probable that labor resources, such as rewards, acknowledgments, feedback and participation, are more likely to be improved in order to reduce the levels of intention to disassociate, rotate and exhaustion and achieve greater job satisfaction. For this purpose, several studies support the fact that it is worthwhile for companies to develop strategies that improve job satisfaction (Fu & Deshpande, 2014), impact on the productivity of the company and, therefore, on its value.

Because of the global changes and the growing complexity of the education system, a similar situation arises in this area. Therefore, a growing number of studies have investigated the perceived impact of the job context on the well-being and job satisfaction of academics, and there is a need to evaluate the academic environment not only in terms of stress and tension, but also of what experiences are its sources of realization (Converso, Loera, Molinengo, Viotti, & Guidetti, 2017).

The objective of this article is to identify the factors that integrate the construct of job satisfaction and to verify if there are differences between the business and the university environment through the literature review.

The article is structured as follows: in the first section the topic related to the concept of job satisfaction in various organizations is addressed. In the second section, a review is made of job satisfaction focused on universities. In the third section, four of the main strategies to raise the level of job satisfaction are reviewed. In the fifth section, the research methodology for making this document is presented. The conclusions and references consulted are presented in the last section.

## II. JOB SATISFACTION

In its classic definition, job satisfaction is understood as a positive and pleasant state, the result of the individual assessment of job or job experience (Locke, 1976); whereas Weiss (2002) defines it as an evaluative judgment, which can be positive or negative, that one makes about the work or the job situation. In the same way, Mérida-López *et al.* (2019) state that job satisfaction represents an evaluative state that expresses satisfaction with the job one performs, as well as positive feelings about it.

For Fan *et al.* (2019), job satisfaction represents the general evaluation of the employees of their jobs and is strongly correlated with mental health and rotation. While for Böckerman and Ilmakunnas (2012), job satisfaction is an important attribute of the labor market, being a useful

summary measure of usefulness at job, as well as a narrow measure of well-being (rather than happiness), covering only the welfare related to work.

Fila *et. al.* (2014) establishes that job satisfaction remains fundamental for organizational research for both humanitarian and pragmatic reasons, becoming the most

studied predictor of rotation (Liu, Mitchell, Lee, Holtom, & Hinkin, 2012). In addition, job satisfaction is considered the result of a series of perceived job characteristics that include intrinsic and extrinsic rewards (Pichler & Wallace, 2009). Therefore, job satisfaction can be analyzed from different conceptions (Table 1).

*Table 1 Definitions of Labor Satisfaction*

Author	Definition of job satisfaction
Böckerman e Ilmakunnas (2012)	Important attribute of the labor market, being a useful summary measure on the usefulness at work, as well as a narrow measure of welfare related to work.
Fan <i>et. al.</i> (2019)	Representation of the general evaluation of the employees of their jobs and is strongly correlated with mental health and rotation.
Fila <i>et. al.</i> (2014)	Fundamental concept for organizational research.
Liu <i>et. al.</i> (2012)	Concept that becomes the most studied predictor of job rotation.
Locke (1976)	Positive and pleasant state, the result of the individual assessment of job or job experience.
Mérida-López <i>et. al.</i> (2019)	Representation of an evaluative state that expresses satisfaction with the job that one performs, as well as positive feelings about it.
Pichler & Wallace (2009)	Result of a series of perceived job characteristics that include intrinsic and extrinsic rewards.
Weiss (2002)	Positive or negative evaluative judgment that one makes about job or job situation.

Source: Own elaboration, 2019.

In summary, job satisfaction is a theoretical construction that refers to the assessment that each person makes about the job they perform, associated with both the climate prevailing in the workplace and the economical aspect. Likewise, it has become a significant factor that impacts on labor turnover and, therefore, on the productivity of organizations.

### 2.1 Concepts related to job satisfaction

In various investigations it is shown that job satisfaction has a significant relationship with intrinsic and extrinsic rewards. The first refers to those job activities that are interesting and challenging, autonomous, and that influence in the job processes; while within the latter are those related to the economical aspect, such as payment and other additional benefits (both financial and professional development), (Pichler & Wallace, 2009). In this respect, Steel *et. al.* (2018) indicates that job satisfaction emphasizes the cognitive assessment of the quality of job welfare, which is related to payments, co-employees or supervisors.

In the study conducted by Mohanty (2019) it is shown that, regardless of the employees' age, the weekly wage is positively related to job satisfaction. While the number of weekly hours is positively related to job satisfaction when the employees are young or mature adults, and negatively, when they are middle-aged adults. Likewise, Son and Ok

(2019) show in their research that both job satisfaction and the impact of personality on it can change over time.

Different investigations concerning satisfaction indicate that, compared to alternative explanations, such as the unemployment rate, the degree of unionization and inequality, the average salary levels explain why the higher occupational classes experience different levels of job satisfaction in the European countries to a greater extent (Pichler & Wallace, 2009). Fila *et. al.* (2014) establishes that job satisfaction is inversely related to the role overload, and that it is positively related to things such as autonomy, the variety of tasks, the support of co-employees and supervisors, and perceived organizational support; however, it is not related to the role conflict.

In contrast, Tumen and Zeydanli (2013) investigate the relationship between job satisfaction and home ownership, concluding that the last can be a restriction for the career prospects of employees, because by reducing mobility, they are forced to depend on local working conditions.

Böckerman and Ilmakunnas (2012) analyze the role of employee job satisfaction in the manufacturing industry in Finland to determine how it affects productivity, finding that the relationship between both is positive. In the same way, Iqbal *et. al.* (2012) found that there is a positive relationship between job satisfaction and job

performance, through the application of surveys in the banking sector and the academic sector.

In his research, Edmans (2012) shows that job satisfaction leads to a stronger corporate performance (as argued in human resource management theories), and that although job satisfaction correlates positively with the returns of shareholders, this is only in the long term.

The results of Moslehpour *et. al.* (2019) indicate that the organizational climate and job style complement and completely mediate the relationship between leadership style and job satisfaction. In this way, an appropriate leadership style is more effective when it matches the organizational climate and the job style of the employees. Therefore, an adequate organizational climate will increase the level of job satisfaction. In other words, if the job style of the employees is respected and taken into

consideration, the leadership style can find its way to job satisfaction.

However, Liu *et al.* (2012) examines how the relationship between an employee's job satisfaction trajectory and subsequent rotation can change depending on how these relate to dispersion.

Fu and Deshpande (2014) established a model of structural equations to examine the relationships between the climate of attention, job satisfaction, organizational commitment and job performance, confirming a direct positive impact of job satisfaction on the employees' commitment to job, as well as an indirect impact on job performance.

Therefore, research has shown that job satisfaction is complex and multidimensional, with constituent parts that are relatively homogeneous and different from each other (Fila, Paik, Griffeth, & Allen, 2014).

*Table 2 Methodologies used to identify the concepts related to job satisfaction*

Author	Methodology	Related concepts
Böckerman e Ilmakunnas (2012)	Ordinary least square Method.	Productivity.
Edmans (2012)	Carhart four-factor model.	Long-term returns of shareholders.
Fila <i>et. al.</i> (2014)	<i>t</i> tests for dependent correlations	Overload of roles. Autonomy. Variety of tasks. Support from colleagues and supervisors. Perception of organizational support.
Fu and Deshpande (2014)	Structural Equation Modeling.	Attention climate. Organizational commitment Job performance.
Iqbal <i>et. al.</i> (2012)	Regression Analysis.	Job performance.
Mohanty (2019)	Structural simultaneous equations model.	Employees' age Weekly salary Weekday (number of hours).
Moslehpour <i>et. al.</i> (2019)	Structural Equation Modeling.	Organizational climate. Job style. Leadership.
Pichler and Wallace (2009)	Random intercept models.	Intrinsic rewards: interesting and challenging activities, autonomy and influence on processes. Extrinsic rewards: payment and additional benefits, both financial and professional development.
Son and Ok (2019)	Random-effects generalized least squares (GLS) model.	Impact of personality. Time.
Steel <i>et. al.</i> (2018)	Meta-analytic procedures.	Quality of job welfare. Payment. Co-employees or supervisors.
Tumen and Zeydanli (2013)	Standard panel data regression frame job with fixed effects.	Home ownership.

Source: Own elaboration, 2019.

According to the publications consulted (Table 2), the authors have resorted to various causality methodologies to identify and explain the construct of job satisfaction, which, in summary, presents significant relationships with aspects such as remuneration, activities to be performed, performance labor and the job environment. Therefore, it must be studied from different points of view in order to identify the most important factors.

### III. JOB SATISFACTION IN UNIVERSITIES

Professional academic activities are increasingly stressful: the image of a relaxed workday of a university professor or researcher goes back to the past under the pressure of market-oriented management in higher education and science (Abramov, Gruzdev, & Terentev, 2017). Therefore, it is very important to identify the factors that influence the job satisfaction of universities teachers. In this section a review of the research on job satisfaction in universities will be conducted in order to know if the concepts related to job satisfaction discussed in the previous section have the same behavior for any type of organization.

It should be remembered that satisfaction is defined as a positive (or negative) evaluative judgment that is made regarding one's job, which allows to reflect the feelings of commitment and / or professional motivation of the teachers. For them being able to have autonomy, significant relationships with colleagues and students, and seeing how that their job translates into students' success are key psychic rewards for job satisfaction. (Ford, Urick, & Wilson, 2018).

On one hand, Cabezas *et al.* (2017) affirm that teachers' job satisfaction is a significant concept that has a direct relationship with teacher retention, commitment and performance. According to their research, there is a positive and robust relationship between the number of non-teaching hours and teachers job satisfaction, and a negative one related with extra-job hours. In addition, they identify the relevance of having formal instances of collaborative job to plan and prepare class material since it has a positive effect on the teacher satisfaction.

On the other hand, Abramov *et al.* (2017) classify teachers into five types of faculties: research professors, professors, researchers, "universal soldiers", and experts. They determined that each one of these types shows different levels of satisfaction regarding their working time budget. Naturally those that do much teaching and administrative jobs tend to be less satisfied, thus affecting the quality of their job.

Generally, university administrators consider that increasing the workload of academic professionals is a

source of productivity growth, but these expectations can hardly be considered justified, since the workload represents a complex system of interrelated aspects of teaching, organizational job, research and expert activities (Abramov, Gruzdev, & Terentev, 2017).

Similarly, according to Quevedo-Blasco *et al.* (2015) there is a moderate satisfaction towards changes applied to the latests configurations of university education since these have brought with them the appearance of new teaching functions, which involve a lot of effort on organizing and developing practical classes, seminars, evaluating students, as well as having a greater orientation and supervision of the students' job. This last one is a consequence of the emergence of competencies such as "acting as a guide / mediator" and "teaching centered on the student", which prevents the teacher from devoting the time he would like to his own research.

Converso *et al.* (2017), through a factorial component analysis, identify the main dimensions of academic work that contribute to the quality of life of the academic staff, such as: research and public participation, didactic work and relations with students, professional development and competition, ordinary obligations and fundraising. In their study they present that the most negative and stressful characteristics were those identified by elements that referred to activities that limited time and those related to the highest competence that characterizes a professional career. In contrast, the most rewarding activities for academics were those related to research and didactic activities.

Falola *et al.* (2018), meanwhile, present information about engagement strategies at work and how they relate to the results of teachers' behavior in the university context. The researchers mention professional opportunities, recognition of work, reputation of the institution, investment in employees and fun at work such as work engagement strategies; while, among the results of the behavior of teachers, are loyalty, intention and job satisfaction. Under this context, Adeniji *et al.* (2018) determined that the three factors that most influence job satisfaction are promotion opportunities, the salary package and communication.

In contrast, Guo and Wang (2017) show that among the factors that affect the job satisfaction of teachers in Chinese universities is the system of organization, which, regardless of salary, plays an important role in the job satisfaction of the teachers.

Al Zo'bi (2018) conducts a study in Jordanian universities to identify participation in the degree of decision-making and its relationship with job satisfaction, showing that these institutions offer a climate of participation and

cooperation in decision-making. The job environment is characterized by collective job and the existence of a culture that emphasizes the importance of participation in decision making, reflecting a high degree of job satisfaction and providing members with feelings of respect, appreciation and happiness within their community. In addition, teachers perceive higher income to other labor sectors, as well as a system of promotions and incentives, that is, there is a positive relationship with economic rewards (Munyengabe, Haiyan, Yiyi, & Jiefei, 2017).

The findings of Ud Din Kahn *et. al.* (2018) support the proposition that employees' perceptions of organizational policies result in low job satisfaction and low organizational commitment. That is, when employees feel disadvantaged and unfairly treated based on political motives, they are inclined to respond with undesirable job

attitudes, such as job dissatisfaction. While Oludayo *et. al.* (2018) indicate that there is a link between excessive workload and employee commitment, affecting morale, motivation and reducing absenteeism.

Kim and Choi (2018) indicate that it is necessary to pay close attention to the suitability of job when employing a highly educated doctoral workforce, because of the effect on salary, job satisfaction and performance. The importance of the study is to demonstrate that these efforts lead not only to individual economic compensation and job satisfaction, but also to economic achievements, such as the performance of research and the initiation of patents.

According to the publications consulted and through different methodologies (Table 3), it is concluded that the job satisfaction of university teachers, as in any organization, is composed of multiple factors.

*Table 3. Methodologies used to identify the concepts related to job satisfaction in universities*

Author	Methodology	Related concepts
Abramov <i>et. al.</i> (2017)	Descriptive and correlation analysis.	Job time budget.
Adeniji <i>et. al.</i> (2018)	Regression analysis.	Promotional opportunities. Salary package. Communication.
Al Zo'bi (2018)	Descriptive method, t-Test, ANOVA test and Correlation Analysis.	Participation in decision-making. Climate and culture of participation. Salary income.
Cabezas <i>et. al.</i> (2017)	Principal component analysis.	Retention. Commitment. Teaching performance Collaborative job for teaching material.
Converso <i>et. al.</i> (2017)	Confirmatory factor analysis.	Investigation. Public participation. Didactic work. Relations with students. Professional development and competence. Ordinary obligations. Collection of funds.
Falola <i>et. al.</i> (2018)	Structural equation model.	Professional opportunities. Recognition of job. Reputation of the institution. Investment in employees. Fun at job.
Ford, Urick & Wilson (2018)	Two-Level Hierarchical Linear Models.	Autonomy. Significant relationships with colleagues and students.

		Job as a student success.
Guo & Wang (2017)	Non-parametric tests.	Organization system. Salary.
Kim & Choi (2018)	Structural equation model.	Suitability of the job to the work force with doctorate.
Munyengabe <i>et. al.</i> (2017)	Descriptive and correlation analysis.	Economic rewards.
Oludayo <i>et. al.</i> (2018)	Descriptive analysis.	Workload as a factor that alters morale, motivation and absenteeism.
Quevedo-Blasco <i>et. al.</i> (2015)	Descriptive analysis.	Changes to the configuration of university education. Appearance of new teaching functions.
Ud Din Khan <i>et. al.</i> (2018)	Partial least squares structural equations modeling.	Perception of organizational policies. Organizational commitment

Source: Own elaboration, 2019.

It is clearly seen that job satisfaction for university teachers is influenced by economic issues such as salary, relationships in the workplace, in this case, both with colleagues and students; the opportunities for growth and a culture of participation and recognition (Figure 1). It should be noted that the aforementioned factors are shared equally by the companies of goods and services.

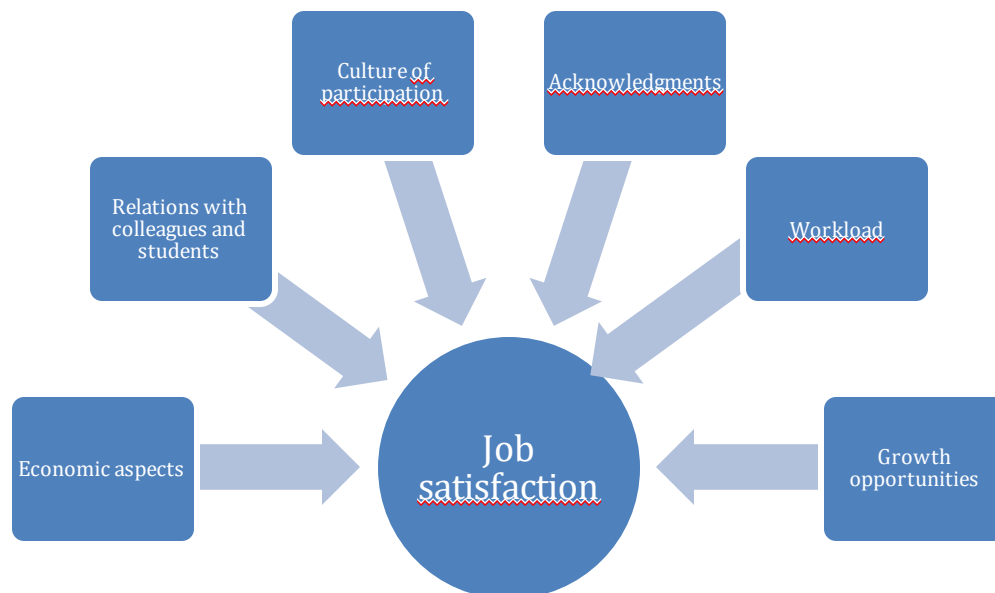


Fig.1: Main factors that influence job satisfaction in universities

Source: Own elaboration, 2019.

In addition, the analyzed studies show that the workload also represents a factor in the level of satisfaction. Because educational institutions must evolve like any organization, changes have been made in the configuration of teaching, which results in greater

workloads for teachers, which does not allow them to devote themselves to class planning and research.

It is very important to identify the factors that influence job satisfaction in companies of goods and services as well as in educational institutions, since several researches highlight the role of satisfaction in the increase

of job performance and productivity, as well as the decrease of absenteeism and staff turnover.

#### IV. STRATEGIES TO INCREASE JOB SATISFACTION

Within the literature on job satisfaction mentioned some strategies that aim to increase it within organizations. In this section some of them are briefly exposed.

##### 4.1 Emotional intelligence

The concept of emotional intelligence (EI) has been developing for 25 years, gaining popularity and visibility among researchers and professionals. Sánchez-Gómez and Bresó (2019) indicate that the definition given by Salovey and Mayer refers to EI as the subset of social intelligence that implies the ability to control one's own and others' feelings and emotions, to discriminate between them and to use this information to guide the thinking and ideas of others. For them, EI is considered a combination of four different skills:

- (1) Adequate perception of one's own and others' emotions;
- (2) Emotional facilitation of thought;
- (3) Understanding of one's own and others' emotions, and
- (4) Appropriate management of emotions to achieve a specific objective.

These interwoven skills influence the ability of people to interact with others in an appropriate way, communicate effectively, manage conflicts or stressful situations, and create a positive work environment, among many other aspects. That is, EI is highlighted as a psychological resource associated with positive personal and organizational results (Mérida-López, Extremera, Quintana, & Rey, 2019).

##### 4.2 Job fit theory

The job fit theory arises in the eighties and refers to the degree to which the characteristics of the job performed by a person and the knowledge, skills and abilities necessary for performance at job correspond or are appropriate (Kim & Choi, 2018).

According to Kim and Choi (2018), this theory establishes that the greater the suitability of the labor characteristics of an individual in the work environment, the greater the individual job performance, which shows the highest relevance for job performance, impacting positively in job satisfaction.

This job fit has also been used for the so-called "job mismatch", from the perspective of highlighting the discrepancy between the characteristics of both job and personal, which refers to the degree to which educational

achievement, competition, the main fields and fields of interest of an employee correspond to the level of difficulty or competence required for a specific job. The imbalance of job, as Kim and Choi (2018) show, has a negative effect on job satisfaction.

##### 4.3 Organizational culture

In general, the theory of organizational culture postulates that it exerts its influence through the configuration of the behavior of the members of the organization. Therefore, as expressed by Meng and Berger (2019), the organizational culture emerges as a necessary condition to improve the commitment and job performance of the members of the organization and, consequently, the confidence of the members within it will be reinforced. In this way, commitment and trust will generate a joint mediation effect when linked to the job satisfaction of professionals.

##### 4.4 Leadership style

The leadership style inspires people with a specific vision to work, helps clarify some concrete goals and motivates and helps employees to communicate well within their team (Moslehpour, Altantsetseg, Mou, & Wong, 2019), which makes it one of the main factors for the success of any group activity. In addition, leadership can indirectly influence performance through corporate social responsibilities, which can be defined as the continued commitment of companies to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families, as well as the local community and society in general (Manzoor, Wei, Nurunnabi, Subhan, Shah, & Fallatah, 2019).

Moslehpour *et. al.* (2019) state that the leadership style:

- (1) Influences the attitude of employees,
- (2) It is an effective organizational engine and is based on the interaction between the leader and the employees in the workplace,
- (3) It is a key factor that influences the satisfaction of employees in their workplace.

Among leadership styles (Moslehpour *et. al.*, 2019; Manzoor *et. al.*, 2019) are:

- Transformational leadership, which emphasizes increasing work commitment, job satisfaction and employee well-being.
- Authentic leadership depends on the organizational context and the positive psychological attitude of an individual, determining the self-awareness and self-regulated positive behaviors of both leaders and employees.

- Business leadership converges and directs the performance of group members towards the achievement of organizational objectives that involve the identification and implementation of business opportunities.

In accordance with the strategies outlined above, it is concluded that to increase job satisfaction it is not enough to identify the factors that influence it, such as the economic aspect, the recognition, the growth opportunities, among others, but it is necessary to create the adequate work environment, where people can make progress.

In other words, organizations of any kind should focus on recognizing the adequacy of an individual's job characteristics in the workplace; encourage leadership, so that it is an engine of effective organization; promote effective communication and conflict management, as well as commitment and trust among all staff, as this will create a positive work environment, impacting individual and collective work performance and, thus, influencing in

the satisfaction of employees. This will result in the reduction of labor turnover, raising the productivity of organizations.

## V. FRAMEWORK OF THE RESEARCH METHODOLOGY

An exploratory investigation was carried out in order to know the concepts that constitute the construct of job satisfaction and, especially, that of teachers in universities. In this way, the level of satisfaction can be raised, which will affect the performance of the teaching staff and, therefore, the productivity of the universities.

The academic publications consulted were obtained through the databases Scopus®, principally, and *Jstor*. 34 publications of 29 journals were consulted. It is worth mentioning that 55% of academic journals are published in countries such as the United States and the United Kingdom; while 18% come from countries such as Spain, Hungary, India, Italy and Serbia (Figure 2).

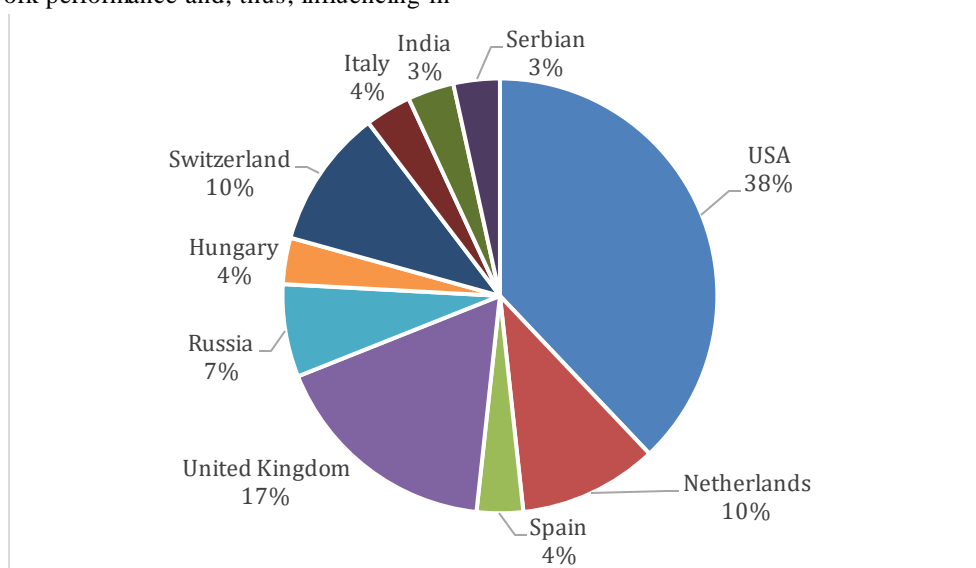


Figure 2 Country of origin of the academic journal

Source: Own elaboration, 2019.

The information search criteria were the key words: job satisfaction, universities, strategies, productivity. In addition, several tasks were carried out, beginning with the discrimination of publications considered relevant based on concepts and references that were significant to the object of study of this article.

Other criteria to determine the relevance of the documents was the analysis of various indices (Table 4), provided by the *SCImago* Journal & Country Rank, which is a publicly available portal that includes the journals and scientific indicators of developed countries based on the

information contained in the Scopus® database (Elsevier BV).

Among the indicators used to evaluate and analyze scientific domains, are the *SCImago* Daily Range Indicator (SJR), H index and the quartile (Qi):

- SJR is a measure of the impact, influence or prestige of the journal. Express the average number of weighted citations received in the year selected by the documents published in the journal in the previous three years.
- While the H index shows the number of articles (h) of the journal that have received

at least h appointments throughout the period.

- The quartile (Qi) is an indicator used to evaluate the relative importance of a journal

within the total number of journals in its area, that is, it is a measure of the position of a journal in relation to all those of its area.

*Table 4. Academic publications consulted*

Journal	Country	Editor	H Index	Qi	SJR 2017
Academy of Management Journal	USA	Academy of Management	266	1	8.55
Academy of Management Perspectives	USA	Academy of Management	108	1	2.95
BMC Health Services Research	United Kingdom	Biomed Central	83	1	1.15
Data in brief	Netherlands	Elsevier	8	1	0.34
Educación XXI	Spain	UNED	11	1	0.78
Education Policy Analysis Archives	USA	Arizona State University	39	2	0.55
Education Policy Analysis Archives	USA	Arizona State University	39	2	0.55
Eurasia Journal of Mathematics, Science and Technology Education	United Kingdom	Taylor & Francis	32	2	0.38
European Journal of Contemporary Education	Russia	Academic Publishing House Researcher	3	4	0.19
European Journal of Mental Health	Hungary	Akademiai Kiado	6	4	0.13
European Sociological Review	United Kingdom	Oxford University Press	68	1	2.73
Frontiers in Psychology	Switzerland	Frontiers Media	66	1	1.04
Human relations	USA	SAGE Publications	105	1	2.2
Human resource management review	United Kingdom	Elsevier	72	1	1.67
Industrial and Labor Relations Review	USA	SAGE Publications	66	1	1.45
International Journal for Quality Research	Serbian	University of Montenegro	9	3	0.43
Journal of Behavioral and Experimental Economics	USA	Elsevier	48	1	0.59
Journal of Business and Psychology	USA	Kluwer Academic/Plenum Publishers	58	1	1.74
Journal of Business Ethics	Netherlands	Kluwer Academic	132	1	1.28
Journal of Open Innovation: Technology, Market, and Complexity	Switzerland	MDPI Open Access Publishing			
Journal of vocational behavior	USA	Elsevier	120	1	1.69
Mediterranean Journal of Social Sciences	Italy	MCSER-Mediterranean Center of Social and Educational research	16	3	0.12
Prabandhan: Indian Journal of Management	India	Associated Management Consultants Private Limited	4	3	0.19
Public personnel management	USA	SAGE Publications	36	2	0.68
Public relations review	USA	Jai press	60	1	0.81

Scandinavian Journal of Psychology	United Kingdom	Blackwell Publishing	61	2	0.63
Social Indicators Research	Netherlands	Kluwer Academic Publishers	82	1	0.77
Sustainability	Switzerland	MDPI Open Access Publishing	42	2	0.54
Voprosy Obrazovaniya/Educational Studies	Russia	National Research University Higher School of Economics	5	3	0.22

76.5% of the academic publications are from 2014 to date and 75.8% belong to the quartiles 1 (Q1) and 2 (Q2) of their area (Figure 3). Finally, the present article was structured and fed.

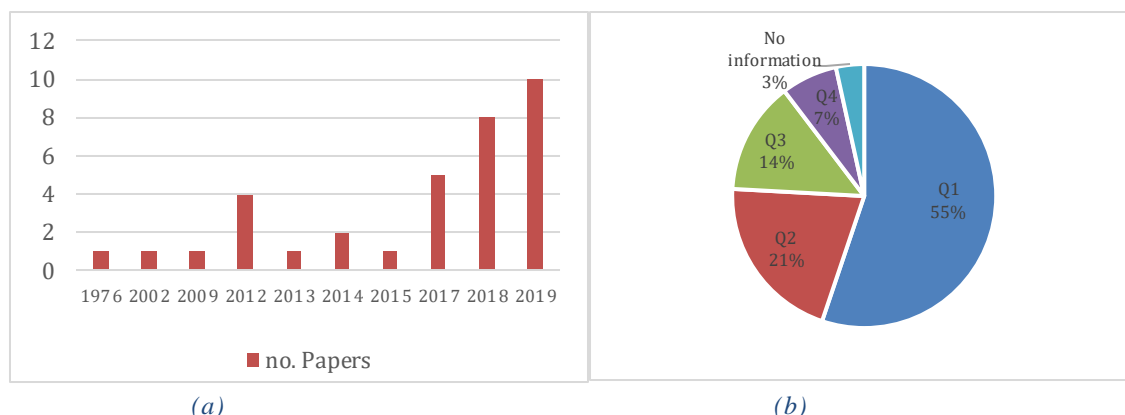


Fig.3: (a) Year of publication of the journal and (b) quartile to which the journal belongs

Source: Own elaboration, 2019.

## VI. CONCLUSIONS

In this article it is identified the various factors that influence the construction of job satisfaction and, particularly, how it is defined in universities.

Job satisfaction is a theoretical construction that refers to the assessment that each person makes about the job they perform and that is associated both with the climate prevailing in the workplace and with the associated economic aspect. This concept has become a significant factor that impacts on labor turnover and, therefore, on the productivity of organizations.

According to the studies consulted, job satisfaction has significant relationships with aspects such as remuneration, activities to be performed, job performance and the work environment. In terms of job satisfaction for teachers in universities, it is also influenced by economic issues such as salary, relationships in the workplace; opportunities for growth and a culture of participation and recognition, aspects that also appear in the companies of goods and services.

Therefore, it is vital to identify the factors and increase job satisfaction through the development and application of strategies such as emotional intelligence, labor adjustment theory, organizational culture and leadership

style, which promote efficient communication between those involved, contributing to create a good work environment and a culture of participation and, in this way, encourage job satisfaction.

In conclusion, in any type of organization it is very important to raise the perception of job satisfaction in the workplace in order to increase job performance and productivity in organizations, reducing absenteeism and staff turnover. And, in the case of universities, contribute to the intellectual development of people and communities.

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# Supply Chain Pricing Decisions under Corporation Social Responsibility

Meixiang Wu, Chengdong Shi, Qiang Sun

School of Management, Shandong University of Technology, Zibo, 255000, China

**Abstract**—The multiple push from the government, the public and non-governmental organizations has increased CSR awareness and makes CSR behavior of cooperators an issue. Considering the impact of sales efforts on demand, making the supply chain which dominated and undertakes the sales effort by retailers as the research object, This paper compares three models of the node enterprise pricing decisions in three CSR commitment models, studies the impact of CSR participation and sales efforts on member profits and social welfare. The study found that the three models can improve social welfare, sales efforts can reduce prices and increase sales; There is a big profit gap and different pricing strategies between M mode and R mode; The social welfare is the largest under MR model, However, there is a threshold for CSR engagement in this model, the supply chain profit shows a downward trend beyond the threshold.

**Keywords**— Corporate social responsibility (CRS), supply chain, pricing decisions, Stackelberg game, sales efforts.

## I. INTRODUCTION

Corporate social responsibility (CSR) refers to the responsibility of enterprises to shareholders and stakeholders such as employees, consumers, environment and communities. Corporate CSR behavior has an obvious effect on forward and reverse supply chain, For example, it affects the overall performance of third-party recycling CLSC network (Li et al 2017), reverse logistics recovery mode (Wen and Dong 2016), supplier quality information (Fan et al 2017), product demand (Li et al 2017) and so on. Corporate social responsibility is becoming a new competition parameter of supply chain (Wu 2013). Therefore, it is of great practical significance to study the decision-making evolution rules of supply chain members under CSR behavior and reasonable planning social responsibilities of all parties.

Supply chain decision-making under CSR can be divided into four aspects: Firstly, Single supply chain pricing decision. Panda (2017) studied the impact of CSR on retailer recycling and manufacturer recycling CLSC decisions respectively. Liu and Zhou (2016) studied the supply chain optimal decision of each member participating

in CSR activities under asymmetric market demand information. Li et al (2017) took the two-level manufacturing chain dominated by component suppliers as the research object, and analyzed the impact of equity concerns supply chain decisions under the circumstance that both parties' social responsibility input influences the demand. Zheng et al (2008) studied the influence of supply chain members' CSR input behavior in closed-loop supply chain.

Secondly, Competitive decision in supply chain. Song et al (2016) studied the pricing decision problem when 1M+1R assumed CSR in 1M+2R supply chain. Liang et al (2013) constructed two competitive supply chain games considering CSR behavior, and proposed that supply chain with CSR differentiation strategy is more competitive.

Thirdly, Supply chain coordination under CSR. Hsueh (2014) proposed an integrated corporate social responsibility and coordination mechanism when manufacturers invest in CSR and charge wholesale prices to retailers. Wu (2016) built three game models of cost-benefit sharing mechanisms according to different subjects of social responsibility, and compared pricing decisions of members under different sharing mechanisms.

Fourthly, CSR integrated governance. Gong et al (2012) constructed a supply chain social responsibility model under consumer preference, and analyzed the internal motivation and government incentive mode of the supply chain to fulfill social responsibility. Li and Huang (2016) proposed an integrated governance model of supply chain social responsibility from the perspective of value creation incentive of supply chain integration. This article focuses only on the first aspect.

At present, most supply chain pricing decisions under CSR are based on manufacturers' leading supply chain, and the considerations focused on equity concerns, Supply chain competition, information asymmetry, consumer preference, sales effort, CSR cost, etc. The innovation of this paper are as follows: Firstly, The research object is the retailer dominated supply chain; Secondly, The demand is influenced by sales efforts and corporate social responsibility are both considered in the supply chain decision-making model.

To sum up, this paper aims to explore the following issues: Firstly, Research on three CSR models: The influence of the two parameters (CSR participation, sales effort) on system pricing, sales volume, member profit and social welfare; Secondly, Comparison of different CSR models: member decision-making, member profits and social welfare; Thirdly, CSR model selection from the perspective of each member. In this paper, the evolution law of supply chain under CSR behavior is discussed to provide decision-making support for enterprises to select and formulate suitable CSR undertaking mode.

## II. PROBLEM DESCRIPTION AND HYPOTHESIS

This paper takes the retailer-led supply chain as the research object. The retailer and the manufacturer both make rational

decisions, have some CSR awareness, and have complete information about each other. The demand

$$p = m + w, q = a - \beta p + \gamma h, \quad q > 0, w > 0, m > 0, p > 0, h > 0$$

is affected by the price and the retailer's sales efforts. represent market demand, wholesale price, retailer's profit per unit product, selling price, and retailer's sales effort, respectively.

Assumed that the seller's cost of selling effort is  $I = 0.5\delta h^2$ , in which  $\eta > 0$  represents the cost coefficient of sales effort; Manufacturers and retailers may have some sense of social responsibility, and the manufacturer's and the retailer's degree of social responsibility are  $0 \leq r_m, r_r \leq 1$  respectively. It

is assumed that consumer surplus is  $CS = \int_{p_{min}}^{p_{max}} q dp = \frac{[a - \beta p + \gamma h]^2}{2\beta^2}$ ,

$\pi_i$  and  $V_i^j$  represent the net profit and profit of member  $i$  under certain social responsibility, in which  $i = m, r, sc$  represent manufacturer, retailer and supply chain respectively and  $j = M, R, SC$  represent three modes of social responsibility: manufacturer, retailer and both parties. For simplicity, take  $r_m = r_r = r$ . In order to ensure that the profit function of each member enterprise is concave and relevant expressions are feasible, assumed that  $0 < \gamma < \sqrt{(2-3r/2)\beta\delta}$ .

## III. MODEL CONSTRUCTION AND ANALYSIS OF EQUILIBRIUM RESULTS

### 3.1 The case of R taking on CSR (R model)

According to the definition of social welfare in economics: social welfare is equal to the sum of retailer surplus (retailer profit) and consumer surplus,

Consumer surplus is the difference between the actual market price and the maximum price of which consumers are willing to pay for a product. In this case, the profit function of manufacturer and retailer is respectively:

$$V_r^R(m, h) = \pi_r^R + CS_r^R = mw[a - \beta(w + m) + \gamma h] - 0.5\delta h^2 + \frac{[a - \beta(w + m) + \gamma h]^2}{2\beta} \quad (1)$$

$$\pi_m^R(w) = w[a - \beta(w + m) + \gamma h]$$

In which,  $0 \leq r \leq 1$  refers to the degree of social responsibility, The larger  $r$  is, the greater the degree of social responsibility it takes.

In R mode, the solution result is shown in equation (2) :

$$m^R = \frac{\delta a(2-r)}{4\beta\delta - \beta\delta r - \gamma^2}, w^R = \frac{\delta a}{4\beta\delta - \beta\delta r - \gamma^2}, p^R = \frac{\delta a(3-r)}{4\beta\delta - \beta\delta r - \gamma^2}, q^R = \frac{\beta\delta a}{4\beta\delta - \beta\delta r - \gamma^2}, h^R = \frac{\gamma a}{4\beta\delta - \beta\delta r - \gamma^2} \quad (2)$$

$$\pi_r^R = \frac{a^2\delta[2(2-r)\beta\delta - \gamma^2]}{2[(4-r)\beta\delta - \gamma^2]^2}, \pi_m^R = \frac{\beta\delta^2 a^2}{(4\beta\delta - \beta\delta r - \gamma^2)^2}, \pi_{sc}^R = \frac{a^2\delta[(6-2r)\beta\delta - \gamma^2]}{2(4\beta\delta - \beta\delta r - \gamma^2)^2}, V_r^R = \frac{[\beta\delta(5-2r) - \gamma^2]a^2\delta}{2(4\beta\delta - \beta\delta r - \gamma^2)^2}, V_{sc}^R = \frac{[\beta\delta(7-2r) - \gamma^2]a^2\delta}{2(4\beta\delta - \beta\delta r - \gamma^2)^2}$$

Theorem 1 :  $w^R, h^R, q^R$  is positively related to  $r$ ,  $m^R, p^R$  is negatively correlated with  $r$ .

Proof:

$$\frac{\partial w^R}{\partial r} = \frac{a\beta\delta^2}{[4\beta\delta - \beta\delta r - \gamma^2]^2} > 0, \frac{\partial q^R}{\partial r} = \frac{a\beta^2\delta^2}{[4\beta\delta - \beta\delta r - \gamma^2]^2} > 0, \frac{\partial h^R}{\partial r} = \frac{a\beta\delta\gamma}{[4\beta\delta - \beta\delta r - \gamma^2]^2} > 0 \quad (3)$$

$$\frac{\partial m^R}{\partial r} = \frac{(-2\beta\delta + \gamma^2)\delta a}{[4\beta\delta - \beta\delta r - \gamma^2]^2} < 0, \frac{\partial p^R}{\partial r} = \frac{(-\beta\delta + \gamma^2)\delta a}{[4\beta\delta - \beta\delta r - \gamma^2]^2} < 0$$

Equation 3 shows that: Under R's social responsibility, R stimulates consumer demand and expands product demand by lowering selling price and improving sales efforts. In R mode, the manufacturers is in a subordinate position, meanwhile it is not constrained by the sense of social responsibility. Therefore, when the market demand expands, the manufacturer will increase the wholesale price without restriction in order to maximize its own profit. The implementation of a series of measures, such as raising the wholesale price, reducing the cost of sales efforts and lowering the selling price, will greatly reduce the unit product profit of retailers.

Theorem 2 :  $\pi_m^R, \pi_{sc}^R, V_m^R, V_{sc}^R$  is positively related to  $r$ ,  $\pi_r^R$  is negatively correlated with  $r$ ;

Proof:

$$\frac{\partial \pi_r^R}{\partial r} = \frac{-2r\beta^2\delta^3 a^2}{2[(4-r)\beta\delta - \gamma^2]^3} < 0, \frac{\partial \pi_m^R}{\partial r} = \frac{2\beta^2\delta^3 a^2(4\beta\delta - r\beta\delta - \gamma^2)}{(4\beta\delta - \beta\delta r - \gamma^2)^4} > 0, \frac{\partial \pi_{sc}^R}{\partial r} = \frac{(4-2r)a^2\delta^2\beta^2\delta^2}{2(4\beta\delta - \beta\delta r - \gamma^2)^3} > 0 \quad (4)$$

$$\frac{\partial V_r^R}{\partial r} = \frac{a^2\beta^2\delta^3(2-r)}{2(4\beta\delta - \beta\delta r - \gamma^2)^3} > 0, \frac{\partial V_{sc}^R}{\partial r} = \frac{(3-r)a^2\delta^3\beta^3}{(4\beta\delta - \beta\delta r - \gamma^2)^3} > 0$$

Equation 4 shows that: With the increasing awareness of social responsibility of leading retailers, the price reduction and sales efforts of retailers not only provide social welfare, but also improve the overall profit of all members of the system. Although the retailer sacrifices some of its own pure profits, all members benefit from it, which is in line with the leading party with a sense of social responsibility to pay attention to its stakeholders. Furthermore, the stronger the retailer's awareness of social responsibility, the more obvious the improvement of the stakeholders' and the system's overall profit.

### 3.2 The case of M taking on CSR (M model)

In this case, the profit function of manufacturer and retailer is respectively:

$$V_m^M(w) = \pi_m + CS_m = w[a - \beta(w + m) + \gamma h] + \frac{[a - \beta(w + m) + \gamma h]^2}{2\beta} \quad (5)$$

$$\pi_r^M(m, h) = mw[a - \beta(w + m) + \gamma h] - 0.5\delta h^2$$

The game process is as follows: Firstly, R determines the degree of sales effort, then M determines the wholesale price, and the solution is:

$$m^M = \frac{(2-r)\delta a}{2(2-r)\beta\delta - \gamma^2}, w^M = \frac{(1-r)\delta a}{2(2-r)\beta\delta - \gamma^2}, p^M = \frac{(3-2r)\delta a}{2(2-r)\beta\delta - \gamma^2}, h^M = \frac{a\gamma}{2(2-r)\beta\delta - \gamma^2}, q^M = \frac{\beta\delta a}{2(2-r)\beta\delta - \gamma^2} \quad (6)$$

$$\pi_r^M = \frac{a^2\delta}{2[2(2-r)\beta\delta - \gamma^2]}, \pi_m^M = \frac{(1-r)\beta\delta^2 a^2}{[(4-2r)\beta\delta - \gamma^2]^2}, \pi_{sc}^M = \frac{[(5-3r)\beta\delta - \gamma^2]a^2\delta}{[2(2-r)\beta\delta - \gamma^2]^2}, V_m^M = \frac{(2-r)\beta\delta^2 a^2}{2[2(2-r)\beta\delta - \gamma^2]^2}, V_{sc}^M = \frac{\delta a^2[3(2-r)\beta\delta - \gamma^2]}{2[2(2-r)\beta\delta - \gamma^2]^2}$$

Theorem3 :  $m^M, h^M, q^M$  is positively related to  $r$ ,  $w^M, p^M$  is negatively correlated with  $r$ ;

Proof:

$$\frac{\partial m^M}{\partial r} = \frac{\delta a\gamma^2}{[2(2-r)\beta\delta - \gamma^2]^2} > 0, \frac{\partial w^M}{\partial r} = \frac{(-2\beta\delta + \gamma^2)\delta a}{[2(2-r)\beta\delta - \gamma^2]^2} < 0, \frac{\partial h^M}{\partial r} = \frac{2a\gamma\beta\delta}{[2(2-r)\beta\delta - \gamma^2]^2} > 0 \quad (7)$$

$$\frac{\partial q^M}{\partial r} = \frac{2a\gamma\beta\delta}{[2(2-r)\beta\delta - \gamma^2]^2} > 0, \frac{\partial p^M}{\partial r} = \frac{(-\beta\delta + \gamma^2)\delta a}{2[(2-r)\beta\delta - \gamma^2]^2} < 0$$

Equation 7 shows that: Under the social responsibility of M, manufacturers will lower the wholesale price and retailers will increase their sales efforts, so as to increase the sales volume of supply chain products. For dominant retailers, without the constraint of social responsibility, R will not reduce the profit per unit product, but increase the net profit per unit product due to

the increase of product demand. In order to stimulate manufacturers' enthusiasm to assume social responsibilities, retailers' net profit per unit product will not exceed the limit, that is, the result is a lower price.

Theorem4 :  $\pi_r^M, \pi_{sc}^M, V_m^M, V_{sc}^M$  is positively related to  $r$ .  $\pi_m^M$  is positively related to  $r$  When  $r$  is less than 0.5, and  $\pi_m^M$  is negatively correlated with  $r$  when  $r$  is greater than 0.5.

Proof:

$$\begin{aligned} \frac{\partial \pi_r^M}{\partial r} &= \frac{4a^2\delta^2}{2[2(2-r)\beta\delta - \gamma^2]^2} > 0, \frac{\partial \pi_m^M}{\partial r} = \frac{\beta\delta^2 a^2(-2r\beta\delta + \gamma^2)}{[(4-2r)\beta\delta - \gamma^2]^3} < 0, \frac{\partial \pi_{sc}^M}{\partial r} = \frac{[2(4-3r)\beta\delta + \gamma^2]a^2\delta^2\beta}{[2(2-r)\beta\delta - \gamma^2]^3} > 0 \\ \frac{\partial V_m^M}{\partial r} &= \frac{[(4-2r)\beta\delta + \gamma^2]a^2\delta^2\beta}{2[(4-2r)\beta\delta - \gamma^2]^3} > 0, \frac{\partial V_{sc}^M}{\partial r} = \frac{[6(2-r)\beta\delta + \gamma^2]a^2\delta^2\beta}{2[2(2-r)\beta\delta - \gamma^2]^3} > 0 \end{aligned} \quad (8)$$

Equation8 shows that: With the increasing social responsibility of manufacturers, the sales efforts of retailers can improve social welfare, retailers' profits and the overall profit of the supply chain. However, for the manufacturer itself, when the degree of social responsibility is small, it is beneficial to its net profit. However, when the coefficient of social responsibility exceeds 0.5, some of its profit will suffer, which will greatly reduce the manufacturer's enthusiasm to assume social responsibility.

### 3.3 The case of MR taking on CSR (MR model)

Under shared social responsibility and centralized pricing:

$$V_{sc}^{MR}(p, h) = p_{sc} + CS_{cs} = p[a - bp + gh] - 0.5dh^2 + \frac{[a - bp + gh]^2}{2b} \quad (9)$$

Proof:

$$p^{MR} = \frac{\delta a(1-r)}{\beta\delta(2-r) - \gamma^2}, h^{MR} = \frac{a\gamma}{\beta\delta(2-r) - \gamma^2}, q^{MR} = \frac{\beta\delta a}{\beta\delta(2-r) - \gamma^2}, \pi_{sc}^{MR} = \frac{\beta\delta^2 a^2(1-r)}{[\beta\delta(2-r) - \gamma^2]^2}, V_{sc}^{MR} = \frac{\beta\delta^2 a^2(3-2r)}{2[\beta\delta(2-r) - \gamma^2]^2} \quad (10)$$

Theorem5 :  $h^{MR}, q^{MR}$  is positively related to  $r$ .  $p^{MR}$  is negatively correlated with  $r$ .

Proof:

$$\frac{\partial p^{MR}}{\partial r} = \frac{\delta a(-\beta\delta + \gamma^2)}{[\beta\delta(2-r) - \gamma^2]^2} < 0, \frac{\partial h^{MR}}{\partial r} = \frac{a\gamma\beta\delta}{[\beta\delta(2-r) - \gamma^2]^2} > 0, \frac{\partial q^{MR}}{\partial r} = \frac{a\beta^2\delta^2}{[\beta\delta(2-r) - \gamma^2]^2} > 0 \quad (11)$$

Theorem 5 shows that: In the MR model, the retailer will reduce the profit of per unit product and increase the level of sales efforts, and the manufacturer will reduce the wholesale price. That is, Concessions from both will be greatly reduced and the sales volume of the product will be increased.

Theorem6 :  $\pi_{sc}^{MR}$  is negatively correlated with  $r$ .  $V_{sc}^{MR}$  is positively related to  $r$ .

Proof:

$$\frac{\partial \pi_{sc}^{MR}}{\partial r} = \frac{\beta\delta^2 a^2[(-r)\beta\delta + \gamma^2]}{[\beta\delta(2-r) - \gamma^2]^3} < 0, \frac{\partial V_{sc}^{MR}}{\partial r} = \frac{\beta\delta^2 a^2[\beta\delta(-1+2r) + 2\gamma^2]}{2[\beta\delta(2-r) - \gamma^2]^3} > 0 \quad (12)$$

In the MR model, When the social welfare is the largest and the overall profit of the supply chain is the best, the CSR threshold is 2/3. With the enhancement of social responsibility, CSR behaviors of members will sacrifice part of their own interests to maximize social welfare.

### 3.4 pattern comparison and analysis

Theorem 7 :  $h^R < h^M < h^{MR}, q^R < q^M < q^{MR}, p^R > p^M > p^{MR}, m^R < m^M, w^R > w^M$

Theorem 7 shows that: Under the three modes, In the MR model, the selling price is the lowest, the sales effort is the strongest and the product sales volume is the largest. This is because manufacturers and retailers at the same time make profits to consumers in the MR model, that is, M reduces the wholesale price and R reduces the profit per unit product, which makes the selling price of products drop sharply and the sales volume rise rapidly.

Theorem 8 :  $\pi_r^R < \pi_r^M, \pi_m^R > \pi_m^M, \pi_{sc}^R > \pi_{sc}^M, V_{sc}^R > V_{sc}^M$

Theorem 8 shows that: Comparing R model with M model, When M assumes social responsibility, R has higher profit, system has higher profit and greater social welfare, but M has lower profit.

#### IV. SIMULATION ANALYSIS

Assuming  $q = 500 - 5p + 2e$ ,  $\delta = 3$ , the simulation results in the three models are shown in the table:

Table 1 Comparison of pricing decision variables in three modes

r	wM	wR	mM	mR	pM	pR	pMR	hM	hR	hMR	qM	qR	qMR
0.05	26.15	27.15	53.67	52.94	81.19	80.09	56.44	18.35	18.10	39.60	137.61	135.75	297.03
0.1	25.47	27.52	53.77	52.29	82.08	79.82	55.10	18.87	18.35	40.82	141.51	137.61	306.12
0.15	24.76	27.91	53.88	51.63	83.01	79.53	53.68	19.42	18.60	42.11	145.63	139.53	315.79
0.3	22.34	29.13	54.26	49.51	86.17	78.64	48.84	21.28	19.42	46.51	159.57	145.63	348.84
0.5	18.29	30.93	54.88	46.39	91.46	77.32	40.54	24.39	20.62	54.05	182.93	154.64	405.41
0.7	12.86	32.97	55.71	42.86	98.57	75.82	29.03	28.57	21.98	64.52	214.29	164.84	483.87
0.85	5.17	35.29	56.90	38.82	108.6	74.12	12.00	34.48	23.53	80.00	258.62	176.47	600.00

It can be seen from Table 1 that:

(1) the common ground of the three models is that with the increase of CSR degree of members, the selling price of products decreases, R's sales efforts increase, and product sales volume increases greatly. In MR mode, the selling price is the lowest, R has the strongest sales effort and the sales volume is the largest.

(2) Through longitudinal comparison, it can be seen that in the R model, with the stronger CSR participation, the higher wholesale price of the manufacturer, the lower unit product profit and selling price of the retailer, and the higher sales

effort. The combination of above is the increase of sales volume. Under M mode, with the enhancement of CSR degree, wholesale price decreases, sales efforts and unit product profits increase, selling price decreases and sales volume increases.

From the perspective of horizontal comparison, manufacturer's wholesale price in mode R is higher than that in mode M, while retailer's unit product profit, selling price, promotion effort and sales volume in mode M are all higher than that in mode R.

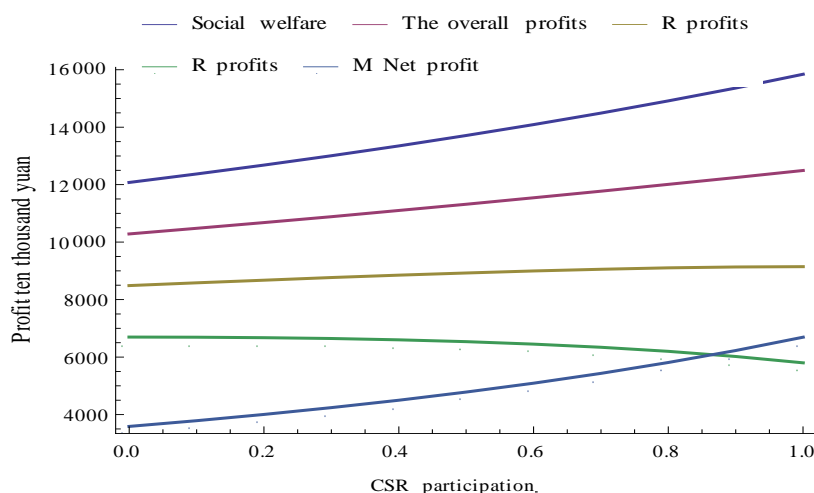


Fig.1: Member profit and social welfare under R mode

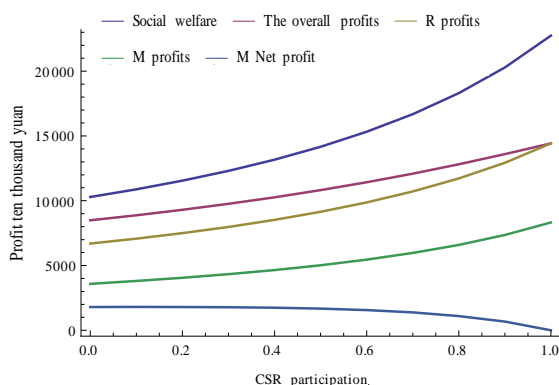


Fig.2: Member profit and social welfare under M mode

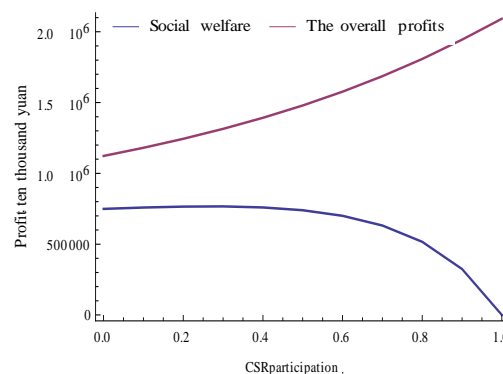


Fig.3: profit and social welfare of SC under MR model

It can be seen from figure 1-3 that: 1) in the M mode, with the increase of M's participation in CSR, social welfare, retailer profit and system profit all increase, but the profits of manufacturers decline. When the CSR degree of M reaches 1, the social welfare reaches the extreme value, the supply chain profit equals the retailer profit, and the manufacturer profit equals to zero. In the R model, with the increase of R's participation in CSR, social welfare, manufacturer profit and supply chain all increase, but the profits of retailer decrease. When the retailer's level of responsibility is relatively small, the retailer's profit is higher than the manufacturer's. When CSR exceeds the threshold, retailers' profits are lower than manufacturers'.

3) In the MR model, as MR's involvement in CSR increases, social welfare increases, while supply chain profit decreases. In a word, with the increase of CSR, the social welfare of three modes all increases, and the net profit of the underwriters declines. This proves theorems 1, 3, 5, 7.

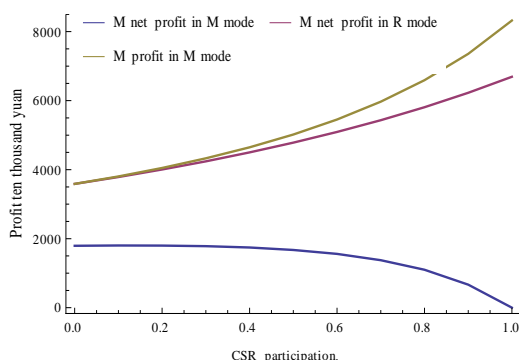


Fig.4: M profit and social welfare under different modes

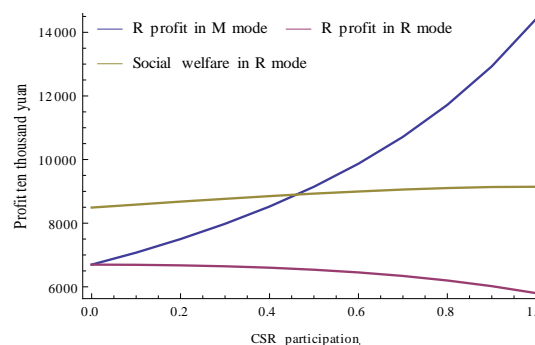


Fig.5: R profit and social welfare under different modes

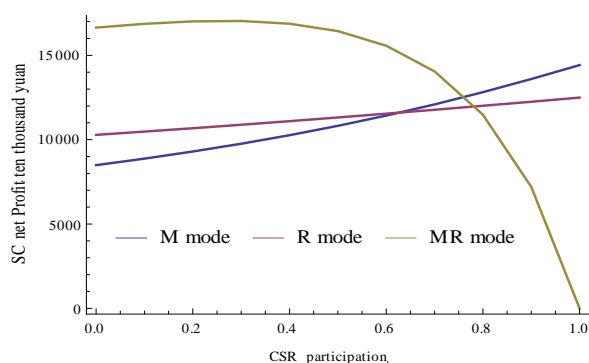


Fig.6: SC profit under different modes

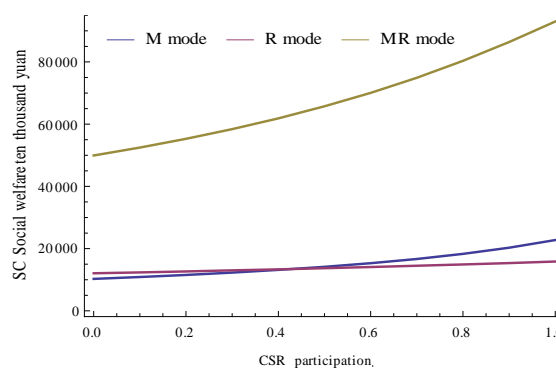


Fig.7: SC social welfare under different mode

It can be seen from Figure 4-7 that:

- (1) the correlation between the profit of each member, social welfare and the degree of social responsibility  $r$ , which verifies the correctness of conclusions 2, 4 and 6;
- (2) For M profit, SC profit and social welfare, R mode is better than M mode, while for R profit, M mode is better. These verify the correctness of conclusion 8;
- (3) From the perspective of supply chain profit, when members participate less in CSR, the MR mode is better, and when the participation degree of social responsibility exceeds the threshold, the M mode is the best, which verifies the correctness of conclusion 8.

## V. CONCLUSION

This paper takes the supply chain dominated by retailers and considering sales efforts as the research object, analyzes and studies the pricing decisions of various responsible parties and CSR members under the participation degree of CSR, and discusses the influence of R's sales efforts and CSR behaviors on the supply chain. The following conclusions are drawn:

- (1) In all three cases, the retailer's sales efforts reduce prices and increase the sales volume. The more CSR is involved, the influence of retailers' sales efforts on selling price and sales volume is more significant.
- (2) In all three cases, the participation of CSR bearers is greater, social welfare is higher, but bear's profits has downward trend.
- (3) CSR model and CSR participation level are closely related to supply chain pricing decisions.

This paper only discusses the influence of different CSR models on the profit of supply chain members and social welfare under the R leading and considering the sales efforts, and considers the production or sales cost, government guidance and other factors, which is the next research direction.

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# Safety Measures and Safety Warning Signages of Road Construction Projects: An Assessment

Jeed Ignacio<sup>1</sup>, Eraldjean Santos<sup>2</sup>, Patrick Socorro<sup>3</sup>, Dr. Noel Florencondia<sup>4</sup>, Dr. Lorinda Pascual<sup>5</sup>, Dr. Gener Subia<sup>6</sup>

<sup>1,2,3</sup> Students, Master of Engineering Management (Graduate School-NEUST)

<sup>4,5</sup> Faculty, Master of Engineering Management (Graduate School-NEUST)

<sup>6</sup> Faculty, Graduate School, Wesleyan University Philippines (WUP)

**Abstract**— This research described the safety measures and safety warning signages of road construction projects in the first and second legislative districts in the province of Nueva Ecija. Forty (40) road motorists and ten engineers who were familiar with roads and road constructions safety procedures were asked to assess the safety qualities of the projects. The data gathered by the researchers were tallied and tabulated using frequency, percentage and weighted mean.

It was found that the Personal Protective Equipment (PPE) used during construction was properly implemented. There were sufficient warning signs and barriers on the road projects. Oftentimes, there was good traffic management to control the flow of traffic passing through the construction site.

However, the traffic signs were sometimes visible and warning signs were often unreadable for drivers especially at night.

**Keywords**— Assessment, barriers, road construction, road safety, safety measures, warning signs.

## I. INTRODUCTION

An efficient road is crucial for the country's economic growth and poverty reduction. It is critical as social arteries for the delivery of government services and distribution of technology to the people. Therefore, it is just necessary to construct a road for a more progressive community. Yet, in the process of the construction of roads, there are necessary things that should be given attention not just the construction alone but also the safety of the motorists passing on the site.

Road accidents were mainly caused by driver's errors, mechanical defect, over speeding, drinking spree before driving and lastly, damaged roads or roads under construction without proper warnings [1].

In Nueva Ecija, Philippines, because of the continuing progress of the province, there were many roads that were constructed. Therefore, there are higher risks on the construction of roads that motorists may bump into, especially at night.

A lot of motorists encounter accidents when vehicles have to pass through the construction roads and more likely, fatal accidents occurred because of lack of warnings and signage on the area of the site. Some motorists didn't have the

chance to slow down because there were no warnings that were placed meters before the exact road construction.

Safety should not be set aside because it is considered as one of the most important things to prioritize in a construction project. The safety of the people working on the site, the motorists and the people involved in the road construction projects should be protected at all times. Lack of safety warning signs visible on the site means that there are more accidents that will most likely occur. There are inconveniences on the people passing on a road project if there are insufficient project safety warning and signage.

This research assessed the safety warning signs and safety measures of the road construction projects in Nueva Ecija that will probably reduce the accidents of the motorists, especially at night. The research aimed to provide information about the safety management of road projects. It aimed to educate the readers that the contractors shall not be held liable for the accident occurred in a construction site if they complied with the contract documents and performed the proper traffic safety plan of the project [2]. Common road construction mistakes that lead to accidents are improper signage, requiring motorists to negotiate too sharp a turn, leaving a dangerous condition in the pavement and

poor road conditions once construction has been completed [3]. All these mistakes are part of both during and after the construction of the road.

The finding of this study will serve as relevant data to the researchers to be able to make accurate decisions given available information [4] to come up with sufficient safety and management plan that will reduce vehicular accidents in road construction sites. Thus, this study finds meaning and relevance.

## II. METHODOLOGY

This research uses descriptive survey research design. Survey research design is a very useful tool to analyze opinions and trends [5]. The instrument used in this research was a close-ended questionnaire [6]. It is a cross-sectional survey that collected the information from the respondents in a single period of time [6]. The closed-ended question

has scale selection of strongly agree, agree, neutral, disagree and strongly disagree. The validity used in the research was both face and content validity. The face validity is the measurement that involves the personal judgment of the respondents while the content validity uses an approach based on statistics [7].

The respondents of the study were chosen purposively based on the following criteria [8]: they were motorists who were characterized based on the time and how long they drive and encounter the road construction site; how frequent they travel per week and how long they have been driving since they started; another were engineers/ architects who were project inspectors of a road construction project. When combined, face and content validity together with the strong approach of the questionnaire will lead to a strong type of validity. The statistical tools used in this research were the frequency, percentage and mean.

## III. RESULTS AND DISCUSSION

### 1. Assessment of the Safety of Traffic and Warning Signs

Table 1. Assessment of the Safety of Traffic and Warning Signs

	Question	Weighted Mean	Verbal Description
1	Traffic signs are visible from afar.	3.38	Sometimes
2	Warning signs are understandable from afar.	3.48	Often
3	Are there sufficient warning signs displayed to ensure no accident would occur?	3.45	Often
4	Are there sufficient safety barriers to separate the area from passing motorists?	3.58	Often
5	From your perception, is it convenient if there is traffic management implemented to control the flow of traffic passing through?	4.15	Often
6	During the night, do you visibly see traffic/warning signs informing that you are approaching in on-going road construction?	3.15	Not sure
7	Are the traffic signs noticeably reflect from your point of view?	3.24	Not sure
8	Are the warning signs noticeably reflect from your point of view?	3.41	Fairly yes
9	Are the barriers visibly reflect to see that some areas are not passable?	3.50	Fairly yes
	<b>Overall Weighted Mean</b>	<b>3.48</b>	<b>Often &amp; Fairly yes</b>

Table 1 shows that the respondents find the traffic signs as sometimes visible from a point of distance or from afar (W.M. = 3.38). Pointed out that often, warning signs are understandable from afar (W.M. = 3.48), there are often sufficient warning signs displayed to ensure no accident would occur (W.M. = 3.45), safety barriers are also often sufficient to separate the area from the passing motorists (W.M. = 3.58) and in the perception of the motorists, it is often convenient if there is traffic management

implemented to control the flow of traffic passing through (W.M. = 4.15). In a similar manner, the road safety warnings and barriers are often sufficient for the road construction and it is more convenient to implement traffic management to control the flow of traffic passing through the construction site.

For the respondents that are well versed in driving at night, they are not sure about the visibility of traffic/warning signs informing that they are approaching in an on-going road

construction (W.M.= 3.15) and that they are also not sure about the traffic signs being noticeably reflecting from their point of view (W.M.= 3.24). However, the warning signs are often (fairly yes) noticeable to reflect from their point of view (W.M. = 3.41) and also the barriers are fairly

noticeable to reflect some of the areas that are not passable (W.M. = 3.50).

## 2. Assessment on the Safety of Road Construction

Table 2. Assessment on Safety of Road Construction

	Question	Weighted Mean	Verbal Description
1	Occupational Safety and Health Program is strictly implemented.	3.80	Often
2	Personal Protective Equipment (PPE) was used during construction.	4.00	Often
3	Sufficient warning signs were installed.	3.50	Often
4	Sufficient barriers were installed.	3.60	Often
5	The contractor practices safety for his/her workers, equipment, and the passers-by.	3.60	Often
6	The contractor is fully responsible, even if he/she follows proper safety procedures when an accident occurs.	3.90	Often
	<b>Overall Weighted Mean</b>	<b>3.73</b>	<b>Often</b>

Table 2 shows that in the road construction sites, Occupational Safety and Health Program is strictly implemented (W.M. = 3.80), Personal Protective Equipment (PPE) was used during construction (W.M. = 4.00), sufficient warning signs (W.M. = 3.50) and Sufficient barriers were installed (W.M. = 3.60). The contractors frequently practice safety for their workers, equipment, and for the passers-by (W.M. = 3.60) and the contractor is fully responsible, even if he/she follows proper safety procedures, when an accident occurs (W.M. = 3.90).

## IV. CONCLUSIONS AND RECOMMENDATIONS

The study found that the Personal Protective Equipment (PPE) used during construction, the sufficiency of warning signs and barriers and the practice of safety for the workers, equipment and the passers-by were usually sufficient and implemented according to the assessment conducted on the survey for the inspectors of the road project. The result of the assessment from the motorist respondents has also resulted in an often-understandable warning sign, sufficient barriers, and traffic management to control the flow of traffic passing through the construction site. However, the traffic signs are sometimes visible from afar only. In the night, the traffic signs and warning signs are often reflecting from the point of view of the driver but only occasionally readable from a distinct distance.

Finally, the recommendations on this research were based also on the comments from the third part of the survey form. It turns out that traffic is sometimes caused by the traffic aide working on the site. It will be more convenient if the traffic aide is well trained to handle the flow of the vehicles. Accessible detour should also be improved and should equip with proper warning and traffic signage. In addition, it is also advised to have signs from 200m, 100m, and 50m before the construction site for the motorists to at least reduce their speed and prevent accidents. Furthermore, improved and upgraded safety equipment is also a good solution to reduce traffic and avoid accidents on the road site construction. Lastly, research to study and explore the performance [9] of drivers in understanding road signs and markings should be undertaken in the future.

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# Predicting Pavement Performance Utilizing Artificial Neural Network (ANN)

Fawaz Alharbi<sup>1</sup>, Omar Smadi<sup>2</sup>

<sup>1</sup>Department of Civil Engineering, College of Engineering, Qassim University; P.O. Box 6677, Buraydah, 51452, Saudi Arabia  
Email: f.a@qec.edu.sa.

<sup>2</sup>Director; Center for Transportation Research and Education, Institute for Transportation, Iowa State University; 2711 South Loop Drive, Suite 4700, Ames, Iowa  
Email : smadi@iastate.edu.

**Abstract**— Pavement management systems (PMS) play a significant role in cost-effective management of highway networks to optimize pavement performance over predicted service life of the pavements. Although, the Iowa DOT manages three primary highway systems (i.e., Interstate, US, and Iowa highways) that represent 8% (approximately 9,000 miles) of the total roadway system in the state (114,000 miles), these systems carry around 62% of the total vehicle miles traveled (VMT) and 92% of the total large truck VMT. In this research, historical climate data was acquired from relevant agencies and integrated with pavement condition data to include all related variables in prediction modeling. An artificial neural network (ANN) model was used to predict the performance of ride, cracking, rutting, and faulting indices on different pavement types. The goodness of fit of the ANN prediction models was compared with the conventional multiple linear regression (MLR) models. The results show that ANN models are more accurate in predicting future conditions than MLR models. The contribution of input variables in prediction models were also estimated. The results indicated that climate factors directly influenced the pavement conditions, and ANN model results can be used by the decision makers to establish appropriate management actions to withstand harsh weather over the years.

**Keywords**— Pavements, Pavement management system, Artificial Neural Networks, Asphalt concrete pavements, Pavement prediction modeling.

## I. INTRODUCTION

State highway agencies spend millions of dollars each year on maintenance and rehabilitation to meet legislative, agency, and public requirements. Effective pavement management requires a systematic approach that includes project planning, design, construction, maintenance, and rehabilitation. Pavement management systems (PMS) play a significant role in managing the condition of highway networks efficiently based on cost-effective strategies to be applied at a given time for maintaining that pavement condition at an acceptable level so the pavement can satisfy the demands of traffic and environment over its service life [1]. Individual PMSs operate at two administrative levels, the network and project management levels. At the network management level, a PMS predicts the overall pavement performance for establishing budget allocations and treatment strategies. At the project management level, more detailed information and specific treatment options are required to determine when a particular pavement section may need maintenance or rehabilitation action [2].

Traffic loading and environmental factors result in pavement distress [3]. The ability to trace that distress

over time allows researchers and agency decision makers to develop performance prediction models. Predicting pavement performance requires historical data about pavement conditions, traffic loading, structural characteristics, and climate data [4]. These data can be acquired from a single test road or from in-service pavements to obtain data for more practical prediction models. However, constructing and monitoring single test roads is expensive and unrealistic for small and local agencies. Developing accurate prediction models for pavements allows transportation agencies to effectively manage their highways in terms of budget allocation and scheduling maintenance and rehabilitation activities.

In this research, historical traffic loading and pavement condition data was obtained from the Iowa Department of Transportation (DOT), and climate data was acquired from the Iowa Environmental Mesonet (IEM) in order to include all related variables in the prediction models. The results of this research will improve pavement management strategies by predicting an accurate pavement distress, and evaluate the impact of Iowa weather conditions on predicting pavement performance.

The Iowa DOT manages three primary highway systems (i.e., Interstate, US, and Iowa highways) that represent 8% (approximately 9,000 miles) of the total roadway system in the state (114,000 miles), but these systems carry around 62% of the total vehicle miles traveled (VMT) and 92% of the total large truck VMT [5]. These highways play a major role in Iowa's economy by connecting customers and supplies across the United States, and the roads are important to economic development in several sectors such as agriculture, manufacturing, and industry. According to the Bureau of Transportation Statistics, in 2012 around 263.36 billion tons of goods valued at \$195.99 billion were transported on Iowa highways to other states [6].

Iowa faces critical challenges in providing a safe, efficient highway system, particularly in terms of balancing optimum highway conditions and available local, state, and federal funds. According to the American Society of Civil Engineers, 45% of major roads in Iowa were in fair condition, and large truck VMT, which directly affects pavement deterioration, will increase by 66% between 2015 and 2040 [5]. The Iowa DOT has allocated about \$2.7 billion for highway construction and \$1.2 billion for improving highway safety during fiscal years 2015 to 2019 [5]. Despite these allocations, Iowa DOT administration, maintenance and construction costs result in an estimated annual funding shortfall of over \$215 million [7].

Current PMS models used by the Iowa DOT do not consider climate factors and as such, may not be accurate. Therefore, the Iowa DOT could benefit from better prediction of the future needs of pavements to ensure they serve as effectively as possible. Therefore, efforts have been made to acquire historical climate data from Iowa Environmental Mesonet (IEM) and integrate it with pavement condition data from Iowa DOT. Then pavement performance models could be developed for asphalt, concrete, and composite pavements.

In addition to pavement performance modeling, some transportation agencies (e.g., cities and counties) do not have the capability for conducting deflection tests on their roadways for structural evaluation because these tests generally require specialized equipment, experience, and knowledge. As a result, these agencies may rely primarily on functional condition data to assess the strength of their roadways. However artificial neural network (ANN) pavement prediction models have been developed that can account for both the pavement conditions and the climate data and can estimate the relationship between structural capacity and rutting depth in asphalt pavement at the network level.

This research aims to explore pavement performance prediction models that can help decision makers take appropriate actions by developing and comparing traditional regression and artificial neural network models in predicting future pavement conditions for asphalt, concrete, and composite pavements and support pavement management decisions, and ii) determining the impact of various input variables on the deterioration of pavement conditions.

## II. METHODS

Predicting pavement performance is often considered to be a difficult task because of several influencing factors. Accurate pavement performance models, including large data, are needed to develop pavement maintenance and rehabilitation strategies. Varying causes of pavement deterioration from one road section to the next makes the modeling of pavement performance a complex process. In this research, multiple linear regression (MLR) and artificial neural network (ANN) models were used to predict pavement performance. Also, the results of ANN models are analyzed to determine the relative contribution of each variable on several distress indices.

Pavement distress data was obtained from the Iowa DOT Pavement Management Information System (PMIS) and climate data was obtained from the Iowa Environmental Mesonet (IEM). Iowa highways are classified into three systems: Interstate highways, US highways, and Iowa highways. The most recent PMIS data is presented in Figure 1. It can be seen in the Figure that Iowa highways system has the longest highways in Iowa, and 55 % of these highways are composite pavements.

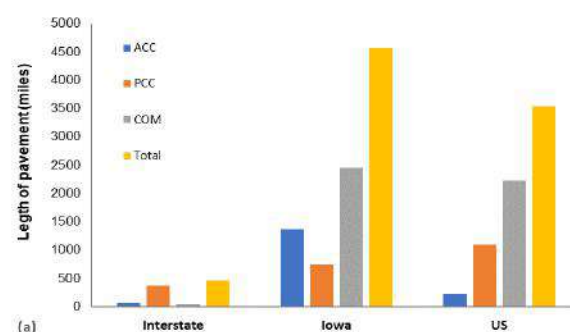


Fig. 1: Length of Iowa highway systems with different types of pavement

Geographic information system (GIS) software was used to integrate the PMIS road condition data and the IEM climate data for each location under study. The GIS spatial integration process provided accurate overlays of the weather stations over Iowa highways. The GIS was also used to display weather conditions as colored maps. To ensure that the climate data and locations of each pavement section were associated, each pavement section was assigned to the closest weather station. For example, Figure 2 shows the 32 pavement sections that were closest to weather station IA0133.

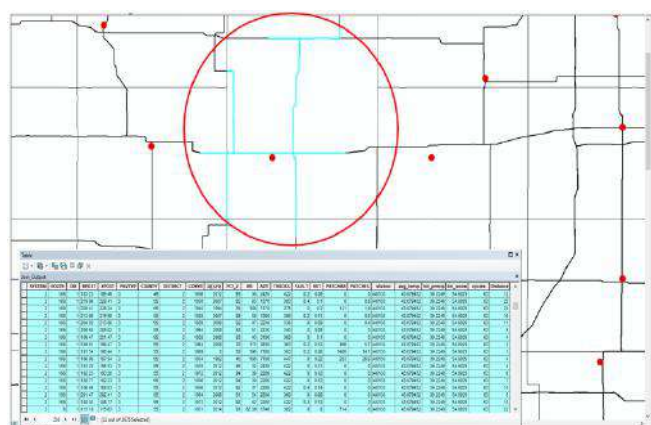


Fig. 2. Pavement sections associated with the closest weather station

Two kinds of pavement performance models, traditional multiple linear regression (MLR) and artificial neural network (ANN) models are developed to study three pavement types with different pavement properties and different material properties. Goodness of fit is a common measure for evaluating model performance. The coefficient of determination ( $R^2$ ) and root mean square error (RMSE) were utilized to measure and compare the performance of the models.

Historical data was used on in both ANN and MLR models to predict individual distresses for three pavement types, ACC, PCC, and COM pavements. These individual distresses were predicted based on weather factors (i.e., temperature, precipitation, and freeze-thaw cycles), traffic loading, pavement age, structure number, layer thicknesses, and subgrade stiffness. For ACC and COM pavements, three models were developed for predicting roughness, cracking, and rutting, and for PCC pavements, three models were developed for predicting roughness, cracking, and faulting. These predicted distresses were aggregated to calculate the PCI values based on Equations 1 and 2 in order to represent the overall PCI over the years. To determine the reliability of ANN models, the results obtained from the ANN models were compared with the results from MLR models.

$$PCI_{Com\&ACC} = 0.4(\text{Cracking Index}) + 0.4(\text{Riding Index}) + 0.2(\text{Rutting Index}) \quad (1)$$

$$PCI_{PCC} = 0.4(\text{Cracking Index}) + 0.4(\text{Riding Index}) + 0.2(\text{Faulting Index}) \quad (2)$$

Three main components are used to develop ANN models: i) the structure of connection between input and output layers (architecture); ii) the method of adjusting the connection weight (learning method); and iii) the neuron activation function.

There is no standard method for selecting the appropriate number of neurons, so training the ANN model with sequential number of hidden neurons and then selecting the number of neurons that achieve minimum RMSE was employed. The lowest RMSE value was achieved at 12 hidden neurons for predicting cracking index in COM pavement. The final layer in the structure of ANN model is the output layer that produces the result from processing provided by the hidden layer.

After determining the architecture of an ANN model, software (e.g., JMP) is used to randomly divide the database. Seventy percent (70 %) of the database was used for training and thirty percent for validation of ANN model. The training data set is used to develop the model, while the validation data is used to assess the accuracy of the ANN model and avoid overfitting in the model [8]. The results of the training process produce the weight matrices that are stored in links between layers and that can also be used to extract information about the contribution of each input in the model output. In the training process, the connection weights between the layers is adjusted, thereby, minimize the overall mean error by using back-propagation algorithm. The basic unit of an ANN model is a neuron that combines inputs and produces an output as shown in Figure 9. The neurons are not individually powerful in terms of computational power, but their interconnection with neurons in different layers produces the desired relationship among variables and demonstrates the processing capabilities of the neurons [9].

Multiple linear regression (MLR) models were used to predict values of pavement conditions (ride, cracking, rutting, and faulting) and those results were compared with prediction results from ANN modeling. MLR modeling has been widely used by highway agencies to predict pavement performance and deterioration rates because of its simplicity and ease of implementation [10].

### III. RESULTS AND DISCUSSION

The analysis showed that the ANN models yield

reasonably accurate models compared to the results of MLR models.

For ACC pavements, the ANN models yielded more accurate predictions than the MLR models in riding, cracking, and rutting indices. The  $R^2$  values indicate there are good correlations between actual and predicted indices for each index. The  $R^2$  values from the ANN models are higher than the  $R^2$  values of the MLR models by 61.40%, 48.15%, and 48.15% for riding, cracking, and rutting index, respectively. For PCC pavements, the ANN models achieve better accuracy models with improvement in  $R^2$  by 23.00%, 26.93%, and 80.00% than MLR models in predicting riding, crack, and fault indices, respectively, compared with MLR models. For COM pavements, the comparison of the results produced by ANN and MLR models showed that the ANN model performed better accurate models than MLR models.

After predicting the pavement condition indices, the weights and biases matrices from ANN layers were used to predict the future performance of riding, cracking, rutting, and faulting indices assuming no future treatment will be applied. The adjusted weights were developed by a back-propagation algorithm during the training process in order to make the predicted values close to the actual values. The weights and biases matrices were stored by JMP software. Predicting the future pavement conditions was predicted incrementally; for instance, the first predicted value for pavement condition in age (t+1) was used to predict the second year pavement condition (t+2) as the input of the previous pavement condition and so on. three pavement sections, one each of ACC, PCC, and COM pavements, were selected to analyze their performance over the years and predict future performance. The curves for each pavement section begin at the year of construction, and it is assumed that no maintenance has been or will be done on the section.

The performance curve for an ACC pavement section from I-35 is shown in Figure 3. The performance curve shows that the pavement section was in poor condition, (i.e., the PCI value is lower than 41) 11 years after construction.

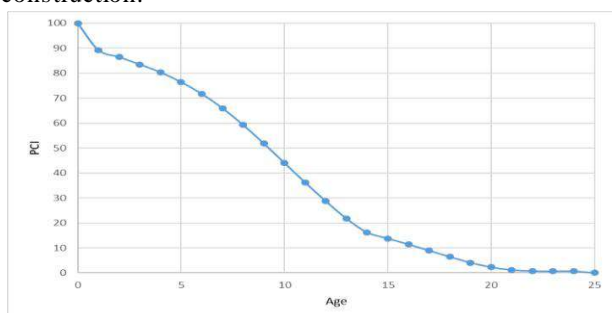


Fig. 3. Pavement performance curves of I-35 section (ACC pavement)

Figure 4 shows the performance curve of a pavement section of US-30 in Story County. The pavement type of this section is a composite pavement with PCC overlaid by ACC pavement. Composite pavement is widely used in Iowa, with around 46% of the total highway. The composite pavements typically last longer than ACC pavement because the concrete base layer makes it a stronger structure. The US-30 pavement section can serve in good or fair condition up to approximately 20 years, which is better performance than the ACC pavement section.

Figure 5 shows the performance curve of a PCC pavement section of Iowa highway 1. This performance curve indicates that PCC pavement lasts longer than both ACC and COM pavements and that PCC deteriorates at a lower rate early age. The curve indicates that this pavement section should be in good or fair condition for almost 40 years.

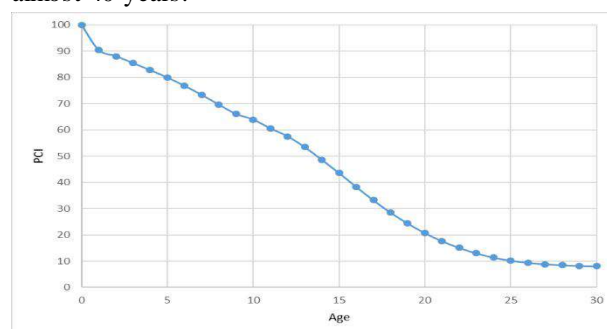


Fig. 4. Pavement performance curves of US-30 section (COM pavement)

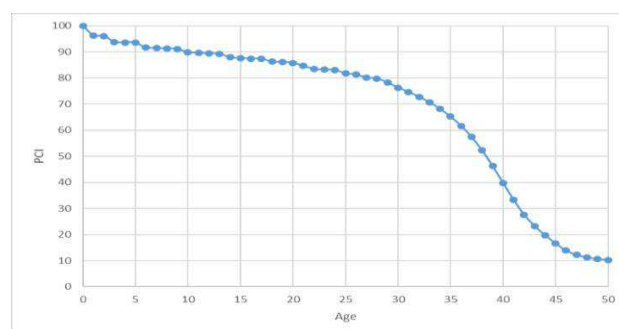


Fig. 5. Pavement performance curves of Iowa-1 section (PCC pavement)

#### IV. CONCLUSION

Predicting future pavement performance is essential for allocating available funding for maintenance and rehabilitation activities at the network level as well as for determining the most cost-effective strategies at the project management level. The models in this study were

developed to include climate data in addition to historical pavement condition data. Results of the ANN models were found to be more accurate than the MLR models, perhaps because ANN models can deal with larger, more complex data sets.

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# Correlation between Load Growth and Reliability of an Electric Service Cooperative in the Philippines

Ron Alvin E. Rodriguez<sup>1</sup>, Israel R. Blancaflor<sup>2</sup>, Rex Christopher G. Encabo<sup>3</sup>,  
Dr. Noel Florencondia<sup>4</sup>, Dr. Gener Subia<sup>5</sup>

<sup>1,2,3</sup> Students, Master of Engineering Management (Graduate School-NEUST)

<sup>4</sup> Faculty, Master of Engineering Management (Graduate School-NEUST)

<sup>5</sup> Faculty, Graduate School, Wesleyan University Philippines (WUP)

**Abstract**— This study determined the relationship between the load growth and the reliability of an Electric Service Cooperative (ESC) in the Philippines. Statistical research design and documentary analysis were utilized in this research.

It was found out that over a period of five years, the demand and energy consumption of the whole franchise area of the respondent ESC power distribution utility has grown significantly. Also, this study disproves that load growth may lead to the overloading distribution lines and equipment and thus, causes power interruptions. Furthermore, demand and energy consumption is not correlated with the frequency and duration of power interruptions. Moreover, this study also revealed that the reliability of the respondent Distribution Utility (DU) does not vary for the period of 5 years.

It is recommended that there should be the right way of clearing activities and line rehabilitations should be done to have a more efficient transfer of energy and to improve the DU's reliability.

**Keywords**— Electrical Engineering, electricity, power distribution, power interruption, reliability.

## I. INTRODUCTION

Republic Act No. 9136(2001) stated that the electric power industry in the Philippines should be composed of four (4) sectors, namely: Generation, Transmission Distribution and Supply. Generation Sector is where electricity or electric power is made. Transmission Sector provides the bulk transfer of electrical power from generation plants to distribution utilities. A Distribution Utility (DU), is any Electric Cooperative, Private Corporation, Government-Owned and Controlled Corporation or Local Government Unit for whom has exclusive franchise rights for a particular area to operate an Electric Power Distribution System [1]. The Electric Power Distribution System refers to the system of wires and associated facilities belonging to a Distribution Utility, extending between the delivery points on the transmission, sub-transmission system, or generating plant connection and the point of connection to the premises of the End-User or a Consumer [2]. Distribution Utilities are the ones in-charge of distributing

power to the residential, commercial, institutional and industrial consumers. The scope of work of the DUs involves the construction, operation and maintenance of power substations and distribution lines, installation and maintenance of distribution transformers and metering equipment and ensuring the delivery of safe, reliable and cost-effective electric power to the end-users.

Load Growth or the increase of demand for electric power and energy consumption is the most significant factor in the management of a distribution system. Forecasting the increase of Energy Consumption and Demand is essential for planning the maintenance, operation and expansion of the distribution facility [3].

The Philippine Distribution Code(2016) defined Reliability as "the probability that a system or component will perform a required task or mission for a specified time in a specified environment. A power system can continuously provide service to its customers." Reliability is basically the ability of any power system to withstand power interruption.

Reliability is measured in four (4) Indexes namely, (a) System Average Interruption Frequency Index (SAIFI) which indicates how often the average customer experiences a sustained power interruption over a predefined period of time; (b) System Average Interruption Duration Index (SAIDI) indicates the total duration of interruption for the average customer during a predefined period of time. It is commonly measured in customer minutes or customer hours of interruption; (c) Customer Average Interruption Duration Index (CAIDI) represents the average time required to restore service; and (d) Momentary Average Interruption Frequency Index (MAIFI) which indicates the average frequency of momentary interruptions [1].

With all these, this study was conducted to investigate the relationship between Load Growth and System Reliability. The data gathered came from the actual monthly engineering report submitted by the respondent DU to the National Electrification Administration from January 2013 up to December 2017.

## II. METHODOLOGY

Statistical research design such as correlational research and documentary analysis were utilized for the purpose of this study. Correlational research, according to [4] as cited in [5] and [6], "is employed to test the degree of relationship between two variables". On the other hand, "document analysis is a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic" [7]. In this study, the documents analyzed were the Monthly Engineering Report of the Distribution Utility that was submitted to the National Electrification Administration from the period of 2013 to 2017. The particular data that were observed were the Monthly Peak Demand, Energy Consumption, SAIFI, SAIDI and MAIFI.

To obtain statistical evidence about Variation on the Demand, Energy Consumption, SAIFI, SAIDI and MAIFI, the data were subjected to the One-way or One Factor ANOVA (analysis of variance), while the correlation on the data of demand and Energy Consumption and SAIFI, SAIDI and MAIFI, Pearson's  $r$  was used.

## III. RESULTS AND DISCUSSION

**Demand:** Using One-way or One Factor ANOVA (analysis of variance), at 5% level of significance, the critical value of F-ratio is 2.53. The calculated value of F-ratio is 26.46. Therefore, the Null Hypothesis is rejected meaning that

there is a significant variation in the data from 2013 to 2017. By observation of the annual mean, we can say that there is an increase in Demand. The mean annual demand for 2013 and 2017 are 13.833 Megawatts and 20.575 Megawatts respectively. The annual mean of demand is shown below in Table 1.

Table 1. The Annual Mean Values

	2013	2014	2015	2016	2017
<b>Demand</b>	13.833	15.253	16.982	19.214	20.575
<b>Energy</b>	6107300	6585759	7204230	8218767	8621702
<b>SAIFI</b>	0.990	1.416	1.451	1.023	0.971
<b>SAIDI</b>	26.736	46.093	40.349	55.309	39.648
<b>MAIFI</b>	4.941	4.732	4.732	4.380	4.876

**Energy Consumption:** Using One-way or One Factor ANOVA (analysis of variance), at 5% level of significance, the critical value of F-ratio is 2.53. The calculated value of F-ratio is 9.99. Therefore, the Null Hypothesis is rejected meaning that there is a significant variation in the data of Energy Consumption from 2013 to 2017. By observation of the annual mean, we can say that there is an increase in Energy Consumption. The mean of the annual Energy Consumption for 2013 and 2017 are 6,107,300 kilowatt-hours and 8,621,702 kilowatt-hours respectively. The annual mean energy consumption is shown below in Table 1.

**SAIFI:** Using One-way or One Factor ANOVA (analysis of variance), at 5% level of significance, the critical value of F-ratio is 2.53. The calculated value of F-ratio is 0.35. Therefore, the Null Hypothesis is accepted meaning that there is no significant variation in the data of SAIFI from 2013 to 2017. This shows that the frequency of power interruptions have not significantly changed over the years. The mean annual SAIFI for 2013 and 2017 are 0.990 and 0.971 respectively. The annual mean energy consumption is shown below in Table 1.

**SAIDI:** Using One-way or One Factor ANOVA (analysis of variance), at 5% level of significance, the critical value of F-ratio is 2.53. The calculated value of F-ratio is 0.13. Therefore, the Null Hypothesis is accepted meaning that there is no significant variation in the data of SAIDI from 2013 to 2017. This shows that the duration of power

interruptions have not significantly changed over the years. The mean annual SAIDI for 2013 and 2017 are 26.736 and 39.648 respectively. The annual mean of energy consumption is shown below in Table 1.

**MAIFI:** Using One-way or One Factor ANOVA (analysis of variance), at 5% level of significance, the critical value of F-ratio is 2.53. The calculated value of F-ratio is 0.02. Therefore, the Null Hypothesis is accepted meaning that there is no significant variation in the data of MAIFI from 2013 to 2017. This shows that the frequency of momentary power interruptions has not significantly changed over the years. The mean annual MAIFI for 2013 and 2017 are 4.941 and 4.876 respectively. The annual mean of energy consumption is shown below in Table 1.

**Correlation of Energy and Consumption to SAIFI SAIDI and MAIFI:** Calculating for the Pearson r Correlation Coefficient of the Demand to SAIFI, SAIDI, MAIFI and Energy to SAIFI, SAIDI and MAIFI, the result is shown in Table 2.

Table 2. Results of the Calculation of the Pearson's r Correlation Coefficient

<b>Demand to SAIFI</b>	0.05
<b>Demand to SAIDI</b>	0.16
<b>Demand to MAIFI</b>	0.06
<b>Energy to SAIFI</b>	0.04
<b>Energy to SAIDI</b>	0.10
<b>Energy to MAIFI</b>	0.05

Based on the calculated value of the Pearson's r coefficient, there is a negligible correlation between the Demand and Energy Consumption to SAIFI, SAIDI and MAIFI.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

The authors hereby conclude that for this particular Distribution Utility, the Power Demand and Energy Consumption has grown significantly over the years relative to the growth of population and the growth on the number of households. However, the frequency and duration of power interruptions are not correlated with the growth on Demand and Energy Consumption disproving the assumption that in a distribution system, higher load causes equipment to fail and hereby causes power interruptions. To improve power system reliability, the

distribution must enhance the capability of the distribution network by rehabilitating lines and doing right of way clearing activities so that power interruptions may be minimized.

Likewise, a direct and simple [8] research on the same discipline with more distribution utility respondents should be to conducted be able to make accurate decisions given much available data or information [9] to further validate the findings of this study.

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# Aquaponics Pilot System: Case Study

Stefan Buchdid Cardoso<sup>1</sup>, Pedro Paulo Teles Bianchini<sup>2</sup>, João Alberto Farinelli Pantaleão<sup>3</sup>, Vitor Miranda Pereira<sup>4</sup>, Mônica Hitomi Okura<sup>5</sup>

<sup>1</sup>Department of Engineer, Federal University of Triângulo Mineiro, Brazil

Email: stefanbuchdid@yahoo.com.br

<sup>2</sup>Department of Engineer, Federal University of Triângulo Mineiro, Brazil

Email: pedro-bianchini@hotmail.com

<sup>3</sup>Department of Engineer, Federal University of Triângulo Mineiro, Brazil

Email: pantaleaojaf@gmail.com

<sup>4</sup>Department of Engineer, Federal University of Triângulo Mineiro, Brazil

Email: vitor\_mpereira@hotmail.com

<sup>5</sup>Department of Engineer, Federal University of Triângulo Mineiro, Brazil

Email: monica.okura@gmail.com

**Abstract**— The aquaponics term derives from the words aquaculture and hydroponics, which by definition, has the meaning of aquatics organisms culture and plant breeding techniques without soil, respectively. This activity has how the main feature the sustainability, once the modality looks for the production with low water consumption and high exploitation of waste generated. The present study had as objective to describe the construction of the aquaponics pilot system. This way, based on the literature and acquired experience during the work, a step-by-step method was established for the assembly of the system. To verify the process efficiency, were analyzed the presence of total and thermotolerants coliforms, counting of facultative mesophiles and quantification of micro and macronutrients in leaves and roots of *Xanthosoma sagittifolium*. There was no presence of total and thermotolerants coliforms in leaves and roots of *X. sagittifolium*. In the count of facultative mesophiles the roots presented  $6 \times 10^4$  CFU/g and the leaves  $1.7 \times 10^2$  CFU/g. In the foliar analysis, 1430mg/kg of Fe was observed in the roots. It was concluded that the pilot project was successfully built and testing can be continued with new plants.

**Keywords**— Aquaculture, Hydroponics, Low water consumption, Sustainability, *Xanthosoma sagittifolium*.

## I. INTRODUCTION

The growing world population associated with the increased demand for water exerts enormous pressure on the food production sectors, where the maximization and optimization of spaces and natural resources needs the development of integrated production systems (ONU, 2016). Therefore, the food production with minimal loss of water and nutrients is one necessity, where the aquaponics shows one possibility to that (CARVALHO et al., 2017). According to Carneiro et al. (2015) aquaponics is a new modality of food production with low consumption of water and high utilization of organic residue generated. This activity can be placed like a solution to the traditional methods of agriculture, which shows high environmental impact (HUNDLEY, 2013).

Aquaponics can stimulate the interested population in the development of the familiar agriculture in the urban perimeter, since it can be realized in small spaces like house gardens, apartments and terrace of buildings. This way the aquaponics study, looking for the technological development of the technique in good prices and within

the norms of sanitary control, allows including a larger number of people who practice this activity. Families can benefit from the food produced and can offer the surplus of their productions in markets near to their residence, dynamizing the economy of low-income regions (PINTO, 2015).

The reasons for reuse of water stems from its scarcity, pollution control and probable economic gains. The necessary water volume to fuel one aquaponic system is not big because the system recycle the water (CARVALHO et al, 2017). The benefits of this culture are multiple and involve subjects like health, nutrition, poverty, sanitation, valuing local culture and, specially, environmental education contributing greatly to the sustainable development of cities (BUSS et al, 2015).

The aquaponic success depends, basically, on water quality, quantity of food supplied, residence time of the water inside the system, the species cultivated, the storage density and biomass of organisms (CARVALHO et al., 2017). The present work proposed to develop an aquaponic system to be used as a research tool,

integrating the production of *Xanthosoma sagittifolium* (L. Schott) with *Astyanax bimaculatus* (Lütken, 1875).

## II. METHODOLOGY

### 2.1 Construction of the system

The present work was conducted based on a bibliographic review, being adapted to the needs of the project. The pilot system was built inside the campus Univerdecidade – unit 1 – Federal University of Triângulo Mineiro (UFMT), Uberaba, state of Minas Gerais, Brazil. It is intended to clarify that all steps were based on Brazilian Agricultural Research Corporation (Embrapa) literature review, followed during the project.

It is emphasized that this system is part of a research project, where the effects of the system in the *Xanthosoma sagittifolium* planted in expanded clay like substract is being analyzed.

### 2.2 Schematic illustrations

The schematic illustrations were elaborated in the program Sketch up (2018 version).

### 2.3 Total and Thermotolerants coliforms and facultative mesophiles counting in leaves of *Xanthosoma sagittifolium*.

The presence of total and thermotolerants coliforms in leaves and roots of *X. sagittifolium* were analyzed. This vegetal species was selected because it was the first plant inserted in the system and exposed to water from the fish tank.

For the microbiological analysis of the plants, we used the technique Most Probably Number (MPN), in which each dilution of the samples was seeded in three series of three glass tubes with Durhan tube containing Lauryl Sulphate Tryptose Broth (LST). Once we found positive tubes, they were incubated in test tubes containing Durhan tubes in Brilliant Green Bile Broth and Escherichia coli Broth. The calculations of MPN were made based on the table of Hoshins.

To the count of facultative mesophiles we used the Pour Plate technique. The water was submitted to three serial dilutions and 1 mL of each dilution gone to sterile Petri plates with 20 mL of Plate Count Agar. The plates were incubated at 37°C for 48 h (SILVA et al., 2007).

### 2.4 Analysis of the concentration of macro and micronutrientes in *Xanthosoma sagittifolium*

For the definition of macro and micronutrients concentrations present in the leaves and roots of *X. sagittifolium*, to assess nutritional status, an adult plant was removed from the grow bed and sent to laboratorial analysis in one accredited laboratory, located in Uberaba – MG, Brazil. The laboratory uses the method proposed by ESALQ, 1997 C6.

## III. RESULTS AND DISCUSSION

### 3.1 Description of the pilot system assembly

Externally to the greenhouse, the intensive recirculation system was built. Composed by one container IBC (Intermediate Bulk Cointaner) cut in 70 cm of height with capacity for 500 liters, which was the fish tank (Figure 1). The chosen species was *Astyanax bimaculatus*.

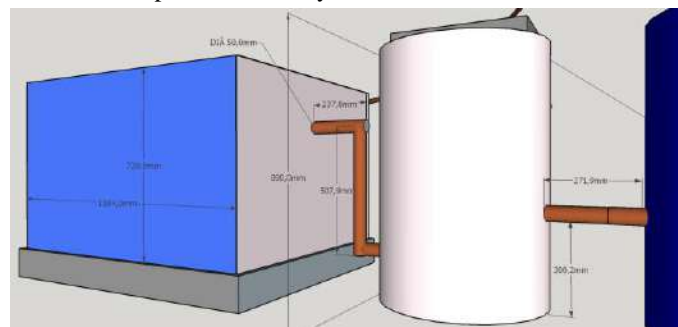


Fig. 1: Schematic illustration of the intensive recirculation system.

The choice of container was because it had a metallic structure on the outside and one pallet below. These structures are very important to the sustentation of the system. The tank was painted in frosted blue to reduce the light input, because the lightness helps the proliferation of algae in the tank. It could be injurious to the system because the algae consume the dissolved oxygen during the night, when they do not realize photosynthesis (Figure 2) (CETESB, 2019).



Fig. 2: Model of IBC container used in the aquaponics pilot system.

Two barrels with 200 L capacity were used. The first one with decanter function and the second as clean water tank (Figure 3).

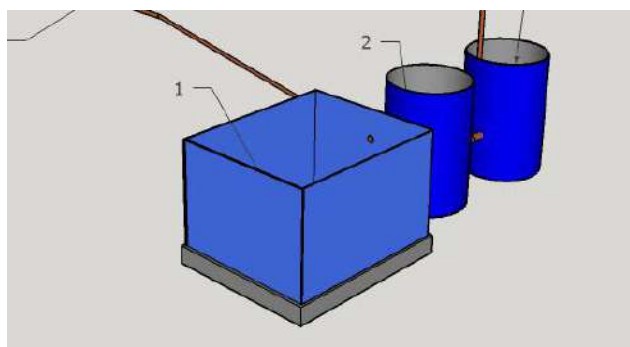


Fig. 3: Disposal of tank and barrels.

The first barrel, with decanter function, receives water from the fish tank through an entrance on the bottom. The barrel has a round shape and, because of this, it was installed in the entrance of water one 90° elbow. In this way, the water can enter tangentially the wall of the recipient, creating a circular movement inside. This movement is responsible to the process of decantation where the solids are retained in the bottom (Figure 4).

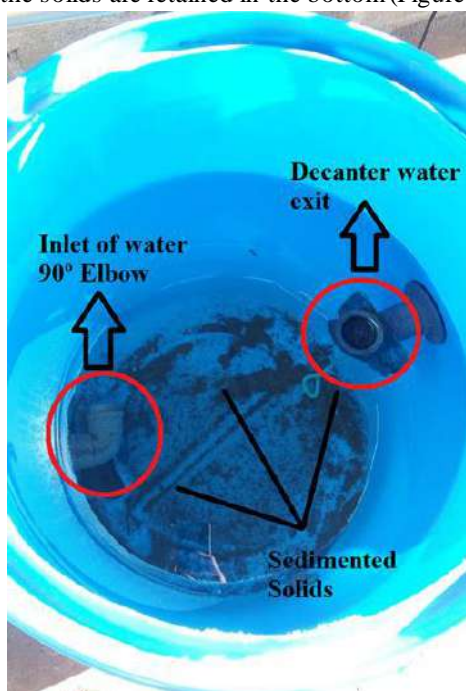


Fig. 4: Inlet and exit of the barrel with decanter function.

The solid residue deposited on the bottom of the barrel can be used as fertilizer in conventional techniques of agriculture, because these solids are organic matter, which came from fish waste.

The second barrel has the function of storing clean water and receives the previously decanted water. From there, the water is pumped to the fish tank and to the grow bed. After that, the entire cycle of recirculation is completed (Figure 5).



Fig. 5: Intensive recirculation system.

The pump chosen was a Sarlobetter® SB2000 with flow rate of 1,950 Lh<sup>-1</sup> and maximum water column height of 2,1m. This model met all the system requirements, making possible all the water circulation by the distance and height needed.

The grow bed was built with the top of cutted IBC container. It has 30 cm of height and is located inside the greenhouse. For its support and leveling, we used concrete blocks, pipelines of 25 mm diameter, pipe fittings, expanded clay and stone gravel. The middle of the container was cut and one 25 mm flange was installed (Figure 6). In this flange one piece of PVC pipe with the same diameter and with 20 cm of height was installed. This pipe determines the height of water. The height chosen was less than 30 cm because the grow bed must have a dry zone, for preventing algae growth (Figure 7).

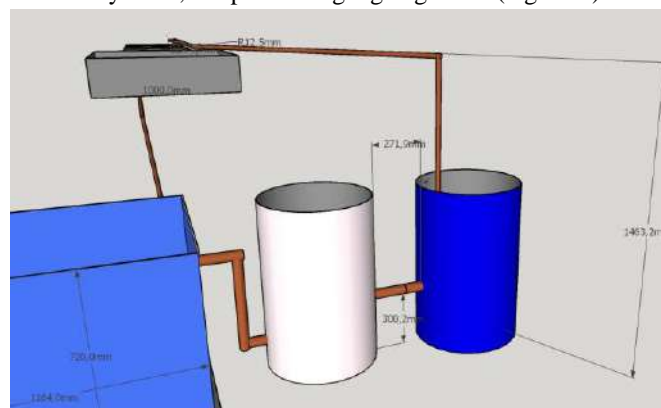


Fig. 6: Distances between decanter, clean water barrel and rhizospheric filter (grow bed).



Fig. 7: Rhizospheric filter with water leveler.

The expanded clay and stone gravel were responsible for the plants sustentation and by the colonization of bacteria. These two materials were placed in the same quantity (in kg), in a proportion of 1:1. The stone gravel is denser than the expanded clay (Figure 8).



Fig. 8: Filter with stone gravel and expanded clay.

According to Embrapa (2018) with the passage of the time the bacteria of the genus *Nitrobacter* and *Nitrosomonas* inhabit the filter and they are responsible to transforming the ammonia contained in the fish excrete into nitrite and nitrate, where nitrate is the assimilable form by the plants.

As well as the grow bed, which has the main function of rhizospheric filtration, three more similar structures with smaller size and volume were built. These structures had the same functioning of the first, but with different objectives. While the first is part of the filtration process, *X. sagittifolium* was planted. In the other three, *Lactuca sativa* L. (Lettuce) was planted (Figure 9).

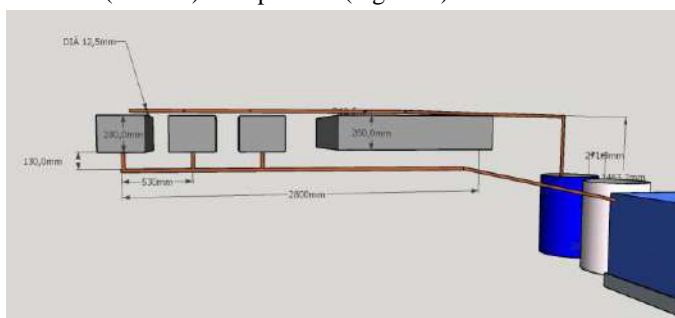


Fig. 9: Measures of the Lettuce grow beds.

Posteriorly, a siphon (bell siphon) with PVC pipe of 75 mm diameter was built. The pipe has 30 cm of height and was placed in the top of water leveler. The pipe was capped and perforated. After that, a piece of 20 cm of hose and with the same diameter of the perforation was installed. The siphon has the function of removing all the water from the grow bed from time to time.

This siphon empties the grow bed only when it is full of water. The liquid takes the place of the air in the hose of siphon, creating a vacuum, removing all the air of the hose, starting the process of emptying. When the entire volume of water in the grow bed is drained, the air enters by the hose and the flush stops, initiating the process of refill.

This process is necessary because the roots of the plants needs to have contact with the air, not only water, avoiding the rotting of the roots. This oscilation brings benefits because the inlet of the atmospheric air in the roots of the plants keeps them healthy (HUNDLEY, 2013).

### 3.2 Total and Thermotolerants Coliforms and facultative mesophiles in *Xanthosoma sagittifolium*.

In the root and leaves of *X. sagittifolium* it was not observed the presence of total and thermotolerants coliforms. In the counting of facultative mesophiles there was  $6 \times 10^4$  CFU/ml in the roots and  $1,7 \times 10^2$  CFU/ml in the leaves (Table 1).

Table 1. Results of analysis

	Roots	Leaves
Total Coliforms (MPN/ml)	0	0
Thermotolerants Coliforms (MPN/ml)	0	0
Standard Plate Count (CFU/ml)	$6 \times 10^4$	$1,7 \times 10^2$

### 3.3 Macro and Micronutrients Concentration in *Xanthosoma sagittifolium*.

According to Pinto et al. (1999), the leaves show high levels of minerals and can be classified as an important source of iron (Fe), potassium (K), calcium (Ca) and manganese (Mn). In addition to low calorie, they show high levels of proteins, fibers, vitamin C (PINTO et al., 2001). In Brazil, *X. sagittifolium* is very appreciated in states of Minas Gerais, Bahia and Rio de Janeiro, being utilized in typical dishes (MANGAN et al., 2008).

Through laboratory analysis we can note that the essential nutrients to the plant development are present (Table 2). The visual aspect is of a healthy leaf (Figure 9).

Table 2. Foliar analysis of roots and leaves of *Xanthosoma sagittifolium*.

Macronutrients	Unit	Leaf and stalk	Roots
Nitrogen (N)	g/kg	25.59	24.64
Phosphorus (P)	g/kg	3.38	3.73
Potassium (K)	g/kg	33.53	31.47
Calcium (Ca)	g/kg	17.3	10.35
Magnesium(Mg)	g/kg	3.34	5.6
Sulfur (S)	g/kg	0.69	1.67
Micronutrients	Unit	Leaf and stalk	Roots
Boron (B)	mg/kg	17.2	10.6
Copper (Cu)	mg/kg	6.2	25.8
Iron (Fe)	mg/kg	128.8	1430
Manganese(Mn)	mg/kg	16.4	46.8
Zinc (Zn)	mg/kg	26.9	98.5

It was also possible to note, with the exception of boron (B), a higher quantity of micronutrients in *X. sagittifolium* roots. Iron (Fe), in particular, accumulated in significantly higher amounts.



Fig. 10: Size and aspect of *Xanthosoma sagittifolium* leaves. (Scale = 30cm)

#### IV. CONCLUSION

It was possible to build a pilot aquaponic system using materials, mostly, reused. The system was used successfully for the development of research projects for students of the Environmental Engineering courses at UFTM.

As there was no presence of total and thermotolerant coliforms in the leaves and roots of *Xanthosoma sagittifolium*, the aquaponic vegetable can be consumed as human food. Besides the leaves are washed and cooked before consumption.

About the concentrations of micro and macronutrients in

*X. sagittifolium* leaves, it was concluded that there is a higher concentration of micronutrients, with the exception of Boron (B), in the roots of the plants. The Iron (Fe) accumulates in an expressive way in the roots.

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# Various Techniques Used in Wireless Sensor Networks for Data Transfer

Ankit Saxena<sup>1</sup>, Sandeep Kumar<sup>2</sup>, Swapnesh Taterh<sup>3</sup>

<sup>1&2</sup>Assistant Professor, Dept. of CSE, Tula's Institute, Dehradun, Uttarakhand, India

<sup>1</sup>[ankit.saxena5@yahoo.com](mailto:ankit.saxena5@yahoo.com), <sup>2</sup>[sandeepkumarsiet@gmail.com](mailto:sandeepkumarsiet@gmail.com)

<sup>3</sup>Associate Professor, AIIT, Amity University Jaipur

<sup>2</sup>[swapnesh\\_t@hotmail.com](mailto:swapnesh_t@hotmail.com)

**Abstract**— Nowadays the wireless sensor networking is the common way for data transfer. So, it is a big task to upload and download data securely without any data loss. As we know in the wireless sensor network there are several nodes which are used to transfer the data. To perform this task there are various data transport protocols available. In this paper, we analyze the various protocol which is used for data transfer in WSN. We also discuss the various challenges which are faced during the data transfer in WSN.

**Keywords**— Wireless sensor network, Challenge in WSN for data transfer, protocols for data transfer in WSN.

## I. INTRODUCTION

A Wireless Sensor Network is one kind of wireless network consist of a large number of circulating, self-directed, low powered devices named sensor nodes which is also known as motes. These networks certainly cover a huge number of spatially distributed, little, battery – operated, embedded devices that are connected to the network. Nodes are the small computers, which work jointly to form the networks. Now a days everywhere is a trend of using the wireless network. As we know it easy to setup and easy to maintain. Now in the various area the WSN is widely used as in monitoring the crowd or any sensitive area. It is also used for tracking the suspect or location finding, the CCTV and the many more. In the wireless sensor network the important role is played by the node as every node is not a normal node it is a sensor node. The sensor node is consisting of three parts

### Sensor Unit

A sensor is device that senses physical phenomenon such as pressure, motion, speed etc and transform it into analog signal using a transducer [1]. A WSN integrates a large number of sensor nodes with each node containing one or more sensors depending on the application area. There is a variety of sensor types that can be employed in WSNs

### Transceiver Unit

This unit is used to transfer data from one node to another. It takes care of the of the all subcomponents of the sensor node and processor and also to establish node to node interaction.[1] The transceiver plays the important

role as it operates and control both the transmitter and receiver.

### Processing Unit

This unit is responsible to monitor the energy consumption as well as the computational capabilities of a node. In the processing unit we use various types of process according our need some of them are microcontroller, FPGAs [1], signal processor. The most commonly processor used is microcontroller as it is simple and cheap. We also use a multi-tasking operating system.

### Power Supply Unit

This unit is responsible for providing power to the sensor node. Generally, battery is the main source for power supply.[1] A battery can be recharged or replaced easily.

## II. ADVANTAGES OF WIRELESS SENSOR NETWORK

- ✓ A network can be increase or decrease without disturbing whole network.
- ✓ It can be setup easily
- ✓ Easy to maintain.
- ✓ It can be used in any area such as river, sea, mountains etc.
- ✓ Less risk of network devices damage as there is no concept of wires.

### III. WIRELESS SENSOR NETWORKING APPLICATIONS

- Area monitoring.
- Society monitoring
- Land slide detection
- Home Applications
- CCTV Monitoring
- Air Pollution Monitoring
- Water quality Monitoring
- Health monitoring
- Military applications
- Radar

### IV. WIRELESS SENSOR NETWORK CHALLENGES

The main challenge in the wireless network is to stop the packet loss. It is responsibility of a network to ensure that data must be transfer in the network smoothly and continuously. The packet loss may be occur due to EMI/RFI, congestion, transmission error or energy depletion problem. The network faces congestion problem due to flooding, whose main cause is that when all the node sends their data to the sink node. So, total data at sink node is in wide amount which cause flooding. [2,3] The reliability of the network can be measure by packet arrival probability and energy efficiency. Reliability can be classified into four types packet reliability, event reliability, upstream reliability and downstream reliability.

### V. DATA TRANSFER IN WIRELESS SENSOR NETWORKS

Transport layer is responsible for deliver reliable data in a timely manner with no congestion and no loss of data with limited energy consumption. Transport layer protocols namely Traditional TCP and UDP are not suitable for WSN. TCP uses end to end transmission control mechanism and the congestion mechanism used is also not suitable for WSN. UDP does not support acknowledgment schemes. UDP is connectionless and does not provide flow and congestion control. [3] However, transport protocols can be made suitable for WSN by taking into account the following design considerations:

1. WSN needs a mechanism for packet loss recovery such as acknowledgement.
2. The initial connection establishment procedure should be simplified. The three ways handshake process will be a big overhead to transfer small volume of sensed data.

3. The protocols should implement proper congestion avoidance schemes.
4. The protocols should guarantee fairness for all sensor nodes.
5. The transport control protocol should provide cross layer optimization.

Data transmission in the network can be either end-to-end or on a hop-by-hop. When data is transfer by end-to-end transmission mechanism, the source and the destination are responsible for the delivery of the entire packet. In case of data loss, the source has to transmit the entire packet. This leads to more energy consumption which is not feasible for wireless sensor networks. And When data is transfer Hop-by-hop transmission, it requires the neighbouring nodes to transmit the data. So, in case of data loss, retransmission can be performed easily with less energy consumption. Hop-by-hop requires local buffer and is more effective in case of multi hop WSN. Therefore hop-by-hop is more suitable for resource constrained WSN.

Reliability is achieved either by retransmission or redundancy. In retransmission mechanisms, the source node after sending the data requires an acknowledgment of its data packet from the receiver to ensure reliability. Redundancy mechanisms on the other hand send multiple copies of the same message to its receivers.

### Various Acknowledgment schemes used in Retransmission Mechanisms

The following acknowledgment schemes are used to verify that the data is secure and completely transfer in wireless sensor network.

#### Explicit acknowledgment (EACK)

In this scheme, the receiver node sends a special control message to the source after the successful arrival of each packet. It results in high transmission overhead as acknowledgment is needed for every sent packet.

#### Negative acknowledgment (NACK):

In this scheme, the receiver acknowledges the sender about the missing packets.

#### Implicit acknowledgment (IACK):

In this scheme, the packet uses the broadcast nature of the wireless channel. The sender after sending the data listens to the channel and makes sure that the data packet is sent by the next hop to its neighbour which is a sign of acknowledgment and so on.

**Selective acknowledgment (SACK):**

In this scheme, Only the lost packet of the entire message is resent again and again, while not received the acknowledgment.

**Retransmission mechanisms for Transport Control Protocols**

Various protocols are used for reliable transport of data. Some provide reliability in data transfer upstream direction and some in transfer data in downstream direction. Only very few protocols provide reliability in both directions. Some protocols are concentrated only on reliability, while some protocols are relay both on reliability and congestion mechanism. To provide reliable data flow, it is essential that the data path is free from congestion. All the protocols use retransmission-based data recovery in case of packet loss.

**Commonly Used Data Transport Protocols****PSFQ**

PSFQ stands for Pump Slowly Fetch Quickly is a downstream reliability protocol [4]. PSFQ protocol slowly injects packets into the network, in case of data loss, the protocol performs aggressive hop-by-hop recovery. It uses NACK scheme. This protocol does not provide congestion mechanism and does not handle single packet loss.

**ESRT**

ESRT stands for Event-to-Sink Reliable Transport protocol is an upstream reliability protocol which is used for transmitting event information rather than data packet in WSN. It includes congestion notification bit. The traffic of the source node is periodically monitored during reporting frequency. This self-configuring nature makes it to adapt to dynamic environment. It does not use NACK/ACK scheme. NACK leads to overhead and ultimately energy expenditure. This protocol also works even in case of multiple event detection using event id, which is used to identify the event.

**DST**

DST stands for Delay Sensitive Transport is an extended version of ESRT. DST focus to achieve event detection reliability at the sink. It introduces a Time Critical Event First scheduling policy. In case of TCEF, the data packet with minimum deadline is given first priority for retransmission in WSN. DST works best for single event and in case of random multiple event, the case becomes a bit complicated.

**GARUDA**

It is a downstream reliability protocol which uses hop-by-hop recovery mechanism. It uses NACK scheme and contains no congestion control mechanism for data transfer. It uses WFP (Wait for First Packet) pulse transmission mechanism in WSN.

**ART**

It stands for Asymmetric Reliable Transport Protocol is based on event and query reliability. This transport protocol works for both upstream as well as downstream that implements congestion control. It consists of a series of the nodes called essential nodes that over the whole sensing area. Few nodes called non-essential nodes are involved in transmission and congestion control.

**RMST**

It stands for Reliable Multi Segment Transport Protocol. It is a selective NACK based protocol. It works only for upstream. It is built on top of directed diffusion which discovers path from sensors to sink. In this protocol a timer is used to detect packet loss and is not suitable for event detection

**PORT**

PORT stands for Price Oriented Reliable Transport Protocol. It provides event reliability with minimum energy consumption. PORT works better than ESRT. It provides energy efficient congestion control mechanisms. It follows end-to-end communication mechanism. It does not support any packet recovery schemes. It is an upstream reliability protocol.

**Importance of Redundancy in Retransmission**

To achieving reliability is to use the concept of redundancy where multiple copies of the same packet are transmitted which is very helpful in case of packet loss. as if any packet loss then we have another copy so there will be no loss. Forward Error Correction (FEC) is used to correct only the lost or corrupted bits. FEC technique is used only in the physical layer of the network. Erasure code which is a class of FEC technique is used for error correction and detection in higher layers as the exact position of the lost or corrupted bits are known at these higher layers.

**Erasure Codes**

The sender divides the data packet into  $n$  fragments and  $k$  redundant bits are added so that the total number of bits send becomes  $(n+k)$ . The receiver receives the data and

decodes them when the received data is greater than or equal to  $(n+k)$ . Erasure coding can be performed in a hop-by-hop or end to end basis. In case of hop-by-hop mechanism, the encoding /decoding is performed at the intermediate nodes whereas end to end performs the encoding and decoding operations only at the source and sink.

### RDTS

RDTS stands for Reliable erasure coding-based data transfer scheme. Here erasure coding is performed at each hop rather than at the source and sink. RDTS applies partial coding mechanism at each hop of the network. Partial coding mechanism reduces overhead as the encoding or decoding is performed on each hop only when there is a packet loss in the network. RDTS is very energy efficient. RDTS only suitable for upstream.

### FBcast

FBcast is a downstream reliability broadcasting protocol based on FEC. FBcast uses fountain codes which are a class of the erasure codes. The technique is to send a block of encoded data to its neighbours node which can be further rebroadcasted to its neighbours node and so on. FBcast is suitable for single hop WSN. In case of multi hop WSN, an extended version of FBcast along with repeaters is used.

### DTSN

DTSN is stands for Distributed Transport for Sensor Networks. It is an energy efficient transport protocol that support upstream data transmission in a reliable way. It provides full or differential reliability levels. When all the packets are necessary to be delivered to the sink, end to end technique is used. Full reliability mode uses ACK/NACK recovery schemes. Enhancement Flow is added with FEC to transfer data in blocks which results in high reliability. This protocol may not suitable when there are a number of hops between the source and the sink.

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# Sanitation Practices of Street Food Vendors in Cabanatuan City

June Jay Irvin B. Pula, Marilou P. Pascual

Department of Hospitality Management, Nueva Ecija University of Science and Technology, Cabanatuan City, Philippines  
[Maloupascual797@yahoo.com](mailto:Maloupascual797@yahoo.com), [pbalaria@yahoo.com](mailto:pbalaria@yahoo.com)

**Abstract**— This study delved on the sanitation practices of street food vendors in Cabanatuan City. It employed descriptive research design which involved the vendors and their customers. Majority of street food vendors belonged to the age bracket 30 to 39 years, have had at least finished secondary level of education, married, had more than ten years of experience as a street food vendor; and spent four to eight hours per day in vending activities. Their attendance to food safety and sanitation trainings had either none, or only one to four trainings to some. Findings further revealed that self-assessments of the respondent-street food vendors on the areas of cleanliness such as hand sanitation, proper work attire, and personal health and hygiene; and food preparation, display, and storage were consistently higher than the assessments made by their customers. Likewise, strong correlation between the respondents' profile and their sanitation practices was only found in the length of experience.

**Keywords**— street food vendors, sanitation practices, food hygiene.

## I. INTRODUCTION

The City of Cabanatuan is a first class component city in Nueva Ecija, Philippines. The continuing progress in the city and the numerous economic and cultural activities has encouraged the spread of an informal trade of street food vending, especially in areas where pedestrian traffic is high. Street food enterprises are usually small, necessitate simple cooking skills and facilities, and offer potential for generating income and employment (Winarno and Allain, n.d.). However, the capabilities of these street food vendors to provide suitable food sanitation to their product are questionable due to the unregulated nature of this food service sector. Dra. Veritas F. Luna of the Department of Food Science and Nutrition of the College of Home Economics, University of the Philippines, emphasizes the lack of sufficient policies and regulations, street food vendors will not practice safe food handling (Defensor, 2006).

In Good Hygienic Practices in the Preparation and Sale of Street Food in Africa (FAO, 2009), the primary factors of food contamination are the following: the improper care of ingredients, display, and food product storage, the utensils used in preparing, cooking, and storing food products which are often inadequate, the poor conditions of food storage, and the incorrect temperatures that allows the development of bacterial pathogens.

Buted and Ylagan (2014) have found that the expectations of customers that should be prioritized by vendors are cleanliness of the work area and environment, cooked foods should be separated from raw ones, and the utensils used. This includes the proper work attire, personal hygiene, and some other practices which may be considered unsanitary.

In another study conducted by Balaria et al. (2015) foodborne pathogen present in a barbecue sample tested in the laboratory of the Department of Science and Technology was *S. aureus* that could be harmful and could cause diarrhea. In the same study, the sample buko juice contained *E. coli*. Further interpretation made by a government doctor on the latter showed that any amount would not be desirable, and would depend on one's tolerance or reaction to this when ingested.

In Cabanatuan City, despite the proliferation of street food vending activities, there is a dearth of literature on the sanitation practices of street food vendors. Hence this study focused on the sanitation practices of street vendors in Cabanatuan City.

Specifically, it sought to answer the following:

1. How may the profile of the street food vendors be described?
2. What is the assessment of the respondents on the sanitation practices of street food vendors?

3. Is there a significant difference between the responses of the two groups of respondents?
4. Is there a significant relationship between the profile of the respondents and their assessment on their sanitation practices?

## II. METHODOLOGY

The study employed the descriptive method of research. Descriptive research answers the needs of the study since the study attempted to describe the profile of street food vendors and examined their sanitary practices. Purposive sampling was used in the study and the 14 respondents were chosen based on the following criteria (Subia, 2018a): a street food vendor and with more than 11 months of working experience. There were two research instruments used in the study. The first research instrument is a two-part questionnaire. The first part gathered data related to the demographics of the respondents, while the second part featured statements that describe sanitary practices. A five-point scale, which indicates the degree of agreement of respondents on the said statements, was used.

The scale used in responding the items in the questionnaires is shown below.

Scale	Verbal Description	Verbal Interpretation
5	Always	Strong Agreement
4	Often	Agreement
3	Sometimes	Moderate Agreement
2	Seldom	Disagreement
1	Never	Strong Disagreement

The second research instrument is a developed Observation Guide for the selected customers of the street food vendors to triangulate data gathered from the first research instrument. This observation guide featured statements that were parallel to the second-part of the first research instrument.

The data gathered were analyzed using the following descriptive measure of statistics: weighted mean, percentage, t-test, and Pearson product-moment correlation test.

The agreements of the respondent's to the statements that described the street food vendors' sanitary practices were determined using the scale given by the table below.

Table.1: Scale for Interpretation of Responses in the Assessment Form

Scale	Verbal Description	Verbal Interpretation
4.20 – 5.00	Always	Strong Agreement
3.40 – 4.19	Often	Agreement
2.60 – 3.39	Sometimes	Moderate Agreement
1.80 – 2.59	Seldom	Disagreement
1.00 – 1.79	Never	Strong Disagreement

## III. RESULTS AND DISCUSSIONS

### On the description of the profile of the street food vendor-respondents.

In terms of age, there were a total of fourteen (14) respondents of which 35.7% were from the ages of 30 to 39 years, 28.6% were aged from 40 to 49 years, 21.4% were from the age bracket of 50 to 59 years, and 14.3% were from the ages to 20 to 39 years. The gender of the respondents was equally distributed at 50% male and 50% female.

Majority of the respondents had secondary level as their highest educational attainment (64.3%), followed by tertiary level (14.3%) and non-degree (14.3%). 7.1% of the respondents only had elementary level education.

A high percentage of the respondents were married (64.3%). 35.7% of the respondents declared their civil status as single.

The respondents have had varying length of experiences measured in years as a food vendor: 35.7% have more than ten years; 28.6% of them have had one to three years; 21.4% have four to six years; while 14.3% have seven to nine years.

The respondents were evenly split on the number of trainings attended on food safety and sanitation: 50% have had no trainings at all, while the other 50% have had attended one to four trainings on the said topics.

The following percentages described the distribution of the respondents in terms of the number of hours they spent on a daily basis in vending activities: 50% spent four to eight hours, 42.86% spent more than eight hours, and 7.14% spent less than four hours.

The respondents possessed differing permits relative to the street food vending activities. Only 7.1% of them have a permit from the City Health Office. 35.7% of them have street food permits. 57.1% of them have permits from various government units.

*On the assessment of the two groups of respondents as regard the street food vendors' sanitation practices.*

*On hand hygiene practices.* There were fifteen (15) statements in the research instrument that describe the practices as regard the item hand hygiene. Customers' overall WM is 1.42, while vendors' overall WM is 4.18. This indicates *strong disagreement* on the customers' assessment and that of the vendors. This discrepancy may be explained by the attention that food clients give to food handlers whereas food handlers have, in general, a high regard on the status of their hygiene practices (FAO, 2007).

*On proper work attire.* Twelve (12) statements were in the research instrument that describes the practices as regard the item proper work attire. The customers' assessment computed mean was 1.92 which signifies their *strong disagreement* to the statements that described the vendors' proper work attire as against the vendors' assessment computed over-all mean of 3.13 which got a *moderate agreement* to the same statements.

*On personal health and hygiene.* There were eighteen (18) statements in the research instrument that describe the practices as regard the item personal health and hygiene practices. The customers' assessment computed over-all mean of 1.81 reveals that they had *disagreement* with the statements that described the vendors' personal health and hygiene practices. The vendors' assessment computed over-all mean of 2.00 also reveals that they had *disagreement* with the statements that described their personal health and hygiene practices.

*On food preparation, display, and storage.* Twenty (20) statements in the research instrument described practices on food preparation, display, and storage. The customers' assessment computed over-all mean of 2.46

reveals that they had *disagreement* with the statements that described the vendors' food preparation, display, and storage practices. The vendors' self-reported assessment computed over-all mean of 4.20 reveals that they had *strong agreement* with the statements that described their food preparation, display, and storage practices.

**Is there a significant difference between the responses of the two groups of respondents?**

Table 2: t-Test on Assessments on Sanitation Practices

Difference in Sanitation Practices	Vendors' Assessment	Customers' Assessment
Mean	3.3890	1.8523
Variance	0.2224	0.0209
t stat	11.46**	
t critical, two-tailed	2.12	

\*\*difference is significant at 0.01 level.

The determination of significant differences between the respondents' actual practices as against their self-assessment was done through a t-test at a confidence level of 1% ( $\alpha = 0.01$ ). There is significant difference in the assessment of the two groups of respondents regarding the sanitation practices of the vendors. The vendors rated their sanitation practices much higher than the customers did. A t value of 11.46 against a t critical value of 2.12 signifies that there is significant difference in the assessment of the sanitation practices made by the respondents.

**Is there a significant relationship between the profile of the respondents and their assessment of their sanitation practices?**

Table.3: Pearson-r Correlation Table on Profile versus Sanitation Practices

Profile	Sanitation Practices, r-value	p-value	$\alpha$ -value	Interpretation
Age	0.150	0.608	0.05	No significant relationship
Gender	-0.077	0.794	0.05	No significant relationship
Highest Educational Attainment	0.072	0.808	0.05	No significant relationship
Civil Status	0.098	0.739	0.05	No significant relationship
Length of Experience	0.594*	0.025	0.05	Significant relationship
Number of Trainings Attended	0.083	0.778	0.05	No significant relationship
Time Spent per Day in Vending Activities	0.046	0.875	0.05	No significant relationship
Possession of Permits	-0.267	0.357	0.05	No significant relationship

\*correlation is significant at 0.05 level

There were eight factors in the respondents' demographic profile that were considered in establishing relationships with their sanitation practices. These were their age, gender, highest educational attainment, civil status, length of experience as a street food vendor, number of trainings attended on food safety and sanitation, number of hours per day spent on street food vending activities, and possession of permits relevant to their street food vending. The respondents' sanitation practices hinged upon the four factors of hand hygiene, proper work attire, personal health and hygiene, and food preparation, display and storage.

Table 3 establishes the Pearson-r correlation between these variables of which it was found that only the vendor's length of experience has significant relationship with their sanitation practices. This implies that the *longera vendor stays* in the food-service business, his performance of sanitation practices is *more assured*.

#### IV. CONCLUSIONS

Based on the results of the study, the following conclusions are drawn:

1. Majority of street food vendors in Cabanatuan City belong to the age range of 30 to 39 years, have had at least secondary level educational attainment, married, have more than ten years of experience as a street food vendor; and spent four to eight hours per day in vending activities. Gender distribution among them is equal. Their attendance to food safety and sanitation trainings are either none, or from one to four trainings.

2. The self-reported assessments of the respondent street food vendors on the areas of food hygiene such as hand hygiene, proper work attire, and personal health and hygiene, and food preparation, display, and storage are consistently higher than the assessments made by their customers.

3. Significant difference between assessments of the respondents on the sanitation practices of street food vendors was found.

4. Significant relationship between the respondents profile and their sanitation practices was only found in the variable length of experience.

#### V. RECOMMENDATIONS

Based on the results of the study, and the conclusions drawn, these recommendations are offered:

1. The results of this study can be used as a basis for awareness campaign on sanitation practices of street food vendors;

2. Sanitation training programs should be conducted immediately by concerned agencies with the participation of State Universities and Colleges who have the capability to conduct such;

3. The Local Government Unit especially the Department of Health should be vigilant in ensuring that this sector abides by its current policies, and intensify its campaign on proper food sanitation;

4. They should further regulate this food industry by making accurate decisions given available information (Subia, 2018b) particularly by amending and/or adding more laws to protect the consuming public;

5. Similar researches be undertaken that will further appraise the sanitation practices of the food services industry.

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# Nutritional Status of School Age Children in Private Elementary Schools: Basis for a Proposed Meal Management Plan

Ralph Christopher M. Ramos, Aileen Y. Vigilia, Kelvin Julius A. Nueda

Department of Hospitality Management, Nueva Ecija University of Science and Technology, Cabanatuan City, Philippines  
[ralphchristopherramos@yahoo.com.ph](mailto:ralphchristopherramos@yahoo.com.ph), [pbalaria@yahoo.com](mailto:pbalaria@yahoo.com)

**Abstract**— Department of Education (DepEd) organizes nutritional programs to improve the health status of children in public schools. Likewise, the researcher believes that health awareness must be raised in private schools as well. This study aimed to affect the community to be aware and more knowledgeable about nutrition. Specifically, this study focused on the nutritional status of school age children in private elementary schools in Santa Rosa, Nueva Ecija. It sought to determine the profile of the learners, anthropometrics, clinical data and the knowledge of the learners as to dietary and the significant relationship between the profile of the learners and the nutritional status of the school aged children. With all the data gathered a meal management program was proposed. The study employed the quantitative description design. The study manifests that majority of the respondents were not yet aware of what they eat. In addition, age, greatly affects the respondent's anthropometrics as to height. More so, age, number of siblings and family income, greatly affect the respondents' anthropometrics as to weight. The researcher adopted the Nutritional Guidelines for Filipino program that was developed by the DOST- FNRI.

**Keywords**— Anthropometrics, Nutritional Status, School Age Children.

## I. INTRODUCTION

According to the World Health Organization (2018) Health has become a major issue for most people in the world. Researchers indulge into different experimentation to find cures to illness and diseases. As the world has never been health conscious, proper diet and nutrition become the main focus of the society. Malnutrition contributes to more than 60% of 10 million child deaths each year where 43% of the children are stunted and 9% are wasted. These global phenomenon resulted to decreased scholastic performance, lower IQ levels, poor psychosocial development, decreased cognitive functions and reduced adult size which lead to deteriorating economy.

Nutritional problems among children require immediate action. Malnutrition in a child results from interplay of causative agents. The common causes of malnutrition are poverty, faulty food intake, scarcity of food, large family size, low level of education, intra-familial food distribution, urbanization, and more (De Guzman, 2006). Apolinar (201) said that epidemiology and ecology of malnutrition should be analyzed in order to develop a new source of wealth with the penetration of mass media in which has affected the pattern of malnutrition in the young. Nutritionists said that health and adequate nutrition are interrelated to each other. The body needs enough amount of proteins, vitamins and other nutrients to maintain healthy normal growth. Since food is of the physiological needs of human, it is his desire to satisfy hunger. On the contrary, people do not get enough of those nutrients either due to bad eating habits or they cannot afford it. However, people nowadays start searching alternative ingredients from the environment to fill in the necessity for food.

Claudio (2007) reiterated that as a child grows, he becomes aware of the relationship of food to a healthy body.

Based on Dimaano's (2007) research, the period of 7 and 12 years is characterized by a slow steady growth,

increased body proportions, enhanced mental capabilities, and more motor coordination. The Department of Education (DepEd) organizes nutritional programs to improve the health status of children in public schools. Likewise, the researcher believes that health awareness must be raised in private schools as well. This study aimed to affect the community to be aware and more knowledgeable about nutrition.

Specifically, this study focused on the nutritional status of school age children in private elementary schools in Santa Rosa, Nueva Ecija. It sought to determine the profile of the learners, anthropometrics, clinical data and the level of knowledge of the learners as to dietary and the significant relationship between the profile of the learners and the nutritional status of the school aged children. With all the data gathered a meal management program was proposed.

## II. METHODOLOGY

The study employed the quantitative description design. Using the Sloven's formula, the study involved 180 respondents from the different private elementary schools in one of the municipalities in Nueva Ecija. The main instrument used in this study was a questionnaire. Comments, revisions and suggestions from the researchers' adviser were incorporated to validate the content of the questionnaire. It was then personally administered by the researchers to the respondents after seeking approval from the authorities. The data gathering procedure included observation every meal break to obtain facts for the development of the meal management plan. Percentage, weighted mean and Pearson r were employed as statistical tool in the treatment of data.

## III. RESULTS AND DISCUSSIONS

Description of the profile of the respondents in terms of age, sex, occupation of parents, order of birth, number of siblings and monthly family income.

Majority of the respondents belonged to 10-12 years old, mostly female, whose parents were OFW, and whose family income ranges from P 25,000 and above.

According to the Dietary Guidelines for Americans (2010), children aged 10-12 need healthy foods because they have a consistent, but slow rate of growth and usually eat four to five times a day. Likewise, Dimaano (2016) stated that most girls start to menstruate during this age and were recommended allowances for one or more nutrients. On the contrary, teenage girl's poor diet can be caused by emotional and social pressures. Based on the researchers' observations, parents whose working in professional positions can afford to provide their children nutritious food. Hatton and Martin (2008) said that birth order can only affect health outcomes if inequality of resource allocation is present in the household. Furthermore, in the survey conducted by Casey (2001), about 2.2% of households are reported to have food insufficiency. Families with low income experience food insufficiency due to lack of money.

**Nutritional status of respondents in terms of anthropometrics as to height and weight of the respondents.**

Survey reveals that majority of the respondents stand 51 inches and above and weigh 71 kilos and above. According to Kidshealth Organization (2015), a child's height is determined by genetics or daily nutritional intake. Most kids' growth slows down after the first year of life breaking down into mini growth spurts. To ensure a child reaching a normal height and weight, they must be taught certain lifestyle habits while practicing patience.

**Clinical data of the respondents as to diseases, allergies and operations underwent, and number of vaccines received during infancy up to present.**

In terms of diseases, majority of the respondents did not have disease when they were young, 72.2% did not have allergy. About 172 of them did not undergo any operations, while 61.7% had 4 vaccines. Paula (2013) defines clinical data as the obtaining of individual's medical history. Vaccines reduce and prevent an individual from infectious diseases (Center for Disease Control and Prevention, 2016).

Table 1 shows the nutritional status of respondents in terms of clinical data as to dietary knowledge

Dietary Knowledge	WM	Verbal Description
1. Eating fruits and vegetables is good for one's health.	4.30	Strongly Agree
2. Too much sugar intake is good for one's health.	2.15	Disagree
3. Eating a variety of foods is good for one's health.	3.29	Moderately Agree
4. Food high in fat is good for one's health.	2.26	Disagree
5. Food with a lot of staple food such rice and rice products are not good for one's health.	2.21	Disagree
6. Fish, poultry, eggs and lean meat are good for one's health.	3.33	Moderately Agree
7. Less consumption of animal fat in the diet is good for one's health.	3.35	Moderately Agree
8. Milk and dairy products is good for one's health.	4.10	Agree
9. Physical activities are good for one's health.	4.44	Strongly Agree
10. Sports or other physical activities are not good for one's health.	2.53	Disagree
11. The heavier one's body, the healthier he or she is.	2.46	Disagree
Overall weighted mean	3.13	Moderately Agree

The table presents the dietary knowledge of the respondents. It shows that the learners Moderately Agree as to their Dietary Knowledge. It can also indicate the lack of information as regard eating nutritious food or is seldom practiced in the Filipino table setting and school environment.

The role of parents in educating their children to eat healthy food at an early stage in life can be a big factor in the latter's nutrition. Nowadays, children are engrossed with eating too much of processed food and softdrinks. This

includes cured meat like hotdogs to be the daily breakfast of every Filipino child. These items are openly sold in school canteens and are often uregulated. Although children are taught in school about proper diet, many factors are to be considered like their utter dislike for vegetables. Cooking this stuff can consume much time, hence the preference of parents for quick-cook food because they are are busy to attend to other household chores. Secondly, the capacity of parents to financially sustain a balanced diet which they still view the process to be costly.

Table.2: Shows the correlation of profile of respondents and their anthropometric height and weight)

Profile	Height, r-value	Interpretation	Weight, r-value	Interpretation
Age	.161 *	Significant relationship	.324**	Significant relationship
Gender	.116	No significant relationship	.035	No Significant relationship
Mother	-.061	No significant relationship	-.027	No Significant relationship
Father	.133	No significant relationship	-.055	No Significant relationship
Birth Order	.036	No significant relationship	-.026	No Significant relationship

Siblings	-.025	No significant relationship	-.151*	Significant relationship
Income	.065	No significant relationship	.333**	Significant relationship

Legend: \*correlation is significant @0.05 level; \*\* correlation is significant @0.01 level

Table 2 shows that gender had no significant relationship in the anthropometrics of the respondents as to height, parents’ occupation, birth order, number of siblings, and family income. On the contrary, age greatly affects their anthropometrics.

As individuals age, the body changes and lifestyle may affect diet and eating habits (Robinson and Segal , 2017).

Moreover, the table shows that weight, gender, parents’ occupation and birth order had no significant relationship to the anthropometrics of the respondents. In contrast, age, number of siblings and family income greatly affect the respondent’s anthropometrics as to weight. Good nutrition is vital to the growth and development of children ( healthypeople.gov.,2006) .

Table.3: Correlation of profile of respondents and their clinical data as to diseases, allergies and operations

Profile	Number of Allergies, Diseases and Operations	
	r- value	Interpretation
Age	0.041	No Significant Relationship
Gender	0.06	No Significant Relationship
Mother	0.053	No Significant Relationship
Father	-0.004	No Significant Relationship
Birth Order	0.088	No Significant Relationship
Siblings	-0.004	No Significant Relationship
Income	0.068	No Significant Relationship

Table 3 implied the significant relationship between the profile and clinical data as to number of diseases, allergies and operations of the respondents using Pearson’s r. It further indicates that there is no significant relationship between the profile and the number of allergies, diseases and operations.

Table.4: Correlation of profile of respondents and their clinical data as to vaccines received

Profile	Number of Vaccines Received	
	r- value	Interpretation
Age	-0.024	No Significant Relationship
Gender	0.078	No Significant Relationship
Mother	-0.057	No Significant Relationship
Father	0.026	No Significant Relationship
Birth Order	0.057	No Significant Relationship
Siblings	0.133	No Significant Relationship
Income	-0.035	No Significant Relationship

Table 4 indicates that there is no significant relationship between the profile and vaccines received of the respondents using Pearson r.

Table.5: Correlation of profile of respondents and their dietary knowledge

Profile	Dietary Knowledge	
	r- value	Interpretation
Age	0.056	No Significant Relationship
Gender	-0.124	No Significant Relationship
Mother	0.084	No Significant Relationship
Father	-0.014	No Significant Relationship
Birth Order	0.032	No Significant Relationship
Siblings	0.123	No Significant Relationship
Income	.162*	Significant Relationship

\*correlation is significant @0.05 level

It can be noted that income has significant relationship on the dietary knowledge of respondents. Since family income bracket gathered is considered moderately high by Philippine criteria, they are able to buy the food they want, but not necessarily conscious of its dietary contents. The latest Family Income and Expenditure Survey ( FIES ) conducted by the Philippine Statistical Authority ( PSA, 2016) found that each Filipino household allots 42.8% of its monthly income to food expenses.

### Proposed intervention program that may employ to improve the health status of the school age children

With the result of the investigation made by the researcher on the dietary knowledge and correlation of the profile and anthropometrics. The researcher highly recommends the implementation in every household and schools the program that was developed by the Food and Nutrition Research Institute of Department of Science and Technology the "National Guidelines for Filipinos 2000". It is a set of dietary guidelines based on the eating pattern, lifestyle and health status of Filipinos. This consists vegetables, fruits, carbohydrates, proteins, water, and dairy products with suggested amounts. The NGF contains all the nutrition messages to healthy living for all age groups from infants to adults, pregnant, and lactating women and the elderly.

### IV. CONCLUSION

Based on the findings, the following conclusions were drawn:

1. Majority of the respondents belonged to 10-12 years old, mostly female, whose fathers are OFW, first child in the family, had one sibling, and had a family income ranging from P 25,000 and above.
2. Majority of the respondents stood 51 inches and above, and weighed 71 kilos and above in terms of anthropometrics. In terms of diseases, majority of the respondents did not have any disease when they were young, 72.2% did not have allergy, 172 of them did not undergo any operations and 61.7% had at least 4 vaccines.
3. Majority of the respondents answered "Moderately Agree" in the statements in the Dietary Knowledge which means that the respondents were not yet aware of what they eat.
4. Gender had no significant relationship to the anthropometrics of the respondents as to height, both parent's occupation, and birth order, number of siblings, and family income. On the contrary, age, greatly affects their anthropometrics. Moreover, weight, gender, parent's occupation and birth order had no significant relationship as to weight. In contrast, age, number of siblings and family income, greatly affect the respondents' anthropometrics as to weight.
5. A meal management plan is proposed to enhance the nutritional status of children.

### V. RECOMMENDATIONS

Based on the conclusions drawn, the following recommendations are hereby offered:

1. Parents may try to control when and where food is eaten by their children by providing regular daily meal times with social interaction and demonstration of healthy eating behaviors.
2. In every household, parents may involve their children in the selection and preparation of foods, and teach them to make healthy choices by providing opportunities to select foods based on their nutritional value.
3. Most students need to reduce the amount of calories they consume. When it comes to weight control, calories do count. Controlling portion sizes and eating non-processed foods helps limit calorie intake and increase nutrients.

4. Parents are encouraged to provide recommended serving sizes of food for children.
5. Parents are encouraged to limit children's video, television watching, and computer use to less than two hours daily and replace the sedentary activities with activities that require more movement.
6. Children and adolescents need at least 60 minutes of moderate to vigorous physical activity on most days to have good health and fitness and for healthy weight during growth.
7. To prevent dehydration, encourage children to drink fluid regularly during physical activity and to drink several glasses of water or other fluid after the physical activity is completed.
8. Parents may try to apply organic farming method in their backyard to promote a healthier environment that is free from chemicals and will provide cheaper but nutritious foods for their children. A food that is free from chemicals will result to a cheaper, nutritious and healthy body.

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# Human Rights, Gender Equality, and the Question of Justice: A Re-Examination of Male Chauvinism in African Culture

Rev. Fr. Dr. Hyginus Chibuike Ezebuilo

Department of Philosophy, Nnamdi Azikiwe University, Awka, Nigeria  
frezebuilo@gmail.com

**Abstract**— Traditional cultural practices reflect the values and beliefs held by members of a community for periods of time. Every social grouping in the world has specific traditional cultural practices and beliefs, some of which are beneficial to all members, while others have become harmful to a specific group, such as women. These harmful and, sometimes, discriminatory traditional practices include early and forced marriages, virginity testing, widow's ritual, female genital mutilation, the primogeniture rule, and witch-hunting. Despite their harmful nature and their violation of national and international human rights laws, such practices persist because they are not questioned or challenged and therefore take on an aura of morality in the eyes of those practicing them. The purpose of this study is to discuss the impact of culture, tradition, customs, and law on gender equality in Africa. Applying the critical and analytic methods in philosophy, the study observes that law reform and development have traditionally focused on state legal institutions to the exclusion of customary legal system, and that where the courts had an opportunity to develop the customary legal system they either reinforced archaic customary laws or imposed Western ideology. This study further investigates, by means of interview in Nsukka part of Igbo-Africa, how ordinary men and women in Africa understand women's right, and how their attitudes are tied to local conception of masculinity. The investigation reveals that a new configuration of gender relations is evident in Africa – one that accommodates some aspects of women's rights while retaining previous notions of innate male authority. It concludes by showing that harmful traditional practices are unjust as they violate women's human rights (guaranteed in the Constitution), perpetuate the inequalities between women and men, and contribute to extreme poverty that government should fight to eradicate. Man and woman have the same dignity and are of equal value ontologically, and as such, we recommend that different African societies should uphold this ontological equality and dignity while socially constructing gender.

**Keywords**— Africa, culture, gender, women, rights.

## I. INTRODUCTION

Culture is the way of life, especially the general customs and beliefs, of a particular group of people at a particular time.<sup>1</sup> It is understood as a social domain that emphasizes the practices, discourses and material expressions, which, over time, express the continuities and discontinuities of social meaning of a life held in common.<sup>2</sup> The revival of tradition, culture and custom is part of the new national and international identity; however, this revival must be rooted in a way of life based on human rights, democracy and equity for all, and understood from a point of view of *igwebuike*.

Much of this research involved unstructured time in the community talking with men and women in shops, bars, markets, on the streets, and in their homes. Our participant observation was complemented by additional qualitative research, including interviews and discussions. We categorized a range of ways people respond to these discourses, from the reactionary (gender inequality) to the mainstream (gender equity) to the transgressive (gender equality).<sup>3</sup> Each of these responses reflects the prevailing hegemonic masculine ideal of being a provider and established notions of male authority in different ways. Reactionary responses reflect an established hegemonic masculinity and are premised on maintaining patriarchal

power relations that frame men's power over women as natural and inevitable. Mainstream responses seek to reconcile men's 'power' role as the primary family provider and exclusive authority in the home with some aspects of women's rights. In this way, mainstream responses are not simply complicit with reactionary responses but instead represent, as Connell asserts, an emergent hegemonic masculinity that is still coalescing.<sup>4</sup> Transgressive responses, in contrast, challenge hegemonic masculinities – established and emergent – by being receptive to gender equality and reformulated ideas of men's roles and male authority.

Prior to this venture, we shall examine the influence of colonialism, imperialism, and apartheid on the African culture, traditions and customs with particular reference to Igbo people of Nigeria. This will include a brief review of what really constitutes African culture, tradition, and custom and their influence. It will be argued that the primogeniture rule (the primogeniture rule is the right, by law or custom, of a firstborn male to inherit the entire estate, to the exclusion of younger siblings) is not an original African cultural principle but a colonial and imperial construct.<sup>5</sup> In our dialogue about the revival of our culture, tradition, and customs, we need to interrogate what is African and what is a colonial or imperial construct.

This paper is divided into six sections. The first is introduction, the second deals with the conceptual and theoretical framework, the third is a highlight of the concepts of gender and human rights, the fourth section attempts to situate our discussion within the context of Igbo-Africa. Section five contains a survey of some of the harmful and discriminatory cultural practices prevalent in different African societies, the sixth section attempts policy oriented advice through which contemporary African societies can promote gender equality and reduce injustices often meted to African women. Section seven concludes the paper.

### **Conceptual and Theoretical Framework**

Culture is the social behaviors and norms found in different human societies.<sup>6</sup> It comprises the range of phenomena that are transmitted through social learning in human societies. Some aspects of human behavior and social practices are said to be cultural universals, found in all human societies. These include culture-expressive forms such as music, dance, ritual, religion, and technologies such as tool usage, cooking, shelter, and clothing. The concept of material culture covers the physical expressions of culture, such as technology, architecture and art, whereas the immaterial

aspects of culture such as principles of social organization (including practices of social organization, political organization, and social institutions), mythology, philosophy, literature (both written and unwritten), and science, comprise the immaterial/intangible cultural heritage of a society.<sup>7</sup>

In the words of E.B. Tylor, culture is 'that complex whole which includes knowledge, belief, art, morals, law, custom and any other capabilities and habits acquired by man as a member of society.'<sup>8</sup> Alternatively, culture is understood as a social domain that emphasizes the practices, discourses and material expressions, which, over time, express the continuities and discontinuities of social meaning of a life held in common.<sup>9</sup> The Cambridge English Dictionary states that culture is the way of life, especially the general customs and beliefs, of a particular group of people at a particular time.<sup>10</sup> The term is also used to denote the complex networks of practices and accumulated knowledge and ideas that are transmitted through social interaction and exist in specific human groups using the plural form.

In fact, there are as many definitions of culture as there are scholars who are interested in the phenomenon. Culture embraces a wide range of human phenomena, practices, material achievements and norms, beliefs, feelings, manners, morals and so on. It is the patterned way of life shared by a particular group of people that claims to share a single origin or descent. For this reason, Bello sees it as the totality of the way of life evolved by a people in their attempt to meet the challenge of living in their environment, which gives order and meaning to their social, political, economic, aesthetic and religious norms thus distinguishing a people from their neighbors.<sup>11</sup> Affirming the notion that culture serves to distinguish a people from others, Aziza asserts that:

Culture...refers to the totality of the pattern of behavior of a particular group of people. It includes everything that makes them distinct from any other group of people; for instance, their greeting habits, dressing, social norms and taboos, food, songs and dance patterns, rites of passage from birth – through marriage – to death, traditional occupations, religious as well as philosophical beliefs.<sup>12</sup>

It should be noted that culture is passed on from generation to generation. Thus, the acquisition of culture is a result of the socialization process. Throwing more light on this point, Aziza observes that the child just grows into and within the cultural heritage of the people and inherits it. He made it clear that culture, in traditional society, is not taught but caught instead. The child, according to him, observes, imbibes and mimics the action of his elders and siblings. Therefore, it is impossible for the child in a traditional society to escape his cultural and physical environments.<sup>13</sup> The fact remains, however, that African culture has experienced rapid change since the colonial invasion. Hence, contemporary African culture is a mixture of traditional elements and alien features. Western cultures tend to be more individualistic and focused on individual achievements and personal interests, whereas African cultures are collective, group-oriented, and concerned with the welfare of their community. This is one African principle that colonialism and imperialism could not manipulate: *ubuntu*<sup>14</sup> or *igwebuiké*.

*Igwebuiké/ubuntu* means I am what I am because of who we all are. These concepts underscore the importance of agreement or consensus. The overall concept of *igwebuiké* or *ubuntu* values people as a community, rather than as individuals. This attitude has its strength and weakness anyway. The Zulus and other peoples have a saying, “*umuntu ngumuntu ngabantu*,” which means a person is a person through other persons.<sup>15</sup> This same idea is conveyed in Igbo sayings: anyukoo amiri onu ogbaa ufufu (urine forms fume when we all urinate together in a common place); ofu osisi anaghi agba ohia (a single tree does not make forest) etc. It is a humanistic way of life which holds ethics and morals at the forefront of everything. All African cultural, traditional, and customary practices, including those pertaining to women and children, were based on *igwebuiké/ubuntu*.

For this reason, the African traditional culture has an almost infinite capacity for the pursuit of consensus and reconciliation, as opposed to being individualistic and competitive. Further, in terms of African culture, there are no orphans because a child is a child of a community in which the child lived. Decision making in the African culture (as expressed in terms of the principle of *igwebuiké*) is by consensus – productivity is optimized, not maximized, as the case may be in other cultures. Rewards are shared and so is suffering, as opposed to the context of an individualistic culture, where rewards are given according to individual merit and suffering is viewed as a penalty for

one's carelessness. Sustainable competitive advantage comes from loyalty to group goals in terms of *Igwebuiké*. But what does this mean in practice for a young girl who has to endure many harmful practices in the name of her culture? This same African tradition permits male chauvinism to the expense of their female counterparts who often fall victim of circumstances.

The idea of male superiority, meanwhile, is not peculiar to Africa. In several passages in the *Summa Theologiae* and elsewhere, Thomas Aquinas asserts the inferiority of women in both bodily strength and in force of intelligence.<sup>16</sup> To top this off, he maintains that feminine intellectual inferiority actually contributes to the order and beauty of the universe. But he also affirms that in Heaven there are and will be women who occupy higher places than men. Perhaps, in this apparent inconsistency he is simply hedging on his seemingly chauvinistic positions to accommodate Mary, Queen of Heaven.

To begin to understand his position, we must ask why Aquinas thinks women intellectually inferior in the first place. Scripture is likely his first guide. St. Paul says in 1Corinthians 11:10 that “man was not created for the sake of woman, but woman was created for the sake of man.” This passage echoes Genesis 2:18, 19: It is not good that the man should be alone. I will give him a helpmate.” Aquinas reasons from these scriptural passages that when one thing exists for the sake of another, it is inferior to that other. Other passages indicate that women's inferiority is something divinely ordained.<sup>17</sup> When in 1Corinthians 11:3 St. Paul says that “man is the head of woman,” and in Ephesians 5:22 that “a husband is the head of his wife,” Aquinas takes it as evident that if men are meant to rule, it can only be by virtue of intellectual superiority.<sup>18</sup> Yet Aquinas says: “Just as some human beings will surpass certain angels in glory despite the inferiority of human nature to angelic nature, so too some women despite their inferiority as to intelligence.”<sup>19</sup>

Regardless of whether we agree with Aquinas' position, with all the inconsistencies, there is at least one important thing we can learn from him about relative inferiorities – we should love who we are. The beauty of nature lies in diversity. It is pride the excessive desire of our own excellence that tends to make us sad when another has perfection or grace we do not have. In our discussion of the differences between the sexes, we must avoid yielding to impulses of envy, but strive rather to love whatever we may have due to our sex. The problematic comes, however,

when society takes undue advantage of natural diversity to suppress one class on the basis of sex or gender.

### **Gender and Human Rights**

In the last few decades, notions of inalienable human rights have reshaped the political landscapes of countries throughout the developing world. Women's rights activists have been at the center of the revitalization of human rights, struggling to address gender inequality across cultures without lapsing into misguided sentiments. George<sup>20</sup> observes that these changes are evident across the African continent, where the language of human rights has become integral to international declarations, regional treaties, national legislation, and grassroots activism. Many African constitutions explicitly recognize women's rights, and in 2003 the African Union passed the far-reaching Protocol on the Rights of Women in Africa.<sup>21</sup>

However, given this new salient issue of women's rights in Africa, there is surprisingly little research on how African men have understood these developments, and how African masculinities are implicated in such changes, hence, the need for this study.

The majority of men with whom we interacted in the course of this research were receptive to greater women's rights, so long as such changes did not undermine their ultimate authority over women, especially within the home. For such views, women's rights should be limited in scope and not synonymous with equality with men. However, some women and a small number of men we encountered did link women's rights to gender equality, and in the process they challenged entrenched notions of a masculinity rooted in male superiority. There was also a backlash to this new configuration because a minority of men we met were adamantly opposed to any notion of greater rights for men. This work, therefore, helps us understand how different engagements with human rights in local contexts are shaped by, and are shaping, gender relations. Importantly, human rights are not understood here as foreign to African societies, or as an imposition of 'Western' values in a 'non-western' setting. As Amartya Sen has argued,<sup>22</sup> the constituent components of modern notions of human rights can be found in many cultures, not just Western cultures. While human rights may have found their fullest articulation in the West, the issues of human rights addresses fundamental questions about the relationship of the individual to society, and "thus is one that has been raised across time and across cultures."<sup>23</sup>

African cultures, which are frequently essentialized as tradition-bound, communal, and incompatible with

individual rights, have engaged with these issues as well. Many pre-colonial African societies articulated clear visions of human dignity, freedom from oppression, as well as rules governing the just distribution of goods.<sup>24</sup> While some have suggested that such African notions of human dignity and justice are not synonymous with human rights,<sup>25</sup> these arguments presupposes a restricted, and rather Eurocentric, understanding of legally-enforceable, individual human rights. Such a narrow view obscures how many pre-colonial African societies espoused religious, moral, and cultural values that incorporated ideas of collective and individual rights – ideas that can validly be considered the contextual equivalent of the modern concept of legal rights.

With the formulation of the Organization of African Unity (OAU) in 1963, member states formally recognized the Universal Declaration of Human Rights. In 1981, the OAU expanded its recognition of human rights by adopting the African Charter on Human and People's Rights, which is unique in its inclusion of collective, or group, rights.<sup>26</sup> While the African Charter does mandate that member states protect women's rights, some African women's rights activists argued that the emphasis on community rights gave legitimacy to cultural practices which discriminated against women.

### **The Context of Igbo-Africa**

Interview research for this article was conducted in Nsukka, a low income community in Enugu, the capital of Enugu state of Nigeria. Like most Western African nations, Nigeria faces challenges in education, poverty reduction, and health care among others. Men dominate better-paying occupations, with men about twice as likely as women to be earning income through self-employment, and there are persistent gender gaps in literacy and education.

Although formal wage labor was virtually non-existent in Nsukka, some men found semi-regular work in Nsukka's auto-repair shops, metal workshops, butchers, farming, mason, and carpentry workshops. So Nsukka did provide men opportunities to earn money, even if the work was often strenuous, available only sporadically, and poorly paid. While men dominated the activity on Nsukka's commercial streets, women were present as well. Some worked in schools, pharmacies, office supply stores, or served food in restaurants or informal stalls. Off the main street, other women were earning money selling produce while they tended to their non-paid work at home.

Despite the economic hardships faced by residents of Nsukka, masculinity remains strongly tied to the breadwinner identity. In Nsukas, there exists one dominant

masculine ideal of being a provider, primarily embodied through responsible fatherhood. However, beyond this uncontested male provider ideal, there was much confusion and conflict over a set of contested masculine ideals related to work, male authority and male sexuality.

There are three main discourses regarding masculinity and gender relations. Gender inequality promotes the notion that men and women are different and unequal, with men being innately superior and, thus, in position of authority. Gender equity retains a notion that men and women are different but emphasizes that women should be afforded the same opportunities as men. Gender equality questions any innate male/female difference and is based on expansive notion of universal human rights that challenges naturalized ideas of male superiority and female subordination.

To gather our data, the method we employed involved unstructured time in the community talking with men and women in shops, bars, markets, on the streets, and in their homes. We categorized a range of ways people respond to these discourses, from the reactionary (gender inequality) to the mainstream (gender equity) to the transgressive (gender equality). Each of these responses reflects the prevailing hegemonic masculine ideal of being a provider and established notions of male authority in different ways.

The following sections focus primarily, but not exclusively, on how men understand these shifting gender discourses. The intention is not to reduce an analysis of masculinity to an examination of men's lives but instead to draw on men's perspectives to illuminate tensions between masculinity, women's rights, and gender equality in Nsukka.

Some men we met in Nsukka were hostile to the idea that men and women were equals. For some men, male physical and intellectual superiority was obvious and the conventional division of labor was a 'natural' outgrowth of such differences. Such understandings were often grounded in nature as a hardware shop manager explained: "This is natural; they are not equal, unless you want to change nature. They are influenced by nature; a woman cannot roof a house, she would require help from the man. The culture naturally does not allow such a thing to happen, especially here in Nsukka. But isn't gender a social construct – assignment of roles? If it is why was it man that was favored? Perhaps it is also something natural.

Some men had a slightly softer edge to their patronizing attitude towards women. A well-respected butcher in Nsukka, saw men and women as complementing each other: "They are not equal. A man is higher because he is the one who goes out to bring the woman to his home. The man

also is the major provider in the home. The relatives and in-laws have to look to the man for any requirements. But this does not mean that the man is too superior, however, because they complement each other.

Others echoed the same emphasis on male superiority being rooted in what they saw as men's long-standing roles as providers and leaders. As one man bluntly put it, "he in Nsukka they are not equal. Women do not control men, men control women. It does not change."

Discourses of gender equity and equality, however, challenges such entrenched ideas of male superiority and often elicited the deep sense of disempowerment and victimization many men felt. The following excerpt from a discussion with a group of four men makes this clear:

- i. Women and men are not equal.
- ii. A man should have been higher than the woman but now women are higher.
- iii. Now, with equity, women will get to the same level as us because of the changing situation, but men are still higher.
- iv. On the government's side, women and men are equal. When the women have money, women and men become equal.

Researcher: Do you think men and women should be treated equally?

- i. They should both have been treated equally but the government has sided so much with the women.
- ii. We men are so hurt.
- iii. We should also advocate for our rights just as the women did...We are not equal, come what may, we shall never be equal.

For this group, perhaps, government programs advocating gender equity had gone too far and infringed on men's natural authority over women.

It was not just men who found shifting discourses on gender relations problematic. Some women were emphatic that men should have higher social status compared to women. "Men have more power and authority," said one woman, "and it should not change. They take on a lot of responsibility in the family, so they should have more power." Yet many of these women were also critical of men for abusing their power and dismiss suggestions that women's rights were now recognized and protected. As one woman puts it, "Men were given power by God, but they misuse it. A man can give any instruction and the women must follow it. A man's strength is greater than a woman's."

In Nsukka, then, there were clearly elements of a backlash against women's rights and more egalitarian gender relations. Some reactionary men placed the blame on the government. For them, there was no distinction between gender equity and equality – both were problematic and threatened their already tenuous sense of authority.

Not all men in Nsukka were so reactionary. Some acknowledged albeit grudgingly, that some change was beneficial. Gender equity discourses had shaped the attitude of these men, and most were trying to reconcile gender equity with ideas of innate male authority. As one man said, "Men should have a special status according to culture. This status is inherited from our grandfathers and our fathers. But if it is to do with life, we should all be treated equally. For example, we are all entitled to medical treatment, whether a man or a woman...[But] I would be unhappy if women are given equal status to men."

Such view regards women and men as having different roles, and women fundamentally lower in status, but it recognized certain shared rights and the benefits of working collaboratively.

In Nsukka, we did encounter a few, mostly young men who wanted to explore more transgressive gender relations that accommodated ideas of gender equality. One such respondent replied:

From my own perspective, they are equal. Men and women are equal. But when it comes to responsibilities that is where the difference comes in: the gender roles or the way society vies men and women...But otherwise women and men are supposed to be the same, especially when it comes to rights.

Generally, it seems that while justice and equality are salient in Igbo Africa, the meaning is more restricted and does not imply an ontological equality of persons. It appears that gender equality by which we mean and women sharing power and cooperating to lead a family/society together is fundamentally incompatible with Igbo society and culture. Gender equity, which implies equal opportunity for women to gain power, is more compatible because it retains the notion of a single person at the head of any given level of society. In addition, the Igbo emphasis on individual achievement and social mobility, although conventionally related to men, may make certain aspects of advancing women's status through gender equity more culturally

acceptable. However, the political advancement of women seems not to change the established relations of domestic hierarchy between husbands and wives. No doubt, then, Merry Sally Engle<sup>27</sup> was right to note that local cultures are both potential barriers to and resources for social change.

### **Some Harmful and Discriminatory Cultural Practices in Africa**

It does appear, as Igwilo and Ogbo<sup>28</sup> rightly observes that while so-called African culture and values have positive, soul-lifting and humanistic dimensions, it also has some negative and dehumanizing aspects. Customary practices such as female genital mutilation, early and forced marriages, virginity testing, widow's rituals, breast sweeping/ironing, the primogeniture rule, and practices such as cleansing after male circumcision, witch-hunting, and other practices that impinge on gender equality, are entrenched, and in practice take precedence over equality in the in the villages where they are carried out. It is therefore questionable whether the constitutional protection of gender equality is making a difference to women living in communities with a strong commitment to traditional norms and practices. These compromises on women's right to equality can thus be interpreted to mean that women, as opposed to men, do not have inherent rights. In order to support this argument, we shall explore the impact of some of the above listed harmful practices.

The revival of traditions, culture, and customs, and the practices derived from them, after the demise of colonialism, imperialism and apartheid will definitely require us to enter into a dialogue on the character of our ancestors and what is really indigenous.<sup>29</sup> However, the process should take the context into consideration. Some of the cultural practices that were necessary then are unnecessary now due to development, globalization and other factors. Below are some cultural practices that need to be scrutinized.

**Virginity testing:** virginity testing is practiced mostly in South Africa.<sup>30</sup> Virginity testing is the practice and process of inspecting the genitalia of girls and women to determine if they are sexually chaste.<sup>31</sup> It is based on the false assumption that a woman's hymen can be torn only as a result of sexual intercourse. It is a very controversial practice, both because of its implications for the girls tested and because it is not necessarily accurate.

The idea is that virginity testing is a form of sex education and it enforces abstinence from sexual activities before marriage. As Connell notes, girls are taught not to allow boys or men to take away their pride by having sexual

intercourse with them before marriage.<sup>32</sup> It is believed, then, that young women will abstain from sex because they fear being discovered to be no longer virgins. Now, the implication of this fear is problematic. This is a stigma not only for the girl but for her entire family. It is believed that virginity testing substantially reduces the spread of sexual transmitted diseases, including HIV/AIDS, and further, that it reduces teenage and unplanned pregnancies that lead to school dropouts.<sup>33</sup>

It appears then that the intention of the practice of virginity testing might be good, but its flip side is gender bias. It does not treat boy and girl children equally. It also has moral implications. Virginity testing poses a threat of discrimination against girl children who are not virgins (some of whom in many instances may have been raped). The reasons advanced for the practice do not focus on prevention and protection.

**Widow's rituals:** Widowhood is a clearly defined social role for women that is associated with prescribed institutionalized cultural and religious norms and the concomitant social sanctions if a deviation from the defined social role occurs.<sup>34</sup> However, an altogether different set of norms applies to men upon the death of their wives in many African societies. Evidence abound that there is large discrimination against widows, including the imposition of burdens, obligations or disadvantages, and the withholding of benefits, opportunities or advantages, as well as the regular harassment of widows in the context of the household, community, state and market place. In fact, a woman's status shifts drastically (downward) after the death of her husband in contrast to the widower's status which remains unchanged (including in terms of the administration of the estate). A decrease in social status not only has implications for women's livelihood, economic status and quality life, but also increases their vulnerability to discrimination, abuse, harassment and gender-based violence, as well as their ability to assert their rights.

Both men and women experience increased social pressure during widowhood/widowerhood, but in different directions. Widows are pressured to remain 'loyal' and 'faithful' to their late husbands, and honour their memory, whereas men are often pressured into a quick remarriage, regardless of their readiness or wish to remarry. If widows remarry, they rarely do so of their own free will. In some communities widows may be forced into new conjugal relations with a male relative or be forbidden to remarry, even if they wish otherwise.

**Witch-hunting:** Witch hunting is a violence against women. It involves violence when one is branded a witch. Witchcraft violence against women has been a global problem since time immemorial. Connell remarks that it was practiced in Europe, as described by William Shakespeare in *Macbeth*, and till recently annual celebration of witches' day is, according to him, celebrated in Denmark.<sup>35</sup> But the question remains, 'how do you identify and verify that someone is a witch?' Most of those blamed for witchcraft are elderly people and women. In *igwebuike/ubuntu*, old age or grey hair is a sign of wisdom and old people were respected, not abused, discriminated against or burned to death. The main ethical values of *igwebuike/ubuntu* are respect for others, including women and children, helpfulness, community, sharing, caring, trust and unselfishness. Morals such as compassion, cooperation and communalism are highly valued and the wellbeing of the whole community is a unified objective.

The patriarchal nature of our societies, as influenced and enhanced by colonialism and imperialism, explains why elderly women are targeted during witch-hunting. According to Connell, they are weak, defenseless and therefore easy targets.<sup>36</sup> It is, therefore, criminal, and the perpetrators must face the full wrath of the law.

**Female genital mutilation (FGM):** Female genital mutilation is disfigurement that includes cutting of the clitoris. In some societies, it marks an important rite of passage into womanhood, while others believe it guarantees virginity, curbs female sexual desires, maintains hygiene, prevents promiscuity and increases fertility.<sup>37</sup>

Whatever the reason for practicing FGM, the consequences are a health hazard. The practice is normally performed without anaesthesia, using unhygienic methods and instruments. Its consequences include sickness or death due to infection, haemorrhage, blood poisoning. This is torture, and the prohibition against torture is contained in Nigerian Constitution, and article 5 of the African Charter on Human and Peoples' Rights. The Nigerian Constitution provides that every individual is entitled to respect for the dignity of his person, and accordingly, states that no person shall be subject to torture or to inhuman or degrading treatment.<sup>38</sup>

**Primogeniture rule:** The primogeniture rule is the right, by law or custom, of a firstborn to inherit the entire estate, to the exclusion of younger siblings.<sup>39</sup> This rule, according to Kimmel Michael was not a customary law principle but a colonial and imperial construct imposed on Africans.<sup>40</sup> The irony of it, however, is that African males embraced it as their customary principle because it benefitted them;

therefore they are the ones who were fighting against its abolition. According to Kimmel,<sup>41</sup> the rule was imposed on Africans in order for the state to be able to litigate against one person rather than to have to join the whole family when the head of the house died.

**Twin killing:** Prior to the arrival of Mary Mitchel Slessor (1848-1905) in Africa, ignorance, superstition, and negative values made multiple births to be seen as an abomination and a herald of evil. Although this practice was not exclusive to only women, there is no doubt that the woman who bore the child felt the pain most. Some of them ended up childless and may sometimes be sent out of her husband's family. Explaining how twins were looked at in those dark days, Udo<sup>42</sup> notes that one of the twins was said to be genuine, the other an imposter. But by sharing the same cradle bed together, they were both infected and cursed. Their parents were equally guilty of defilement, particularly the mother.

The birth of twins was seen as a very bad omen in traditional Igbo-African society. In order to save the community from the anger and wrath of the deities, the twins were killed together – sometimes with their mothers. Since this barbaric custom was stopped by Mary Slessor,<sup>43</sup> multiple births are now seen as multiple blessings. Members of the public freely make donations for their upkeep and we do not experience any wrath of those deities that demanded the heads of twins today. Twins have grown up to become normal, healthy, respected and respectable members of our society contributing economically, socially, morally, politically, religiously, and intellectually to the development of the African society. The custom had evolved from the practice of killing twin to recognizing that they are supernatural gifts.

### **Promoting Gender Equality in Contemporary African Cultures**

As we have already observed, the idea of equal rights of men and women has been enshrined in the constitution of many African countries nowadays. The Nigerian Constitution of 1999, for instance, prohibits discrimination on the basis of sex and ensures that men and women have equal access in all civil matters.<sup>44</sup> Explicit recognition of women's equal rights is contained in article 17[1] and [2](a). It recognizes equality of rights, obligations, and opportunities before the law. Article 11 states that women shall have equal rights as men with respect to employment opportunities, choice of professions, promotion and remuneration.

Similarly, speaking on gender equality, Pope Benedict XVI says:

The Church has the duty to contribute to the recognition and liberation of women,...Giving women opportunities to make their voice heard and to express their talents through initiatives which reinforce their worth, their self-esteem and their uniqueness would enable them to occupy a place in society equal to that of men...<sup>45</sup>

Now, gender refers to the roles of women and men of all ages, which are defined culturally, socially, economically and historically. These ideas vary across culture. 'Gender' itself is a term that evokes various debates and controversies. At a minimum, to the word 'gender' rather than 'sex' is to indicate that male and female roles in a given society are shaped not only by biology but by social practice, and that the role of women and men will not be identical in every society.<sup>46</sup> In general terms, 'sex' refers to the biological differences between males and females, such as the genitalia and genetic differences, while gender can refer to the role of a male or female in society, or an individuals' conceptions of themselves in terms of identity. While a clear understanding of what we mean by gender and the difference between 'sex' and 'gender' is essential for policy development and practice, our motivation in prioritizing the gender dimension is rooted in the commitment to justice, solidarity and equality of women and men. We believe that gender equality is vital to the pressing need to tackle poverty and promote the development of wellbeing of the African communities. A deep commitment to justice and rejection of all forms of unfairness is at the core of genuine human society.

Indeed, the need for development calls for deliberate promotion of gender equality within Africa. In recent decades, there has been growing awareness in the development sector of the crucial significance of gender questions for both understanding and promoting development. Issues surrounding gender equality are therefore not peripheral but central for the achievement of development in Africa.

Firstly, poverty itself is not 'gender blind'. The situation of men and women in the poorest countries differ so that, by most measures, development outcomes are consistently worse for women than for men.

Hence, Amartya Sen insists that confronting gender inequality involves transforming unequal power relations between men and women.<sup>47</sup> In this context, promoting equal opportunities for women and men is a major priority. Restrictive attitude towards gender roles can lead to a denial of the basic human right of equality. As such stereotypical gender roles can prevent human development and social justice. Equal opportunities, Mamdani observes, means that men and women “have equal access to and control over resources and decision making process; enjoy equality under the law; have autonomy to make life choices free of violence.”<sup>48</sup>

Historically, interventions to promote development have not necessarily served African women and men equally. Because more men are employed in the formal economy in developing countries, more women are left outside of initiatives that promote labour rights, minimum wages, safe working conditions and so on. There is therefore an onus on governments and agencies to develop projects which will more explicitly target the development needs of women. The *Catechism of the Catholic Church* leaves no room for doubt: “Man and woman have the same dignity and are of equal value.”<sup>49</sup> This is not merely a truth to be acknowledged but a statement that needs continuous and active promotion.

## II. CONCLUSION

This paper is a re-examination of male chauvinism in African culture. Culture is like an umbrella under which some people like to hide from rain, and also to shade themselves from the sun. But sometimes you need to fold it. Every social grouping in the world has specific traditional cultural practices and beliefs, some of which are beneficial to all members, while others have become harmful to a specific group, such as women.

The paper investigated and condemns some unjust African traditional customs which deny identity and welfare to women. It examined the dictates of patriarchy that militate against female emancipation and lay a foundation for their marginalization and oppression. The study is a call for gender balance and equal treatment for men and women in a modern African society. It asserts that if modern Africa should experience a participatory socio-economic development it is urgent to end sexism and gender oppression in families and society, and to give men and women equal opportunities to emerge as fulfilled free beings.

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