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Scientific and Technical Research Association (STRA) is an international community of researchers, practitioners, students, and educationists for the development and spread of ideas in the field of science and technology.

STRA is promoted by Eurasia Research. STRA aims to bring together worldwide researchers and professionals, encourage intellectual development, and treat opportunities for networking and collaboration. These objectives are achieved through academic networking, meetings, conferences, workshops, projects, research publications, academic awards, and scholarships.

The driving force behind this association is its diverse members and advisory board, who provide inspiration, ideas, efforts and drive collaborations. Scholars, Researchers, Professionals are invited to become a member of STRA and join this ever-growing network, working for benefit of society and research with the spirit of sharing and mutual growth.

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Preface

Scientific & Technical Research Association (STRA) is a conglomeration of academia and professionals for promotion of research and innovation, creating a global footprint. STRA aims to bring together worldwide researchers and professionals, encourage intellectual development and providing opportunities for networking and collaboration. These objectives are achieved through academic networking, meetings, conferences, workshops, projects, research publications, academic awards and scholarships. STRA strives to enrich from its diverse group of advisory members. Scholars, Researchers, Professionals are invited to freely join STRA and become a part of a diverse academic community, working for benefit of academia and society through research and innovation.

For this conference around 40 Participants from around 11 different countries have submitted their entries for review and presentation.

STRA has now grown to 16,450 followers and 9500 members from 85 countries.

Membership in our scholarly association STRA is chargeable.

List of members: <https://straweb.org/membership/list-of-members/>

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Proceedings is a book of abstracts, all the abstracts are published in our conference proceedings a day prior to the conference.

You can get our conference proceedings at: <https://straweb.org/conference/proceedings/>

We hope to have an everlasting and long-term friendly relation with you in the future.

In this context we would like to share our social media web links:

<https://www.facebook.com/eurasiaresearch/>

You will be able to freely communicate your queries with us, collaborate and interact with our previous participants, share and browse the conference pictures on the above link.

Our mission is to make continuous efforts in transforming the lives of people around the world through education, application of research & innovative ideas.

Editor: Dr. Anupam Krishna

Publication Process

All accepted original research papers in the English Language will be published in selected journals as per the publication policy, as available on the conference website. Once you receive the Invitation/ Acceptance letter, that means your full paper is also accepted for publication in an International Journal, if you follow the communicated editorial instructions/ guidelines.

The journal publication will be peer-reviewed, checked for plagiarism, indexed, archived, open access, referenced by CrossRef and will carry ISSN number and DOI.

Even if your full paper is not yet ready, you may participate in the desired conference with your abstract. The abstract must contain the following:

Article Title

Full Names/ Emails/ Affiliations of the authors

Abstract in 100-300 words

3-7 Keywords

You may update your submitted abstract/ title/ co-authors/ submit your full-paper on a later stage (before the conference).

You may submit your full original paper for publication in the conference journal, when it is complete, till the conference date. The last date of submission is the conference day itself. While submitting the full paper, please provide the following in the email:

Full paper in MS Word format. (Ideally, a research paper should be 2500-3000 words).

Details of 2 reviewers with their names, affiliations, contact numbers and email IDs (If possible, send two emails for each reviewer).

Duly filled and scanned the 'Consent to Publish' form with a handwritten signature.

We follow the following steps for publication in our associated International Journals. The publication process takes around 70 days, starting from the end of the conference.

A list of registered papers is sent to all the participants of the conference within a week's time after the conference. Please see, if your paper is included in the list. If not, please write back to us for inclusion. This list would also mention for any deficiency/incompleteness found in the submitted paper. You would be given 10 days to return your complete papers/ required information.

After this, the editorial team would send all complete papers for review (usually 5-7 reviewers). The review process takes around 30 days.

Following this, our editor would send the editorial comments/ suggestions to the corresponding author. Please improve the paper as indicated in the review and send it back to us within 10 days.

If the paper received is complete in all regards as per the comments/ suggestions, it would be sent for final publication, else we would send it again to you and finally, 5 days would be given to you for its improvement.

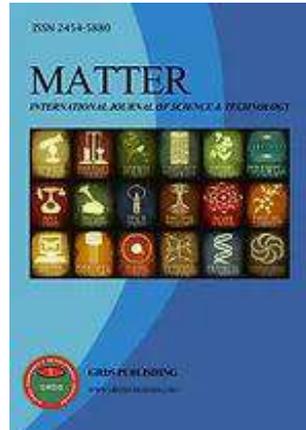
Finally, the paper is published and the authors are informed about the published paper by email, which contains the paper URL, DOI, Citation, and other related information.

If you fail to meet the deadlines/ correct the paper as per review comments, the paper may be rejected or it will be postponed for publication in the next issue. Normally, the entire process takes around 70 days.

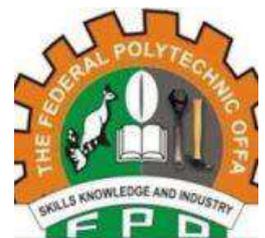
Authors may request the conference secretariat for withdrawing their paper, for publishing it elsewhere (in the journal of their choice). In such cases, the requested papers are removed from the publication process. The withdrawal requests may be given to the conference secretariat before the commencement of the publication process (7 days after the conference).

Our sincere thanks go to our outstanding supporters who made this great and interesting conference possible.

Publishing



STRA Institutional Members



Some special thanks go to our outstanding Key-Note speakers, not only for their inspiring and highly interesting presentations but also for their input and contributions in the discussions and Q&A sessions during the conference:

KEYNOTE SPEAKERS 2022

Topic: Mentoring as a Science to Develop a Prolific Career



Ana Sofia Saldanha, Professional Translator, University Lecturer and Mentor. Associate Board Member of the International Mentoring Association in USA and member of the TERA Research Group. Interested in Mentoring, Soft Skills, Training and Continuous Professional Development for Translators. Also interested in applying Mentoring in other areas of studies/professional development.

Ana Sofia Saldanha
Translator, University Lecturer in Translation,
Universidade Autónoma de Lisboa, Ph.D. student in Translation in University of Vigo, Spain

Topic: Petri Nets as a Tool for University Curriculum Modelling



Dr. Liudmyla Gryzun is a Full Professor of the Information Systems Department at the National University of Economics preparing IT specialists for various branches of the economy. Liudmyla earned an M.A. in Applied Mathematics from the State University of Kharkiv (Ukraine); Ph.D. and Post-Doctoral Degree in Pedagogical science from the National Pedagogical University of Kharkiv (Ukraine). Her sphere of research is focused on the synchronized curriculum and holistic educational content design in higher education; Artificial Intelligence application to pedagogical problems solution; Petri networks apparatus as a tool for modeling in education; IT tools for inquiry-based and holistic learning etc. Dr. L. Gryzun's recent successful contributions include (1) participation in a regional research group "Artificial Intelligence and its Application to Pedagogical Diagnostics Systems" (2013-2015); (2) work as an international expert of the Open European-Asian Research Analytics Championship under the Program of the International Academy of Sciences and Higher Education (London, UK) (2012-2017); (3) participation in the European educational fair for STEM teachers "Science on the stage" (2019); (4) work as a member (since September 2021 as a President) of the International organization Scientific and Technical Research Association (STRA), presenting the results of her research as a Keynote Speaker at the number of Eurasia Research International conferences (2018 – 2022). Prof. L. Gryzun is a member of the editorial team of the journal

EducationalTechnologyQuarterly(Ukraine)<https://acnsci.org/journal/index.php/etq/about/editorialTeam>), and a reviewer of the "Universal Journal of Educational Research" (USA)

Dr. Liudmyla Gryzun
PhD & Post-Doctoral Degree in Pedagogical Science, Full Professor of Simon Kuznets Kharkiv
National University of Economics, Kharkiv, Ukraine

Topic: Lean Systems for Educational Institutions



Engr. Marizen B. Contreras is a Registered Professional Industrial Engineer of the Mechanical Engineering Department of the College of Engineering of the University of Batangas, Batangas City, Philippines. She is a full-time Associate Professor at the College of Engineering and the Graduate School of the University of Batangas, where she finished her graduate studies in Business Administration and undergraduate studies in Industrial Engineering. She has also finished her academic requirements in Doctor of Business Administration at Pamantasan ng Lungsod ng Maynila, Philippines, where she obtained her MS degree in Management Engineering. Prior to her present designation, she was assigned as the chairperson of Industrial Engineering at the University of Batangas for 8 years. She is an ISO Auditor, ALCUOCA Accreditor, researcher, adviser, and statistician. Different professional organizations, local and international, recognized her scholarly works and vested her with the following awards: Best Presenter at the International Conference on Innovative Research in Engineering and Technology (ICIRET 2021), Outstanding Paper Award recipient at World Conference in Business and Management 2018, Best Presenter Award at 2019 – 11nd International Conference on Business, Economics, Law, Language, & Psychology (ICBELLP), Best Paper Award at 5th Hernando B. Perez Search for the Best Faculty Research Paper, Best Quantitative Paper Award at the 13th Network of CALABARZON Educational Institutions, Inc. (NOCEI) Research Forum and • Selected Paper Award recipient at the World Conference in Business and Management 2019. She served as Session Chair at WCBM 2018 (Jeju National University) and 2019 (University of Kuala Lumpur). She also served as Keynote Speaker at the International Conference for Science and Technology Research (ICSTR 2019) at Ramada Grandview Hotel, North Point, Hong Kong, and at the International Conference for Science and Technology Research (ICSTR 2020) at Nine Tree Premier Hotel, Myeongdong 2, Seoul, South Korea. She has published her research paper in the Global Business and Finance Review 2018, a Scopus (Elsevier) indexed journal.

Marizen B. Contreras
Associate Professor, College of Engineering, University of Batangas, Hilltop Site,
Batangas City, Philippine

Topic: Science and Technology in Public Security



The professor has distinguished academic experience with post-Doctoral degrees from King's College London and a Doctorate from the University of Liverpool in England. In the field of business administration, he stands out for being the first Brazilian to be World Director of the Forensic Police of the International Criminal Police Organization (INTERPOL) managing 190 countries at the headquarters in Lyon, France. It is worth mentioning that he was a Criminal Expert of the Federal Police in the area of combating cybercrimes and computer crimes for more than 20 years and Chief of the Technical-Scientific Sector of the Federal Police. He was also Data Protection Officer (DPO) of the Institute of Science and High Technology. He is currently the Superintendent of the Superintendent of Research and Public Security Strategy (SUPESP) of the Government of the State of Ceará, Member of the INTERPOL Global Knowledge Hub, Titular Councilor of the State Council for Public Security and Social Defense, Titular Councilor of the State Council of Education of Security, Consultant to the Commission on Law and Information Technology and Innovation of the OAB/RJ and Honorary Member of the Ceará Academy of Law (ACD). In the international academic field, he was professor of the disciplines of Combating Cyber Crimes, Forensic Cybernetics and Strategic Technology Management for the Master's and Doctorate courses at the University of Liverpool in England. In Brazil, he was a professor at the Federal University of Ceará (UFC), State University of Ceará (UECE), FURG / RS, PUC / RJ, National Academy of the Federal Police (ANP / PF), among others. He is currently a professor at the Farias Brito University Center (FBuni), at the Faculty of Advanced Technology (FTA), at the Graduate Institute (IPOG) and at the Superior School of Magistrates of Ceará (ESMEC). Author of several books, such as: Global Crises Management, Software Engineering, Digital and Cyber Law, Cyber Security Fundamentals.

Prof. Dr. Helano Nogueira
Professor at Farias Brito University and Superintendent of Research and Strategy in Public Security, Ceará, Brazil

Topic: Process Analytical Technology as a Key Toll in Biopharmaceuticals Production



Cecília R.C. Calado
ISEL-Instituto Superior de Engenharia de Lisbon, Portugal

Cecília Calado, has a PhD and an MSc in Biotechnology, and a degree in Biochemistry. She is professor at the Lisbon High Engineering Institute (ISEL- Instituto Superior de Engenharia de Lisbon, <https://www.isel.pt/en/>), were coordinates the BSc and MSc in Biomedical Engineering and the R&D Lab. in Medical Bioengineering. She presents a broad experience in R&D in Development of Platforms to Discover Drugs and Diseases Biomarkers and Bioprocess Monitoring.

Topic: Monumentality in Chinese Architecture



Nancy Steinhardt
Professor of East Asian Art and Curator of Chinese Art,
University of Pennsylvania

Nancy S. Steinhardt is Professor of East Asian Art and Curator of Chinese Art at the University of Pennsylvania. She has broad research interests in the art and architecture of China and China's border regions, and on-going field projects in China, Korea, Japan, and Mongolia. Steinhardt is author, editor, or translator of fifteen books and more than 100 scholarly articles. Her most recent books are *The Borders of Chinese Architecture* (Harvard 2022) and the prize-winning *Chinese Architecture: A History* (Princeton 2019). In 2019 she received the Distinguished Teacher of Art History from the College Art.

Topic: Innovation in the marketing of tourism products in the post-pandemic era



Davut Uysal
Full-time Assistant Professor Dr at İzmir Katip Çelebi University,
Tourism Faculty, Department of Tour Guiding, İzmir, Turkey

Davut Uysal is a full-time Assist. Prof. Dr at İzmir Katip Çelebi University, Tourism Faculty, Department of Tour Guiding, İzmir, Turkey. Dr Uysal earned his BA and MA degree in English language teaching at Anadolu University (Eskişehir, Turkey) and earned his Ph.D. in Tourism Management from Eskişehir's Osmangazi University. His Ph.D. dissertation was on English curriculum development for higher education tourism students based on their needs. He has focused on designing outcome-based English courses and course materials, developing outcome-based English assessment tools, and needs analysis. He has participated in many international conferences on English teaching and tourism management. He has also received training on curriculum development, developing assessment tools, web [1] based teaching applications, and integration of technology into learning environments. He is also the author or co-author of several publications. He is also interested in, besides English for Specific Purpose (ESP), vocational English, tourism management, crisis management in tourism, and destination management.

Presenters

Implementation of Biorhythm Graph with Trigonometric Functions Using Python

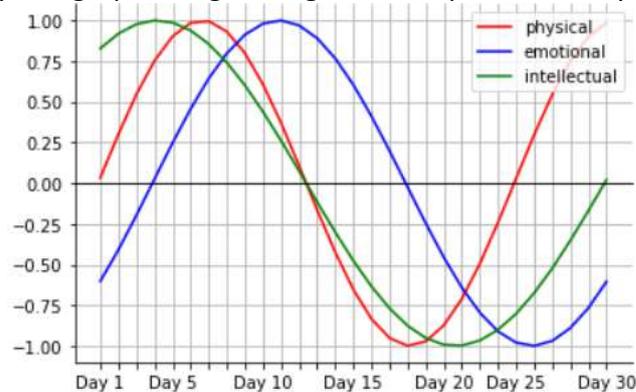
Gyubee Kang

9th, 10th Grade Student in My Paul School, My Paul School, South Korea, Geosan

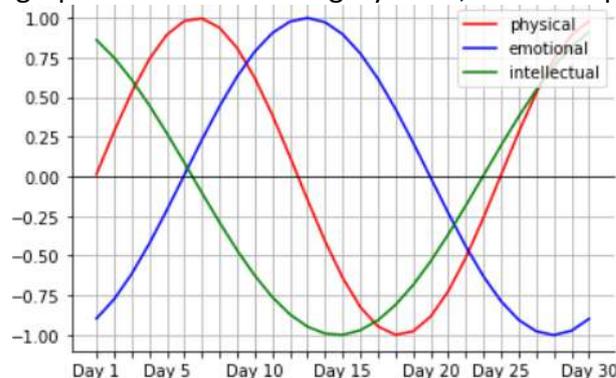
Jeon Ye Won

My Paul School, Goesan, Republic of Korea

Abstract: This study aimed to implement the researcher's biorhythm graph using a programming language called Python in relation to trigonometric functions. The etymology of biorhythm is a combination of two Greek words, Bio, which means life, and Rhythm, which means regular and accurate rhythm, and means the rules of human life rhythm. In other words, the biorhythm is a theory that everyone is governed by three rhythm curves called physical rhythm, emotional rhythm, and intellectual rhythm that start inside the body from birth to death. In the course of this study, biorhythm and trigonometric functions were studied in depth, and biorhythm graphs were implemented with trigonometric functions when the researcher's date of birth was entered through Python. A biorhythm graph was implemented based on Python, the most used programming language. The Python syntax used in the algorithm is typically a sympy function, a datetime function, arrange function, and a function. The value obtained after implementing the algorithm using this grammar is as follows. This is the result of implementing a biorhythm graph using the algorithm implemented by the two researchers.



<Biorhythm graph of researcher Kang Gyu Bee, born on April 30, 2007>



<Biorhythm graph of researcher Jeon Ye Won, born on December 13, 2006>

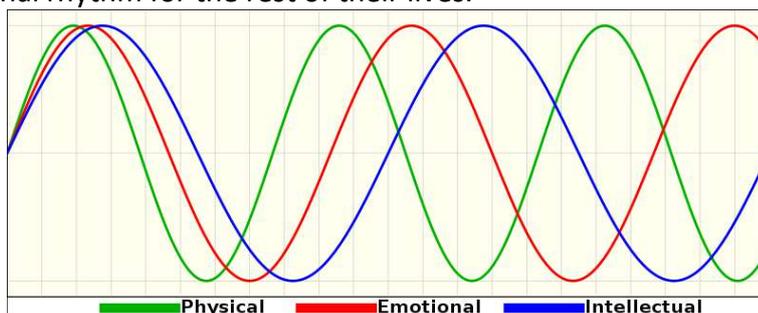
This paper can be used in various fields related to the relationship between biorhythms and

trigonometric functions.

Keywords: Python, Trigonometric Functions, Biorhythm

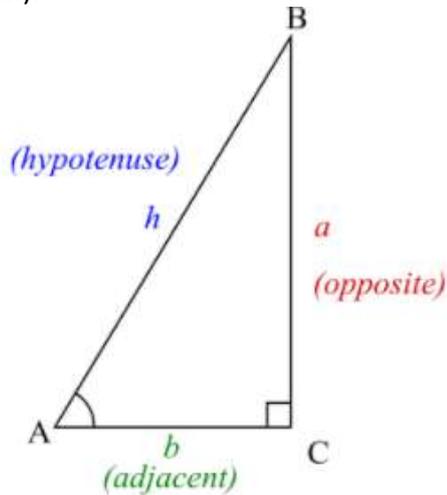
1. Introduction: This study started to implement the researcher's biorhythm graph using a coding language called Python in connection with trigonometric functions. As we entered the era of the 4th industrial revolution, we found biorhythm while looking for what fields are developing in medical technology that is developing at the same time among the evolving IT technologies. Python, one of the most used coding languages, was used to directly shape a graph representing a biorhythm. This thesis was written while researching the biorhythm using this. And while I was researching biorhythms, I came to know that biorhythms are not science, but pseudo-science, but are recognized as science by many people and are separate from the actual applied biorhythms. Several questions arose in this regard, which prompted me to proceed with the research. This study was conducted to find out that the graph representing the biorhythm is related to the trigonometric function and the use cases of the biorhythm. During this study, the in-depth part about biorhythms and trigonometric functions is explored, and the desired results are produced through them. The goal of this study is to implement a biorhythm graph with a trigonometric function when a researcher's date of birth is input through Python. At this time, the graph is implemented using the fact that a biorhythm graph can be drawn with a sine function using the date of birth of the subject. In addition, it aims to learn, refer to, and use concepts that can be obtained during research, such as the relationship between biorhythms and trigonometric functions. This paper can be used in various fields related to the relationship between biorhythms and trigonometric functions.

2. Body: 2.1 Biorhythm: Biorhythm is also called the human periodicity and is also called the PSI doctrine after the first letter of the body, emotion, and intellect. The etymology of the word biorhythm is a combination of two Greek words: Bio, meaning life, and Rhythm, meaning regular and precise rhythm. In other words, the biorhythm theory is a theory that everyone is governed by three rhythm curves, called the physical rhythm, emotional rhythm, and intellectual rhythm, that start inside the body from birth to death. These three rhythms influence and dominate an individual's physical, emotional, and intellectual state. Research on such a cycle started in Hippocrates 1400 years ago, and it is said that clinical observations were made on the physiological changes of the human body, and the patient was instructed to distinguish good days from bad days and heal them (Korea Occupational Health Association, 1988). Biorhythm (Biorhythm) is a false theory that "the state of the body and mind in human's changes with a certain regular cycle". The origin of this theory is that in 1906, a German doctor, Fritz, was examining a patient's medical history card, thinking that he had regular symptoms. Fritz found that the male factor was given at 23 days and the female factor at 28 days. This biorhythm refers to a chemical and perceptual force that changes with a certain period to change a person's behavioral patterns, etc. Draw a graph, and at the intersection of the first half and the second half, there is a day of the week or a dangerous day (Jongho Lee, Yeonsuk Kwak, 1990). Along with birth, the human body follows three biorhythms: the physical cycle, the emotional cycle, and the intellectual cycle. According to this theory, the above three cycles are repeated based on a person's date of birth. A biorhythm can be represented as a sinusoid that is part of a trigonometric function. If the sinusoid is above the horizontal axis, it is good, and if it is below it, it is a depressed period. When the sinusoid meets the horizontal axis, it is an unstable point where the air currents of the body, emotion, and intellect change. It is said that by looking at the three cycle curves of the biorhythm comprehensively, the state of the day and the state of the future can also be predicted. Since biorhythm is a rhythm based on the date of birth, people born on the same day have the same physical rhythm, intellectual rhythm, and emotional rhythm for the rest of their lives.



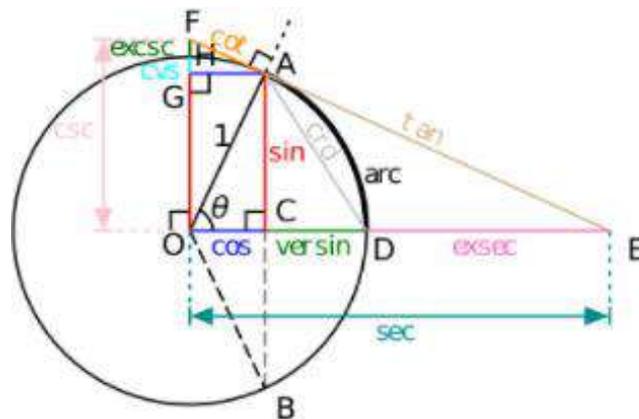
<Biorhythm Graph>

2.2 Trigonometric Functions: In mathematics, the size of an angle expressed as a triangle is called a trigonometric function. The etymology of the angle method is the trigonon measure (metron) (Crossfield, Shepherd, Stein, & Williams, 2009: 183). Triangle measurement was invented in 2000-3000 BC, and it became a function of angle as an applied tool of astronomy in the Greek era when geometry blossomed. After algebraic symbolism developed, it was included in hermeneutics in the 17th century became (David, 1925: 600). The term trigonometry was first introduced by Pitiscus in Germany in 1595 as a book title (Adamek, PenKalski, & Valentine, 2005). There are basic functions in trigonometric functions and they are called sine (sin), cosine (cos), and tangent (tan).



<Right Triangle> When the opposite sides of the triangle above are a, b, and h <Trigonometric Formula 1> Cosecant, secant, and cotangent are inverses of the above three functions, and their definitions are as follows.

<Trigonometric Formula 2>



<Trigonometric Function Name>

According to the figure above, a circle centered at the origin and having a radius r of length 1 is called a unit circle. For a point A(x,y) on this unit circle, when is a straight angle connecting the x-axis, point A, and the origin, it can be defined as follows.

$$\sin \theta = \frac{y}{r}$$

$$\cos \theta = \frac{x}{r}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{y}{x}$$

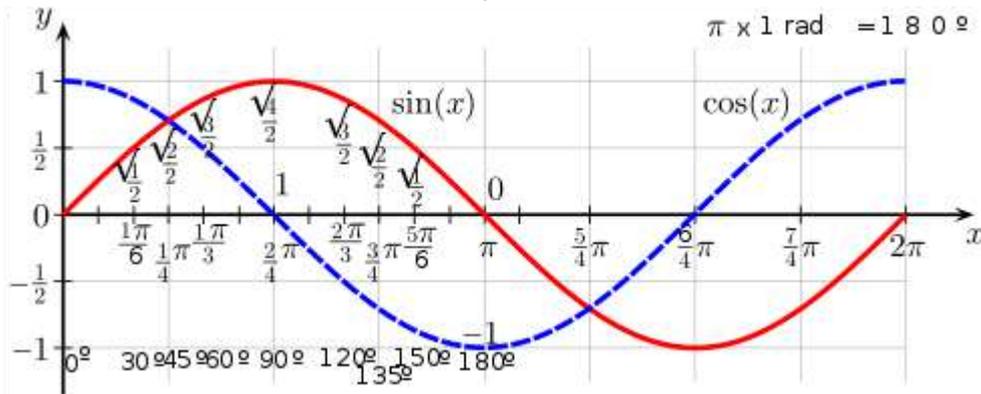
$$\sec \theta = \frac{1}{\cos \theta}$$

$$\csc \theta = \frac{1}{\sin \theta}$$

$$\cot \theta = \frac{1}{\tan \theta} = \frac{\cos \theta}{\sin \theta}$$

<Trigonometric Formula 3>

Sine, cosine, cosecant, and secant have periodicity. These four functions are periodic functions with a period of 2π . Tangent and cotangent are periodic functions with period π . The trigonometric function used in this study is a sine function, and its basic form is $\sin=y/r$.

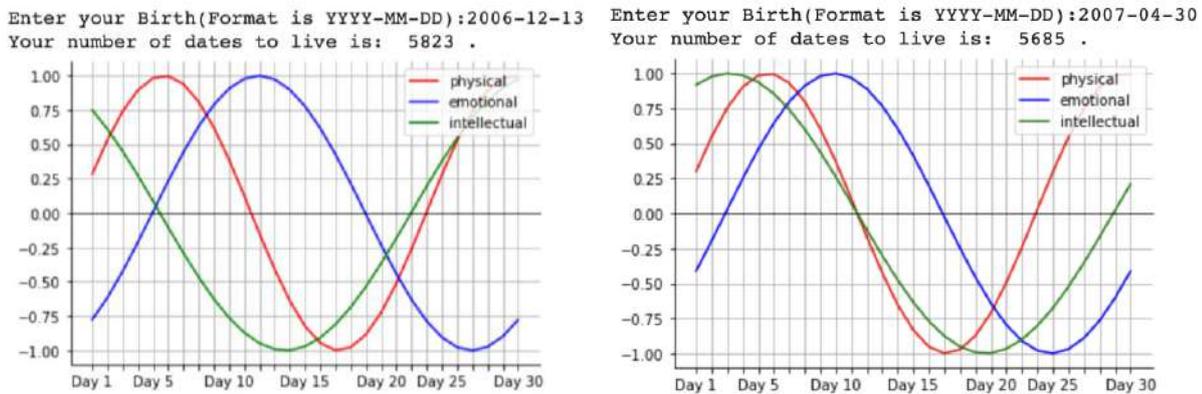


<Graphs of Sine and Cosine Functions>

2.3 Relationship between Biorhythm and Trigonometric Functions: Trigonometric functions are used to describe and represent various phenomena with periodicity. Since the biorhythm is the human periodic rate expressed in three cycles, it is also used for granted in the biorhythm. Although biorhythms are made of a sinusoidal curve, which is a kind of trigonometric function, the shape of the graph is different because the cycles of the three rhythms are different. When looking at the biorhythm graph, if the sinusoid is on the horizontal axis, it means that the examiner is in good condition. If it is located below, it means that it is an unfavorable and stagnation period, and the time when the sinusoidal curve meets the horizontal axis is regarded as a dangerous day. As above, the biorhythm repeats the physical cycle, the emotional cycle, and the intellectual cycle. Therefore, a curve representing three periods can be described as a sinusoid. The physical cycle based on 23 days is expressed as $y=\sin 2\pi/23 x$, the emotional cycle based on 28 days is expressed as $y=\sin 2\pi/28 x$, and the intellectual cycle based on 33 days is $y=\sin 2\pi/33 x$. The overall biorhythm can be expressed as a box of sine numbers as follows. $y=\sin 2\pi/23 x +\sin 2\pi/28 x +\sin 2\pi/33 x$. The curves of trigonometric functions and biorhythms are very similar, so it is easy to recognize them briefly when several equations are implemented as graphs. Through this, they were mistaken to know the state of the day and the state of the future. This is because the state was guessed by looking at the height of the graph. Although the biorhythm graph can be implemented through trigonometric functions, it can be known that it is difficult to see that it has an effect because it is not scientifically proven.

2.4 Implementation of Graph using Python: For visualizing the graph, we used function datetime, sympy, matplotlib, numpy. The datetime package provides datetime class that stores both date and time, date class that stores only date, time class that stores only time, and timedelta class that stores time interval information. To find the number of days of survival by comparing the current date with the researchers' birth dates, the datetime function was imported and the current date was called. Sympy is a symbolic math library. We imported sympy for importing all of functions in sympy library. We also, imported matplotlib library for graphing our data. We can draw the graph using matplotlib.pyplot. Lastly, we imported numpy that is a package to speed up matrix-related calculations. After we imported all of functions, we use input function to get information of the birthday for calculating number of dates to live. Input form was YYYY-MM-DD. After got the information of birthday data, the datetime function was used to convert a string into a date format. Datetime.strptime can make string type data to date format. We put this data on variable named "birth." We made another variable named "today," and we put current date using datetime.now function. After made all of variable, we lastly made variable named "t" is number of dates to live, its format is (today-birth). days. now we could print the number of dates to live. We put the data to variable "x", number of dates to live to after thirty days using numpy arrange function. After that, we designated variable named "p, e, i" respectively. Each variable had sin function about physical, emotional, and intellectual cycle. Its format is $\sin\left[\frac{2\pi t}{23}\right]$, $\sin\left[\frac{2\pi t}{28}\right]$, $\sin\left[\frac{2\pi t}{33}\right]$ respectively assuming t is the number of days to

live. Fig, `ax = plt.subplots()` is used to clearly distinguish between figure and axis. After we calculated all of data using many kinds of functions, we designed the graph using `plt.plot`. we designated graphs' color differently and we put the legend located upper right. Also, we set up x labels to day 1 to day 30, and we designated grid. **3. Conclusion:** In this study, a biorhythm graph was implemented in Python. Results about all this process is as follow:



<Results of Algorithm>

The graph is implemented as shown in the picture above.

Enter your Birth(Format is YYYY-MM-DD):

<Process of Algorithm>

When we go through the same process as in the picture above, you will get a graph like the picture presented above. Set the date of birth to be received in the form of 8-character - in input. Although the researcher of this study went through numerous trials and errors while conducting the research, but we had finally able to draw biorhythm trigonometric function graphs using Python. A trigonometric function and a biorhythm graph can be related with a sine function, and intelligence, emotion, and body indices can be expressed as a sine function graph. In this paper, the concept of trigonometric functions, the origin and detailed concept of biorhythms, and the programming language Python are all intertwined to calculate the number of days a person lives and build an algorithm that displays a graph of the person's biorhythm when the person's date of birth is entered. This study can be cited in trigonometric or biorhythm studies and is reliable. From a different perspective, the scientific truth of the concept of biorhythm needs to be questioned. Although the researcher of this study went through numerous trials and errors while conducting the research, but we had finally able to draw biorhythm trigonometric function graphs using Python. To reiterate once again, trigonometric function and a biorhythm graph can be related with a sine function, and intelligence, emotion, and body indices can be expressed as a sine function graph. In this paper, the concept of trigonometric functions, the origin and detailed concept of biorhythms, and the programming language Python are all intertwined to calculate the number of days a person lives and build an algorithm that displays a graph of the person's biorhythm when the person's date of birth is entered. This study can be cited in trigonometric or biorhythm studies and is reliable. **REFERENCES:** Michael Dowling, Brian M.Lucey. (2005). Weather, biorhythms, beliefs and stock returns-some preliminary Irish evidence. International Review of financial Analysis. Vol.14, No.3. pp337-355 JC Maerz, NL Panebianco, DM Madison. (2001). Effects of predator chemical cues and behavioral biorhythms on foraging activity of terrestrial salamanders. Journal of chemical ecology. P. Mahoney, JJ Miszkiewicz, S Chapple, Mona Le Luyer, Stephen H. Schlecht, Tahlia J. Stewart, Richard A. Griffiths, Chris Deter, Debbie Guatelli-Steinberg. (2018). The biorhythm of human skeletal growth. Journal of Anatomy P.J. BUSHELL, D.E. EDMUNDS. (2012). Remarks on generalized trigonometric functions. The Rocky Mountain Journal of Mathematics. Vol.42, No.1 pp25-57 Valer Csernus, Bela Mess. (2003). Biorhythms and pineal gland. Neuroendocrinology Letters. Vol.24, No.6

Investigating The Optimal Conditions for Filtration of Heavy Metals by Active Carbon in An Aqueous Solution

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Abstract: Throughout history, water pollution has always been one of the significant concerns of humanity, one of the critical factors that cause water pollution is heavy metals. Heavy metals are among the crucial elements that the high concentration of these metals is considered pollutants and cause various problems for humans and should be removed. One of the ways to remove these metals is to use different absorbents, such as activated carbon, which is one of the low-cost ways to remove heavy metals from water environments and industrial wastewater. Therefore, this research investigates the absorption efficiency of activated carbon prepared from coconut tree wood to remove heavy metals from an aqueous solution. This research has been done in a non-continuous manner in laboratory conditions by changing the influential factors such as pH, contact time, and the amount and size of adsorbent particles. This research used three metals, Co, Zn, and Cu, as representatives of other heavy metals. The concentration of the metals was measured using AAS, and the absorption efficiency was determined. Based on the obtained results, the optimal pH for removing these cations by activated carbon is 5.5. The duration of 30 minutes was accepted as the optimal time, and the optimal amount of adsorbent was about two g/liter, which was the most optimal filtration rate for the zinc element of 96.08%. However, in the ideal possible conditions, 97.87% of zinc metal was filtered using activated carbon adsorbent. In this research, surface adsorption isotherms were also examined. The adsorbent adsorption of the desired cation by the adsorbent was more consistent with the Langmuir model, which indicates monolayer surface adsorption. The maximum adsorption value for the adsorbent was 51.81 mg/g.

Keywords: Activated Carbon, Water Purification, Removal of Heavy Metals, Zinc, Cobalt, Copper

1. Introduction: Water is a vital and fundamental substance for all living things. Having clean water is a crucial issue because polluted water can endanger the health of living organisms through contact with harmful chemicals (Zaynab et al., 2022). These days, the rapid increase in water pollution is a huge global problem that has attracted everyone's attention Because it can be hazardous if it is not controlled (Omer, Dey, Eltaweil, Abd El-Monaem, & Ziora, 2022). Today, humanity is facing a wide range of threats related to the issue of water. For example, the increase in urbanization and expansion of cities has caused the reduction of usable water resources. For this reason, there is concern about the water shortage that may occur in the future (Ahmed et al., 2022). On the other hand, there were contaminations in the drinking water that made it impossible to use the water in the usual way; therefore, humankind thought of water purification, which means improving water quality (Shannon et al., 2008). With this work, potable water can be enhanced, waste can also be purified, and the range of water use can be increased (Ambashta & Sillanpää, 2010). Heavy metals are the most important things that must be filtered and enter the water through industrial wastewater (Dąbrowski, Hubicki, Podkościelny, & Robens, 2004). Any metal or semi-metal that affects the environment is called heavy metal. Generally, metals that have a density of more than 5g/cm³ are called heavy metals (Zhang et al., 2021). In the past, metals such as copper, iron, and tin and precious metals such as gold, silver, and platinum were known as heavy metals. However, other metals such as gallium, thallium, and hafnium were also discovered over time. Some metals, such as iron, cobalt, and zinc, are essential brain materials. Others, such as silver, indium, and ruthenium, are harmless metals, but their large amounts are toxic (Briffa, Sinagra, & Blundell, 2020). Separating and distinguishing heavy metals from each other and checking their physical and chemical characteristics requires very high accuracy (Sutherland, Petersen, Levings, & Martin, 2007). The high density of these metals reduces their reactivity (Song et al., 2021). Some heavy metals, such as zinc, mercury, and lead, have characteristics similar to light metals, and lighter metals, such as beryllium, scandium, and titanium, have characteristics similar to heavy metals (Ali & Khan, 2018). Heavy metals enter the environment through various

industries, such as metal industries (Gonzalez-Munoz, Rodríguez, Luque, & Álvarez, 2006), mining industries (Huisman, Schouten, & Schultz, 2006), chemical fertilizer and pesticide manufacturers, battery factories (Bahadir, Bakan, Altas, & Buyukgungor, 2007), and paper factories. Heavy metals have become one of the most severe environmental threats. In order to protect people's and the environment's health, these elements must be removed from industrial wastewater and purified. Unlike organic pollutants, heavy metals are not degradable and have an ecological cycle in natural waters (Fu & Wang, 2011). These metals have accumulative properties and are easily transferred in the food chain of consumers and accumulate in different tissues. (Jezierska, Ługowska, & Witeska, 2009) Most heavy metals are toxic in high concentrations and have an inhibitory effect on many vital functions of cells (Jaishankar, Tseten, Anbalagan, Mathew, & Beeregowda, 2014). Activated carbon is a microcrystalline and non-graphite form of carbon, which is intended to have high porosity and specific surface area for the absorption process (Dinesh, 2011). The high specific surface increases the capacity to absorb chemicals (Rostami et al., 2019). The specific surface of commercial activated carbon is between 800 and 1500 square meters per gram, which is usually determined by nitrogen gas absorption (Ioannidou & Zabaniotou, 2007). The difference in size affects the absorption capacity of molecules with different sizes and shapes; it is a characteristic of carbon considered for special applications (Kneller, 2005). Activated carbon is a type of solid adsorbent with excellent surface absorption, which is very porous, has an internal surface and high mechanical resistance, and does not dissolve in any known solvent. Furthermore, its most prominent feature is the selective removal of pollutants; in some cases, they are used for material recycling. The absorption rate of activated carbon depends on the size of the carbon pore structure and the size and shape of pollutant molecules. Moreover, it depends on the production conditions (Arami-Niya, Daud, & Mjalli, 2010). Different materials can be used to produce activated carbon, in which the ratio of carbon to organic materials is very high, and few organic materials are used in them. For example, it is possible to produce activated carbon from various cheap materials such as coal (Acharya, Sahu, Sahoo, Mohanty, & Meikap, 2009), coconut tree husks, and sawdust (Selvi, Pattabhi, & Kadirvelu, 2001), rice husks (Sahu, Agarwal, Meikap, & Biswas, 2009), almond husks (Kobya, Demirbas, Senturk, & Ince, 2005), and sewage sludge (Chen, Jeyaseelan, & Graham, 2002).

2. Experimental part: This section examines three major topics: materials and equipment, techniques, and the optimal filtering method.

2.1. Materials and equipment: Salt of heavy metals: In order to make standard solutions for copper from its salt $\text{Cu} \left[\text{So} \right]_{-4} \cdot 5\text{H}_2\text{O}$, zinc from its salt $\text{Zn} \left[\text{So} \right]_{-4} \cdot 7\text{H}_2\text{O}$ and cobalt from its salt $\text{Co} \left(\left[\text{No} \right]_{-3} \right)_{-2}$ are used. Activated carbon: In this research, activated carbon synthesized from coconut tree wood has been used. NaOH: Sodium hydroxide manufactured by Merck was used to adjust the pH in the alkaline ranges. HCl: To adjust the pH in acidic environments, HCl acid with a purity of 37% and a density of 1.18 grams per cubic centimeter manufactured by Merck was used. Buffer solution: To calibrate the pH meter, standard buffers with pH=7 and pH=4 made by Metrohm company were used. Atomic Absorption Spectroscopy (AAS): This research measured the metal concentration before and after the absorption process using the novAA atomic absorption device manufactured by Jena Analytic. PH Meter: The pH of all the solutions was measured and adjusted using a pH meter device made in Iran from the Teft Azma Teb brand. Scale: In order to accurately weigh the amount of absorbent, the 200-HR scale made by AND company was used with a very high accuracy of about 0.0001 grams. Magnetic stirrer: A magnetic stirrer model 81-L made by LABINCO company was used to stir the metal solution and absorbent.

2.2. Techniques: This article examines the optimal conditions for filtration of three elements of zinc, copper, and cobalt that are considered heavy metals; First, standard solutions are made of metals at specified concentrations. Then, according to the adsorption data from the solution analysis, the standard calibration curve is formed by the AAS device. The curve is used to investigate the concentration of the elements in the samples based on their adsorption. Salt of these metals has been used to make standard solutions for copper and zinc, and cobalt in to make the primary solution, the salt of each element is dissolved in water. According to the primary solution made with 100ppm concentration, standard solutions have been made at 2ppm, 4ppm, 6ppm, 8ppm, and 10ppm. After measuring the absorption rate of each solution, the standard calibration curve is plotted, And the line equation is formed for the curve. This is done to measure the concentrations based on

each element's absorption amount. Next, some 400ppm solutions are made of the desired element. High concentration is for better filtration percentage. Then, the conditions are optimized according to the various factors mentioned below.

2.2.1. pH impact on activated carbon: To achieve the optimal PH, the pH value is set by NaOH and NaCl to locate the base and acid ranges. The solutions made in the range of 2 to 8 have been sorted by PH meter. Each solution initially added 2 grams of active carbon from coconut tree wood. Then, using a magnetic stirrer for 30 minutes with a rotation speed of 500 rpm in STP conditions mixed, the resulting solution is immediately smoothed using filter paper. An AAS device measured the concentration of heavy ions in the solution. Due to the reduction of solution concentration, the filtration percentage is determined for each pH in table 1.

Table 1: The Effect of Ph on The Removal of Metal Cations Using Activated Carbon Adsorbent

PH	2	3	4	5	5.5	6	7	8
%Zn (II) Removal	11.23	76.13	89.41	92.39	92.95	91.73	89.34	84.44
%Co (II) Removal	13.79	77.26	88.97	92.09	93.07	91.85	89.24	85.25
%Cu (II) Removal	12.27	75.33	88.36	91.79	92.51	90.75	88.43	83.33

2.2.2. Active carbon content:

In this part, the amount of active carbon is variable; considering that the optimal pH is between 5 and 6, the pH value will be adjusted to 5.5. 400ppm solutions are mixed with various amounts of activated carbon. Then it was mixed with a magnetic stirrer at a speed of 500 rpm for 30 minutes. These steps were carried out at room temperature. After 30 minutes, the solutions were filtered using filter paper, and an AAS device checked the concentration of the desired ions from the solution under the filter. The percentage of filtration was reported in table 2.

Table 2: The Effect of Adsorbent Amount on The Removal of Metal Cations by Activated Carbon

Mass (g)	0.1	0.2	0.5	1	2	3	4
% Zn (II) Removal	24.71	53.45	72.79	78.87	92.78	92.91	92.99
% Co (II) Removal	27.37	55.43	74.28	81.17	93.40	93.72	93.88
% Cu (II) Removal	26.11	54.85	73.69	76.92	92.27	92.49	92.81

2.2.3. Contact time of active carbon with the solution: In this case, the amount of 2 grams of active carbon in each of the 400ppm solutions has been tested by a magnetic stirrer at a speed of 500 rpm for different periods to investigate the effect of carbon contact time. Then the samples were filtered with filter paper, an AAS device checked the desired concentration, and the filtration percentage was obtained, which is reported in table 3.

Table 3: The Effect of Contact Time on Metal Cation Removal by Activated Carbon

Time (Min)	1	2	5	15	30	60	120
% Zn (II) Removal	42.12	75.59	83.68	90.73	92.28	93.83	95.29
% Co (II) Removal	43.21	73.23	84.37	90.32	93.48	93.33	94.04
% Cu (II) Removal	41.15	74.43	86.29	90.87	92.39	93.03	94.32

2.2.4. Size of active carbon particles: The size of these particles has been checked using plates called Mesh; Mesh is a filter that allows particles with a specific diameter to pass. According to the previous steps, some 400ppm solutions with PH 5.5 have been prepared, but this time the carbon particles are filtered using a mesh and classified into different sizes. In each solution, 2 grams of carbon with a specific size was used, which was mixed using a magnetic stirrer at a speed of 500 rpm at room temperature for 30 minutes. Then the solutions were filtered using filter paper, and an AAS device checked the concentration of the desired ions in the filter solution. And the filtration rate is reported at table 4.

Table 4: Effect of Particle Size on Metal Cation Adsorption by Activated Carbon

Size (Microns)	595	250	149	105	74	53	38
% Zn (II) Removal	91.94	91.93	92.54	93.38	94.98	95.21	96.08
% Co (II) Removal	92.59	92,75	92,98	93.47	93.94	94.34	95.14
% Cu (II) Removal	91.85	92.03	92.58	93.26	93.83	94.59	95.19

2.2.5. Examining surface adsorption isotherms: In this experiment, two surface adsorption isotherms have been examined. 1. Langmuir isotherm: The Langmuir isotherm was described in 1918 by Irving Langmuir (Liu, 2006). This isotherm examines the amount of adsorbed substance on the solid surface kinetically (Elmorsi, 2011). He believed that to reduce the intermolecular forces quickly, the thickness of the adsorbed components should be only one layer; as a result, the surface of the adsorbent will be uniform. The Langmuir isotherm relation is reversible (Günay, Arslankaya, & Tosun, 2007). where q_e is the amount of heavy metal adsorbed on carbon at equilibrium, and C_e is the secondary concentration of absorbed heavy metal after passing the equilibrium time. K_L is the Langmuir coefficient, and q_{max} is the maximum amount of absorption per unit of absorbent mass (Ayawei, Ebelegi, & Wankasi, 2017). 2. Freundlich isotherm: The Freundlich isotherm was expressed by Freundlich in 1926. This isotherm assumes that the surface absorbance is non-uniform and consists of different absorption levels (Limousin et al., 2007). The equation of this isotherm is used to describe heterogeneous surfaces in this equation, q_e is the amount of heavy metal adsorbed on the adsorbent in the equilibrium conditions, C_e secondary concentration of heavy metal after passing the equilibrium time K_L constant indicator of absorption intensity $1/n$ is the absorption intensity constant (Dada, Olalekan, Olatunya, & Dada, 2012). For this purpose, the amount of 2 grams of active carbon in each of the 400 ppm solutions was mixed by a magnetic stirrer at a speed of 500 rpm for 30 minutes. Moreover, the effect of the initial concentration of zinc metal on the absorption process has been investigated and analyzed. In this analysis, which has been done for zinc on behalf of 3 other elements, the degree of adherence of the data to one of the two Langmuir and Freundlich isotherms has been examined. According to the points obtained on the graph C_e/q_e on q_e , the equation of the line (1) obtained for the Langmuir isotherm, and table 5 components are as follows: $Y = 0.0193x + 0.077$ (1)

Table 5: The Results Obtained for The Langmuir Isotherm Components

Langmuir isotherm	$R^2 = 0.9965$	$q_{Max} = 51.81$	$K_L = 0.254$
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Also, according to the points obtained on the $\log q_e$ on $\log C_e$ graph, the equation of the line (2) obtained for the Freundlich isotherm, and table 6 components are as follows: $Y = 0.4312x + 1.1109$ (2)

Table 6: The Results Obtained for The Freundlich Isotherm Components

Freundlich isotherm	$R^2 = 0.9604$	$n = 2.319$	$K_f = 12.9$
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2.3. Examining the ideal environment for removal of heavy metals: In the last stage of this research, the ideal condition for filtration has been considered to achieve the highest percentage of filtration. First, a 400ppm solution of zinc metal with a pH of 5.5 was prepared, and the amount of 4 grams of active carbon was mixed in a 400 PPM solution using a magnetic stirrer at a speed of 500 rpm for 120 minutes. Then the solution was immediately passed through the filter paper to better filter the active carbon. This process was repeated three times with three different filter papers. In the end, the concentration of the solution under the filter was measured by the AAS device, and the percentage of filtration for zinc was about 97.87%.

3. Result: In this research, the activated carbon synthesized from the coconut tree was used as an adsorbent with very high porosity to remove heavy metals, which absorbed many heavy metals in the solution. Different absorption parameters have been investigated in a discontinuous system to investigate the performance of activated carbon. One of the most critical parameters that were very effective is the pH of the solution, which is considered to be the optimal pH of 5.5. In strong acidic and strong alkaline environments, the absorption efficiency decreases due to an increase in H^+ ions or $[OH]^-$ ions. From the examination of the contact duration parameter, it was found that in the first minutes of absorption, because the number of available

absorption sites in the active carbon adsorbent increases, the absorption proceeds at a faster rate. Nevertheless, over time, the absorption sites are filled, the absorption process has reached equilibrium, and no noticeable change in the absorption efficiency is observed. According to the obtained results, the time to reach the equilibrium of heavy metal removal is 30 minutes. Another investigated parameter was the consumption amount of adsorbent material, and the optimal amount of adsorbent for synthesized activated carbon was 2 grams/liter. At a low amount of adsorbent, due to less active sites of absorption, absorption efficiency is low, and absorption efficiency increases gradually with the increase of the amount of adsorbent. With the increasing amount of adsorbent, due to the non-saturation of adsorption sites, the slope of changes in adsorption efficiency decreases and becomes almost constant. Another effective parameter investigated was the optimal size of the particles, which was adjusted using the Mesh as the particle size decreased. The absorption efficiency increased due to the increase in the contact surface area. In the investigation of equilibrium equations, two Langmuir isotherms and Freundlich isotherms were examined, and it was observed that the results of experimental data followed the Langmuir isotherm more, which indicates single-layer surface absorption and the maximum absorption value for activated carbon adsorbent was 51.81 mg/g. In the last part of the research, 97.87% of zinc metal was separated from the aqueous solution, which was tested under ideal conditions.

REFERENCES: Acharya, J., Sahu, J., Sahoo, B., Mohanty, C., & Meikap, B. (2009). Removal of chromium (VI) from wastewater by activated carbon developed from Tamarind wood activated with zinc chloride. *Chemical Engineering Journal*, 150(1), 25-39. Ahmed, S. F., Mofijur, M., Parisa, T. A., Islam, N., Kusumo, F., Inayat, A., . . . Ong, H. C. (2022). Progress and challenges of contaminate removal from wastewater using microalgae biomass. *Chemosphere*, 286, 131656. Ali, H., & Khan, E. (2018). What are heavy metals? Long-standing controversy over the scientific use of the term 'heavy metals'—proposal of a comprehensive definition. *Toxicological & Environmental Chemistry*, 100(1), 6-19. Ambashta, R. D., & Sillanpää, M. (2010). Water purification using magnetic assistance: a review. *Journal of hazardous materials*, 180(1-3), 38-49. Arami-Niya, A., Daud, W. M. A. W., & Mjalli, F. S. (2010). Using granular activated carbon prepared from oil palm shell by ZnCl₂ and physical activation for methane adsorption. *Journal of Analytical and Applied Pyrolysis*, 89(2), 197-203. Ayawei, N., Ebelegi, A. N., & Wankasi, D. (2017). Modelling and interpretation of adsorption isotherms. *Journal of chemistry*, 2017. Bahadir, T., Bakan, G., Altas, L., & Buyukgungor, H. (2007). The investigation of lead removal by biosorption: An application at storage battery industry wastewaters. *Enzyme and microbial technology*, 41(1-2), 98-102. Briffa, J., Sinagra, E., & Blundell, R. (2020). Heavy metal pollution in the environment and their toxicological effects on humans. *Heliyon*, 6(9), e04691. Chen, X., Jeyaseelan, S., & Graham, N. (2002). Physical and chemical properties study of the activated carbon made from sewage sludge. *Waste management*, 22(7), 755-760. Dąbrowski, A., Hubicki, Z., Podkościelny, P., & Robens, E. (2004). Selective removal of the heavy metal ions from waters and industrial wastewaters by ion-exchange method. *Chemosphere*, 56(2), 91-106. Dada, A., Olalekan, A., Olatunya, A., & Dada, O. (2012). Langmuir, Freundlich, Temkin and Dubinin–Radushkevich isotherms studies of equilibrium sorption of Zn²⁺ onto phosphoric acid modified rice husk. *IOSR Journal of applied chemistry*, 3(1), 38-45. Dinesh, S. (2011). Development and characterization of pellet activated carbon from new precursor. PhD diss: National Institute of Technology Rourkela. Elmorsi, T. M. (2011). Equilibrium isotherms and kinetic studies of removal of methylene blue dye by adsorption onto miswak leaves as a natural adsorbent. *Journal of Environmental Protection*, 2(06), 817. Fu, F., & Wang, Q. (2011). Removal of heavy metal ions from wastewaters: a review. *Journal of environmental management*, 92(3), 407-418. Gonzalez-Munoz, M. J., Rodríguez, M. A., Luque, S., & Álvarez, J. R. (2006). Recovery of heavy metals from metal industry waste waters by chemical precipitation and nanofiltration. *Desalination*, 200(1-3), 742-744. Günay, A., Arslankaya, E., & Tosun, I. (2007). Lead removal from aqueous solution by natural and pretreated clinoptilolite: adsorption equilibrium and kinetics. *Journal of hazardous materials*, 146(1-2), 362-371. Huisman, J. L., Schouten, G., & Schultz, C. (2006). Biologically produced sulphide for purification of process streams, effluent treatment and recovery of metals in the metal and mining industry. *Hydrometallurgy*, 83(1-4), 106-113. Ioannidou, O., & Zabaniotou, A. (2007). Agricultural residues as precursors for activated carbon production—a review. *Renewable and sustainable energy reviews*, 11(9), 1966-2005. Jaishankar, M., Tseten, T., Anbalagan, N., Mathew, B. B., & Beeregowda, K. N. (2014). Toxicity, mechanism and health effects of some heavy metals. *Interdisciplinary toxicology*, 7(2), 60.

Jeziarska, B., Ługowska, K., & Witeska, M. (2009). The effects of heavy metals on embryonic development of fish (a review). *Fish physiology and biochemistry*, 35(4), 625-640. Kneller, R. (2005). Frontier technology, absorptive capacity and distance. *Oxford Bulletin of Economics and Statistics*, 67(1), 1-23. Kobya, M., Demirbas, E., Senturk, E., & Ince, M. (2005). Adsorption of heavy metal ions from aqueous solutions by activated carbon prepared from apricot stone. *Bioresource technology*, 96(13), 1518-1521. Limousin, G., Gaudet, J.-P., Charlet, L., Szenknect, S., Barthes, V., & Krimissa, M. (2007). Sorption isotherms: A review on physical bases, modeling and measurement. *Applied geochemistry*, 22(2), 249-275. Liu, Y. (2006). Some consideration on the Langmuir isotherm equation. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 274(1-3), 34-36. Omer, A. M., Dey, R., Eltaweil, A. S., Abd El-Monaem, E. M., & Ziora, Z. M. (2022). Insights into recent advances of chitosan-based adsorbents for sustainable removal of heavy metals and anions. *Arabian Journal of Chemistry*, 15(2), 103543. Rostami, R., Zarrebini, M., Sanginabadi, K., Mostofinejad, D., Abtahi, S. M., & Fashandi, H. (2019). The effect of specific surface area of macro fibers on energy absorption capacity of concrete. *The Journal of The Textile Institute*, 110(5), 707-714. Sahu, J., Agarwal, S., Meikap, B., & Biswas, M. (2009). Performance of a modified multi-stage bubble column reactor for lead (II) and biological oxygen demand removal from wastewater using activated rice husk. *Journal of hazardous materials*, 161(1), 317-324. Selvi, K., Pattabhi, S., & Kadirvelu, K. (2001). Removal of Cr (VI) from aqueous solution by adsorption onto activated carbon. *Bioresource technology*, 80(1), 87-89. Shannon, M. A., Bohn, P. W., Elimelech, M., Georgiadis, J. G., Mariñas, B. J., & Mayes, A. M. (2008). Science and technology for water purification in the coming decades. *Nature*, 452(7185), 301-310. Song, J., Huang, G., Han, D., Hou, Q., Gan, L., & Zhang, M. (2021). A review of reactive media within permeable reactive barriers for the removal of heavy metal (loid) s in groundwater: Current status and future prospects. *Journal of Cleaner Production*, 319, 128644. Sutherland, T., Petersen, S., Levings, C., & Martin, A. (2007). Distinguishing between natural and aquaculture-derived sediment concentrations of heavy metals in the Broughton Archipelago, British Columbia. *Marine Pollution Bulletin*, 54(9), 1451-1460. Zaynab, M., Al-Yahyai, R., Ameen, A., Sharif, Y., Ali, L., Fatima, M., . . . Li, S. (2022). Health and environmental effects of heavy metals. *Journal of King Saud University-Science*, 34(1), 101653. Zhang, C., Daofan, T., Mingyi, C., Fu, G., Xiangyu, C., Xuetao, L., . . . Peng, Z. (2021). A novel MagLev-based separation approach for heavy metal recycling. *Resources, Conservation and Recycling*, 174, 105769.

Review of Links between Climate Change and Dams in View of Adaptation



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Abstract: Climate change and dams seem to have significant relationship and such relationship needs to be considered fully before prioritizing large dam as a means of adaptation to climate change. Thus, a review of literature that linked dam and climate change was conducted to ascertain the position of research on the links between climate change and dam; identify the impacts of climate change on dams and then determine the implication of dam construction on climate. Reports from all parts of the world were considered. Preference was given to recent studies but those from the 1960 were illegible. Results

were summarized in table and diagrams. There are two opposing views on the links between climate change and dams. Majority of researches shared negative view on the links between climate change and dam while minorities were positive. Among those that were negative, majority blamed climate change for poor performance of dams while minority blamed dam for climate change. The impacts of climate change on dams were seen in reduction of rain and consequent lower volume of water in the reservoir to perform its function. Dams are not climate-neutral and affect the climate through deforestation and alteration of the natural river system. Therefore, dam construction to adapt to climate change must be properly weighed among other options.

Keywords: Dam, Climate change, Adaptation, Drought

1. Introduction- There is a growing demand and proposals for dam construction, to offset the impacts of climate change on agriculture, energy, fishery and general economy globally. However, the fear of unknown has compounded dam construction following the recent climate change menace. So why some experts proposed dam construction to solve climate change problems others opposed it due to contribution of dam to climate change. Consequently, U.S. Congress for instance recently has introduced several bills that demand feasibility studies relating to the construction of new dams (Christensen, 2014, Feinstein and Boxer, 2015, Huffman et al., 2015). Dam projects are often seen as key to economic solution through hydroelectric power supply (). However, there are two opposing views on links between climate change and dams. Some studies see dam negatively and as an agent of climate change (Abugu *et al.*, 2018;) while others shared positive view on dam and sees it as a solution to climate change. Most of this later group proposed construction of new dams to adapt to climate change (). For examples, it is well documented that the Sahelian droughts in the 1970s and 1980s triggered the rise in dam development in Nigeria (World Bank, 1995; Federal Ministry of Water Resources, 2014; Adeniran et al., 2021). Most of the dams were developed in Northern Nigeria to promote agriculture in the midst of drought (Oyekale, 2009). Northern Nigeria has been being ranked the most vulnerable region to climate change in Nigeria (Madu, 2020). The region also hosts almost all the dams in Nigeria (Ezeh, et al., 2019) as an adaptation measure to drought and climate change in general. However, dam itself comes with adverse effects that have been attributed as casual factors of climate change (Abugu et al., 2018). Dam construction and operation can promote climate extremes such as flood since it involves deforestation (Haider, 2019). According to a report by International Rivers in 2011, proponents of large dams capitalized on climate change in proposing for construction or expansion of large dams. This is not withstanding that dams are highly vulnerable to climate change as it alters rivers in an unpredictable way. Thereby affect the ability of rivers to regulate climate as it ought to and enhance adaptation to climate change. Dam is a barrier in the form of concrete, earth or steel that is built across a river or stream to obstruct or control the flow of water, especially in order to create a reservoir (Youdeowei, *et al.*, 2019). Dams are anthropogenic devices to harness water resources (energy, water and fishes). Climate change on the hand can occur naturally but mainly influenced by human activities that alter the pattern of weather conditions over a long period. Both climate change and dam constructions are more pronounced in the Northern part of Nigeria than the Southern part. Dams serve many purposes like irrigation, tourism, fishing and power generation (Youdeowei, *et al.*, 2019). Though, all sizes of dams are linked to climate change as cause or solution, but emphasis is on large dams. The types of material used for dam construction also play a role on its vulnerability to climate change. For instance, Atkins (2013) showed that dams with earth fill are erodible and most vulnerable to climate change extremes like erosion and flooding. Concrete dam on the other hand, are prone to problems associated with cracking or joint movement. In general, extreme fluctuations in water levels due to rainfall variations, deforestation and prolonged drought can promote challenges in dam operation. Climate change can affect dam function in a variety of ways, such as changes in hydrology or water quality, fluctuation in water level leading to poor capacity, utilization and effectiveness. Despite that dam itself have been blamed for local climate change, the economic benefit of dam has continued to drive the demand for dam construction and expansions especially in developing countries. Thus, about half of the planet's major river systems are currently regulated by dams (Poff and Schmid, 2016 cited in Boulanger et al., 2021) and only 23% of rivers worldwide flow uninterrupted to the ocean (Grill, *et al.*, 2019). Consequently, "dams generally alter the frequency, duration, and timing of annual flooding events" (Voeroesmary, *et al.*, 1997 cited in Boulanger et al., 2021). Dam communities lose their homes and farmlands annually to the flooding of dams (Youdeowei *et al.*, 2019). In short, increased incidence of flood in Nigeria is mainly due to dam operation not heavy rainfall arising from climate change (Olofin, 2022). Dam is a major factor in sustainable climate adaptation planning at regional and global scales due to their long lifespans and interaction with the natural environment (Bhaduri *et al.*, 2016). Thus, there is need to understand clearly the links between climate change and dams to contribute on the debate about dam and climate change links. Therefore, a

critical review of literatures was conducted to ascertain the position of research on the links between climate change and dams and to identify the impacts of climate change on dams and then determine the implication of dam construction on climate.

2. Materials and Methods: Mixed methods were used in this study. However, it is mainly qualitative due to its descriptive nature. More than six hundred and fifty (650) research articles related to climate change and dams or reservoir were gathered from internet (Google and Wikipedia) hard copies of published researches and sorted for review. Out of which seventy (70) representing 10.77% were considered applicable, based on contextual and temporal scopes of the study (Abugu *et al.*, 2021). On the basis of context, article must be on climate change and dam or its features or uses such as reservoir water resources, irrigation. Reports from all parts of world were considered due to the facts that both climate change and dams have global perspective. Moreover, preference was given to articles published in 2007 and upwards. This is because 2007 was when the fourth Intergovernmental Panel on Climate Change (IPCC) assessment report declared that climate change is an issue to be taken seriously (Abugu *et al.*, 2021). However, articles must not be published before late 19th century as scientists generally regard the later part of the 19th century as the point at which human activity started influencing the climate.

3. The Links between Climate Change and Dam: Vicente-Torres and Revuelta (2020) are of the view that dams have positive role on climate change mitigation if properly operated. In their words, “dams play an important role in mitigating climate change by producing clean and not polluting energy (Goal 7 SDG) but can also play a major role in adapting to climate change if spillway operations are optimized”. However, Vicente-Torres and Revuelta (2020) revealed shortcoming on the implementation of regulations meant to combat climate change impacts from dam operation and concluded that proper implementation of regulations analyzed can offset dam impacts and mitigate climate change. Ojo *et al.* (2020) also concluded that it is essential to strengthen the institutional and legal system, information management mechanism, public awareness, and participatory water resources management. In line with Vicente-Torres and Revuelta (2020), Yusuf *et al.* (2021) sees dam construction as a solution to climate change extremes and proposed the construction of dams in strategic locations of the affected flood areas in Jigawa State, Nigeria. However, Energy Digest (2008) reported climate change as one of the factors that are threatening the water levels and adequate water flow into Kainji and Jebba dams in Nigeria. National Water Resources Institute (2018) has it that there is a general reduction in the water levels of the reservoirs and the apparent drying up of the water. In the same vein, Future Learn (2021) posited that “climate change causes unpredictable rainfall and drought patterns that reduce the water level in Kainji Dam and other smaller ones. Consequently, the amount of hydroelectric power generated declines and affects power distribution nationwide”. Program for Infrastructure Development in Africa (PIDA) has also called for an expansion of hydroelectric power generation capacity by more than 54,000 megawatts (MW) and of water storage capacity by 20,000 cubic kilometers. Much of these investments will support the construction of long-lived infrastructure (e.g., dams, power stations, and irrigation canals), which will be vulnerable to the potentially harsher climate of the future (Cervigni *et al.*, 2015). Climate change in Northern Nigeria could lead to changes of the hydrological cycle and water availability. Moreover, the linkage between climatic changes and stream flow fluctuations is poorly documented in this area (Okafor and Ogbu, 2018). According to Odjugo (2009), there is a dwindling water resource in Nigeria that has led to changes in water levels in the Kainji dam, and other smaller dams in Nigeria. Studies have noted that reduction in potentials dam establishment due to low water mark in most rivers especially in the Northern Nigeria (NEST 2003; Nyelong, 2004; Odjugo, 2009). Unlike others studies (Vicente-Torres and Revuelta, 2020; Groeskamp and Kjellsson, 2020) that sees dam as a solution to climate change and proposed dam construction, Odjugo (2009) was of the view that climate change has reduced the potential for dam construction. Chima *et al.* (2009) opined that increasing number and size of dam/irrigation projects in northern Nigeria are having a corresponding increase in rainfall in spite of the threat of climate change. According to them, dam construction increases evaporation and consequently rainfall in Northern Nigeria. Similarly, Olofintoye and Adeyemo (2011) also explained that Kainji dam had produced favourable climate conditions favouring increased rain in the areas surrounding the dam. Like Chima *et al.* (2009), Olofintoye and Adeyemo (2011), Okoli and Ifeakor (2014) in their study “drought and its recurrence: implications for water resources development in Northern Nigeria” shared positive view on dam in relation to climate as they stated that: North Central zone has a relatively more favourable condition and this could be attributed to the presence of earth dams. The Earth dams could have influenced the volume of rainfall in the North-Central Zone hence they have a better prospect for enhanced livelihood than the North-East and North-West Zones of Nigeria. Muller (2015) was also positive on dam as a solution to climate change, when author stated that “climate change is the greatest present threat to aquatic ecosystems and reservoirs should be viewed as potential

places to store carbon". However, Muller cautioned that dam posed negative effects on the environment especially in this era of climate change. Author also advised that dam construction and operation should ensure balance with the natural environment. While Chima *et al.* (2009) and Okoli and Ifeakor (2014) claimed that dam increases rainfall in Northern Nigeria through increased evaporation, Machina and Sharma (2017) disclosed decreased rainfall in Dams surrounding areas. They pointed that increase in temperature aids in excessive evaporation from the reservoir and excess water has to be released from the dam to sustain hydropower generation over the years. This has invariably affected storage at the dam as well as the energy generation. On the contrary, Ludwig *et al.* (2013) showed that more water will be available for hydropower in the future. So, on average, climate change will have a positive impact on potential electricity production. However, the river discharge will also become more variable which will increase the flood risks and could make the power production less reliable. The increased flow variability however will make dam management more complicated because the balance between flood prevention and optimal power production will be more difficult to manage. Melchioly (2021) has it that one of the implications of climate change is insufficient rain water. According to Melchioly (2021), Mindu Dam operated beyond its design capacity in June and November 2016, to mitigate water shortages due to drought. Groeskamp and Kjellsson (2020) lamented on the future threat of global-mean sea level rise and proposed the construction of a Northern European Enclosure Dam (NEED) that will stretch from France to United Kingdom and Norway as means to safeguard more than twenty-five million (> 25,000,000) people and economic regions. Authors, noted that NEED may seem an overwhelming and unrealistic solution at first. However, they suggested that NEED is feasible and cost-effective compared to and alternatives such as (managed) migrations and that of country-by-country protection efforts. They concluded that the constructing NEED will offer solution if mitigation efforts fail to limit sea level rise. Thus, Groeskamp and Kjellsson (2020) like Vicente-Torres and Revuelta (2020) sees dam construction as solution to rise in sea level due to climate change. According to Zhao *et al.* (2021) construction of additional large dams is considered as one of the best available options to meet future increases in water food, and energy demands, although this may drastically affect the surrounding natural environment. However, the issue about the degree of such effects is still unclear, although the interactive impacts of dams and related reservoirs on the changes in meteorological variables are of great scientific importance. Fluixá-Sanmartín *et al.* (2018) have pointed that climate-change-related information is vast and scattered, and its application to specific analyses such as dam safety assessments remains a challenge for the dam engineering community. The level of knowledge and application of climate change on dam management is still at infant stage demanding for more researches. According to Bahls and Holman (2014) application of climate change knowledge to current dam safety practice is still uncertain and must be based on national and supranational overall adaptation plans (OECC, 2008; European Commission, 2013; Commonwealth of Australia, 2015). However, the impacts of climate change effects on dam safety are usually analysed separately and aim at specific aspects (Fluixá-Sanmartín *et al.*, 2018). For instance, studies like Bahls and Holman, (2014), Chernet *et al.* (2014) and Novembre *et al.* (2015) focused only on the impact of climate change on the hydrological loads (relegating or ignoring other aspects). Loza and Fidelis (2021) were of the view that large infrastructures such as dams may be vulnerable to climate change and need to be resilient to related impacts. In line with Loza and Fidelis (2021), Aras (2018) noted that a large number of dams have been built around the world; and lamented that these dams have significant impacts on river ecology and climate change. According to Aras (2018), it can be predicted that many dams and dam lakes built in the North of Turkey may increase the impact of climate change. Ehsani *et al.* (2017) stated that the hydrological implications of future climate will affect the design capacity and operating characteristics of dams. However, authors suggested that the importance of dams in providing water security in the Northeast of United States will increase. Thus, they created an indicator of the Effective Degree of Regulation (EDR) by dams on water resources and showed that it is expected to increase, particularly during drier months of year, simply as a consequence of projected climate change. Mulumba *et al.* (2012) *in* a study that addressed climate change impacts that challenge hydropower production and distribution in southern Africa, also suggested a quick move towards adaptation measures as well as their effective implementation would constitute a significant benchmark for the maximization of hydropower generation capacity. Studies (Pahl-Wostl, 2006; McDaniels *et al.*, 2008; Asadieh and Krakauer, 2015; Asadieh *et al.*, 2016) have anticipated more increases in the frequency and intensity of extreme weather events that will in turn alter stream flow patterns affecting the operations and downstream hydrologic impacts of existing water infrastructure and may result in flooding events that will exceed the design limits of dams. The issue of extreme climate events, is a major concern in dam construction and operation which according to Ehsani *et al* (2017), modification of dam operations, has become necessary to offset the vulnerabilities of water resources systems to future climate

uncertainties. In the same vein, Loza and Fidelis (2021) have suggested that approval of dam construction should require a comprehensive assessment of associated climate change risks. Also, Fluixá-Sanmartín *et al.* (2018) noted that climate change is likely to affect different factors driving dam risk. Consequently, drew attention on the need for taking recognition of climate change in dam management. According to them, dams as well as protective dikes and levees are critical infrastructures whose associated risk must be properly managed in a continuous and updated process. They complained that dam safety management has been usually carried out assuming stationary climatic and non-climatic conditions. Although some reference institutions develop guidance for including climate change in their decision support strategies related. Sarah *et al.* (2013) asserted that changing hydroclimatic conditions will likely impact water temperatures below dams and affect downstream ecology. Olofintoye *et al.* (2012) reported that temperatures in the vicinity of Vanderkloof Dam have been in a significant uptrend over the years. In accordance with Sarah *et al.* (2013), Ayron (2020) posited that successful management of surface water within a social-ecological system will be challenged by the increasing unpredictability of rainfall. According to Ayron (2020), climate-driven shifts in the distribution, intensity, and amount of rainfall will alter runoff that feeds reservoirs. However, there are assumptions that expansion of water infrastructure reduces the vulnerability of water resources to climate change (Watts *et al.*, 2011 cited in Ehsani *et al.*, 2017). A study by researchers in the University of Waterloo in 2017, concluded that “water reservoirs created by damming rivers could have significant impacts on the world's carbon cycle and climate system that aren't being accounted for”. Similarly, Fearnside (2005) opined that Hydroelectric dams in tropical forest areas emit greenhouse gases and consequently promote climate change in Brazil. According to Fearnside (2005), the Curuá-Una Dam emitted 3.6 times more greenhouse gases than would have been emitted by generating the same amount of electricity from oil. Taylor (2022) blamed climate change for the failure of two Michigan dams. According to Taylor, climate change has resulted in more extreme weather patterns. However, Taylor warned that removing rather than repairing dams would result in less storage and water shortage. Meiyán *et al.* (2013) also posited that there have been frequent reports of extreme events, including both droughts and floods around the Three Gorges Reservoir in China. *Meiyán et al.* (2013) further revealed as follows: a positive relationship between annual precipitation variability and variation in reservoir water levels. *Meiyán et al.* (2013) noted that: an increase in the frequency and intensity of extreme climate events may lead to exceptional floods, increasing the burden of flood control; an increase in the inter-annual variability of precipitation may result in more droughts, especially in the dry season, affecting the impoundment of the Three Gorges Reservoir and associated power generation, shipping and the water environment; and a temperature rise may aggravate the eutrophication of water bodies, thus increasing the vulnerability of natural ecosystems in the reservoir area. Tabucanon *et al.* (2021) investigated the impact of climate change on the reliability of the current reservoir operation rules of Bhumibol Dam. They concluded that there is high risk of current reservoir operating rules towards the operation reliability due to climate change. Thus, authors suggested the need to redesign the rules. Similarly, Watts *et al.* (2011) opined that current dam practices may not adequately cope with the impacts of climate change on the reliability of water supply, flood risk, health, agriculture, energy generation and aquatic ecosystems. Watts *et al.* (2011) have suggested modification of dam operations to assist with adaptation to climate change and help restore ecosystems. Modification according to them may require integration across sectors or involve multiple dams, enhancing benefits such as water supply or hydropower while simultaneously achieving ecosystem restoration. Eduvie and Oseke (2021) have it that water shortage due to this climate change variability has compelled the dislocation of the socioeconomic life of people, families and livestock, forcing migration of human and animal life, thereby igniting social tension and poor personal and communal hygiene, resulting in epidemics including cholera and dysentery. Thus, they propose immediate remedial solutions, including the construction of tubewells and effective integrated water management of the entire water resource in order to improve and mediate these multiple and widely varying impacts on the settlements of Goronyo infrastructures, including on their dependents and beneficiaries. Nasser *et al.* (2019) quantified the impact of climate change on streamflow at Dokan Dam until year 2050 using. The results indicated “a significant decrease on the projected streamflow until year 2050 with average streamflow for the six climate models of 167 m³/sec in past compared with the observed streamflow of 176.5 m³/sec for the base period (1980-2013). In addition, the study showed that most runoffs come from Iranian part of the Dokan Dam Watershed with 65% of total simulated runoff”. Paul (2022) also reported that 54 per cent of dams assessed are exposed to floods and 23 per cent to droughts by 2050. International Energy Agency. (IEA, 2020) has warned that expanding the share of hydropower in Africa may increase the continent's exposure to climate hazards and risks to electricity systems if carried out without assessing the potential impacts of climate change. Houteta (2012) also advised that integration of climate change impacts and future

scenarios is important in dam operation and management.

3.1 Impacts of Climate Change on Dams: Butu et al. (2019) investigated the effects of key climatic variables such as rainfall, temperature, and relative humidity on inflows to Kainji hydropower station from 1985-2017. They reported that annual rainfall showed an insignificant statistical change in mean annual rainfall but significant change in annual temperature. They also reported a positive correlation between Lake level and climate variables (temperature and rainfall) as the Pearson's Product Moment correlation values were 0.69 and 0.45 for temperature and rainfall respectively. Since Northern Nigeria is known to have a decreasing volume of rainfall as a result of climate change (Ogbuabor and Egwuchukwu, 2017; Haider, 2019; Jellason, 2019; Ideki and Weli, 2019) volume of water in the lake will also decrease. Then, Butu *et al.* (2019) suggested that climate change can affect the volume of water in Kainji Lake and as well the Reservoir Inflows to Kainji Hydropower Station. The implication of this report is that there will be reduction in the reservoir inflows to Kainji hydropower station if climate change is unabated. Machina and Sharma (2017) assessed Climate Change Impact on Hydropower Generation in Nigeria. The results showed is evidence of climate change in the areas around the dam and that rainfall has a negative trend which implies that there is tendency for the reservoir inflow to reduce drastically over time while temperature has a positive trend. According to Machina and Sharma (2017), dam has produced unfavourable climate conditions as a result of decreased rain in the areas surrounding the dam as well as increase in temperature which aids in excessive evaporation from the reservoir. Similarly Yang *et al.* (2022) reported that in the years of 1952–1983, downstream river water temperature rose by 0.31 °C after damming. Meanwhile, the construction of dam increased the average annual water temperature by 0.55 °C, while climate change oppositely made it decreased by 0.26.

3.2 Implications of Dam Construction on Climate: According to Olofin (Udated), “rainfall storms (heavy or not) might have contributed about 10 – 15% to the cause. The remaining 85 to 90% of the cause relates to faults in the management of land and water within the drainage basins”. Olofin further explained that the incidences of flood in Nigeria started far beyond the era of recent climate change. The position of Olofin is that dams are responsible for flooding in Nigeria not climate change. Similar, to the position of Olofin, it has been reported that “dams and reservoirs are responsible for almost a quarter of all human-caused methane emissions. These 104 million tonnes of methane are responsible for at least 4% of all human-caused warming” (International Rivers, 2011). International Rivers (2011) criticized large dams nothing that: Climate change has begun to significantly and unpredictably change precipitation patterns. On the one hand, more frequent droughts will make many hydropower projects uneconomic, while on the other, more extreme rainfall will increase siltation of dams (reducing their useful lifetimes) and increase the risk of dam failures and catastrophic flood releases. In line with International Rivers (2011), Olofintoye and Adeyemo (2011) had revealed evidence of global warming in the areas around Kainji dam. Zhao *et al.* (2021) explored the impacts of reservoir characteristic factors (RCFs) on local climate change near the reservoir and reported that: (a) the correlations of the RCFs with evaporation are the opposite of those with precipitation; (b) dams and related reservoirs can have completely opposite (weakening or enhancing) effects on different meteorological variables; and (c) the RCFs outperform the geographical factors in terms of the impact on precipitation whereas the variation of evaporation is more sensitive to geographical factors. World Commission on Dams (WCD, 2000) disclosed that the major implications of climate change for dams and reservoirs are firstly that the future can no longer be assumed to be like the past, and secondly that the future is uncertain. WCD, (2000) has encouraged more adaptive, flexible water management, which includes the use of scenario analysis in estimating future dam safety and reservoir reliability. Research is needed into techniques for incorporating uncertainty over different possible futures into dam and reservoir assessment, particularly in the context of reservoir operation and decision-support systems.

4. Results and Discussions: From the review, one can say that there are two opposing views on links between climate change and dams. Some studies see dam negatively and as an agent of climate change while others shared positive view on dam and sees it as a solution to climate change. Most of this later group proposed construction of new dams to adapt to climate change (Table 1). Table 1 presents the position of authors on the links between climate change and dam.

Table 1: Position of Authors on the Links between Climate Change and Dam

Authors	Position on Climate Change and Dam.	Positive (+)	Negative (-)
Vicente-Torres & Revuelta (2020)	Dams play an important role in mitigating climate change by producing clean and not polluting energy.	+	
Groeskamp &	Concluded that the constructing Northern European Enclosure Dam	+	

Kjellsson (2020)	(NEED) will offer solution if mitigation efforts fail to limit sea level rise.		
Yusuf et al. (2021)	Proposed the construction of dams in strategic locations of the affected flood areas in Jigawa State, Nigeria to adapt to climate change.	+	
Chima <i>et al.</i> (2009)	Increasing number and size of dam/irrigation projects in northern Nigeria are having a corresponding increase in rainfall in spite of the threat of climate change.	+	
	Dam construction increases evaporation and consequently rainfall in Northern Nigeria.		
Muller (2015)	Climate change is the greatest present threat to aquatic ecosystems and reservoirs should be viewed as potential places to store carbon.	+	
Okoli & Ifeakor (2014)	North Central zone, has a relatively more favourable condition and this could be attributed to the presence of earth dams.	+	
Butu <i>et al.</i> (2019)	Climate change can affect the volume of water in Kainji Lake and as well the Reservoir Inflows to Kainji Hydropower Station.		-
Odjugo (2009)	There is a dwindling water resource in Nigeria that has led to changes in water levels in the Kainji dam, and other smaller dams in Nigeria.		-
Machina & Sharma (2017)	Dam has produced unfavourable climate conditions as a result of decreased rain in the areas surrounding the dam as well as increase in temperature which aids in excessive evaporation from the reservoir.		-
Olofin (Udated)	Increased incidence of flood in Nigeria is mainly due to dam operation not heavy rainfall arising from climate change.		-
Energy Digest (2008)	Climate change is one of the factors that are threatening the water levels and adequate water flow into Kainji and Jebba dams in Nigeria.		-
National Water Resources Institute (2018)	There is a general reduction in the water levels of the reservoirs and the apparent drying up of the water		-
Future Learn (2021)	Climate change causes unpredictable rainfall and drought patterns that reduce the water level in Kainji Dam and other smaller ones.		-
International Rivers (2011)	Dams and reservoirs are responsible for almost a quarter of all human-caused methane emissions		-
	More frequent droughts will make many hydropower projects uneconomic while more extreme rainfall will increase siltation of dams (reducing their useful lifetimes) and increase the risk of dam failures and catastrophic flood releases.		

Table 1 shows that some researches that took position on the links between climate change and dam were negative while some were positive. This suggests that dam and climate change have both positive and negative implications to each other. However, majority blamed climate change for poor performance of dams (Energy Digest, 2008; Odjugo 2009; International Rivers, 2011; National Water Resources Institute, 2018; Butu *et al.* 2019; Future Learn, 2021) while minority blamed dam for climate change (Machina and Sharma (2017; Olofin, Udated). Moreover, studies that shared positive on the adoption of dams for climate change adaptation also cautioned on the implementations of regulation to minimize impacts (Vicente Torres and Revuelta, 2020; Ojo *et al.*, 2020). The impacts of climate change on dams were seen in reduction of rain and consequent lower volume of water in the reservoir to perform its function such as energy generation, irrigation and fishing. Climate changes affect hydrology or water quality, fluctuation in water level leading to poor capacity, utilization and effectiveness. The biggest dam safety challenge in the recent decades is climate change. In the Sahel or dry region, it can cause cracks on the dams due to dryness while it promotes flood in wet regions like the Southern Nigeria, Ghana others (Figures1, Plates 1-2). Figure 1 illustrates the impacts of climate change on dams in Sahel or dry regions.

Figure 1: The Impacts of Climate Change on Dams in Dry Region

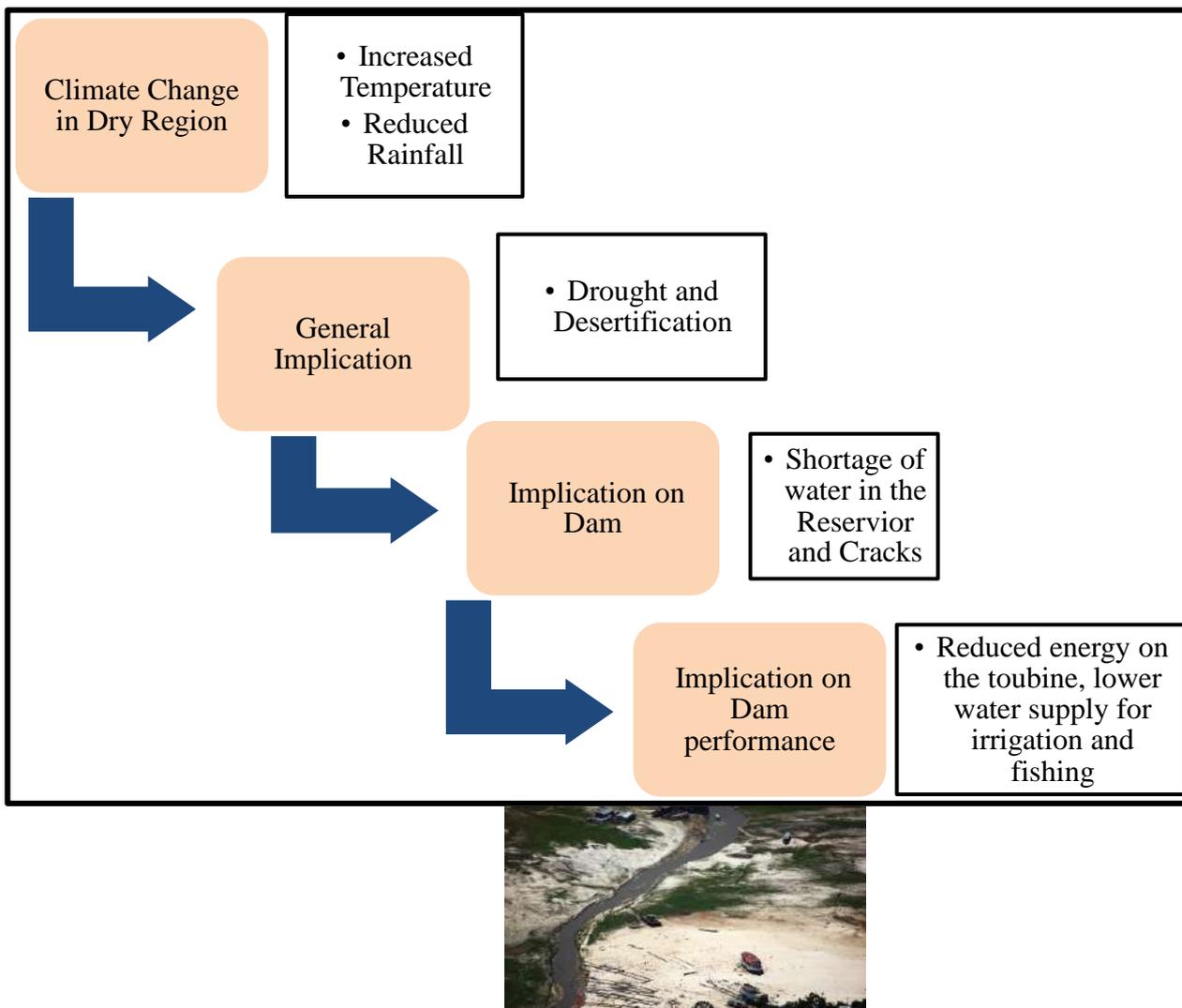


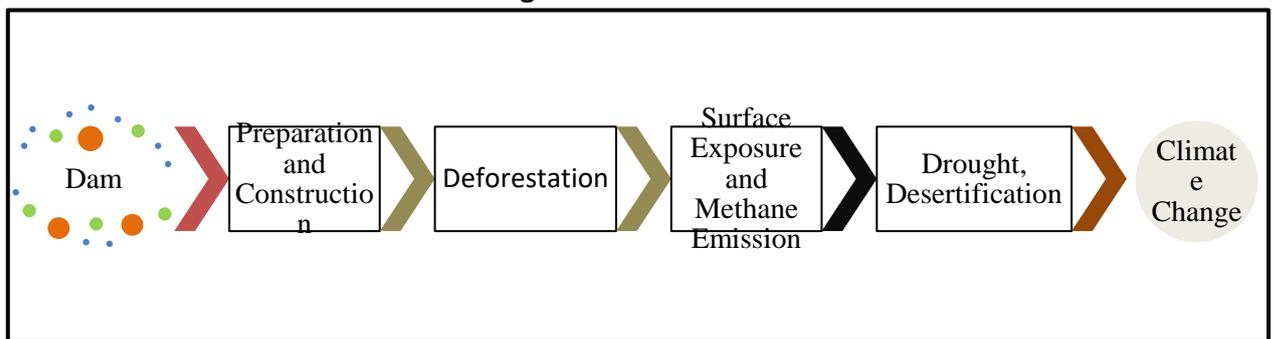
Plate 1: Drought in The Amazon Basin Leaves Boats – And Dam Reservoirs – High and Dry
Source: International Rivers (2011)



Plate 2: Crack in Kangimi Dam in Igabi Local Government Area of Kaduna State (Source: National (2018))

Dams also have impact on climate and can contribute to climate change. Results from reviewed articles shows that dam construction removes vegetation cover and expose the surface to drought and flood. It also reduced biodiversity and affect river system. Dam can increase methane emission through decomposition of organic matter (plant) cleared during preparation for construction. Moreover, dams are not climate-neutral. Particularly in the Northern Nigeria where the organic matter rotting in their reservoirs emits methane which contribute to climate change (Figure 2). Figure 2 illustrate how dam contribute to climate change in Northern Nigeria. Deforestation

Figure 2: Dam



Contribution to Climate Change in Dry Region

Figure 2 shows that dam preparation and construction lead to deforestation which in turn exposes the surface and causes methane emission from the decaying plants consequently resulting to drought, desertification and flooding and overall climate change. However, wet region experienced flooding and erosion as a consequence of climate change (Figure 3). Figure 3 illustrate the impact of climate change on Dam in wet and low-lying regions.

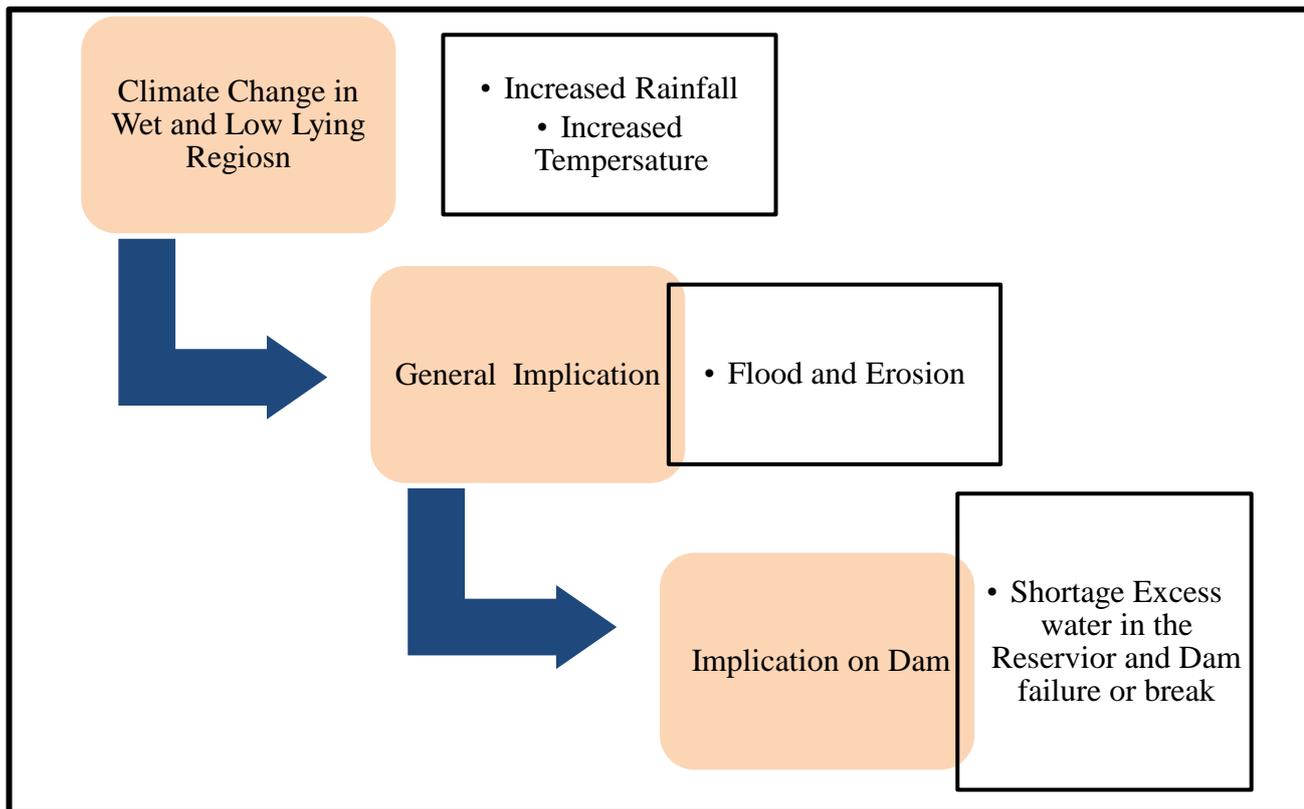


Figure 3: The Impacts of Climate Change on Dams in Wet and Low-lying Regions

5. Conclusion and Recommendations: Dam is both causal factor and solution to climate change menace. Dam influences the climate of place and must be carefully weighed among other options for climate change adaptation. Climate change affects dam performance in dry region through reduction in water volume whereas it leads to overflow and dam failure in wet and low-lying regions. Dam on the other hand causes climate change via deforestation and exposure of land surface. Thus, proper monitoring of existing dams is critical while construction of new dam must be properly weighed, planned and implemented in line with standard guidelines and regulations. There is need for regular climate studies and monitoring for future dam construction.

References: Abugu N.A, Yero A.B, Y.S Daku and Patrick N.O. (2018). Evaluation of the Impact of Gurara Dam on Surface Water Quality within the Catchment in Kaduna State, Nigeria. *NSUK Journal of Environmental Management & Sustainability*, 1(1). Achugbu I C and Balogun I.A. (2018). Spatial-temporal characteristic of drought in Northern Nigeria. *global journal of pure and applied sciences*, 24: 81-89. Adegun O. (2015). Drought and its recurrence: implications for water resources development in Northern Nigeria. *Journal of the Environment*, 9(1). Adeoti, O. (2011). Development of River Basin Organizations in Nigeria. *Res. J. Soil Water Manag.* 1: 91–100. Allani M., Mezzi R., Zouabi A., Béji R., Joumade-Mansouri F., Hamza M. E and Sahli A. (2020). Aras, E. (2018). Effects of multiple dam projects on river ecology and climate change: Çoruh River Basin, Turkey. *Advances in environmental research*, 7(2):121-138. Atkins (2013). FD2628 Impact of Climate Change on Dams & Reservoirs. Final Guidance Report for the Department of Environment, Food and Rural Affairs' information UK. August 3rd yron M. S. (2020). Evaluating the Management of a Tropical Reservoir: Implications of Climate Change for Water Availability. *Pacific Science*, 74(2):115-135 (2020). <https://doi.org/10.2984/74.2.2>. Bahls, V. and Holman, K. (2014). Climate Change in Hydrologic Hazard Analyses: Friant Dam Pilot Study - Part I: Hydrometeorological Model Inputs, Tech. rep., U.S. Department of the Interior, Bureau of Reclamation. Bhaduri A., Bogardi J., A. Siddiqi H., Voigt C., Vörösmarty C., Pahl-Wostl S.E., Bunn P., Shrivastava R., Lawford S., Foster H., Kremer F.G., Renaud A., Bruns A and Osuna V.R. (2016). Achieving Sustainable Development Goals from a Water Perspective *Front. Environ. Sci.*, 4:64, 10.3389/fenvs.2016.00064. Boulange J, Hanasaki N, Yamazaki D and Pokhrel Y. (2021). Role of dams in reducing global flood exposure under climate change. *NATURE COMMUNICATIONS*, 12(417). Butu A.W, Emeribe C.N Idehen O.F and Musa I. (2019). Investigating the Effects of Climatic Variability on Reservoir Inflows to Kainji Hydropower Station, Nigeria. *Dutse Journal of Pure and Applied*

Sciences (DUJOPAS),5 (1). Chernet, H. H., Alfredsen, K., and Midttømme, G. H. (2014). Safety of Hydropower Dams in a Changing Climate. *J. Hydrol. Eng.*, 19, 569–582, [https://doi.org/10.1061/\(ASCE\)HE.1943-5584.0000836](https://doi.org/10.1061/(ASCE)HE.1943-5584.0000836). Chima G. N., Nwagbara M.O and Ijioma M. A.(2009). Rainfall response to dam/irrigation projects in Northern Nigeria. *Global journal of social sciences* 8 (1): 111-120. Christensen, D. (2014). H.R. 83: Consolidated and Further Continuing Appropriations Act, 2015. Daily May 17. Retrieved from www.sciencedaily.com/releases/2017/05/170517090509 Drought Recovery and Resilience Act of 2015. 114th CONGRESS, 1st Session. Eduvie, M.O and Oseke, I.F. (2021). Cumulative Impacts of Climate Change Variability Around the Goronyo Dam in the Iullemeden Basin, Northwest Nigeria. In: Diop, S., Scheren, P., Niang, A. (eds) *Climate Change and Water Resources in Africa*. Springer, Cham. Retrieved from https://doi.org/10.1007/978-3-030-61225-2_8. Ehsani N, Charles J.V, Balázs M.F and Eugene Z.S. (2017). Reservoir operations under climate change: Storage capacity options to mitigate risk. *Journal of Hydrology*, 555:435-446. <https://doi.org/10.1016/j.jhydrol.2017.09.008> Get rights and content. *Energy Digest* (2008). Climate change, Low water levels threatens Kainji power plant. *Nigerian Energy Digest* 8(223/224): 1-2. European Commission. (2018). An EU Strategy on adaptation to climate change, available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52009DC0147&from=EN>. Ezeh CO, Onyekwelu K and Akinwale O.P. (2019). Urinary schistosomiasis in Nigeria: a 50-year review of prevalence, distribution and disease burden. published by *EDP Sciences Parasite* 26, 19 (2019). <https://doi.org/10.1051/parasite/2019020>. Fearnside P.M. (2005). Do Hydroelectric Dams Mitigate Global Warming? The Case of Brazil's CuruÁ-una Dam. *Mitigation and Adaptation Strategies for Global Change* ,10: 675–691. <https://doi.org/10.1007/s11027-005-7303-7>. Federal Ministry of Water Resources. (2014). Supporting Report 5: Water Resources Sub-Sector Development Plan; Japan International Cooperation Agency (JICA): Abuja, Nigeria, 5. Fluixá-Sanmartín J, Altarejos-García L, Morales-Torres A, and Escuder-Bueno I. (2018). Climate change impacts on dam safety. *Nat. Hazards Earth Syst. Sci.*, 18: 2471–2488. <https://doi.org/10.5194/nhess-18-2471-2018>. Freshwater Resources and Operation of the Vanderkloof Dam System in South Africa. *IntechOpen, Global Warming – Impacts and Future Perspective*166. Available at <http://dx.doi.org/10.5772/50414>. FutureLearn (2021). What are the impacts of climate change in Nigeria? <https://www.futurelearn.com/info/futurelearn-international/impacts-climate-change-in-nigeria#:~:text=Climate%20change%20causes%20unpredictable%20rainfall,and%20affects%20power%20distribution%20nationwide>. Grill, G. (2019). Mapping the world’s free-flowing rivers. *Nature* 569, 215–221 Groeskamp S and Kjellsson J. (2020). The Northern European Enclosure Dam for if Climate Change Mitigation Fails. *BAMS American Meteorological Society*. Haider, H. (2019). Climate change in Nigeria: Impacts and responses. *K4D Helpdesk Report* 675. Brighton, UK: Institute of Development Studies. Houteta D.K. (2020). Modeling the impacts of climate change, land use change and dam management on water resource in West Africa: Case of the Mono River Basin, Togo-Benin. A Thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy (PhD) of the University of Abomey- Calavi (Benin Republic) In the framework of the Graduate Research Program on Climate Change and Water Resources (GRP-CCWR). https://app.dimensions.ai/details/publication/pub.1111649369?and_facet_journal=jour.1137264. <https://doi.org/10.1175/BAMS-D-19-0145.1>. Huffman F Mc Nerney D, Thompson H, Lowenthal E, Garamendi T, DeFazio H.R. (2015). 2983: Ideki, O. and Weli, V.E. (2019). Analysis of rainfall variability using remote sensing and GIS in North Central Nigeria. *Atmospheric and Climate Sciences*, 9: 191-201. <https://doi.org/10.4236/acs.2019.92013>. Impact of future climate change on water supply and irrigation demand in a small Mediterranean catchment. Case study: Nebhana dam system, Tunisia. *Journal of Water and Climate Change*, 11(4). Impacts. Nossaman LLP| Attorney Advertising. International Energy Agency. (IEA, 2020) Climate Impacts on African Hydropower. *International Rivers* (2011). Wrong Climate for Big Dams - destroying rivers will worsen climate crisis. Retrieved online from www.internationalrivers.org/node/6910. Jellason, N. P. (2019). Climate change perceptions and attitudes to smallholder adaptation in Northwestern Nigerian Drylands. *Social Science*, 8(31). Jothityangkoon C, Hirunteeyakul C, Boonrawd K and Sivapalan. M. (2013). Assessing the impact of climate and land use changes on extreme floods in a large tropical catchment. *J. Hydrol.*, 490:88-105, 10.1016/j.jhydrol.2013.03.036. Loza A and Fidelis T. (2021). Literature review on the analysis of climate change risks in the environmental impact assessment of dams. *Impact Assessment and Project Appraisal*,39(4):277-289.

Ludwig F., Franssen W., Jans W., Beyenne T., Kruijt B., Supitl. (2013): Climate change impacts on the Congo Basin region. In: Climate Change Scenarios for the Congo Basin. In Haensler A., Jacob D., Kabat P., Ludwig F. (eds.). Climate Service Centre Report No. 11, Hamburg, Germany.

Machina M.B and Sharma S. (2017). Assessment of Climate Change Impact on Hydropower Generation: A Case Study of Nigeria. International Journal of Engineering Technology Science and Research 4(8). Available at www.ijetsr.com.

Madsen H, Lawrence D., Lang M., Martinkova M and Kjeldsen T.R. (2014). Review of trend analysis and climate change projections of extreme precipitation and floods in Europe. *J. Hydrol.*, 519: 3634-3650, 10.1016/j.jhydrol.2014.11.003.

Meiyan J, Lianchun S, Jun W, Yiming K, Zhang C, Zhou T, Xu Y, Jiang T, Zhu C, Chen X, Gao X, Tang S and Zhang P (2013). Addressing the Potential Climate Effects of China's Three Gorges Project. World Meteorological Organization Bulletin 62 (Special Issue).

Muller M. (2015). Dams have the power to slow climate change. Mitigate global warming and produce clean, cheap hydropower at the same time. Springer Nature Limited 566 (315).

Mulumba J. P. M., Afullo T. J. O and Ijumba. N. (2012). Climate Change and Hydropower Challenges in Southern Africa. Rwanda Journal, 27 Series C. DOI: <http://dx.doi.org/10.4314/rj.v27i1.4>.

Najibi N., Devineni N and Lu M. (2017). Hydroclimate drivers and atmospheric teleconnections of long duration floods: An application to large reservoirs in the Missouri River Basin, *Adv. Water Resour.*, 100:153-167, 10.1016/j.advwatres.2016.12.004.

Nasser H.A, Saeed, F and Al-Ansari, N. (2019). Impact of Climate Change on Water Resources National (2018). Communities raise alarm over cracks in Kaduna dam. National Newspaper 17th January. National Water Resources Institute (2018). Climate variability and extreme event, hydrology and reservoir management, agriculture and water in Northern Nigeria. Progress Report Submitted to the African Networks of Centres of excellence on Water Science Phase II (Ace Water 2). Novembre, N., Holman, K., and Bahls, V. (2015). Climate Change in Hydrologic Hazard Analyses: Friant Dam Pilot Study – Part II: Using the SEFM with Climate-Adjusted Hydrometeorological Inputs, Technical Memorandum 8250-2015-010, U.S. Department of the Interior, Bureau of Reclamation.

Odjugo P. A. O. (2009). The impact of climate change on water resources: global and Nigerian analysis. *FUTY Journal of the Environment*, 4(1). of Dokan Dam Watershed. *Engineering*, 11:464-474. Doi: [10.4236/eng.2019.118033](https://doi.org/10.4236/eng.2019.118033).

Ogbuabor, J. E. and Egwuchukwu, E. I. (2017). The impact of climate change on the Nigerian economy. *International Journal of Energy Economics and Policy*, 7(2), 217-223. <https://dergipark.org.tr/en/download/article-file/361739>.

Ojo S, Mensah H, Albrecht E and Ibrahim B. (2020). Adaptation to Climate Change Effects on Water Resources: Understanding Institutional Barriers in Nigeria. *MDPI Climate*, 8, 134.

Okafor G.C and Ogbu K.N. (2018). Assessment of the impact of climate change on the freshwater availability of Kaduna River basin, Nigeria. *Journal of water and land development*, 38 (9): 105–114. DOI:10.2478/jwld-2018-0047.

Okoli J N and Ifeakor A.C. (2014). An Overview of Climate Change and Food Security: Adaptation Strategies and Mitigation Measures in Nigeria. *Journal of Education and Practice*, 5(32). www.iiste.org.

Okon E.M. Falana B.M. Solaja S.O. Yakubu S.O, Alabi O.O., Okikiola B.T, Awe T.E., Adesina B.T, Tokula B.E, Kipchumba A.K and Edeme A.B. (2021). Systematic review of climate change impact research in Nigeria: implication for sustainable development. *Heliyon* 7. Olofin E.A. (Udated). Flood Disasters in Nigeria: Beyond Climatic Borders. Text of a Public Valedictory Lecture. Geography Department Bayero University, Kano.

Olofintoye O and Adeyemo J. (2011). The role of global warming in the reservoir storage drops at Kainji dam in Nigeria. *International Journal of the Physical Sciences*, 6(19): 4614-4620. Available online at <http://www.academicjournals.org/IJPS>. DOI: 10.5897/IJPS11.772.

Olofintoye O, Adeyemo J and Otieno F. (2012). Impact of Regional Climate Change on Oyekale A.(2009). Climatic variability and its impacts on agricultural income and households' welfare in Southern and Northern Nigeria. *Electronic Journal of Environmental, Agricultural and Food Chemistry* 8(1):13-34.

Paul M. (2022). Climate change will intensify pressure on Ghana's Weija dam which provides water to Accra. Down to Earth News Published: Friday 08 April.

Poff, N. L. and Schmidt, J. C. (1997). How dams can go with the flow. *Science* 353, 1099

reservoir systems of the world. *Ambio* 26, 210–219.

Sarah E. N, Scott T. L and Joshua H. V. (2013). A Method to Consider Whether Dams Mitigate Climate Change Effects on Stream Temperature. *Journal of the American Water Resources Association* -12-0146-P. <https://doi.org/10.1111/jawr.12102>.

Sarki A.M and Roni B.L. (2019). This disease is “not for hospital”: myths and misconceptions about cancers in Northern Nigeria. *J Glob Health Rep*, 3(7).

Tabucanon, A.S, Rittima A, Raveephinit, D, Phankamolsil, Y, Sawangphol, W, Kraisingka, J, Talaluxmana, Y, Vudhivanich, V

and Xue, W... (2021). Impact of Climate Change on Reservoir Reliability: A Case of Bhumibol Dam in Ping River Basin, Thailand: 10.32526/enrj/19/2021012. Environment and Natural Resources Journal, 19(4), 266–281. Retrieved from <https://ph02.tci-thaijo.org/index.php/enrj/article/view/243077>

Taylor S. (2022). Water Storage and Dam Management Strategies in Light of Climate Change the World Bank. Nigeria—Second Multi-State Agricultural Development Project; The World Bank: Washington, DC, USA, 1995. their management. WCD Thematic Review II.2 Environmental Issues, Second Draft: 27 March. Umar D, U, Ramli M. F, Aris A, Z, Jamil N and Tukur A.I. (2019). Surface water resources management along Hadejia River Basin, Northwestern Nigeria. H2Open Journal, 2 (1). United Nations Economic Commission for Africa African Climate Policy Centre (UNEC-AACPC, 2011). Climate change and water resources of Africa: challenges, opportunities and impacts. Working Paper 5. University of Waterloo. (2017). Dams are major driver of global environmental change. Science Vicente-Torres M and Revuelta I. (2020). Dams’ operation and climate change adaptation: proposals for better regulation. A Paper presented at the fourth International Dam World Conference on 17th December, in Lisbon, Portugal. Voeroesmarty, C. J. (1997). The storage and aging of continental runoff in large reservoir systems of the world. Ambio 26, 210–219 Watts R. J., Richter B. D., Opperman J. J and Bowmer K. H. (2011). Dam reoperation in an era of climate change. Marine and Freshwater Research 62(3) 321-327. <https://doi.org/10.1071/MF10047>. World Commission on Dams (WCD, 2000). Implications of climate change for large dams and Yang R, Shiqiang W, Xiufeng W, Mariusz P, Xudong L, Mariusz S, Renata G, Jiangyu D and Senlin Z.(2022) .Quantifying the impacts of climate variation,damming, and flow regulation on river thermal dynamics: a case study of the Włocławek Reservoir in the Vistula River, Poland. Environmental Sciences Europe, 34:3. Yang R, Wu S, Wu X, Ptak M, Li X, Sojka M, Graf R, Jiangyu D, Senlin Z and Melchioly S.R. (2021). Effects of Climate Changes on Water Resources: A Case of Mindu Dam in Morogoro Municipality, Tanzania. Tanzania Journal of Science 47(3): 1252-1265, DOI: <https://dx.doi.org/10.4314/tjs.v47i3.33>. Youdeowei, P.O; Nwankwoala, H.O, Desai, D.D (2019). Dam Structures and Types in Nigeria: Sustainability and Effectiveness. Water Conservation and Management, 3(1): 20-26. Yusuf A.M, Salihu M. K and Sule I.K. (2021). Estimating the Cost of Improving Households' Resilience to Floods through the Construction of a Dam in Some Parts of Jigawa State, Nigeria. International Journal of Management and Social Sciences, Federal University, Gusau,4 (1). Zarfl, C., Lumsdon, A. E., Berlekamp, J., Tydecks, L. & Tockner, K. A global boom in hydropower dam construction. Aquat. Sci. 77, 161–170 (2015). Zhao Y, Liu S and Shi H. (2021). Impacts of dams and reservoirs on local climate change: a global perspective. Environ. Research Letter 16 (104043).

Simplified Predictive Models on Sustainable Local Content Policy and Human Capacity Development in Nigeria’s Oil and Gas Industry



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Abstract: Simplified predictive models developed to determine sustainable local content policy and human capacity development in the Nigeria’s oil and gas industry was carried out using secondary data from the Petroleum Technology Development Fund (PTDF) within ten years. The research was formulated on both descriptive and analytical statistical methods for the prediction of the expected capacity development value at optimum conditions based on critical industry need assessment and audit report between 2018 -2023 - a baseline study and the secondary data sets from PTDF tri

capacity development strategies from 2011 – 2021. From equations 2.1 – 2.11, it was established that challenging weaknesses could be turned into opportunities for the Fund. A comparative analysis of the Skills Gap Audit (SGA) and Simplified Predictive Models (SPM) was carried out using arithmetic mean, standard deviation and correlation coefficient from the assumed mean of the unclassified data. Tables 2.1 - 4.5 and Figures 2.1 and 2.6 are reference commonality data sets. The results established that more key performance indicators were captured in the SPM models (mean of 23.04 and deviation of 0.4) against the imputed values in the SGA, (mean 4.52 and deviation of 0.5) respectively. This research is useful for policy formulation and decision-making on local content policy formulations and capacity development programmes in Nigeria.

Keywords: Predictive Models, Sustainable Local Content Policy, Petroleum Technology Development

Introduction: Several studies have been carried out on the role of sustainable local content policy, human capital development and the Nigeria oil and gas industry performance enhancement productivity (Ozim, 2010). The term local content has been defined according to NNPC (2006), as the quantum of composite value added or created in the Nigerian economy via the utilization of Nigerian human and material resources for the provision of goods and services to the petroleum industry within acceptable quality, health, safety, and environmental standards to stimulate the development of indigenous capabilities. This definition, according to (James et al 2018), emphasizes that the essence of local content is to develop an economic engine for growth, driving employment, wealth creation, and improved linkage between the oil and gas industry and other sectors of the economy. However, this paper is premised on the robust contributions of the Petroleum Technology Development Fund (PTDF) in the past ten years using key performance indicators and data sets from 2011-2021 to assess the impacts of the intervention programmes of the Fund in the actualization of the local content initiative in Nigeria. Aside the assertion that PTDF is an agency saddled with the enormous task of developing technology and building capacity, is the fact that PTDF is the only government agency in the oil and gas industry in Nigeria with the mandate to develop technology for the industry, (Gusau, 2022). Therefore, local content policy as it relates to the mandate of the Fund must be seen to be sustainable and implementable based on the need of the industry. The Nigerian petroleum industry is dominated by expatriate workers, while indigenous oil companies, on the other hand, are left to be at a disadvantage in a technologically insolvent state. According to (Ozigbo, 2008), Nigerian companies are unprepared to get oil service contracts and other benefits in the industry. For instance (Nwosu et al. 2006), on the other hand, provided a succinct definition by stating that local content is the combined contributions to any of the myriad of activities, operations, or inputs in the crude oil and natural gas extraction process, which are made by Nigerian registered companies in which Nigerians virtually own a majority of the equity. Furthermore, (Shumway 1988) adopted the frequency domain approach to established trend with little variation of the event over time in content estimation. Human capacity development is about managing transformations, people's capacities, institutional capacity and a society's capacity change over time. Most successful countries have developed and implemented local content policies to maximize the profits and benefits realized from their oil endowment, which in return improves the economy and the lives of the citizens as well. The adaptation of local content in the oil and Gas sector in Nigeria is crucial in the improvement of the nation's economy (Uwem, Mary and Olusola, 2020). However, sustainable policies on local content are a subset of measures capable of achieving the desired goals that are politically feasible and commercially viable. Understanding the carrying capacity concept is essential for formulating a sustainable policy, especially in local content development for the oil and gas industry (ScienceDirect, 2009). This is one crucial ground that distinguishes PTDF's relevance in the industry. The Skills-gap audit report shows the feedback of over 3000 past beneficiaries of various PTDF capacity development programmes, carried out by the Fund in the order of major concentration which include Engineering Design / CAD (17.39%), Welders Training & Certification Programme (26.09%), M.Sc. (26.09%), Welding and Fabrication (8.76%), ULSEP (8.70%), Train-The-Trainer Welding Certification Programme (4.35%), and 4.35% Ph.D. Flowing from the above, the PTDF carrying capacity needs to be strengthened with robust legal and legislative provisions to increase its operational frontiers and strategically advance its mandate to contain the local content needs of the industry—improving on the celebrated achievements in the last twenty years.

1. Materials and Methods: The present work utilizes qualitative and quantitative (mixed method) approaches for secondary data gathering and analysis from the investigation of the role of sustainable local content policy on human capacity development in Nigeria's oil and gas industry focusing on the Petroleum Technology Development Fund (PTDF). The mixed method approach was favored because this research is both quantitative and qualitative in nature. The gathered secondary data spanning between years 2001 and 2021 consists of numbers and names of institutional upgrade projects, information

communication technology (ICT) centers, centers of excellence, professorial chairs, training, overseas undergraduate programs, overseas masters' programs, overseas PhD programs, research grants and patents. In addition, a simplified statistical model was developed in this work for both descriptive and comparative purposes on the selected existing datasets and arranged in tabular form (see Tables 2.1 – 2.5, and Figs.2.1 – 4.6) that represents the quantum populations. Certain variables that relate to the measure of impact conditions in the oil and Gas industry are equally reflected the narrations and in the linear model equations to ascertain the relationship between the actual data and the expected impacts under ideal situations. The first principle is that PTDF intervention impact assessment is a function of several other factors such as project time, project rate, fund's concentration rate, production time, the actions of beneficiaries, and the presence of monitoring and evaluation etc. Mathematically, the above is reduced to equation 2.1, thus: $P_{intv} = KPtPRBFCME$2.1 Where P_{intv} represents PTDF interventions, P_t represents

Project time, P_r represent project rate, F_c represents Fund concentration, B represents Beneficiaries actions, ME represents Monitoring and Evaluation, and K is a factor of constant representing government policy and politics etc. $P_{intv} = KPt \times PR \times B \times FC \times ME$2.2 Equation 2.2 is a geometric relationship that when linearized

yield: $\log P_{intv} = \log k + X_3 \log P_t + X_3 \log PR + X_3 \log B + X_3 \log FC + X_3 \log ME$2.3 The coefficients $X_3 + X_3$ and X_3 and the independent variables P_t , FR , MC , B are kept at the same cycle in the measured sample sizes. Both descriptive and analytical statistics are used for arithmetic mean, standard deviation, coefficient of correlations and assumed mean for the comparative data. Where, X = arithmetic mean, X_A is the assumed mean and D_1, D_2 are Deviations from each data point

The simplified equation below helps to illustrate the relationship between the Skills-Gap Audit (SGA) represented as the estimated values and the Secondary Data Sets (SDS) represented as the actual values on the Fund's intervention programmes. $X = X_A \sum_{i=1}^N \left(\frac{D_{1,2}}{N} \right)$2.4

Where the determination of the Project rate (P_r) is considered prime in the intervention schemes, equation 2.3 is rearranged for the actual and the estimated values thus:

$$a_1 = \frac{n \sum X_1 P_r - \sum X_1 \sum P_r}{n \sum X_2 P_r - \sum P_r} \dots\dots\dots 2.5$$

$$\frac{\sum P_r - a_1 \sum X_1}{n} \dots\dots\dots 2.6$$

The standard error of estimate of P_r then becomes:

$$SEOE = \sqrt{\frac{\sum (P_r - P_{rest})^2}{n}} \dots\dots\dots 2.7$$

Which when expanded to accommodate the unknown terms becomes:

$$SEOE = \left(\frac{\sum P_r^2 - a_0 \sum P_r - a_1 \sum x_1 P_r}{n} \right) \dots\dots\dots 2.8$$

The multiple variables of equation 2.2 could be modeled in a complex statistic advanced beyond the scope of this work using both the SGA and SDS respectively.

Equation 2.8 is useful to evaluate the standard error of estimate of project rate on every cycle which by implication is the standard error of estimate of project rate on project time per cycle since

$$SEOE \approx \sum (a_i x_i) \dots\dots\dots 2.9$$

It follows therefore that as x_i increases, a_i also increase.

In the same principle, the Coefficient of Correlation (COCOREL) becomes:

$$COCOREL = \frac{\sum (P_{rst} - P_r)^2}{\sum} \dots\dots\dots 2.10$$

This is also expanded to accommodate unknown terms thus:

$$COCOREL = a_0 \sum P_r + a_1 \sum x_i P_{r_{est}} t - \sum \dots\dots\dots 2.11$$

Table 2.0: Feedback & Analysis of PTDF Beneficiaries (2018 -2023), Skills Gap Audit Report

S/No.	PTDF HUMAN CAPITAL DEVELOPMENT (HCD) PROGRESSION	% COVERAGE
1	Underwater Welding	0.00%
2	Welding & Fabrication	8.70%
3	Advanced Underwater Welding	0.00%
4	Geosciences (Geophysics and Geology)	4.35%
5	Engineering Design/CAD	17.39%

6	Helicopter Underwater Safety	0.00%
7	Welders Training and Certification Programme	26.09%
8	BOSIET	0.00%
9	Occupational Health and Safety	0.00%
10	Train-The-Trainer Welding Certification Programme	4.35%
11	Instrumentation & Control Systems	0.00%
12	Facilities Engineering & Maintenance Management	0.00%
13	Marine Engineering & Operations	0.00%
14	M.Sc (OSS)	26.09%
15	Ph.D (OSS)	4.35%
16	M.Sc (LSS)	0.00%
17	Ph.D (LSS)	0.00%
18	ULSEP	8.70%
19	Logistics & Supply Chain	0.00%
20	Other Related Courses	0.00%

2.1: Algorithm for Evaluating Standard Deviation

Get the average corrosion rate
 Also get the deviation from average
 Subtract the average from deviation
 And square the value obtained
 The sum of average and divide by N
 **The square root of the value obtain is **
 The standard deviation computed

START

Get (CR,Nma,d); N: =5

$a = (\sum CR) / N$

$S2 = (a-d)^2$

Count = CR.

Get $(\sum CR) / N$ ** obtain value of a

Get $(a-d)^2$ ** obtain value of S2

While count = K + 1

Do until

Get $(a-d)^2 / N$

Then

Get (S.d) **Square root of S2 **

End

Data: a,d, S2, S.d.

End

Stop

RESULTS AND DISCUSSION:

3.1: RESULTS: Every raw data remains statistically deceptive, invalid, and non-informative until it is transformed by way of analysis to give reasons for making decision. The trend requires diligent and persistent effort, systematic thinking, and intelligence of established principles and standards in translating the raw data into useful results with which to do business. A proper and detailed systematic approach of data analysis is required, and the outcome clearly stated as shown in tables and figures of the expected results below:

3.1.1: Qualitative Data Analysis: Every data set is presented in three cycles to enable the frequency per counts matched with the basic assumptions in the simplified model equations, and to apply the principles of descriptive statistics and qualitative analysis. Table 3.1 represents vocational and skills-based training specifically designed to bridge the gaps in technical manpower in the Oil and Gas industry. A total of 7510 skills manpower had been trained per average of three cycles, with the distributions showing a combined training in capacity enhancement, industry-based training and welders training representing 75.5% of the total trained skills. The fractional representation is shown in the pie-charts, Fig3.1. Table 3.2 represents the number of intellectual property and patents registered from two streams of research and development intervention programmes namely, the professorial endowment and the grant research respectively. A total of seven patents are registered and the grant research represents 43% of the patent valuation while endowment has 53% distribution. Fundamental goals of the Fund’s upgrade intervention programme in the Nigerian Universities, and selected Departments with needed manpower for the oil and gas industry, includes the provision of modern infrastructural buildings and equipment for teaching -learning processes comparable to the standards obtainable in advanced economy globally. The upgrade intervention programme covers engineering, science, geoscience, information and communication technology and military science etc. Essentially, 52 upgrade centers, 146 ICT centers, and 2 centers of excellence, totaling 200 of the infrastructural intervention programmes, of the infrastructural interventions are analyzed in this work.

Table 3.1: Vocational and Skills-based training for the Oil and Gas Industry.

S/N.	AREA OF STUDY	NUMBER
1.	WELDERS TRAINING AND CERTIFICATION PROGRAMME	1,717
2.	ENGINEERING DESIGN TRAINING PROGRAM (EDTP/DETP)	1,664
3.	INDUSTRY BASED TRAINING FOR STAKEHOLDERS	1,975
4.	SPECIAL TRAINING & EDUCATION SCHEME - HELICOPTER PILOT	20
5.	INSTITUTIONAL CAPACITY ENHANCEMENT TRAINING PROGRAMME	1,978
6.	POST-AMNESTY CAPACITY BUILDING PROGRAMME	156
	TOTAL	7510

Under vocational training, (Table 3.1) above, 7510 trainees in six categories were trained and equipped for the Oil and Gas industry. It is further simplified into categories with 23% of the total representing the welders training programme. 22.2% representing engineering design programme, 26.3% is the fractional percentage, representing industry-based training, 0.3% accounted for special training, 26.3% representing institutional capacity enhancement training programme while 2.1% accounted for post amnesty capacity building programme. These essential training of the Fund affirm the mandate of training Nigerians as technicians and craftsmen for the Oil and Gas industry and conserving foreign exchange for Nigeria.

Table 3.2: Patents from Research and Development (Intellectual Intervention).

S/N.	RESEARCH/INSTITUTION	RESEARCH FOCUS	PATENT TITLE
1.	Ahmadu Bello University Zaria Prof A.S Ahmed	Potentials and Development of Zeolite Catalyst for Nigerian Oil and Gas Industry from Kankara Clay	Potentials and Development of Zeolite Catalysts from kaolin Using Novel Processing Method.

2.	University of Benin, Prof T.O.K Audu	Development of Sustainable Technology for Bioenergy from Non- Edible Oil Seeds	Development of Sustainable Technology Solar Photo-Voltaic Bio-Diesel Production from Non-Edible Oil Seeds
3.	University of Port Harcourt Prof Adewale Dosunmu	Database for Wellbore Stability Management in the Niger Delta	Development of Stress Detection Software on Database for Wellbore Stability Management in the Niger Delta
4.	University of Port Harcourt (IPS) Prof Micheal Onyekonwu	Control of Fine Migrations Reservoirs Using Nanoparticles	Control of Fine Migrations Using Aluminum Silicate Nanoparticles
5.	Delta State University Abraka Prof. Frank Oroka	Production of Fuel Briquettes and Biogas from Water Hyacinth Cow- Dung Mixture for Domestic and Industrial Application	Production of Fuel Briquettes and Biogas from Water Hyacinth Cow-Dung Mixture Domestic and Industrial Application
6.	University of Ibadan Prof. Sunday Isehunwa	Flow Assurance Studies of the Offshore Niger Delta Advance Thermodynamic	Petroleum Products Adulterate Meter
7.	Ahmadu Bello University Zaria Prof A.S. Ahmed	Potentials and Development of Zeolite Catalyst for Nigerian Oil and Gas Industry from Kankara Clay	Development of ZSM-5 Zeolite from Kaolinite at Low Pressure and Shorter Crystallization time Using Novel Processing

Table 3.2 represents an aspect of the intellectual intervention programme of the Fund and focuses on research and development patents. Seven patents have been registered and acquired as breakthrough in the funding of indigenous research for global impact in the oil and gas industry. These novel technologies and patents are products of extensive research activities of the PTDF, available for domestic utilization, commercialization, and deployment for industrial utilization.

3.1.2: Quantitative Data Analysis: Due to the nature of the secondary data gathered, tables and figures were used instead of mean and standard deviations as required in quantitative analysis. Accordingly, Table 3.3 represents Overseas Scholarship Programme for the MSc category, with a total of 4632 scholars from three cycles. The distribution of trained scholars in their various field of specialization is as shown in Fig 3.2 below.

Table 3.3: O.S.S. M.Sc. Scholarship (Intellectual interventions).

S/N.	AREA OF STUDY	NUMBER
1.	ENGINEERING	1,770
2.	GEOSCIENCES	348
3.	ENVIRONMENTAL	227
4.	ENERGY STUDIES	319
5.	INSTRUMENTAL ANALYTICAL/NANO SCIENCES	50
6.	INDUSTRY/OFFSHORE & OCEAN TECHNOLOGY	267
7.	GAS REFINING, MINERAL EXPLORATION AND PETROCHEMICAL	9
8.	CHEMISTRY AND PURE SCIENCE	183
9.	BIOLOGY/MICROBIOLOGY/ BIOTECHNOLOGY	104
10.	OCCUPATIONAL HEALTH AND SAFETY	132
11.	INFORMATION TECHNOLOGY/COMPUTING	314
12.	ELECTRICAL POWER & MECHATRONICS	20
13.	ASSET AND OPERATIONS MANAGEMENT	47

14.	ECONOMICS (PETROLEUM, ENERGY, OIL & GAS)	18
15.	ACCOUNTING/FINANCE	555
16.	LAW AND POLICY	65
17.	SUPPLY CHAIN MANAGEMENT	93
18.	OTHERS (General Studies)	111

Table. 3.4: Comparative Analysis between Skills Gap Audit and Secondary Data Set (%)

S/No.	SGA1	SDS2	D1	D2
1	8.70	22.86	-3.3	-0.14
2	4.35	6.98	-7.65	-16.02
3	17.39	22.16	5.39	-0.84
4	26.09	26.29	14.09	3.29
5	4.35	26.33	-7.65	3.33
6	26.09	67.56	14.09	44.56
7	4.35	32.44	-7.65	9.44
8	8.70	8.70	-3.3	-14.30
Σ	$100.02/8 = 12$	$187.16/8 = 23$	$4.02/8 = 0.5$	$29.32/8 = 0.4$

The level of comparison between the data sets used for analysis in this work with reference to the Skills Gap Audit report (2018 -2023) as presented in Table 2.1 is further subjected to simple arithmetic mean and deviation using the assumed mean method of the unclassified data. The assumed mean equals the arithmetic mean of the data plus the mean of the deviation from the assumed mean (Ngaage, 1999).

3.2: DISCUSSIONS: Although the Nigerian Content Act came into effect in 2010, the Petroleum Technology Development Fund had been involved in capacity development programmes from 2000. Thus, the aggregate data for this work reflects its years of contribution to local content development through capacity development activities enshrined in its core mandate. The variation in the actual interventions at the M.Sc level and the projected figures based on the simplified linear model is also shown in Fig.3.4. From the trends in figure 3.4, the engineering family has the highest peak because the oil and gas industry are driven by high technical manpower needs from the engineering family, the management and accounting family is the second highest because human resources is needed to manage materials and all the equipment for operation. The geoscience family is the next in rank, especially because most of the operations of the geoscience family are concentrated at the upstream sector of the value chain. Very interesting distributions in this plot are the growing demand for health and safety as well as the need to care for and preserve the environment. These two areas of human capacity building need to be scaled up as the world prepares for energy transition and divestment from the fossil fuel era under the Petroleum Industry Act (PIA). The irregular distributions and the expected projections are seen in Fig. 3.4 using the simplified statistical model from the fundamental assumptions in equation 2.1 – 2.11 above.

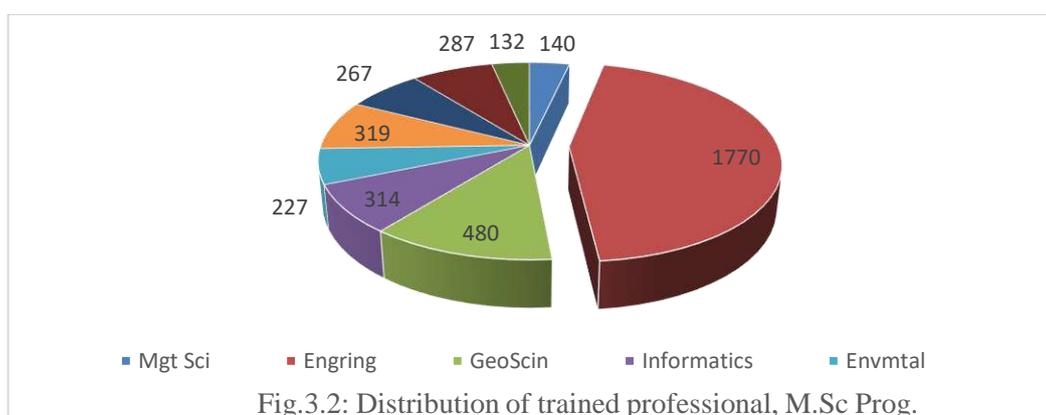


Fig.3.2: Distribution of trained professional, M.Sc Prog.

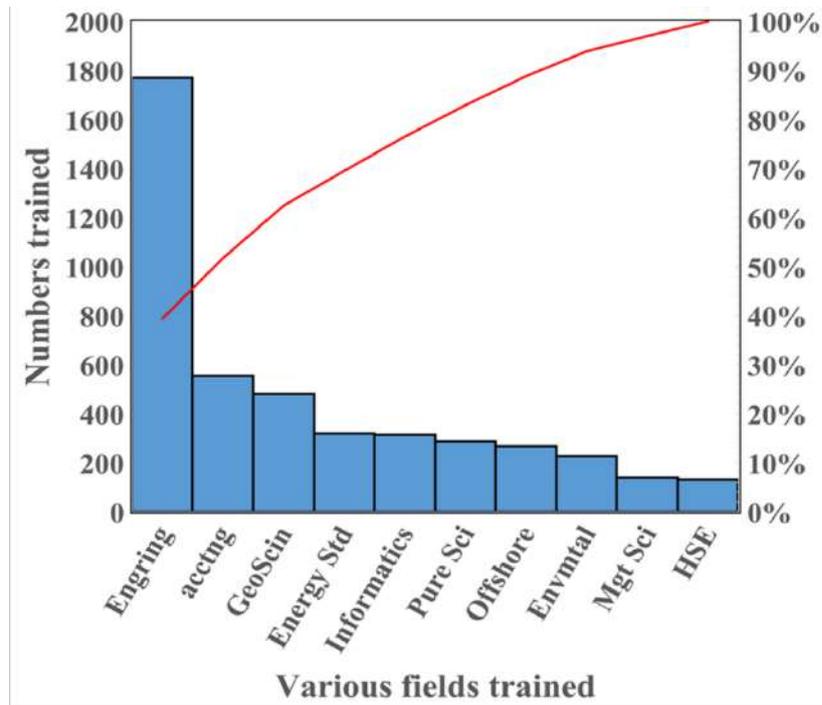


Fig. 3.3: Capacity Gaps in Percentage from the M.Sc Programme.

Fig. 3.4 represents the simplified statistical model, which is stochastic and defines the actual value (657), the earned value (1770) and the projected value (2225) for the engineering family of scholars using the M.Sc programme base data. The plot predicts the optimum manpower needs, all things being equal. The orange line shows the gradual progression from the estimated skills gap audit reports, benchmarking on the highest (engineering) and the lowest (Health and Safety) figures. For the manpower need to be at 100%, it is projected that in 2021, all professions identified in this study should have at least 600 scholars trained and documented. In the distribution, accounting scholars grow a little above 550 followed by the geosciences with about 500 while Health and Safety is about 135 respectively. The gaps indicated that there are needs for more human capital development in the various fields sampled for this analysis. The dynamics of the industry requires the growing need for human capital, and that is the core mandate of the PTDF. Figure 4.5 is a correlational plot of the SGA and SDS with 46.5% of the total human capacity development of the Fund., Interestingly, the research component has seven (7) patents registered that could re-produce spinoff for the Fund. This is relatively comparable to the skills-gap audit report which estimated 56.59% to vocational training programme and 39.14% to the intellectual intervention programme. The skills-gap audit did not account for research and development indices in the computation of the intellectual intervention neither were the undergraduate scholarship programme included in the overall estimate. These two components added to the estimate under the current research increased the intellectual intervention percentage to 52.3% and reduce the vocational intervention percentage to 46.5% as shown in the Pie-chart above.

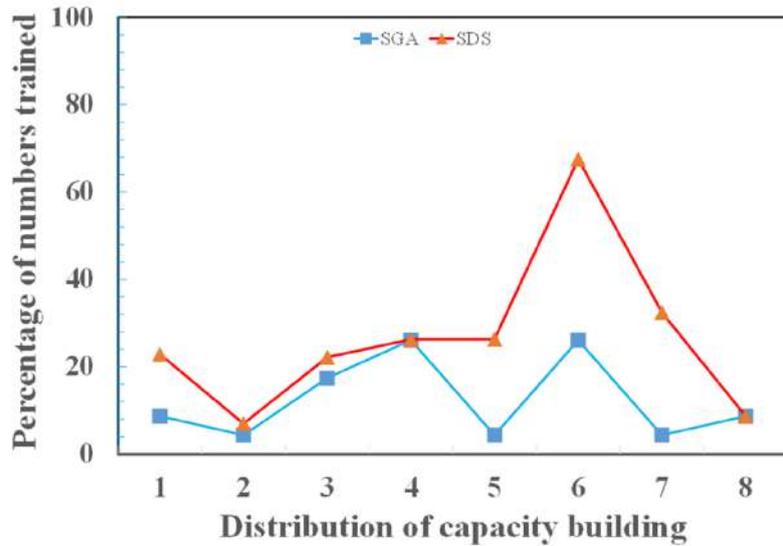


Fig. 3.4: Correlational plots of SGA and SDS on OSS, M Sc programme.

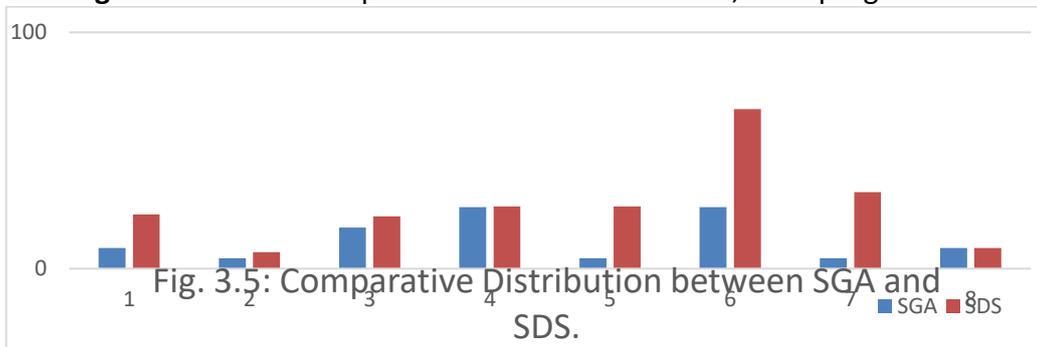


Fig. 3.5: Comparative Distribution between SGA and SDS.

4. Conclusions and Recommendations:

4.1: Conclusions: From the simplified statistical models developed, and the secondary data analyzed, there are strong indicators that the Petroleum Technology Development Fund's consistent capacity development intervention programmes have significantly impacted the Oil and Gas industry in Nigeria through: Producing tremendous pools of infrastructural, intellectual, and human capital developments needed for impactful operations in the oil and gas industry; More infrastructural and skills-based interventions structured on research and innovations for the energy industry in the era of the Petroleum Industry Act and global energy transition; Developing computational variables in equations 2.1 – 2.11 that could be used as strong indicators in PTFD opportunities to strategically pursue aggressive collaborations with relevant stakeholders to foster sustainable local content policy in Nigeria; Enhance the culture of public private partnership in the implementation of capacity development initiatives from the various streams of intervention programmes, for sustainable local content policy in Nigeria; Leverage on comprehensive skills-gap audit in future capacity development strategy, with emphasis on key indicators in the determinant matrix such as infrastructure, research, technology, and innovation components for a long-term development plan.

4.2: Recommendations: Flowing from the systematic data analysis carried out, it is recommended that: The petroleum Technology Development Fund should be empowered through the policy of government to sustain the various capacity development programmes through expanded frontiers in the extant law as a FUND. Petroleum Technology Development Fund should adopt strong public-private-partnership policy in mainstreaming the next phases of capacity development programmes for visible revenue generation and sustainable development. There is need for strong advocacy on policy shift and amendment to the core mandate of the Fund to accommodate investment-divestment strategy through commercialization of developed technologies and innovations of the various intervention programmes. Petroleum Technology Development Fund should engage in strategic manpower aggregation of the past and present beneficiaries of the various intervention programmes and develop strong database for sustainable local content partnership trade-off for alternative revenue generation. Petroleum Technology Development Fund should sustain regular evaluation of the various capacity development programmes by leveraging on comprehensive industry-based skills gap audit that would input comprehensive success determinant indicators on need assessment of the oil and gas industry. The Petroleum Technology

Development Fund should deepen the participation in renewable energy development to accommodate the global energy transition and sustainable local content development in that sector.

REFERENCES: Aliyu Gusau (2022): Capacity Building Mandate, Functions and Achievements: A presentation at the Ministry of Petroleum Resources, Block D, NNPC Towers, Abuja, March 2022. \ James U. Monday (2018): Local Content Policy, Human Capital Development and Sustainable Business Performance in the Nigerian Oil and Gas Industry. Journal of Management and Sustainability, Vol.5 No.1. Kunekebari, T. Ngaage (2007): Essentials of Descriptive Statistics for Business Decisions. Horizon Concept publishers, Ikwerre Road, Port Harcourt. Pp. 58 – 62. Nwosu, H.U; Nwachukwu, I.U; Ogaji, S.T and Robert S.O (2006): Local harnessing in the crude oil and natural gas in Nigeria. Applied Energy 83, 1274 – 1287. Ozigbo, N.C (2018): Technological Capacity Building in the Nigeria’s oil and gas industry. Proceedings of the 19th Annual International Information Management Association, San Diego, CA, 13 – 15 October, 51 – 63. Ozim, I. O (2010): Analysis of the Nigerian Oil and Gas Industry Content Act 2010. Aalex Newsletter, Lagos, 1- 6. ScienceDirect, (2009): Available online@ www.ScienceDirect/sustainable local content policy/researchgate.net/publication. Accessed April 10th 2022. Shumway, H.F (1988): Applied Statistics: Time Series Analysis. Practice Hall, Eaglewood, Cliffs, New Jersey, P.46. Uwem, U; Mary, U and Olusola, O (2020): Local Content Development in the oil and gas industry in Nigeria: Problems and Prospects. Retrieved from Global Journal of Politics and Law Research: [https:// www. Eajournals.org/wp-content/upload/oil- and -gas-industry-Nigeria-1.pdf](https://www.Eajournals.org/wp-content/upload/oil-and-gas-industry-Nigeria-1.pdf).

Laboratory Investigation of The Effect of Nanomaterials on The Asphalt Pavement Performance

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Abstract— Rutting is one of the most common problems that occurred on asphalt pavements. This research focuses on the application of using nanomaterials to enhance the performance of the hot mix asphalt (HMA). In this research two nanomaterials are used to modify the asphalt binder. Both nanomaterials are locally produced and they are available in the market. Nanoclay (NC) and Nanosilica (NS) are the modifiers used. NC and NS were added to the bitumen as modifiers with different percentages of the bitumen weight. Optimum contents of both nanomaterials were selected based on the results of a series of conventional bitumen tests. Pure bitumen (without additives) was used in the production of the control mix. Bitumen modified with NC or NS was used to produce the modified mixes. The control mix was designed according to Marshall Method. Pure bitumen was replaced by modified bitumen in the case of modified mixes. All mixes were tested using Hamburg Wheel Track Tester. The results show that the stability increased dramatically. Also, the modified mixes gave higher resistance to the rutting. The rut depth decreased by 15.56 %, and 67.41% in the case of using NC and NS as modifiers respectively.

Index Terms: Hot Mix Asphalt, Nanomaterials, Stability, Rutting

1. INTRODUCTION: Nanotechnology is relatively a new branch of science that is interested in small-scale materials and science. It has many applications in all branches of science. HMA production is one of the branches that give great

concern to applying nanomaterials to it. Researchers employ nanomaterials to take advantage of its properties in improving the characteristics and the performance of asphalt pavement to give higher performance and great resistance to aging, weather conditions, and high traffic loads. Last decade, Nano-silica has served as a promising material for designing and preparing new functional materials because of its high surface area and stability [1], [2]. Nano-Silica can improve the anti-aging performance, and fatigue cracking of the asphalt binder and pavements [3], [4]. Sarsam illustrated that when 1% to 2% silica fume is added to asphalt cement, penetration decreases, ductility reduced, softening point increases, elastic strain recovery increases, and also temperature susceptibility increases [5]. Rutting, in other words (permanent deformation), is an accumulation of depression over the long term. This depression is caused along the wheel path in the asphalt pavement [6]. Wheel track testers (WTT) express the rutting performance of asphalt mixtures by applying a repeated load until failure to a test specimen. WTT relates the rutting performance to the number of load repetitions before failure. Rut depth is usually measured utilizing a displacement-measuring device (Oliver and Tredrea 1998) [7]. However, this type of tester is not available in most asphalt material laboratories. In addition, it is difficult to conduct a wheel track test for ordinary mix design. Oliver and Tredrea (1998) [8], found that the Strategic Highway Research Program (SHRP) parameter ($G^*/\sin\delta$) had a good correlation with WTT results for unmodified binders rather than polymer-modified binders. If the subgrade and granular layers are compacted well and have proper strength, rutting is caused by the permanent deformation of the asphalt courses, especially the upper layers. This deformation of the asphalt concrete layers is caused by the viscoelastic behavior of the bituminous binder, the low shear strength of the asphalt mixture, or a combination of both. If the HMA has a proper enough shear strength, it is expected that rutting will happen after a long time. On the other hand, if the shear strength of the asphalt mixture is low, rutting will take place within a short time after construction. In general, increasing the shear strength of the mixture and/or using modified binders can enhance the rutting resistance of asphalt mixes. The shear strength can be increased by choosing an aggregate gradation that causes the particle to particle contact or by using a stiffer binder (Nikolaides 2000) [9]. Many researchers concluded that using polymer-modified bitumen is the best solution to improve the rutting resistance of flexible pavements. Generally, polymer-modified bitumen could prevent severe rutting for up to seven years. At low temperatures and high frequencies (short loading time), bitumen behaves as an elastic solid. While, at high temperature and low frequency, it acts like a viscous fluid and results in an irrecoverable strain. Between the two extremes, bitumen's behavior is visco-elastic, The material doesn't recover completely, but still, there is a small permanent deformation. Modified polymers are used to enhance this visco-elastic performance. Some polymers are used to increase the stiffness, so the total visco-elastic reaction is reduced (Atkins 1996) [10]. If the aggregates have poor quality, the rutting resistance can be increased using a suitable amount of stiff binder. For high-quality aggregate, the binder role has a low effect, but at the same time, the higher asphalt binder content of the stiffer binder leads to some reduction in strain. Higher stiffer binder content causes the accumulated strain to be decreased and shows the helpful contribution of the bitumen (Brown and Gibb 1996) [11]. The rutting resistance test is performed according to the procedures of AASHTO T 324[12].

2. Research Objectives: To overcome the distresses that occurred in the asphalt pavements due to the heavy traffic loads, aging of the asphalt pavements, weathering conditions, and other factors, it becomes necessary to produce modified asphalt mixtures that can resist these problems. The objectives of this experimental work are divided into two main objectives. The first objective is to study bitumen modification by two different nanomaterials NS and NC. The second objective is to produce modified HMA, then judge the performance of modified HMA. Each objective is divided into some stages as illustrated below.

Stages of the first objective: Characterizing the base asphalt binder (virgin bitumen) by using some conventional experimental tests. Characterizing both nanomaterials by Scanning Electron Microscope (SEM), X-Ray Diffraction (XRD), and Transmission Electron Microscope (TEM). Selecting a proper method to blend nanomaterials inside the bitumen under the appropriate conditions of mixing time, mixing temperature, and rotating speed of the used mixer. Adding different amounts of NS and NC (3, 5, and 7)% as modifiers. Selecting the optimum Nanomaterials Content (ONMC), for both nanomaterials.

Stages of the second objective: Design a control mix by the Marshall method. From that obtain the Optimum Asphalt Content (OAC). Using the same asphalt content to produce modified HMA by replacing the virgin bitumen with

modified bitumens. Evaluate the improvements in modified HMA compared to the control mix. Investigate the improvements in the resistance to permanent deformation (rutting resistance).

3. Materials:

A: Modifiers: In this research, NC and NS were the modifiers used to enhance asphalt performance. Both modifiers were added to the bitumen. Both materials are available in the local market. The high efficiency of both nanomaterials in modification of asphalt binder properties. They can enhance the properties of the bitumen. These improvements appear in the performance of the asphalt pavements. The high efficiency of their performance as modifiers is the main reason for selecting them in this research. The availability of the source and the ease to get them were some of the main reasons to select them as asphalt binder modifiers. For the physical properties, both nanomaterials are in powder form. NS has a white color, while NC has a grey color. The shape of particles has a spherical form for both. The degree of purity in NS is higher than in NC. NS purity is 99.8%, on the other hand, NC purity is 92%. For the chemical composition, the predominant chemical compound for the chemical composition is SiO₂. NC contains a high content of MgO. Table I is a list of the main chemical compounds of NS and NC.

TABLE I: CHEMICAL COMPOSITION

Chemical compound	NC (%)	NS
SiO ₂	46.3	99.8
MgO	40.2	0
Al ₂ O ₃	5.5	0
Impurities	8	0.2

For NC, the size of NC's particles is almost less than 6 nm. Both nanomaterials are located in the Nano-scale zone according to ASTM E2456-06[13]. Despite this, the particles were found to cluster and form batches up to 150 nm. Adding NC up to 5% in asphalt binder decreases the penetration value and increased the softening point [14]. Helal et al. found that softening point increases as increasing the Nano-Clay percentage up to 3%, but at higher than this percentage, binder properties were affected by an adverse effect[15]. Clay mostly consists of alumina–silicates, which have a layered structure, and consist of silica SiO₂ tetrahedron bonded to alumina Al₂O₃ octahedron in various ways[16]. Jahromi et al., 2012, utilized NC as a modifier to e bitumen with 54°C softening point and 243°C flashpoints. They found that NC can increment the stiffness and aging resistance of the asphalt binder. Physical properties for bitumen were improved when using small content of NC. Results appeared that NC modification can enhance the rutting resistance of bitumen in terms of the rutting parameter ($G^*/\sin\delta$). NC can also decrease fatigue within the low to medium temperature ranges[17]. NC is commonly used in the modification of bitumen to get significant enhancement in rheological, thermal, and mechanical properties. Montmorillonite (MMT) is one of the most widely used, MMT has a 2:1 layered structure with two silica tetrahedrons sandwiching an alumina octahedron[18]. For NS, NS used in this research is also manufactured and prepared at Bani Sweif University by the Faculty of science it consists mainly of 99.8% of SiO₂ and a negligible quantity of impurities as mentioned in table (II). Fig (1) presents an SEM image of NC. Fig (2) shows the XRD pattern of NC. A TEM image of NS is presented in fig (3). Fig (4) indicates the XRD pattern of NS.

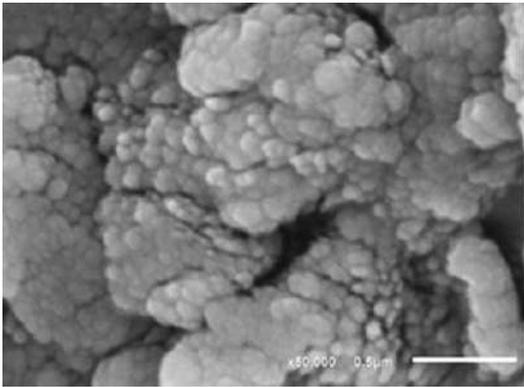


Figure (1) NC under SEM

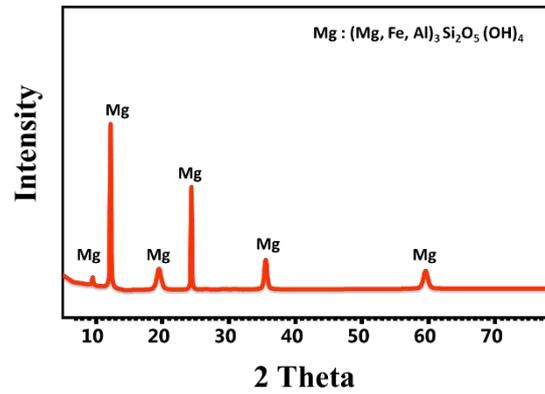


Figure (2) XRD pattern of NC

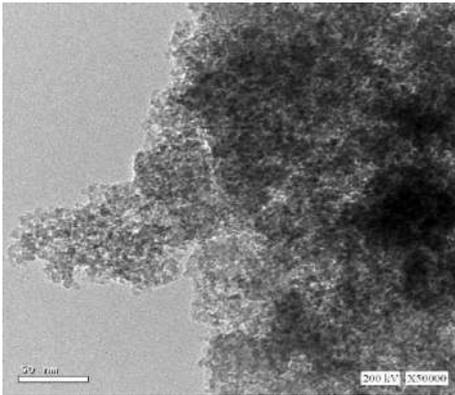
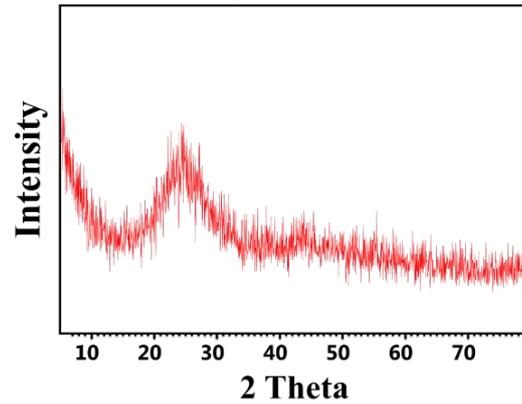


Figure (3)

Figure pattern



TEM image of NS

(4) NS XRD

B. Asphalt cement: Bitumen 60/70 is the asphalt binder used in this research. This bitumen is one of the products of El-Nasr Petroleum Company. table I is a list of bitumen properties. Bitumen properties are listed in table (II).

Table II: Bitumen properties

Test	value	ASTM
Penetration (0.1mm)	54	D5 [19]
Softening point (°C)	42.5	D36 [20]
RV @ 135 C (cP)	345.67	D4402 [21]
RV @ 165 C (cP)	75	
Flashpoint (°C)	250	D92 [22]
Firepoint (°C)	268	

C. Aggregates: Aggregates (coarse and fine) are completely produced by crushers, supplied from (Attaqa) crushers (Suez). Aggregates used are: Coarse Aggregate number 1 (CA1). Coarse Aggregate number 2 (CA2). Coarse Aggregate number 3 (CA3). Crushed sand (CS). Mineral filler (MF). The aggregates gradations are listed in table (III)

TABLE III: GRADATION OF AGGREGATES

SIEVES	CA1	CA2	CA3	CS	MF
1"	100	100	100	100	100
¾"	100	100	83.7	100	100
3/8"	100	5.5	0.3	100	100
#4	15.3	0.2	0	99.2	100
#8	0.6	0	0	81.2	100
#30	0	0	0	39.2	100
#50	0	0	0	25.8	98
#100	0	0	0	11.4	92.1
#200	0	0	0	3.7	70.3

D. Experimental Work: A program of experimental work is designed to evaluate the rutting resistance of modified HMA

The flowchart of the program is presented in figure (5).

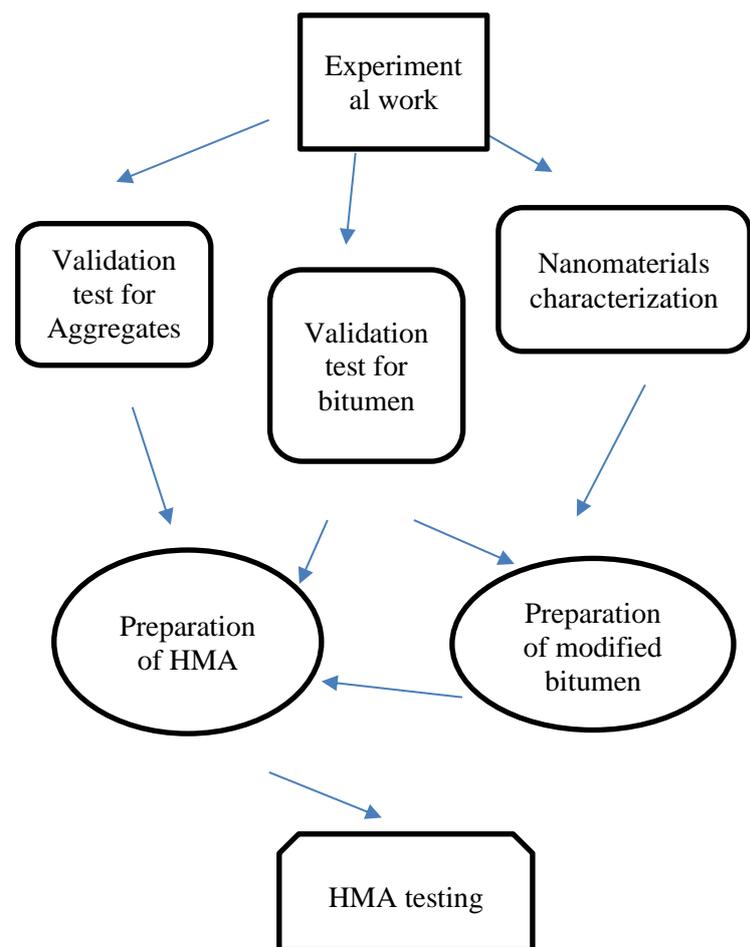


Fig (5): Experimental work flowchart.

5. Results and discussion: A. Validation tests of bitumen: A comparative study is performed to compare the behavior of modified bitumen samples with virgin fresh samples to evaluate changes in behavior. Tests are performed to measure and illustrate the rheological and physical properties of bitumen. The conventional tests performed on bitumen are penetration test, softening point test, flashpoint, fire point test, and rotational viscosity tests at 135°C and 165°C. Validation tests and their results are mentioned in [23].

B. Preparation of the modified bitumen: Both nanomaterials are added to the bitumen with percentages of 3%, 5%, and 7% of the bitumen weight. Bitumen and nanomaterials are mixed using a mechanical mixer. NS and NC are added gradually to the heated bitumen up to 145°C. A mechanical mixer with the following properties is used to mix NS or NC with the bitumen. After mixing the nanomaterials with bitumen SEM images are taken to ensure that the modifiers are homogeneously distributed within the bitumen. The mixing conditions are mentioned briefly in table (IV).

TABLE IV: MIXING PROCESS

Mixer type	Mechanical mixer
Mixing speed	2200 rpm
Mixing temperature	145± 5 °C
Mixing period	60 Minutes

The nanomaterials are completely added continuously for the first 30 minutes. The second 30 minutes is only for mixing the nanomaterials to ensure that the nanomaterials are completely distributed within the bitumen.

C. Aggregates properties: Samples were extracted from the stockpiles of aggregates that were used in some projects in the new capital. Aggregates were produced by crushers in Attaqa Mountain in Suez. These projects were constructed by Orascom Company. The coarse aggregate properties are listed in table (V).

TABLE V: COARSE AGGREGATE PROPERTIES

Test	CA1	CA2	CA3	
Abrasion (%)	20	19.7	13.7	
Gsb	2.5	2.53	2.67	
Absorption (%)	1.8	2	1.09	
Disintegration (%)	0.18	0.2	0.15	

The gradations of CA1, CA2, and CA3 are listed in table (VI)

TABLE VI: GRADATIONS OF THE COARSE AGGREGATES USED

Sieve size (mm)	CA1	CA2	CA3
25.4	100	100	100
19	100	100	83.7
9.51	100	35.5	0.3
4.76	15.3	0.2	0
2.38	0.6	0	0
0.595	0	0	0
0.297	0	0	0
0.149	0	0	0
0.074	0	0	0

The gradations of crushed sand (CS) and the mineral filler (MF) are listed in table (VII)

TABLE VII: GRADATIONS OF THE COARSE AGGREGATES USED

Sieve size (mm)	C.S	M.F
25.4	100	100
19	100	100
9.51	100	100
4.76	99.2	100
2.38	81.2	100
0.595	39.2	100
0.297	25.8	98
0.149	11.4	92.1
0.074	3.7	70.3

Both CS and MF are not plastic (Plasticity Index (PI) = 0). A blend of the aforementioned aggregates is calculated to match the gradation (4C). The job mix formula is calculated and presented in tables (VIII).

TABLE VIII: GRADATIONS OF THE BLEND (JMF)

Sieve size (mm)	Gradation of the blend (JMF)
25.4	100
19	98.7
9.51	47.6
4.76	52
2.38	41.6
0.595	22.6
0.297	16.5
0.149	9.7
0.074	5.2

D. Samples preparation: W. Oda et al., [23] studied the behavior of the modified bitumen with NS and NC. The physical and rheological properties were evaluated to find the optimum content for each modifier. The optimum contents were 3% and 5% for NC and NS respectively. In this research, three groups of HMA plates are prepared with the OAC (5.2%), as designed

in [23]. In the first group, the used asphalt binder is the virgin bitumen without any modifiers. The second group is produced by using modified HMA by NS. The modified HMA has the same contents as the control plate, but the only difference between them is the bitumen used. The bitumen used in the second group is modified by 5%NS. The third group is modified by 3%NC. The three groups are tested to evaluate the effect of bitumen modification on rutting resistance. The Hamburg wheel tracker is the machine used to perform that test. The dimensions of the HMA plates after compaction are 30.5*30.5*5.3 cm.



Fig (6): wheel tracking specimen (HMA plate)



Mix (B)



Fig (7): Preparing specimens for testing



Mix (C)

Fig (8): Deformation occurred in HMA plates

The three mixes (control mix, 5% NS modified mix, and 3% NC modified mix) are prepared and molded into standard plates as shown in Fig (6) to fig (8).



Mix (A)

The permanent deformation of the specimens exposed to the modifiers is shown in Table (IX), and Fig. (8). MIX A is the control MIX, it is prepared from the control HMA specimen. MIX B refers to the 5% NS modified HMA. And MIX C refers to 3%NC modified HMA. The HMA plates are subjected to 10,000 load cycles under a standard wheel load at the standard rate of loading, rate of passing, and standard temperature. A relationship is plotted between the number of loading cycles and the deformation in millimeter units.

TABLE IX: RUTTING IN THE THREE SPECIMENS

Property	Mix A	Mix B	Mix C
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Rut depth (mm)	2.7	0.88	2.28
Reduction in deformation (%)	0	- 67.41	-15.56

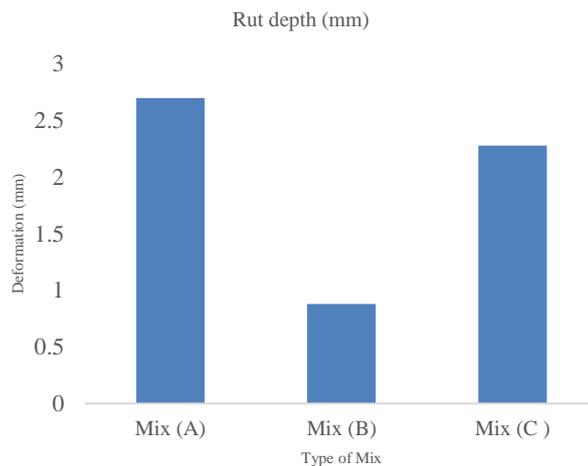


Fig (9): Deformation after 1000 load cycles
Reduction in deformation values (%)

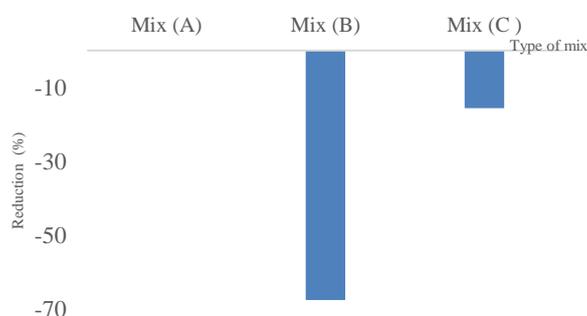


Fig (10): Reduction in deformation

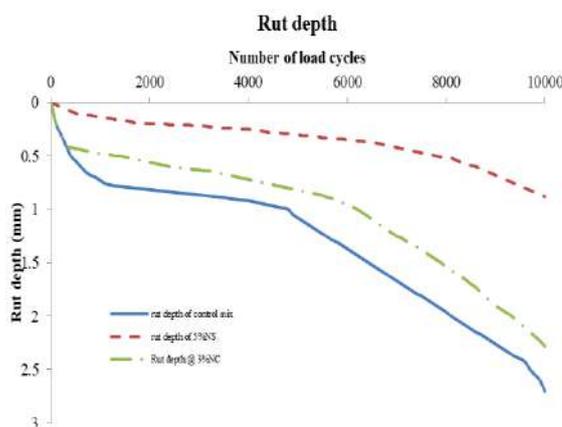


Fig (11): Performance o asphalt mixes under the wheel loading

As shown in table (IX) and fig (8) to (11), using NC as a bitumen modifier leads to a reduction in permanent deformation by 15.56%. the mixes modified with NS by 5% of the bitumen weight show improvement in the resistance to permanent deformation (rutting) after 10000 load cycles in the Hamburg wheel tracker by 67.41%. **E. Conclusion and Recommendations:** In this research, two nanomaterials are used to modify bitumen. The two nanomaterials are NS and NC which are locally produced. Both nanomaterials are added to the virgin bitumen in percentages of the weight of bitumen. The percentages selected based on the previous studies were 3%, 5%, and 7%. The results of the conventional tests that are performed showed great significant improvements in the properties of bitumen. The modified asphalt mixtures are

produced by using modified bitumen instead of virgin bitumen. Modified HMA shows good indications of distress resistance. The conclusions are mentioned and summarized in the following points: • Modified HMAs introduce higher values of stability (MQ (stiffness modulus), and IDT) than the control mix. These results are expected due to using stiffer bitumen in the modified mixtures. The results also express that the modified HMA mixtures have higher load resistance. The modified HMA can withstand heavy traffic loads higher than the control HMA. The modified HMA also has a higher resistance to fatigue cracking and thermal cracking. • As predicted from the results of the modified bitumen, the desired pavements have higher strength and higher resistance to different deformations. The wheel tracking test gave results that agree with the expected behavior of the modified HMA. The modified HMA gave lower rut depth than the control mix which means higher resistance to permanent deformations. That means that the modified HMAs have higher resistance to permanent deformations than the control HMA. • Improving the rutting resistance has significant benefits on road safety and the cost of repair. • It is recommended to redesign the modified mixtures to evaluate the effect of bitumen modification on the amount of OAC. It is expected that the OAC in the case of modified mix may be less than the OAC of virgin bitumens. • Evaluate the modified bitumen by using both nanomaterials together in the same bitumen samples. • Investigate the performance grade of the bitumen (virgin and modified) by using BBR and RTFO. • Develop a suitable method and appropriate technique for mixing modifiers with bitumen inside the asphalt mixing plant. • Discuss the life-cycle cost to investigate the economic benefits of asphalt modification by the different modifiers.

REFERENCES: [1] L. P. Singh, S. R. Karade, S. K. Bhattacharyya, M. M. Yousuf, and S. Ahalawat, "Beneficial role of nanosilica in cement-based materials - A review," *Constr. Build. Mater.*, vol. 47, pp. 1069–1077, 2013, doi: 10.1016/j.conbuildmat.2013.05.052. [2] M. H. Zhang and J. Islam, "Use of nano-silica to reduce setting time and increase early strength of concretes with high volumes of fly ash or slag," *Constr. Build. Mater.*, vol. 29, pp. 573–580, 2012, doi: 10.1016/j.conbuildmat.2011.11.013. [3] O. M. M. Ahmed W. Oda, Ahmed El-Desouky, Hassan Mahdy, "Effects of Asphalt Modification with Nanomaterials on Fresh and Stored Bitumen," *Int. J. Archit. Environ. Eng.*, vol. 16, no. 3, pp. 85–90, 2022. [Online]. Available: <https://publications.waset.org/10012462/effects-of-asphalt-modification-with-nanomaterials-on-fresh-and-stored-bitumen> [4] J. Yang and S. Tighe, "A Review of Advances of Nanotechnology in Asphalt Mixtures," *Procedia Soc. Behav. Sci.*, vol. 96, no. Cictp, pp. 1269–1276, 2013, doi: 10.1016/j.sbspro.2013.08.144. [5] S. I. Sarsam, "Impact of nanomaterials on rheological and physical properties of asphalt cement," *Int. J. Adv. Mater. Res.*, vol. 1, no. 1, pp. 8–14, 2015. [6] R. L. L. F. Gu, Y. Zhang, C.V. Drodody, R. Luo, "Development of a new mechanistic empirical rutting model for unbound granular material," *J. Mater. Civ. Eng.*, vol. 25, no. 8, 2016, doi: 1943- 5533.0001555. [7] W. S. Stuart, K.D. and Mogawer, "Validation of Asphalt Binder and Mixture Tests that Predict Rutting Susceptibility Using the FHWA ALF," *Asph. Paving Technol. J. Assoc. Asph. Paving Technol.*, vol. 66, pp. 109–143, 1997. [8] P.. Oliver, J.W.H. and Tredrea, "Relationships between Asphalt Rut Resistance and Binder Rheological Properties," *Asph. Paving Technol. J. Assoc. Asph. Paving Technol.*, vol. 67, pp. 623–643, 1998. [9] M. F. Haque, Standard test procedure, no. May. Ramna, Dhaka, Bangladesh: Roads and Highways Department, Bangladesh Road Research Laboratory, 2001. [Online]. Available: www.rhdbangladesh.org [10] Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates (C 136-01), vol. 04.03. WestConshohocken, 2001. [11] BS 812-103, "Methods for Determination of Particle Size Distribution," *Br. Stand. Inst.*, no. August, p. 12, 1985. [12] American Society for Testing and Materials, "Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine," vol. i, pp. 1–5, 2014, doi: 10.1520/C0131. [13] ASTM E2456-06(2020), Standard Terminology Relating to Nanotechnology. West Conshohocken, PA: ASTM International. doi: 10.1520/E2456-06R20. [14] ASTM D 2456-06 (2012): Standard Terminology Relating to Nanotechnology. West Conshohocken, PA: ASTM International, 2012. [15] H. Ezzat, S. El-Badawy, A. Gabr, E. S. I. Zaki, and T. Breakah, "Evaluation of Asphalt Binders Modified with Nanoclay and Nanosilica," *Procedia Eng.*, vol. 143, no. Ictg, pp. 1260–1267, 2016, doi: 10.1016/j.proeng.2016.06.119. [16] S. G. Jahromi and A. Khodaii, "Effects of nanoclay on rheological properties of bitumen binder," *Constr. Build. Mater.*, vol. 23, no. 8, pp. 2894–2904, 2009, doi: 10.1016/j.conbuildmat.2009.02.027. [17] C. K. Ganapathi Malarvizhi, Sabermathi R, "Laboratory study on nano clay modified asphalt pavement t," *Int. J. Appl. Eng. Res.*, vol. 10, no. JANUARY 2015, pp. 20175–20190, 2016. [18] Z. You et al., "Nanoclay-modified asphalt materials: Preparation and characterization," *Constr. Build. Mater.*, vol. 25, no. 2, pp. 1072–1078, 2011, doi: 10.1016/j.conbuildmat.2010.06.070. [19] ASTM D5/D5M – 13, Standard Test Method for Penetration of Bituminous Materials, vol. i. West Conshohocken, PA

19428-2959: ASTM International, 2013. doi: 10.1520/D0005-13.2. [20] ASTM D 36 – 95, Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)1, vol. 04.04, no. d. West Conshohocken: ASTM Committee, 2006. doi: 10.1520/D0061-75R10.2. [21] ASTM D4402 / D4402M-15 (2015): Standard Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer. West Conshohocken, PA: ASTM International, 2015. [22] ASTM D 92 - 12B, Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester, no. March. West Conshohocken, PA 19428-2959: ASTM International, 2013. doi: 10.1520/D0092-12B. [23] and O. M. M. Ahmed W. Oda Ahmed El-Desouky, Hassan Mahdy, "Effects of asphalt modification by Nanosilica and Nanoclay on asphalt binder and hot mix asphalt properties," in Conference Series: Materials Science and Engineering., 2020, p. 012003.

Efficient Random Number Generator Based on Genetic Optimization

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Abstract: In this paper, an efficient random number generator is proposed using genetic optimization with the help of a pseudo essential random number generator. The random numbers are taken from various cryptographic systems ensuring the confidentiality and the integrity of data exchanged over insecure public channels. With online transaction processing and e-commerce constantly on the rise, cryptography has become imperative in protecting private data. Genetic algorithms are a method of optimizing algorithms which can be used to answer many problems through modeling a basic type of genetic procedures. The proposed technique for random number generation is based on Genetic algorithms which attempt to mimic the process of biological evolution to find good solution. The results extracted have been used to generate superior randomness properties. The randomness of the numbers generated has been assessed based on The National Institute of Standards and Technology (NIST) tests, namely: the frequency test, frequency test within a block, the runs test, the cumulative sums test, the serial test, the matrix rank test, and the non-overlapping template matching test. The random numbers generated by the proposed method have successfully passed the above tests. We present a comparison between the proposed RNG and PRNG using autocorrelation test to show that the proposed RNG outperforms the PRNG. Keywords: Network security, random number generator, genetic optimization.

I. INTRODUCTION: Different applications require the generation of high-quality random number sequences, such as Cryptography and image processing [1]. Cryptography aims at keeping messages safe: a private message, sent via physical media in form of electromagnetic waves or electrical signals, must be read only by the recipient it's addressed to. The degree of security of the message depends on the cipher and the key used for encoding. Therefore, it is of major importance to have complex ciphers and keys to prevent unauthorized persons from breaking the confidentiality of the message by simply guessing the encoding parameters [2][3]. In the optimal case, the cipher must guarantee a broad space in which the key is selected, and the probability to choose a specific key must be uniformly distributed between all possible values. The latter requirement is often achieved by selecting the key using randomly generated numbers. Ideally, a random number generator (RNG) provides unbiased and unpredictable data; hence its output is completely independent from previously generated numbers sequences [4]. Various methods of selecting and testing random number generators, such as the types used in many cryptographic applications, like those used to generate key material, are discussed by this paper. The yield of generators used in sensitive work like cryptography typically more stringent safety requirements than those used for other applications mainly because the outputs must be predictable without knowledge of the inputs. This study also outlines statistical tests for randomness as recommended by The National Institute of Standards and Technology (NIST) for detecting deviations of a binary sequence from randomness. The caveat testers must be aware of is that apparent deviations from randomness primarily under two conditions: a poorly designed generator or anomalies happening in the binary sequence tested [4][5]. We introduce a new random number generator using genetic optimization and we show by using The National Institute of Standards and Technology (NIST) tests, namely, the frequency test, frequency test within a block, the runs test, the cumulative sums test, the serial test, the matrix rank test, the non-overlapping template matching test that the new random number generator is a success. We present a comparison between pseudo random number generator (PRNG) and the proposed generator algorithm using the correlation coefficient to show that the proposed algorithm outperforms the

PRNG. The paper is organized as follows: In Section 2 and 3, a literature survey about statistical testing and Genetic optimization is introduced. Section 4 proposes the new random number generated by using genetic optimization and illustrates the success of the algorithm. In Section 5, we describe the pseudorandom number generator to show that the new random number generator proposed in Section 4 has better performance. An autocorrelation Test will be used in Section 4 to test the randomness of the new random number generator. We propose the new random number generated by using genetic optimization and a comparison with the PRNG to show that our algorithm is better. Finally, section 6 concludes the paper.

II. STATISTICAL TESTING - A simple hypothesis testing is formulated. The sequence under testing is either random or deterministic. The corresponding hypotheses are referred to as null hypothesis (H_0) and alternative hypothesis (H_a) respectively. For each applied test, a decision is made to choose among the two competing hypotheses. [4] [5]. To create an unbiased test, a test statistic value is calculated by utilizing the sequence being tested. Such a statistic can represent many variable values based on the assumption of randomness. We determine a theoretical reference distribution of this statistic under the null hypothesis using mathematical methods. Then this reference distribution allows a critical value to be determined (typically, this value is residing in the tails of the distribution, say out at the 99 % point) and this statistic value is compared to the critical value. The null hypothesis for randomness is rejected if the test statistic value exceeds the critical value, but if the test statistic value fails to reach the critical value, the null hypothesis (the randomness hypothesis) is proved. We now define some parameters related to the hypothesis testing. Let α be the probability that the test chooses H_a when H_0 is true. Sometimes even a "good" generator can produce sequences with non-random properties. The most recognized value of α in cryptography is about 0.01. An α of 0.01 indicates that one would expect one rejected sequence in a test of one hundred sequences. A P-value ≥ 0.01 would mean that the sequence would be considered to be random with 99% certainty. A P-value < 0.01 would mean that the sequence is non-random with a certainty of 99%. For the examples in this paper, α value has been chosen to be 0.01. The P-value is commonly known as the "tail probability" and works in conjunction with the proposition that the test statistic selected will assume values that are equal to or less than the recognized test statistic value when considering the null hypothesis. Testing is a necessity and this researcher has therefore selected the NIST Test Suite, an array of statistical tests developed to test the randomness of binary sequences produced by either hardware or software based cryptographic random. These tests fit the criteria needed to focus on a plethora of different categories of non-randomness that could exist in a sequence. The following describes these tests: [5], [6]

1. The Frequency (Monobit) Test: This test focuses on the ratio between ones and zeros for the entire sequence. The idea of the test is to determine whether the number of ones is close to the number of zeros in the sequence under test. The number of ones and zeros should be approximately the same in a truly random sequence. The test assesses the fraction of the numbers of ones and how close it is to $\frac{1}{2}$. This should result in the fraction of the number of zeros being close to $\frac{1}{2}$ as well. Passing this test is mandatory prior to embarking on subsequent tests.

2. Frequency Test within a Block: This test is similar to the frequency test, but it is done on numbers of M-bit block. The purpose of the test is to measure the frequency of ones in a given M-bit block and determine if that number is close to $M/2$. The same is for the number of zeros. If this is met, the assumption of randomness will be validated.

3. The Runs Test: The run test is defined as an uninterrupted sequence of identical bits. In this test the total number of runs is determined in the sequence. For example, a run of length k would consist of exactly k identical bits. The boundary of the run would be of bits of the opposite value. The test would measure the number of runs of various lengths of ones and zeros and verify if the lengths are as expected for a random sequence. The test would give an identical if the rate of change between such zeros and ones is too fast or too slow.

4. The Binary Matrix Rank Test: This test has two primary focuses. First, testing the hierarchy of disjoint sub-matrices for the complete sequence, and secondly, to determine if there is linear dependence between fixed length substrings of the original sequence.

5. The Non-overlapping Template Matching Test: This test looks for non-periodic patterns and checks if the number of occurrences of such patterns is acceptable. This is done by calculating the number of occurrences of target strings.

This test and the Overlapping Template Matching test are performed as follows; an m-bit window is used to search for an m-bit pattern in the pattern n. then there are two possible outcomes: if an m-bit pattern is not found the window slides one bit position but if the pattern is found, the window is reset to the bit following the found pattern, and the search resumes.

6. The Serial Test: The test calculates the frequency of all possible overlapping m-bit patterns occurrence sequences under test. It also determines whether the randomness of the sequence is truly identifying the number of occurrences of the 2m-bit overlapping patterns. In general, random sequences

have been uniformly defined as sequences where every m-bit pattern where has an equal chance of recurring. 7. The Cumulative Sums (Cusums) Test: First let's examine elements of a random sequence. The digressions of the random walk should be near zero. In some types of non-random sequences, the digressions of this random walk from zero will be huge. [5] [6] The maximal digression (from zero) of the random walk, as defined by the cumulative sum of adjusted (-1, +1) digits in the sequence, is the purpose of the test, while focus is to determine whether the cumulative sum of the partial sequences occurring in the tested sequence is too large or too small relative to the predicted behavior of that cumulative sum for random sequences. This cumulative sum may be considered as a random walk.

III. GENETIC OPTIMIZATION - Charles Darwin's survival of the fittest theory forms the basis of Genetic Algorithms which are heuristic search procedures [6] [7]. From a theoretical point of view these algorithms aim to imitate the randomness of nature, and subsequently attempt to emulate nature to a high degree. To achieve this GAs create a population wherein the attribute which is contemporary, also having a higher fitness value that can be replicated more, as is found in nature. This is the primary concept of evolution, which is why these algorithms are called evolutionary algorithms [8]. In order to avoid local optima in improving search [8]. Genetic algorithms are widely used. These algorithms try to imitate the process of biological evolution development to find better solutions. [8]. Better solutions are constantly being researched to enhance the end result but, to date, the best single solution found is always part of the population, with each generation will also including a full array of other possible outcomes. In a perfect world, some solutions will be nearly as good in the objective function as the best and all will be feasible. In reality not all solutions are ideal. New solutions are formed when pairs of individuals are combined from the database. Local optima occur infrequently as this combining process does not typically achieve the best current solution. Genetic Algorithms Operators: The three constantly factors in Genetic algorithms are reproduction, crossover and mutation [8], [9], [10], with the majority of each algorithm's power coming from reproduction and crossover. 1. Reproduction Operator: Chromosomes from the initial population are selected and entered into the mating procedure to achieve reproduction, much like a Roulette Wheel spins and the ball lands on black or red. 2. Crossover Operator: In order to determine the probability of producing a new chromosome from the parents a Crossover Rate (0 to 1) is employed. For example, the strings 10000101 to 11111111 could be crossed over after the third locus in each to produce the two offspring 10011111 to 11100101. The crossover operator, for the purpose of this study, attempts to mirror the process of biological recombination between two single chromosomes organisms. 3. Mutation Operator: A Mutation Operator randomly changes its genetic makeup by flipping some of the bits in a chromosome. For example, the string 10000101 might be mutated in its second position to yield 01000101. There is a very small probability that mutation will occur at each bit position in a string.

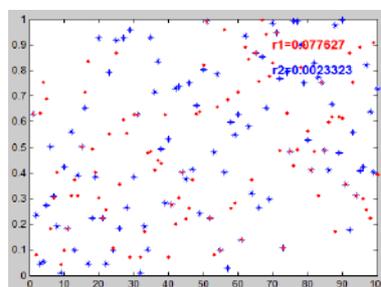
IV. RANDOM NUMBER GENERATOR USING GENETIC OPTIMIZATION - For cryptographic purposes, the output of RNGs must be unpredictable. The process of generating the random number from the Genetic Population has the following steps: Step 1: A population having p individuals are randomly generated using PRNG. These individuals represent an initial starting feasible solution. Step 2: Divide the generated string or population into two equal parts. Step 3: Perform the crossover operation on the selected string to ensure a high level of randomness in the key. Step 4: Swap the bits of the string after the crossover operation again to permute the bit values (mutation). Step 5: The same process from step2 to step4 is iterated n times so we will have a new n sample. Step 6: Calculate Correlation Coefficient (CC) of each sample. Step 7: Select CC nearest to zero. Step 8: Calculate fitness value =1/CC. Step 9: Choose sample with highest fitness value. In the proposed method, GA will be used in the random number generation process which can be applied to different systems. Good examples of this include: randomly generated keys like the type used in universal cryptosystems, and the aggregation of cryptographic protocols such as auxiliary quantities used in generating digital signatures or for generating tests or challenges in verification protocol, all of which demand random inputs in a variety of places throughout the process. In Table 1, we present the results of applying The National Institute of Standards and Technology (NIST) tests for last algorithm using MATLAB simulations. We present the random number generated by using genetic algorithm and PRNG. We applied the frequency test, frequency test within a block, the runs test, the cumulative sums test, the serial test, the matrix rank test, the non-overlapping template matching test [4], [5]. The output of these tests is the so-called p-value, which is a random variable whose distribution converges to the uniform distribution in the interval [0,1]. For a significance level $\alpha = 0.01$, the average P-value ≥ 0.01 implies that the sequence is considered random with a confidence of 99%. Thus, the generated random numbers by the proposed methods have successfully passed the above tests with an average success rate of 99%.

Random Number Generation Test	P-value	Result
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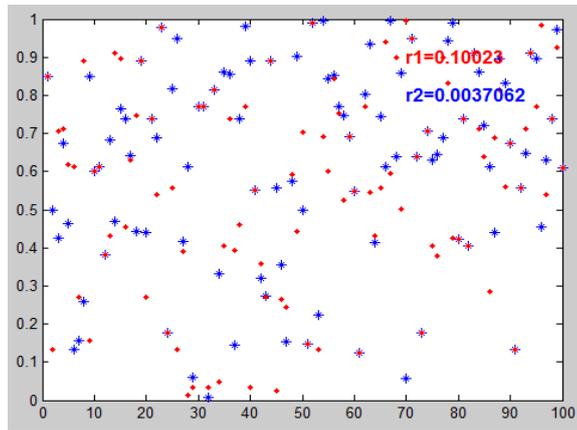
Frequency (Monobit) Test	0.6892	Success
Frequency Test within a Block	0.4042	Success
The Runs Test	0.1555	Success
The Cumulative Sums (Cusums) Test	0.3108	Success
The Serial Test	0.0261 0.0980	Success Success
The Matrix Rank Test	0.2316	Success
The Non-overlapping Template Matching Test	0.9564	Success

Table 1. Results Of Randomness Tests for The Proposed RNG

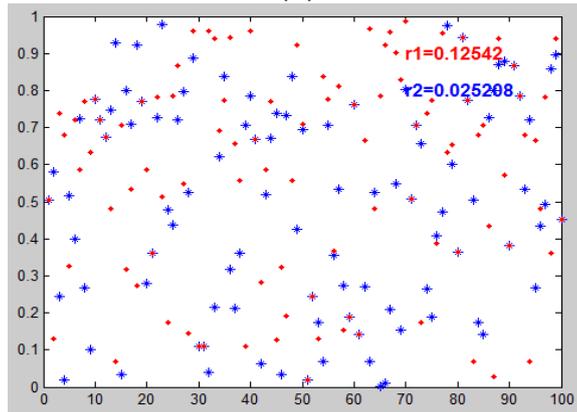
V. COMPARISON BETWEEN THE PROPOSED RNG AND PRNG USING AUTOCORRELATION TEST - This section presents a comparison between the proposed RNG and PRNG using autocorrelation test to show that the proposed RNG is better. The quality of generated random number using GA is good in terms of autocorrelation test and non-repeated which yields a better secured cipher and harder to break. We now present the PRNG algorithm and some of the associated difficulties. 1. Pseudorandom Number Generator - An algorithm exists to create for sequence of numbers that mimic random numbers and is called a pseudorandom number generator (PRNG), also known as a deterministic random bit generator (DRBG) [11]. Although the sequence is not truly random since the set of initial values that completely determine it is relatively small set called the PRNG's state, which do include a truly random seed. Pseudorandom numbers are central in applications such as simulations, in cryptography, and in procedural generation, where their speed in number generation and their reproducibility render them invaluable. Cryptographic applications also require the output to be unpredictable, with more elaborate designs, which do not inherit the linearity of simpler solutions. Periodicity: A seed state is used in starting a PRNG from a discretionary starting point.[11]. It is noteworthy to mention that said PRNG always produces the same sequence after being initialized with that state. The definition of a period of a PRNG is the maximum overall starting states of the length of the repetition free prefix of the sequence. The period is bounded by the size of the state, measured in bits. At the end of their period PRNGs will repeat their results. 1. Problems with Deterministic Generators - In practice, the output from many common PRNGs exhibits artifacts which cause them to fail statistical pattern detection tests [12], [13]. Defects exhibited by flawed PRNGs range from unnoticeable to very obvious. These include: 1- Periods for some seed states fall behind expectations 2- Abundant quantities of generated numbers don't meet uniformity of distribution. 3- Interconnection of successive values. 4-The output sequence contains below standard dimensional distribution. 5- The distances between where certain values occur in PRNGs aren't distributed the same as those in a random sequence distribution. 3. Autocorrelation Test - In statistics, the Pearson product-moment correlation coefficient [14] is a measure of the linear autocorrelation (dependence) between two variables X and Y, giving a value between +1 and -1 inclusive, where 1 is total positive correlation, 0 is no correlation, and -1 is negative correlation. It is widely used in the sciences as a measure of the degree of linear dependence between two variables. It was developed by Karl Pearson from a related idea introduced by Francis Galton in the 1880s [14].



(a)

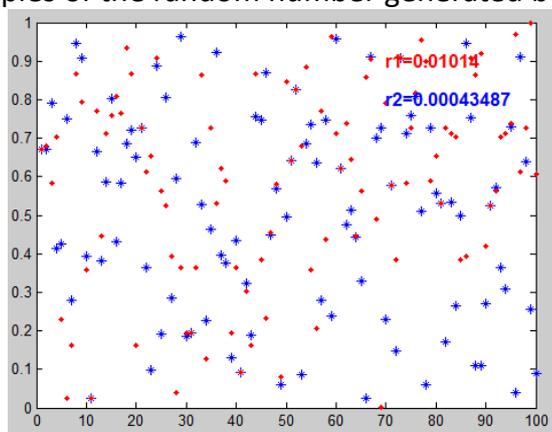


(b)

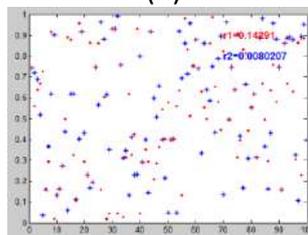


(c)

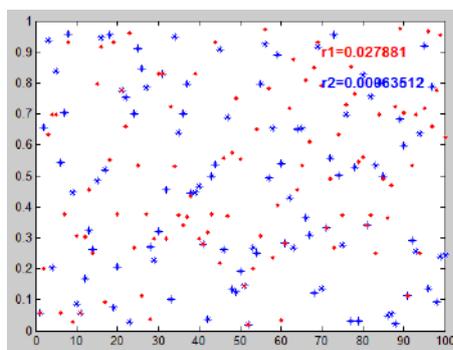
Fig 2: (a, b, c, d, e, f) represent a samples of the random number generated by using genetic algorithm and PRNG



(d)



(e)



(f)

In Figure 2, we present the results of the last algorithm using MATLAB simulations. We present the random number generated by using genetic algorithm and PRNG. In Table 2, we present the results of applying autocorrelation test for PRNG and the proposed generator algorithm using MATLAB simulations. The results of comparison between the proposed RNG and PRNG using autocorrelation test show that the proposed generator is better because the linear autocorrelation is smaller and near to zero with large dropping value. As result, we succeed in making the Correlation Coefficient of the random number generated by genetic algorithm less than the generated by PRNG, indicating the superiority of the proposed algorithm.

Iteration no	Autocorrelation Test for PRNG	Autocorrelation Test for the Proposed Generator
1	0.077626	0.0023323
2	0.10023	0.0037062
3	0.12542	0.025208
4	0.01014	0.00043487
5	0.14291	0.0080207
6	0.027881	0.00063512

Table 2: A comparison between the proposed RNG and PRNG using autocorrelation test

CONCLUSION-This paper introduces a new random number generator based on the basis of genetic optimization with PRNG. We produce very high-quality random bit streams. The randomness of the numbers generated has been assessed based on The National Institute of Standards and Technology (NIST) tests, namely, the frequency test, frequency test within a block, the runs test, the cumulative sums test, the serial test, the matrix rank test, the non-overlapping template matching test. The random numbers generated by the proposed methods have successfully passed the above tests with an average rate of 99%. We present a comparison between the proposed RNG and PRNG using autocorrelation test to show that the proposed RNG outperforms the PRNG. The results obtained are good in terms of coefficient of autocorrelation.

REFERENCES - [1] Douglas, R. Stinson, "Cryptography - Theory and Practice", CRC Press, 1995 [2] Menzes A. J., Paul, C., Van Dorscht, V., Anstine, S. A., "Handbook of Applied Cryptography", CRS press 5th Printing; 2001. [3] Parasitism C, Prada J "Evaluation of Performance Characteristics of Cryptosystem Using Text Files", Journal of Theoretical and Applied Information Technology, Jatit, 2008 [4] A Statistical Test Suite for Random and Pseudorandom Number Generators for Cryptographic Applications, National Institute of Standards and Technology (NIST) Special Publication 800-22, Rev.1a, Apr. 2010. [5] Fabio Pareschi, Riccardo Rovatti, and GianlucaSetti, "On Statistical Tests for Randomness Included in the NIST SP800-22 Test Suite and Based on the Binomial Distribution" IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY, VOL. 7, NO. 2 APRIL 2012. [6] Ronald L. Rardin "optimization in operation research" [7] FarhatUllah Khan, SurbhiBhatia "A NOVEL APPROACH TO GENETIC ALGORITHM BASED CRYPTOGRAPHY" International Journal of Research in Computer Science eISSN 2249-8265 Volume 2 Issue 3 (2012) pp. 7-10 [8] Harsh Bhasin, Surbhi Bhatia, "Use of Genetic Algorithms for Finding Roots of Algebraic Equations", IJCSIT, Volume 2, Issue 4, Pages 1693-1696 [9] Harsh Bhasin, Supreet Singh, "GA-Correlation Based Rule Generation for Expert Systems" ,IJCSIT, Volume 3, Issue 2, Pages 3733-3736 [10] Harsh Bhasin, Surbhi Bhatia "Application of Genetic Algorithms in Machine learning", IJCSIT, Volume 2, Issue 5, Pages 2412-2415 [11] http://csrc.nist.gov/publications/nistpubs/800-57/sp800-57_part1_rev3_general.pdf [12] Press, William H., et al. (1992) Numerical Recipes in Fortran 77: The Art of Scientific Computing (2nd ed.). ISBN 0-521- 43064-X. [13] Dr. Werner Schindler "Functionality Classes and Evaluation Methodology for Deterministic Random Number Generators", Federal Office for

Information Security [14] J. L. Rodgers and W. A. Nicewander, "Thirteen ways to look at the correlation coefficient. "The American Statistician, 42(1):59–66, February 1988.

Finite Element Analysis and Topology Optimization of Package Sealer Jaw Chassis of Autonomous Packaging Machine that Can Operate According to Continuous Motion Logic



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Abstract: Today, after the global Covid-19 epidemic, which affects the whole world, the need to reach hygienic and sealed packaged food products has gained importance and the packaging machinery sector has become a very important sector for the sectors that produce in all product types. Especially with the increasing population and increasing product variety, the need for packaged products has increased day by day and this has required manufacturers to produce more packaged products per unit time. In order to fill more packages with product in a unit of time and make the package ready, packaging machines also need to operate at faster performance values. As a solution to this situation, it has been proposed to develop a double capacity machine structure by developing minimal designs of all mechanical and mechatronic systems, unlike traditional packaging machines. In packaging machines, after the package is filled with the product, the jaw mechanism which ensures that the package film mouths, which are usually made of thermoplastic material, are sealed and joined making the package fully closed and sealed, is in constant motion. The jaw mechanism within the scope of the study performs the package sealing function by opening and closing 200 times per minute, and the jaw chassis carrying the jaw mechanism is exposed to the same series of movements. Therefore, the design of the relevant jaw chassis component should be as light as possible so that no additional load is placed on the motors that provide the movement, while its strength should be high since it carries the entire load from the jaw plates to the motors. In order to solve this problem, a structural optimization solution called topology optimization, which regulates the distribution of the elements in the design volume within the framework of the determined constraints, is used. Thanks to this study, the interaction of the special machine jaw chassis which has a laterally "narrow" structure, created with a special design study, with the movable connecting rod mechanism system, which acts as a drive mechanism that provides high-speed sealing process specially designed for small-sized packages, was taken into account, and with the topology optimization study carried out, it has been determined that the new solid model, which continues to provide sufficient strength when exposed to a force of 5000 N, provides a weight gain of 11%. With this study, the suitability of topology optimization was verified by an analysis program using the finite element method and set an example for structural optimization solutions of all mechatronic component designs of the packaging industry in the future.

Keywords: topology optimization, packaging machine, jaw design, finite element method, connecting rod mechanism, rigid

dynamic analysis

1. Introduction: We need packages to protect food quality, nutritional values, taste, appearance and texture, to provide hygiene, to meet storage, logistics, distribution, retail, information and advertising needs. In particular, food packaging processes must ensure that food packages achieve the highest possible quality for consumers. When the size of the domestic and foreign markets of the packaging machines that make the packaging process is investigated, it is seen that it is 38.95 billion dollars on a global basis and that many foreign companies on a global basis have a large share in the market and in the sector [1]. Within the scope of the packaging sector, the flexible food packaging sector is growing day by day, the cost pressure is increasing, the processes must be safe, reliable and ready for automation, the requirements related to the increase of flexibility and optimization studies are expected to meet, and the concepts of packaging-Industry 4.0 are emerging. Especially after the global Covid-19 epidemic, which affects the whole world today, the need to reach hygienic and sealed packaged food products has gained importance and the packaging machinery sector has become a very important sector for the sectors that produce in all product types. Uncovering the packaging machinery and know-how to be exported internationally has become a strategic priority. When the general structures of packaging machines are examined, it is seen that the chassis and packaging flow process are in horizontal, vertical and similar axes, and the types of packaging machines are named according to this axial orientation (for example, mattress packaging machine). In addition, the manufacturability of package types can be adjusted horizontally, vertically, etc. of the machines. It is also related to the case of being in machine types. The packaging machine that will be included in the scope of the study is used to produce packs that can form the small package type and to bring the "form, fill and seal" function in general and to pack particles or multiple objects. At the beginning of the packaging operation, the package film is pulled over a forming collar (mold, forming collar, shoulder) and then after all necessary processes (pack forming, package edge cutting and sealing, product filling, package mouth (top) sealing, package transfer, classification) and cartoning) a fully sealed protective package full of product is created. While all the relevant operational stages are very important, the milestones of the packaging process are the development of package sealing systems [2]. When the most important criteria regarding the packaging processes in the packaging industry are examined, it is seen that there are criteria such as the number of packages per unit time (hence the jaw welding/sealing speed), the package sealing (indirectly the package welding/sealing quality) and the area occupied by the packaging machine. Traditional vertical packaging machines contain a single sealing jaw intermittently and can perform packaging operations at low capacity and quality due to this mechanical limitation. In the state of the art, more than one packaging machine investment is made in order to increase the packaging capacity in a food factory and to obtain more packaged products per unit time. In particular, improved sealing jaw systems, etc., of capacity increase. It has been seen that it can be done with systems to a very limited extent and it has been determined that two separate machines must be purchased to double the capacity. In this case, the cost of purchasing more than one machine (purchasing, maintenance, spare parts, control operator costs, etc.) is incurred and more packaging line space has to be allocated. The motto of "double capacity in one machine" has been revealed as a result of the idea of creating a product with the capacity of two machines with a single machine cost by occupying less lateral area. In order to bring this idea to life, a special sealing jaw with double capacity was designed instead of the traditional package sealing jaw [3]. The demand for the special jaw to perform package sealing operations with the increase in capacity has revealed the need for this system to have a rigid, light and optimized motion system and to include a jaw frame component. In this study, the design process of this component, which consists of aluminium material, in accordance with the demand for the special jaw to perform package sealing operations with the increase in capacity has revealed the need for this system to have a rigid, light and optimized motion system and to include a jaw frame component. operating conditions of the system, is explained in order to reduce the weight of the package adhesive jaw chassis of the packaging machine. Topology optimization was applied to create the lightest jaw chassis design suitable for system operating conditions. Structural analysis verification of the optimized model was also done with the help of Solid works Simulation program with Finite Element Analysis method.

2. Topology Optimization: Numerous structural design alternatives are needed to create design configurations that meet various performance indicators such as strength, weight and cost. Therefore, in the design phase, structural optimization methods are important in order to create designs with the lowest mass but maximum strength performance according to the determined boundary conditions [4]. According to the types of design variables to define the designed geometry, these methods are classified as size, shape or topology optimization methods. The objective function and constraints should be expressed as functions that can be defined in terms of design variables. Structural optimization techniques change the size

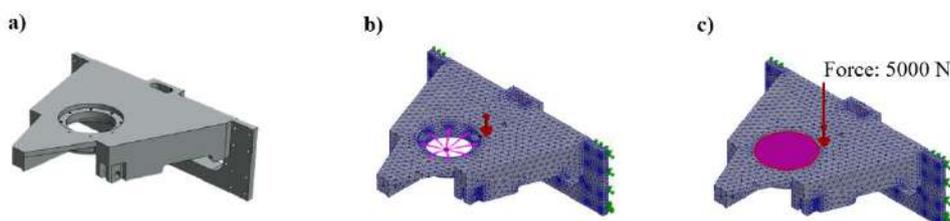
shape and topology of the design depending on the boundary conditions and constraints to which the design is subject, until the structure is optimal. Two different methods, the homogenization method and the density method, are used in topology optimization to determine the distribution of elements. The most general method used to solve this problem is to use continuous variables ranging from 0 to 1 instead of the integer variables determined for the volumetric density value ρ , and to introduce some limitations (penalization) to direct the results to the values 0 and 1. After this process, the optimization problem in a given design space evolves into a dimensioning problem expressed as a function of the strength matrix and material density. This material model used to perform the topology optimization is called SIMP (Solid Isotropic Material with Penalization) [5]. Here \tilde{K} is the penalized stiffness matrix of the element, 'K' is the real stiffness matrix of the element, ' ρ ' is the density and 'p' is the penalty coefficient and it always takes the values $K > 1$

$$\tilde{K}(\rho) = \rho^p K \quad (1)$$

In summary, the topology optimization problem is formulated as the maximization of stiffness depending on a mass constraint. Topology optimization is used in various applications in the automotive industry. For example; used topology optimization to improve the structural performance of a rear suspension subframe [6]. Within the scope of the study, this structural optimization method will be used in a special chassis.

3. Topological Optimization of Pack Sealer Jaw Chassis - Contrary to traditional packaging systems, product-filled packages with increased capacity can be produced with the special jaw system, which will be examined in terms of operation. The related new system should realize much more than the amount of packaged product that two traditional vertical packaging machines will produce on a unit time basis, with specially placed components in a single machine and with a unique design by occupying much less space. Thus, within the scope of the study, impermeable, durable and hygienic packages with a package film structure that flows easily on the system without wrinkling and deformation will be obtained with rapidly lightened, durable and rigid mechatronic component designs. At this point, the design of the chassis that carries the jaw components, which serve as package sealing, is very important at this point. Since it will carry the drive motors, jaw structures, resistances, jaw shafts and all similar components on the relevant carrier chassis, it must meet the strength conditions. However, the lower the weight of the chassis, the less load will be placed on the motors that move in the +Y axis direction during the sealing process, and it will be possible to select motors with lower capacity and lower cost. The relevant chassis must be designed to withstand a force of 5000 N. Topology optimization has been used to design the lightest package sealer jaw chassis that meets the required strength requirements. Solid works Simulation program special modules are used for topology optimization and related finite element modeling. Analyzes were performed in a single step and results for static analysis are listed. In addition, the topological optimization of the model was carried out with 50% mass reduction and the best stiffness and weight ratio condition. In order to represent the motor and similar loads carried by the relevant chassis, a force of 5000 N was applied to the entire surface in the '-Y' direction and the part chassis table was fixed on the left and right flange surfaces. Figure 1 shows the initial design volume, unloading zones and nodes.

Fig. 1:



Determination of Topology Optimization Boundary Conditions, A) The First Design Showing the Design Volume, B) Unloading Desired and Undesired Areas, C) Boundary Conditions for Jaw Frame Structural Analysis

In the topology optimization study of the package sealing jaw carrier chassis component, the areas where unloading is desired as the design variable, the stress value of 195.00 MPa, which is determined to be safely less at the yield stress of the 5000 series aluminum alloy, as the constraint, and the optimization purpose is determined as weight reduction. Aluminum material parameters to be used as constraints in topology optimization are given in Table 1. In order to take into account the manufacturability of the model to be optimized, when performing topology optimizations, since the part is symmetrical with respect to the xy plane, the fact that it is symmetrical with respect to this plane has been added as a manufacturing

constraint.

TABLE I: Mechanical Properties of 5000 Series Aluminum Alloy

Elastic Modulus (GPa)	Poison Ration	Yield Strength (MPa)
70	0.33	195

4. Results and Discussion: Static analysis and topological optimization were performed for the full (not emptied) state of the package sealer jaw chassis component coded in the system as AY-00172935. The analysis results made according to the operating conditions required by the system, the place where the force is applied and the reference value taken, were compared with the static tension value of this part in the packaging machine system and the yield strength value for the part material. As a result of the static analysis performed to observe the deformation of this part, it was determined that the maximum stress value of 23.575 MPa was lower than the yield strength of 195 MPa. In this case, this part has been observed to be safe. In addition, thanks to the topology optimization, a revised design of the model was made by applying a mass reduction with a similar strength value. The element density distributions according to the topology optimization results are shown in Figure 2.

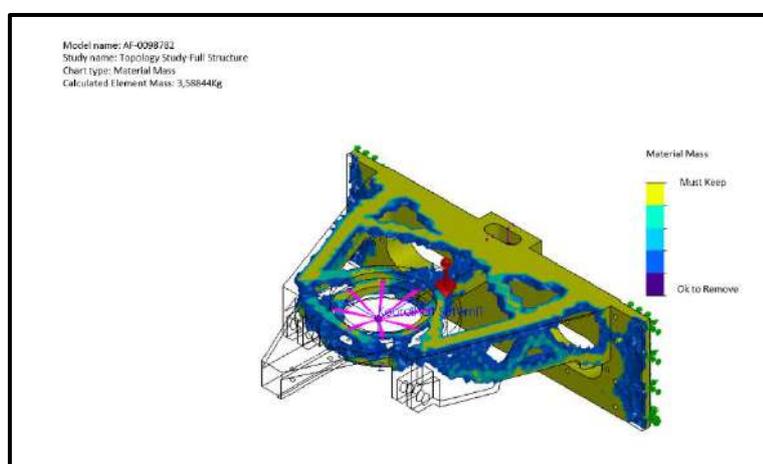


Fig. 2: Topology optimization result the areas shown in yellow show the areas that should not be emptied (Must Keep), while the areas in blue colour and close tones show the areas that should be emptied (OK to Remove). An iterative approach was used to reach this design image with general lines. Based on the topology optimization element density distribution map the design lines were determined for the chassis and the new model is shown in comparison with the initial model in Figure 3. This new model has slots in the form of triangular geometry especially in the chassis end areas and trapezoidal geometry slots in the chassis upper surface areas. Although the weight of this part is theoretically reduced to 3.59 KG, according to the approximately 50% mass reduction condition, it will be higher in the final model due to stiffness and similar static structure limitations.



Fig. 3: Design model comparison before and after topology optimization a) initial model b) new model for the revised model. Static analysis was performed again to observe the deformation of this part. As a result of this analysis, it was determined

that the calculated maximum stress value of 24.550 MPa was lower than the yield strength of 195 MPa. In this case, it has been observed that the new model, which has a new form with topology optimization, is safe. In Figure 4, the results of the comparative structural analysis of the old and new models are compared with the stress results and displacement results. Considering the displacement results, it was determined that there was no significant difference between the old and new models.

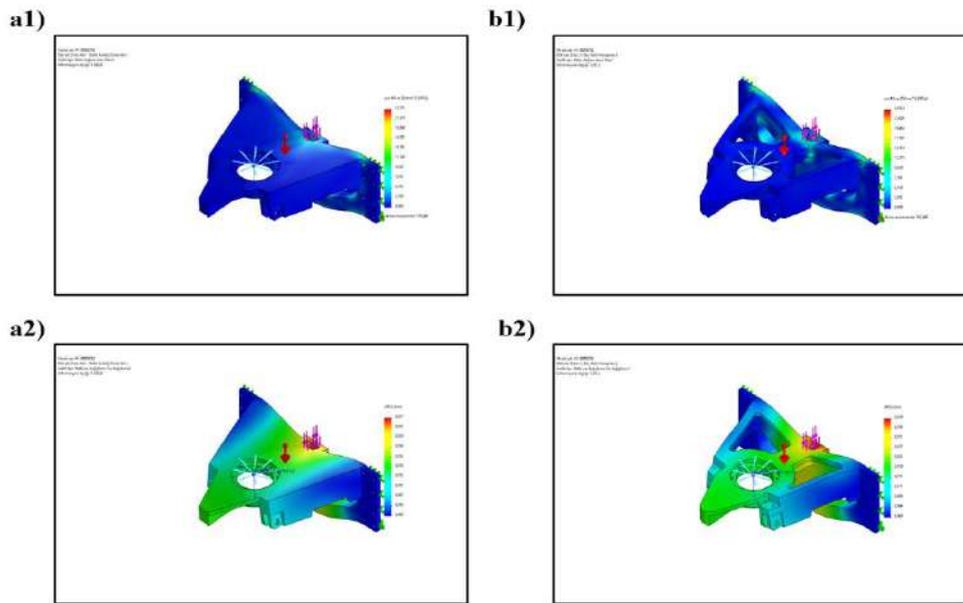


Fig. 4: Comparative structural analysis results a1) Initial model stress result, a2) Initial model displacement result, b1) New model stress result, b2) Result of new model displacement. According to the results of the structural analysis, there was no significant loss of strength in the new model of the package sealing jaw chassis, in which certain parts were unloaded with topology optimization, and the weight of the initial model was reduced to 6.16 KG in the new model, which was 6.86 KG. It is also necessary to examine the effect of this weight reduction in the chassis component on the connecting rod mechanism shaft, which moves the chassis in the +-Y axis direction with the components on it and is connected to the chassis component. Figure 5 shows the package sealing mechatronic system components with which the chassis in the study interacts.

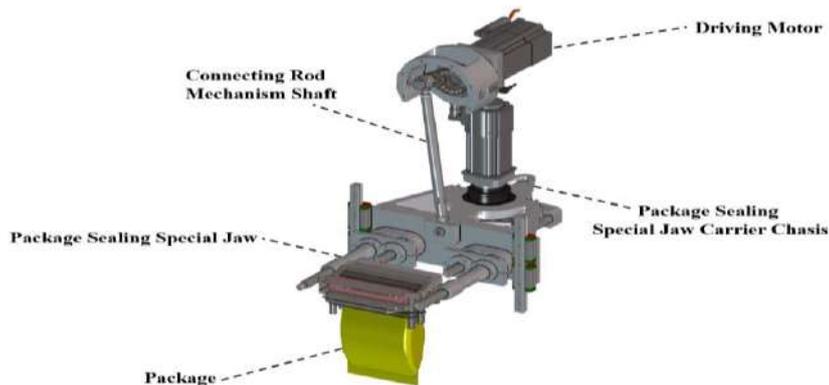


Fig. 5: Illustration of the package sealing mechatronic system component. Package sealing is achieved by

contacting the front and rear thermal conductive plates of the special jaw and welding the thermoplastic film material between the two jaws by melting. The opening and closing movement of these jaw plates to each other is provided by a connecting rod mechanism. The connecting rod mechanism shaft carries out the up and down movement of the chassis which carries the jaw drive motors, jaws and similar components, with the driving power it receives from the engine that provides rotational movement. Since this shaft is subject to an iterative movement depending on time, it is necessary to establish a dynamic analysis model and to perform analysis according to this model. As can be seen in Figure 6, as a result of this dynamic analysis, no stress value exceeding the limit value was observed for the shaft component under dynamic

load. Thus, it has been shown that the weight of the new lightweight chassis model does not cause an undesirable effect on the connecting rod shaft.

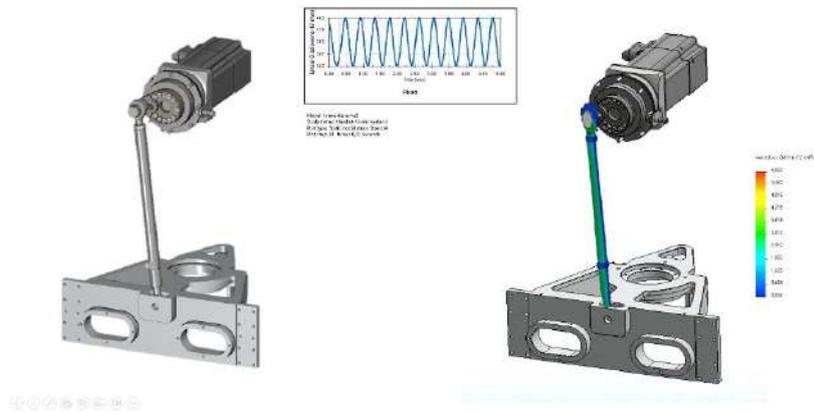


Fig. 6: Connecting rod shaft dynamic analysis study a) Real model display, b) Dynamic analysis display 5. Conclusion: After

Covid-19, the need to develop high-capacity packaging machines has emerged to meet the growing demand for hygienic and packaged food products to reach quickly. As a result of the idea of creating a twin system, which will be a very important alternative to this need, a double capacity sealing jaw packaging system has been developed. With the new special jaw structure, it is aimed to stitch 2 times more packages with the thermal sealing system and to produce 50 packages x 2 = 100 packages per minute. This situation reveals that the special connecting rod drive system must make 100 cycles per minute. In other words, the jaw chassis, which is connected to the connecting rod mechanism by means of a shaft, must move 50 times down and 50 times per minute with the loads on it. This very fast movement should not deform the jaw chassis due to stress under dynamic conditions. At the same time, it should be aimed that the chassis weight is designed to be minimum so that it does not impose an additional load on the drive motors, which are already exposed to dynamic load. In this study topology optimization, which regulates the distribution of the elements in the design volume within the determined constraints, is used to increase the strength while reducing the weight. Topology optimization includes different methods such as density-based method, evolutionary structural optimization and so on. As mentioned briefly in the relevant parts of the study, many computer programs that can be optimized for topology use the SIMP method, which is derived from the density-based method. The Solid works program we use within the scope of the study also progresses on this method. In the new system related to the work carried out using this program, the double-capacity jaw chassis design has been optimized topologically and has a geometric form with a special triangular and hollow structure. With the topology optimization, 11% lighter chassis was obtained compared to the first design. The tensile strengths of the shaft and its connecting elements have been maximized with the lightweight chassis, the engine selected in appropriate dimensions and the simulated connecting rod dynamic system, and this has been confirmed by the finite element analyzes made. In future studies, the different components of serial machines such as packaging machines can be examined with topology optimization and the manufacturability of the parts can be increased by integrating the manufacturing constraints into the process in more detail.

6. References: 1. Brody, A.L. and Marsh, K.S., The Wiley Encyclopedia of Packaging Technology, 2nd ed. New York,USA. John Wiley & Sons, Inc., 1997, ch 2, pp. 397-401 2. Merabtene, M; Tanninen, P; Varis, J; Leminen, V., "Heat Sealing Evaluation and Runnability Issues of Flexible Paper Materials in a Vertical Form Fill Seal Packaging Machine", Bio Resources; vol. 17, pp.223-242, February 2022.3. John A. Messenger, "Packaging machine with continuous sealing jaw movement," U.S. Patent US6138442A, October 13, 1999. 4. Lee, S.J. Lee, HA. Yi, S.I. Kim, D.S. Yang, H.W. Park, G.J., "Design flow for the crash box in a vehicle to maximize energy absorption" proceedings of the institution of mechanical engineers," Journal of Automobile Engineering, vol.2, pp. 179–200. July 2012. 5. Zheng, B, "Topology optimization considering design dependent loadings," M.S.thesis, Dept. Mechanic. Eng., The State Univ., New Jersey, USA, 2007. 6. Yildiz, A.R. Kaya, N. Öztürk, F. Alankuş, O. "Optimal design of vehicle components using topology design and optimization," International Journal of Vehicle Design, vol. 4, pp. 387-398, January 31, 2019

Management Competencies and Organisational Performance at A Research Institution in South Africa

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Abstract: It is not a secret that developed countries achieved economic growth through increased research and development. Consequently, these countries continuously commercialise their research output resulting in the creation of strong economies. This is however not the case with most developing countries. Developing economies, for example South Africa still lags in terms of research output and its commercialization despite huge financial investment made by the government each year to revive research institutions. Financial investment without considering soft aspects such as management competencies is not enough to bring success in research institutions. This study therefore argues that assessing management competencies in research institutions is one of the strategies that can be adopted to revive performance of research institutions in developing countries. It is therefore upon this background that the objectives of this research were two-fold, thus: (i) to assess if direction establishment, sense of purpose, people alignment, self-confidence, innovation and risk-taking, motivation and inspiration and ethical standards are significant factors influencing management competencies; (ii) to investigate the relationship between management competencies and employee performance; and (iii) to establish the influence of employee performance on organisational performance at the Research Institution in South Africa. A quantitative descriptive approach methodology, with the use of a structured questionnaire was employed to collect data from a minimum sample of 142 employees at a research institution in South Africa. Statistical Package for Social Sciences (SPSS) was utilised to conduct descriptive and inferential analyses that include one sample T-test, correlation and regression analysis. The sub-constructs direction establishment, sense of purpose, people alignment, self-confidence, innovation and risk-taking, motivation and inspiration, and ethical standards were found to be statistically significant sub-constructs for management competencies. A positive relationship between management competencies and employee performance was identified. It was also found that there is a positive relationship between employee performance and organisational performance. These findings led to major theoretical and practical implications aimed at improving management and output within research institutions. **Keywords:** Management Competencies, Performance, Research Institutions, Innovation, Risk Taking

1.1 INTRODUCTION AND BACKGROUND: Most developed countries achieved economic growth through increased research and development (Shehata, ElMashad & Hassan, 2017:39). Consequently, these countries (i.e. United States of America, Germany, China) continuously commercialise their research output resulting in the creation of strong economies (Commonwealth Education, 2019:2). On the other hand, developing economies still fall behind in terms of research output and its commercialisation (Cirera, Pacchioni & Maloney, 2017:1). South Africa is not exempted from this problem. To resolve this situation the South African government established research institutions through its National Research Foundation Act 28 of 1998. Examples of these research institutions include the South African Medical Research Council (SAMRC) and the Council for Scientific and Industrial Research (CSIR) (WITS, 2019:1). Despite the establishment of these research institutions the shortfall still exists. Managerial authorities, such as Hough, Thompson, Strickland and Gamble (2011:44) and Dias and Borges (2017:104) argued that establishing research institutions without implementing effective management is not enough to ensure the achievement of set goals and objectives. Fulmer (2017:59) and Bass and Avolio (2014:167) deplore that most technical institutions, including research institutions, have not realised the importance of effective leadership and management in their programmes. Subsequently, the failure to establish sound management in technical institutions lead

to decreased employee morale, employee performance and productivity (Buchanan & Huczynski, 2014:135). Among other issues, ineffective management in technical organisations is most likely caused by the inability to handle the transition of technical experts to management positions. Leadership and management competencies should be considered essential for the success of these research institutions (Buchanan & Huczynski, 2014:135; Dias & Borges, 2017:104). Dias and Borges (2017:105) and Fulmer (2017:59) bemoan the fact that most organisations including research institutions do not realise the importance of measuring employees' opinions on management competencies. It is therefore upon this background that this study sought to understand the perceptions of emp

1.2 The Definition of Leadership: Leadership is defined as a process through which both the individual and the team are influenced or inspired to act for the purpose of achieving organisational objectives (Hersey, Blanchard & Johnson, 2014:13). Wehrich and Koontz (2015:35) argued that leadership is a process of influencing people to act willingly with enthusiasm to achieve organisational goals.

1.3 Management and Leadership Competencies: There is a consensus regarding what should be expected as management and leadership competencies (Goleman, 2008:32; Perren & Burgoyne, 2010:144; Voon, 2011:24). Buchanan and Huczynski (2014:113) as well as Irfanullah and Allah (2016:144) described competencies of leadership and management as direction establishment, sense of purpose, people alignment, self-confidence, innovation and risk-taking, motivation and inspiration and ethical standards. These competencies are explained in the next subsections.

1.3.1 Direction establishment: People in managerial positions should be able to establish direction for the organisation and its employees. Perren and Burgoyne (2010:144) stated that for direction to be established, a clear vision must be formulated to show where the organisation is going. It is also important for managers to clearly understand the mission of the organisation and to share it appropriately so that employees can be directed on how to perform their duties (Voon, 2011:24). Leadership and management should be able to set goals and objectives that are specific, measurable, attainable, realistic and time bound (Irfanullah & Allah, 2016:144).

1.3.2 Sense of purpose: There must be a clear sense of purpose among the managers and leaders of an organisation. This is seen through the way people in managerial positions handle themselves when carrying out organisational duties (Goleman, 2008:32). Voon (2011:24) found that the actions of leaders and managers should show commitment towards the achievement of an organisation's goals and objectives. Consequently, they need to encourage employees to act in a manner that shows a clear sense of purpose.

1.3.3 People alignment: People alignment refers to employees being aligned to the values and norms of an organisation. According to Wellman (2017:586), it includes the ability to streamline employees towards actions that lead to goal accomplishment. It is, therefore, important for leaders and managers to encourage employees to act according to organisational expectations (Wehrich & Koontz, 2015:35). The goals and objectives of the organisation as well as the strategies for achieving them must be clearly explained so that employees understand how work should be carried out.

1.3.4 Self-confidence, innovation and risk-taking: Considering that the environment is constantly changing, it is important for organisations to continually evolve and strive for improvement (Voon, 2011:24). Continuous improvement occurs when leaders and managers display self-confidence through their actions (Perren & Burgoyne, 2010:144). Self-confidence is therefore, a necessary attribute which leads to objective thinking. This calls leaders and managers to be creative and innovative while pursuing their mandates. According to Yuan, Sheng and Soutar (2015:147), leaders and managers should promote an environment where employees can take risks.

1.3.5 Motivation and inspiration: Employees who are inspired and motivated perform their duties beyond expectations. Therefore, the ability to inspire employees is a skill that leaders and managers must learn and uphold (Perren & Burgoyne, 2010:144). Wellman (2017:596) argued that the most successful leaders and managers are those who inspire their employees to act in ways which lead to the attainment of organisational goals and objectives.

1.3.6 Ethical standards: Good leadership and management are attributed through the ability to observe ethical standards within the organisation (Yuan et al. 2015:147). According to Vosloban (2012:660), ethical standards refer to the norms, values and general ways in which employees are expected to behave. These also refer to the ways in which leaders and managers of an organisation should act.

1.4 Problem Statement: Evidence shows that developed countries achieved economic growth through increased research and development (Shehata et al. 2017:39). Consequently, these countries (i.e., United States of America, Germany, China) constantly commercialise their research output resulting in the creation of strong economies. On the other hand, developing

economies still fall behind in terms of research output and its commercialisation (Cirera et al. 2017:1). South Africa is no exception, exempted from this problem. To resolve this situation the South African government established research institutions through its National Research Foundation Act 28 of 1998. Despite the establishment of these research institutions there is still a gap in the amount of research output and its commercialisation. Managerial authorities, such as Hough et al. (2011:44) and Dias and Borges (2017:104) argued that establishing research institutions without implementing effective leadership and management is not enough to ensure the achievement of set goals and objectives. Fulmer (2017:59) deplored that most technical institutions, including research institutions, have not realised the importance of effective leadership and management in their programmes.

1.4.1 Objectives of The Study: This study aimed to assess:(i) to assess if direction establishment, sense of purpose, people alignment, self-confidence, innovation and risk-taking, motivation and inspiration and ethical standards are significant factors influencing management competencies, (ii) to investigate the relationship between management competencies and employee performance; and (iii) to establish the influence of employee performance on organisational performance at the Research Institution in South Africa.

1.5.2 Research Question: In order to achieve the research objectives, the research question that needs to be answered is:

1.5.2.1 To what extent does management competencies influence employee performance?

1.5.3 Hypotheses of The Study: In line with the research problem and objectives the following hypotheses have been formulated: H1: Direction establishment, sense of purpose, people alignment, self-confidence, innovation and risk-taking, motivation and inspiration and ethical standards are significant sub-constructs for management competencies. H2: There is a statistically significant positive relationship between direction establishment and employee performance at the Research Institution in South Africa. H3: There is a statistically significant positive relationship between sense of purpose and employee performance at the Research Institution in South Africa. H4: There is a statistically significant positive relationship between people alignment and employee performance at the Research Institution in South Africa. H5: There is a statistically significant positive relationship between ethical standards and employee performance at the Research Institution in South Africa. H6: There is a statistically significant positive relationship between self-confidence, innovation and risk-taking and employee performance at the Research Institution in South Africa. H7: There is a statistically significant positive relationship between motivation and inspiration and employee performance at the Research Institution in South Africa. H8: There is a statistically significant positive relationship between employee performance and organisational performance at the Research Institution in South Africa.

1.6 Research Methodology: A quantitative descriptive research design was employed to conduct the investigation. The investigation on management competencies in a research institution in South Africa, was based on a conceptual theoretical framework developed by Bolden (2004:15) and later employed by Buchanan and Huczynski (2014:62). The target population were employees reporting to former technical employees in managerial roles. The research institution had a total population of 371 employees at management level countrywide (South Africa, 2017:2). Based on the Slovin's Formula (Tejada & Punzalan, 2012:130), the minimum sample size for this population was 142.

$$n = \frac{N}{1 + N(e)^2}$$

Where n = the desired sample size e = probability of error (i.e., the desired precision, e.g., 0.05 for 95% confidence level) N = the estimate of the population size A non-probability method using a convenience sampling technique was used to select the sample, accommodating the homogeneous elements of employees at the research institution in South Africa. This sampling method was also used in similar studies; therefore, it did not compromise the quality of the research (Saunders & Lewis & Thornhill, 2012:146; Malhotra, 2010:54). The data was collected using a self-administered survey questionnaire accessed online from SurveyMonkey®. The questionnaire was adapted from the instrument used in the theoretical framework of Buchanan and Huczynski (2014:64) and adjusted to suit the present study. The collected data was analysed using SPSS and prepared by evaluating it for missing data, extreme outliers and normalities. Data analysis was carried out through one sample T-sample, correlation and regression analysis (Babbie & Mouton, 2015:124). The validity of the study was established using factor analysis (principal component analysis), while the reliability was confirmed through Cronbach's Alpha coefficient analysis (Babbie & Mouton, 2015:117; Evanschitzky, Baumgarth, Hubbard, & Armstrong, 2007:411). A pilot study was carried out through ten employees of the research institution in order to ensure that the data collection tool was

free from spelling and grammatical errors.

1.7 Research Findings:

1.7.1 The Statistical Significance of Factors as Sub-Constructs for Management Competencies and Hypotheses Testing

One sample T-test was used to establish the significance of the sub-constructs as factors for management competency. A p-value below 0.05 and a high population sample mean indicate statistical significance of a sub-construct to the specific construct. On the other hand, a p-value above 0.05 and a small population sample mean conclude that there is no statistical significance of a sub-construct to the specific construct. As displayed in Table 1.1, all the sub-constructs are statistically significant factors of management competencies. The p-value in every instance is equal to 0.000 and the population sample mean varies between 10 for sense of purpose and 18.06 for people alignment. Hypothesis 3 is thus accepted at 0.05 significant level.

Table 1.1: One sample t-test statistical results

Test Value = 3									
	N	Mean	Std. Deviation	S. E. Mean	t	p-value	Mean Difference	95 % Confidence Interval	
								Lower	Upper
Direction establishment	142	12.77	4.91	.41	23.72	.000	9.18	8.95	10.58
Sense of purpose	142	10.00	3.89	.33	21.44	.000	10.55	6.35	7.65
People alignment	142	18.06	6.74	.57	26.65	.000	8.31	13.95	16.18
Ethical standards	142	10.48	3.72	.31	23.94	.000	7.65	6.86	8.10
Self-confidence, innovation risk-taking	142	10.58	4.08	.34	22.13	.000	9.12	6.90	8.25
Motivation and inspiration	142	12.85	4.66	.39	25.19	.000	10.55	9.08	10.63

The results (p – value < 0.05; population sample mean = 12.77) indicates that direction establishment is a statistically significant sub-construct for management competence. It is also shown that sense of purpose is a significant sub-construct of management competence (p – value < 0.05; population sample mean = 10.00). The findings (p – value < 0.05; population sample mean = 18.06) also show that people alignment is a statistically significant sub-construct for management competence. It is also shown that ethical standards are a statistically significant sub-construct for management competence (p – value < 0.05; population sample mean = 10.48). Results shows that self-confidence, innovation and risk taking is a statistically significant sub-construct for management competence (p – value < 0.05; population sample mean = 10.58). It is also shown that motivating and inspiring is a statistically significant sub-construct for management competence (p – value < 0.05; population sample mean = 12.85). At this stage, hypothesis H1 that states that direction establishment, sense of purpose, people alignment, self-confidence, innovation and risk taking, motivating and inspirational, and ethical standards are significant sub-constructs for management competence can be accepted at 0.05 significant level.

1.7.2 Tests for Reliability and Validity: For research to be of value it is important to establish the reliability and validity thereof. Reliability analysis was carried out using Cronbach’s Alpha while validity analysis made use of factor analysis. The minimum threshold of 0.4 should be reached on factor analysis for an item to be regarded valid (Field, 2009:134). In this study, all the items exceeded the minimum threshold for factor analysis except EPE3 at 0.39 and OP4 at 0.36. These two items were removed for inferential analysis. In terms of reliability test, a minimum threshold of 0.7 is needed for the Cronbach’s Alpha to be regarded reliable. All the sub-constructs had a Cronbach’s Alpha above 0.7 indicating reliability. The details of these results can be seen in Table 1.2.

Table 1.2: Results of Validity and Reliability Analysis

FACTORS								
	1	2	3	4	5	6	7	8
ED1	.78							
ED2	.83							
ED3	.75							

ED4	.74							
ED5	.81							
SP1		.81						
SP2		.76						
SP3		.82						
SP4		.81						
PA1			.79					
PA2			.79					
PA3			.83					
PA4			.76					
FACTORS (Continue)								
PA5			.77					
PA6			.82					
RS1				.78				
RS2				.79				
RS3				.78				
RS4				.82				
MI1					.75			
MI2					.79			
MI3					.76			
MI4					.67			
ES1						.47		
ES2						.46		
ES3						.52		
ES4						.73		
ES5						.73		
EPE1							.44	
EPE2							.47	
EPE3							.39	
EPE4							.40	
OP1								.45
OP2								.42

OP3								.45
OP4								.36
α	.94	.96	.95	.93	.92	.84	.74	.88

1.7.3 CORRELATION ANALYSIS AMONG SUB-CONSTRUCTS OF MANAGEMENT COMPETENCIES, EMPLOYEE PERFORMANCE, AND ORGANISATIONAL PERFORMANCE: Correlation analysis was used to test the strength and direction of relationship between two or more constructs. The Pearson coefficient (R-value) ranges between -1 and 1 and measures the strength and direction of the relation. R-value = 1 indicates a perfect positive relationship, R-value = -1 indicates a perfect negative relationship and R-value = 0 indicates no relationship. The p-value measures the significance of the statistical relationship between constructs, where $P \leq 0.05$ indicates a strong significance (Saunders et al. 2012:44). The findings of the correlation analysis are provided in Table 1.3. Correlation analysis

		1	2	3	4	5	6	7
1	Direction establishment	1						
2	Sense of purpose	.82*	1					
3	People alignment	.69 *	.68 *	1				
4	Ethical standards	.60 *	.62 *	.61 *	1			
5	Self-confidence	.73 *	.71 *	.74 *	.62 *	1		
6	Motivation and inspiration	.63 *	.60 *	.72 *	.63 *	.69 *	1	
7	Employee performance	.38*	.31 *	.45 *	.30 *	.35 *	.35 *	1
8	Organisational performance	.29*	.28 *	.42 *	.25 *	.35 *	.38	.66*

*p < .001

The findings indicate that the strength of the relationship among the sub-constructs for management competencies, employee performance and organisational performance, varied from weak, moderate to strong relationships. Based on this result, regression analysis was performed.

1.7.4 REGRESSION ANALYSIS AND HYPOTHESES TEST: Ten hypotheses were formulated in this study of which six related to the relationship between the sub-constructs and employee performance and one to the relationship between employee performance and organisational performance. These hypotheses were tested using regression analysis. The higher the value of R², the greater the explanatory power of the predictor variable. The significance level and t-statistics are also shown. The β is used to measure the relationship between independent variables and dependant variables in this study. The results for regression analysis are provided in Table 1.4.

1.7.4.1 Hypothesis 2: Hypothesis 2 states that there is a statistically significant positive relationship between direction establishment and employee performance at the Research Institution of South Africa. Hypothesis 4 is accepted at $p < 0.001$ significant level based on regression analysis results ($p < 0.001$, $r = 0.38$, $\beta = 0.38$) given in Table 1.4. A positive relationship therefore, exists between direction establishment and employee performance. This result implies that the ability of the leadership team to establish a clear direction is important for improving employee performance. This finding is also in line with Irfanullah and Allah (2016:144) and Perren and Burgoyne (2010:144) who found that setting a clear direction is critical for ensuring that employee performance is educed.

1.7.4.2 Hypothesis 3: Hypothesis 3 stating that there is a statistically significant positive relationship between sense of purpose and employee performance at the Research Institution of South Africa, is accepted at $p < 0.01$ significant level. This is based on the findings ($p < 0.001$, $r = 0.31$, $\beta = 0.31$) on regression analysis which shows that sense of purpose has a relationship with employee performance. Establishing a clear sense of purpose is, therefore, regarded important for employee performance. This finding is in line with Coleman (2008:32) and Voon (2011:240) who showed that the actions of

leaders and managers should show commitment towards the achievement of the goals and objectives of the organisation for employee performance to be achieved.

1.7.4.3 Hypothesis 4: Hypothesis 4 which states that there is a statistically significant positive relationship between people alignment and employee performance at the Research Institution of South Africa, is accepted at $p < 0.001$ significant level. This decision is based on regression results ($p < 0.001$, $r = 0.45$, $\beta = 0.45$) indicating that a positive relationship exists between people alignment and employee performance. Wellman (2017:586) and Wehrich and Koontz (2015:35) also found that people alignment attributes, such as the ability to streamline employees towards action, is critical for employee performance.

1.7.4.4 Hypothesis 5: Hypothesis 5 which states that there is a statistically significant positive relationship between ethical standards and employee performance at the Research Institution of South Africa, is accepted at $p < 0.001$ significant level. Hypothesis 5 is accepted based on regression analysis results ($p < 0.001$, $r = 0.30$, $\beta = 0.30$) given in Table 1.4. A positive relationship, therefore, exists between practicing ethical standards and employee performance. This result implies that the ability of leadership to promote ethical standards is important for improving employee performance. This finding is in line with Irfanullah and Allah (2016:144) and Perren and Burgoyne (2010:144) who found that the establishment of ethical standards is critical for ensuring that employee performance is improved.

1.7.4.5 Hypothesis 6: Hypothesis 6 stating that there is a statistically significant positive relationship between self-confidence, innovation and risk-taking and employee performance at the Research Institution of South Africa, is accepted at $p < 0.001$ significant level. The results on regression analysis ($p < 0.001$, $r = 0.35$, $\beta = 0.35$) show that there is a relationship between self-confidence, innovation and risk-taking and employee performance. This finding is in line with Perren and Burgoyne (2010:144), Voon (2011:24) as well as Yuan et al. (2015:147) who found that a leader's ability to maintain high confidence levels and remain innovative is critical for ensuring employee performance.

1.7.4.6 Hypothesis 7: Hypothesis 7 states that there is a statistically significant positive relationship between motivation and inspiration and employee performance at the Research Institution of South Africa. It is accepted at $p < 0.01$ significant level. This is based on the findings ($p < 0.001$, $r = 0.35$, $\beta = 0.35$) of regression analysis which show that motivation and inspiration have relationships with employee performance. Motivation and inspiration are, therefore, regarded important for employee performance. This finding is in line with Voon (2011:240) and Coleman (2008:32) who showed that the actions of leaders to motivate employees are essential for the sake of achieving employee performance.

1.7.4.7 Hypothesis 8: Hypothesis 8 which states that there is a statistically significant positive relationship between employee performance and organisational performance at the Research Institution of South Africa, is accepted at $p < 0.001$ significant level. This is evidenced by the regression results ($p < 0.001$, $r = 0.66$, $\beta = 0.66$) which show that employee performance has a positive relationship with organisational performance. This finding follows Koech and Namusonge (2012:5) and Howel and Avolio (2013:891) who found that employee performance results in organisational performance. The findings indicate that management competencies influence employee performance. It was also found that employee performance results in organisational performance. People alignment with $R^2 = 0.21$ had the highest explanatory effect followed by direction establishment with $R^2 = 0.15$, motivation and inspiration with $R^2 = 0.13$, self-confidence, innovation and risk-taking with $R^2 = 0.12$, sense of purpose with $R^2 = 0.10$ and lastly ethical standards with $R^2 = 0.09$.

Table 1.4:Regression analysis

Dependent variable: Overall employee performance							
Constant	B	SEB	β	t	Sig	R2	Hypothesis
Perceived direction establishment	10.66 .26	.73 .05	0.38	14.59 4.88	0.000*	0.15	Accept H2
Perceived sense of purpose	11.27 .27	.74 .07	0.31	15.19 3.92	0.000*	0.10	Accept H3
Perceived people alignment	9.89 .23	.72 .04	0.45	13.69 6.04	0.000*	0.21	Accept H4

Perceived ethical standards	11.15 .27	.81 .07	0.30	13.80 3.72	0.000*	0.09	Accept H5
Perceived self-confidence, innovation and risk-taking	10.92 .29	.74 .07	0.35	14.81 4.45	0.000*	0.12	Accept H6
Perceived motivation and inspiration	10.71 .25	.78 .06	0.35	13.7 4.48	0.000*	0.13	Accept H7
Dependent variable: Overall organisational performance							
Perceived employee performance	3.10 .80	1.09 .08	0.66	2.84 10.50	0.000*	0.44	Accept H8

*p < 0.001

1.8 CONCLUSIONS ON OBJECTIVES:

1.8.1 Conclusion on objective 1: Objective 1 aimed to assess if direction establishment, sense of purpose, people alignment, self-confidence, innovation and risk-taking, motivation and inspiration and ethical standards are significant factors influencing management competencies. Based on the findings it is concluded that all the sub-constructs tested in this study were statistically significant factors of management competencies. This was concluded based on the p-value that was below 0.05 for each of the sub-constructs and high sample population means.

1.8.2 Conclusion on objective 2: Objective 3 aimed to investigate the relationship between management competencies and employee performance. The study concluded that the sub-constructs (direction establishment, sense of purpose, people alignment, self-confidence, innovation and risk-taking, motivation and inspiration and ethical standards) tested had statistically significant positive relationships with employee performance. The regression analysis confirming this conclusion are reported in Table 1.4.

1.8.3 Conclusion on objective 3: Objective 3 at establishing the influence of employee performance on organisational performance at the Research Institution in South Africa. It was concluded that employee performance had a statistically significant influence on organisational performance with $p < 0.001$, $r = 0.66$ and $\beta = 0.66$.

1.9 IMPLICATIONS FOR PRACTICE: The results showed that the participants had negative perceptions on the management competencies of technical employees who transitioned to management roles. Descriptive analysis provided evidence that these managers failed to communicate the vision of the organisation. It was also shown that they were not able to communicate the strategy of the organisation, to create teams that accept the validity of goals or to decide on the structure of their departments. Based on the results they also failed to staff their departments effectively and to develop policies which incorporate a monitoring approach. Furthermore, it was indicated that they were not capable of motivating, inspiring and energising employees and could not satisfy human needs. The following recommendations are thus made, guided by the results of the study.

1.9.1 Communicate the vision of the organisation: Every organisation carry a vision and it is important for management to understand the importance of this vision. The vision gives direction to the institution for the future and managers should firstly understand the vision themselves and then communicate it clearly to the employees. The employees need to grasp the goals and objectives of the institution.

1.9.2 Communicate the strategy of the organisation: Strategies are game plans through which goals and objectives are achieved. Managers should contribute in formulating the strategies that are adopted by the research institution. For managers to share the strategies with the employees, they should have a thorough understanding thereof. They should also understand the role of the employees in the effectiveness of the institution.

1.10.3 Create teams that accept validity of goals: Team building is an essential responsibility of every manager. They should understand their employees and what motivate them to convert them into effective team players. Managers should further ensure that the employees understand and accept the objectives of the institution, since that will lead to success.

1.10.4 Decide on the structure of the department: Technical employees who are promoted to management positions should be equipped with knowledge on the structure of the different departments. Relevant training and support should be provided for new managers to develop a working structure in their departments. This is required for the effective allocation

of responsibilities.

1.10.5 Build the capability to staff the department effectively: Managers should continuously evaluate their departmental requirements in order to identify the human resources needs. Failure to source the right employees could lead to failure in a department and ultimately an institution.

1.10.6 Develop policies which incorporates monitoring approach: Departments function well under the guidance of effective policies. Policies are also good measures of how organisational activities should be performed. Developing such policies requires managers to have a good understanding of the vision, mission and objectives of the organisation. New managers should, therefore, receive training in this regard and solid support should be provided.

1.10.7 Motivate and inspire people: The work of a leader is carried out through people. It is therefore important for managers to develop mechanisms through which they motivate their subordinates. Employees should be motivated through the enrichment and enlargement of their roles and by being part of decision making in the institution. Managers should lead by example and show appreciation for their employees. They need to be compassionate regarding human needs and family responsibilities.

1.11 LIMITATIONS OF THE STUDY: Considering that this study employed the quantitative research method through a structured questionnaire. This method does not allow participants to express their own views and is limited to the provided constructs. Secondly, only six sub-constructs were included in the questionnaire, yet there are other constructs that could be significant to management competencies. Thirdly, the study sample involved a single research institution. It is therefore implied that responses provided cannot be generalised to other research institutions in South Africa. Fourthly this study was carried out using a cross-sectional research approach over six months. This means that the study does not capture a change in the perceptions of participants over time. Lastly the opinions of the managers were not considered in the research.

1.12 RECOMMENDATIONS FOR FUTURE RESEARCH: This study identified several gaps that can be exploited by future researchers. The use of the qualitative research method, including interviews, could allow participants to express their own views, leading to an informed data set. The use of alternative conceptual frameworks can also be considered since perceptions might be different when measured to other management competencies. A wider study population could be targeted by including different research institutions using a longitudinal research process which will capture any changes in perceptions over time. Managers could also be included in a future study to identify the challenges they face during the transition period.

1.13 CONCLUSION: This chapter concludes the study and offers discussions of the results. A general negative perception of the management competencies of previous technical employees were identified. It was found that gender and age do not influence these perceptions. The six sub-constructs tested were confirmed to be significant as management competencies. A positive relationship between management competencies and employee performance was identified as well as between employee performance and organisational performance. It was established that management competencies influence employee performance at varying levels. These findings answer the research question effectively, therefore, the study objectives have been met.

REFERENCES: BABBIE, E. & MOUTON, J. 2015. The practice of social research. 2nd ed. Cape Town: Oxford University Press. BASS, B.M. & AVOLIO, B.J. 2014. Improving organizational effectiveness through transformational leadership. Thousand Oaks, CA.: Sage Publications. BOLDEN, R. 2017. What is leadership? Leadership South West Research Report 6, University of Exeter, Centre for Leadership Studies. BUCHANAN, D. & HUCZYNSKI, A. 2014. Organisational behavior: An introductory text. 5th ed. Harlow: Pearson Education limited. CIRERA, X., PACCHIONI, E.A.G. & MALONEY, W. 2017. Why poor countries invest too little in R & D. [Online]. Available from: <https://voxeu.org/article/why-poor-countries-invest-too-little-r> [Accessed: 30/05/2019]. COMMONWEALTH EDUCATION. 2019. Research institutes in South Africa. [Online]. Available from: www.commonwealthofnations.org/sectors-south-africa/education/research-institutes/ [Accessed: 30/05/2019]. DIAS, M.A.M.J. & BORGES, R.S.G.E. 2017. Performance and leadership style: When do leaders and followers disagree? *Mackenzie Management Review*, 18(2):104-129. EVANSCHITZKY, H., BAUMGARTH, C., HUBBARD, R., & ARMSTRONG, J.S. 2007. Replication research's disturbing agenda. *Journal of Business Research*, 60(7):411-415. FULMER, R.M. 2017. The evolving paradigm of leadership development. *Organisational Dynamics*, 25(4):59-73. GOLEMAN, D. 2008. What makes a leader? *Harvard Business Review*, November – December. HERSEY, P., BLANCHARD, K. & JOHNSON, D.E. 2014. Management of organizational behaviour. 8th ed. Englewood Cliffs, NJ.: Prentice Hall. HOUGH, J., THOMPSON, A.A., STRICKLAND, A.J. & GAMBLE, J.E. 2011. Crafting and executing strategy: Creating sustainable high performance in South Africa: Text, Readings

and cases. 2nd ed. United Kingdom: McGraw-Hill Higher Education. IRFANULLAH, K. & ALLAH, N. 2016. The leadership styles and the employees' performance: A review. Gomal University Journal of Research, 32(2):144-150. MALHOTRA, N.K. 2010. Marketing research: an applied orientation. 6th ed. Upper Saddle River, NJ.: Pearson. PERREN, L. & BURGOYNE, J. 2010. Management and leadership abilities: an analysis of texts, testimony and practice. London: Council for Excellence in Management and Leadership. SAUNDERS, M., LEWIS, P. & THORNHILL, P. 2012. Research Methods for Business Students 5th ed. England: Pearson Education Limited. SHEHATA, S.M., ELMASHAD, N.M. & HASSAN, A.M. 2017. Current review of medical research in developing countries: A case study from Egypt. Intech Open. SOUTH AFRICA. 2017. Government system structure and functions in South African government. SA [Online]. Available from: <http://www.gov.za/about-government/government-system/structure-and-functions-south-african-governemnt> [Accessed: 27/07/2019]. TEJADA, J.J. & PUNZALAN, J.R.B. 2012. On the misuse of Slovin's formula. The Philippine Statistician, 61(1):129-136. UNIVERSITY OF THE WITWATERSRAND (WITS). 2019. Scholarly research and related resources: Research institutions (SA). [Online]. Available from: <https://libguides.wits.ac.za/c.php?g=145381&p=953593> [Accessed: 30/05/2019]. VOON, M.C. 2011. The influence of leadership styles on employees' job satisfaction in public sector organisations in Malaysia. International Journal of Business Management & Social Science, 2(1):24-32. VOSLOBAN, R.I. 2012. The influence of the employee's performance on the company's growth – a managerial perspective. Procedia Economics & Finance, 3:660-665. WEIHRICH, T.J. & KOONTZ, M. 2015. Personal factors associated with leadership. Journal of Psychology, 25:35-71. WELLMAN, N. 2017. Authority of community? A relational model's theory of group-level leadership emergence. Academy of Management Review, 42(4):596-617. YUAN, G., SHENG, V. & SOUTAR, G.N. 2015. The role of ethical behaviour in the relations between leader styles and job performances. Conference of Corporate Responsibility.

Risk Assessment of Dengue Fever Transmission by Using Analytic Hierarchy Approach in Punjab Province, Pakistan



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Background: Dengue incidents have grown abruptly around the globe in recent decades, it is estimated 390 million infections occur due to this communicating disease. Dengue outbreak occurs in Punjab, Pakistan in 2011. Meteorological factors like temperature, rainfall, humidity and old tires imported from Bangkok caused dengue virus transmission in Punjab province.

Methods: Dengue risk assessment model was developed by using analytic hierarchy process (AHP). Five significant indexes were selected, presented to ten experts of concern domain, to identify a score for each attribute. A hierarchical structure was developed on the basis of score given by experts. In this way we developed a significant model to evaluate spatial and regular transmission risk of dengue.

Results: We identified 10 significant factors that possibly influenced the dengue transmission risk. Average and the combined weight of each factor was calculated, the factor with leading weight was endemic of dengue fever in Punjab (CP=0.40) trailed by a meteorological factor (CP= 0.25) and mosquito density (CP=0.12). The risk identification of dengue fever among 38 districts in Punjab province was reflected monthly.

Keywords: Dengue Fever, teenager, risk assessment, Meteorological factor, Punjab

Introduction: It is rapid growing bone-breaking disease in tropical and sub-tropical countries due to active travelers [1]. Dengue has infected about 125 countries by infecting 3.9 billion individual male and female of all ages [2]. There are almost three thousand species of mosquito in the world, that spread more frequently in tropical and sub-tropical areas due to suitable weather conditions. Now a day due to dynamic and frequent air traffic flow made it possible to spread the dengue

virus from one geographical boundary to other in no time. Dengue virus is spread due to biting of female mosquito known as *Aedes aegypti* [3]. Male mosquito never bites to human, female mosquito bite to human, mammals, reptiles, and birds to fulfill its reproduction system requirements [4]. Female mosquito is recognized due to her head antennae thin feathery male antennae help him to sense female in specific geographical area [5]. *Aedes aegypti* hunts her prey with the help of odor of prey, body heat, carbon dioxide and movement [6]. The flight range of mosquito is in the range of three-kilometer area adjacent to its breeding site. There is variation in the lifetime of male and female mosquito, male live up to 20-30 days while female survives more [7]. Life cycle primarily concerns to the environmental factors like temperature, rainfall, and humidity which are controlled by nature. The newborn mosquito has to observe four stages as egg, larva then pupa and finally convert to adult [8]. The geographical flow of dengue virus has grown up drastically in a couple of decades. The real number of dengue patients are under-reported and some may be misclassified. Around the year near 100 million of dengue infections are observed and fifty percent are dengue hemorrhagic fever [9]. Clinically there are four types of dengue virus DEN-1, DEN-2, DEN-3, and DEN-4 [10]. Primary clinical sign appears after four to five days after the dengue infection [11]. Dengue fever is classified into three sorts with respect to increasing in intensity of fever along with clinical signs. It is Dengue Fever (DF), Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS) [12]. A person maiden infected with dengue can recover from inevitably due to his/her strong immune system [13]. Mosquito life cycle comprised of four stages and accomplished in almost eight to ten days; this process is known as metamorphosis [14]. Female mosquito produces 100-200 eggs in each session and maximum it conducts five sessions [15]. Mosquito incubation period accomplished in 3-15 days along with some clinical signs [16][17].

Literature Review: Dengue outbreak abruptly occurs in Punjab, Pakistan in 2011 which ruin human and health resources in short time. During the outbreak, twenty-one thousand infections occurred along with three hundred casualties. First dengue case registered in March and prolonged up to December. The month of September to November, the outbreak was on a rampage. Female infected during the outbreak were classified into five groups, the most infected group was thirty years which 47% geographical area [18]. Dengue outbreak occurred due to the old tires imported from Bangkok to Lahore, march to December consistently dengue remains in Lahore. So, the Lahore proved the dengue hub during the outbreak and also emerged as hotspot area. In Brazil, 2014 different dengue cases were reported from the cities with tropical and subtropical environments. The environment in tropical regions supports dengue to flourish during humid, drizzling season in populous areas [19]. With the help of meteorological factors advance prediction can be done concern to the flow and outbreak of dengue. A model developed in Brazil on the eve of the world cup to predict in advance about the dengue outbreak, three million people could be saved from the threat of viral disease. For the development of model three significant administrations were cooperated like a mathematician, public health department and meteorological authorities. Dengue data was incorporated with meteorological data to predict the expected results. Facts showed a dozen of geographical regions were at marginal threat, but chances of the outbreak were in north-eastern cities.

Risk Structure: There are different sort of risk concern to dengue outbreak like meteorological, population, social, endemic and density risk. We calculated (TR_n) total risk for each district, n is district number, and finally, sum up total risk of 38 districts to the grand total risk (GTR).

$$TR_n = MTR_n + PR_n + SR_n + ER_n + DR_n \quad \text{Eq: 01}$$

$$GTR = TR_{n1} + TR_{n2} + TR_{n3} \dots \dots \dots TR_{n38} \quad \text{Eq: 02}$$

Point Calculation of each Index: Indexes like rainfall, temperature, humidity, mosquito density, larvae were measured at different scales, so standardization was necessary to remove potential issues with indexes. We conduct standardization process with the help of following formula [20].

$$Std (T_{in}) = \frac{I_n}{max_i} \quad \text{Eq: 03}$$

In the formula, Std (T_{in}) is standardized index i for district n, whereas T_{in} is no standardized index i for district n, while max_i is the prime value of index i among all districts. With the help of this approach each index was interpreted in common measurement scale that ranged 0 and 1. We used Analytic hierarchy approach to determine the score of each index, before processing standardized point of each index.

Calculation of TR_n: We apply the points of each index to the formula in Eq: 01. Each district was calculated with respect to total risk in each district.

$$TR_n = PE_1 * E_1 + PE_2 * E_2 + PE_3 * E_3 \dots \dots \dots PE_n * E_n \quad \text{Eq: 04}$$

In above Eq: 04 E shows indexes for risk disclosures 1 ~ n, while P define the points of each index. The higher value of TR_n

shows the immense dengue transmission risk in this district. After taking the TRn value of 38 districts of Punjab province we deployed these values in ArcView, GIS tool to display the distribution of TRn among the districts of Punjab province.

Data Collection: We collected data from Punjab health department for this research studies. Data comprised of almost 14000 male patients of all ages among them 3838 were a male teenager. Data comprised of different attributes like registration date, name, age, sex, address, lab results, and status.

Geographical Analysis: Punjab province is our study area in this research, it is the most populated province of Pakistan along with rich agriculture and textile resources. The province comprised of eight division and thirty-eight districts, 110million people are inhabitant which sprawled over 205,344 km² with the spatial address (30°55'59.63" N/73°46'22.72" E).

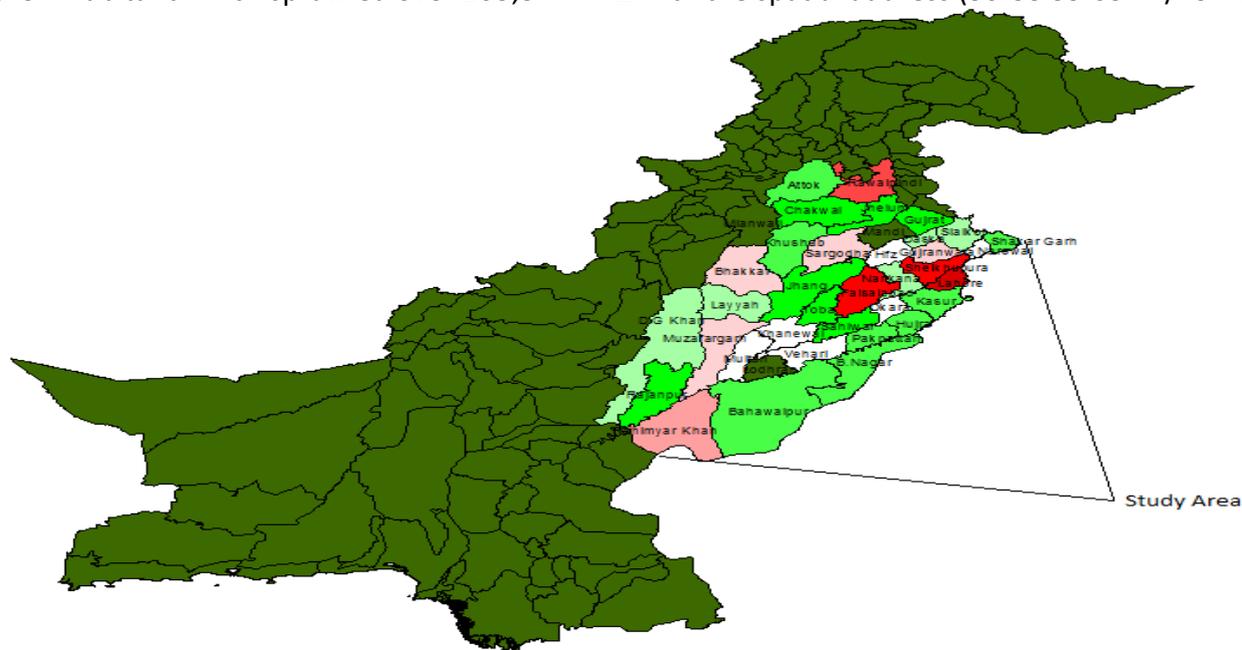


Figure 1 Shows Our Research Area, In the Heart of Pakistan at A Central Geographical Location with Respect to The Country Map

Table 1: Features of indexes nominated by experts

index	Sub-index	Root	Data time slot
Mosquito density	Larvae density	PHD	March-December 2011
	Mosquito density	PHD	March-December 2011
Epidemic of dengue fever in Punjab province	Fever cases in Punjab		March-December 2011
Meteorological factors	Rainfall	PMD	March-December 2011
	Temperature	PMD	March-December 2011
	Humidity	PMD	March-December 2011
Population factor	Population density	PBS 5th census	2017
Social activity	Social media	websites	2017
	Dengue precautionary measures and control	PHD	2017

Table 2: Analytic hierarchy process and points of each index defined by experts

Class	Index	Expert Points										Average Point	Combine Point	
		1	2	3	4	5	6	7	8	9	10			
Density	Larvae Density	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.2	0.02	0.034	0.12
	Mosquito Density	0.2	0.02	0.03	0.1	0.02	0.02	0.2	0.14	0.1	0.02	0.02	0.089	
Endemic of dengue fever in Punjab Province	Imported dengue cases in Punjab Province	0.03	0.02	0.02	0.2	0.1	0.2	0.02	0.02	0.0	0.02	0.02	0.061	0.4
	Local dengue cases in Punjab	0.26	0.23	0.29	0.3	0.23	0.45	0.36	0.32	0.3	0.39	0.313		
Meteorological factors	Temperature	0.02	0.13	0.14	0.12	0.12	0.02	0.02	0.02	0.0	0.02	0.03	0.058	0.25
	Rainfall	0.12	0.14	0.01	0.12	0.12	0.12	0.02	0.13	0.1	0.26	0.117		
	Humidity	0.02	0.02	0	0.02	0.02	0.02	0	0.02	0.0	0.2	0.031		
Population factor	Population density	0.02	0.02	0.02	0.02	0.2	0.02	0.02	0.02	0.0	0.02	0.035	0.035	
Social activities	Social media	0.02	0.02	0	0.02	0.02	0	0	0.02	0.0	0.02	0.01	0.03	
	Dengue precautionary measures and control	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.06	0.0	0.02	0.023		
consistency ratio		0.07	0.05	0.05	0.09	0.08	0.08	0.06	0.07	0.8	0.09			

Results: We identified 10 significant indexes which favor the risk of dengue transmission, with the help of three departments Pakistan meteorological department, Punjab health department and Pakistan Bureau of statistics. Ten experts give points to each index, we calculated average points of each and combined indexes (table: 2). Similarly, ten experts from metrological health and bureau of statistics departments nominated ten significant indexes which caused the dengue transmission are in (table:1). The attribute which gained the maximum points was Endemic of dengue fever in Punjab Province (CP=0.40) trailed by a meteorological factor (CP= 0.25) and mosquito density (CP=0.12). The analysis shows that these three attributes are significant, which cause dengue transmission, while consistency ratio of each expert was CR< 0.10. For multiple attribute decision making, AHP has primarily used utility [21]. It is a significant method for risk assessment of viral disease like dengue chikungunya, malaria, zika etc. Our research study mainly targets the analysis of intensity, the geographical flow of dengue fever in each district monthly.

Conclusion: Hotspots areas perceived in upper Punjab comprised of Lahore, Faisalabad, Rawalpindi, Okara and Sheikhupura and there was a high-level threat in the months August to November.

Abbreviations: CP: Combined Point PHD: Punjab health department PMD: Pakistan meteorological department PBS: Pakistan bureau of statistics TRn: total risk (n=district identification number)

References: [1] I. G. N. M. Jaya and H. Folmer, "Identifying Spatiotemporal Clusters by Means of Agglomerative Hierarchical Clustering and Bayesian Regression Analysis with Spatiotemporally Varying Coefficients: Methodology and Application to Dengue Disease in Bandung, Indonesia," *Geogr. Anal.*, vol. 53, no. 4, pp. 767–817, Oct. 2021. [2] F. Yavari Nejad and K. D. Varathan, "Identification of significant climatic risk factors and machine learning models in dengue outbreak prediction," *BMC Med. Inform. Decis. Mak.*, vol. 21, no. 1, pp. 1–12, 2021. [3] T. Chouin-Carneiro, A. Vega-Rua, M. Vazeille, A. Yebakima, R. Girod, D. Goindin, M. Dupont-Rouzeyrol, R. Lourenço-de-Oliveira and A.-B. Failloux, "Differential Susceptibilities of *Aedes aegypti* and *Aedes albopictus* from the Americas to Zika Virus," *PLoS Negl. Trop. Dis.*, vol. 10, no. 3, p. e0004543, Mar. 2016. [4] M. Salah Debes, M. Al Tayeb, M. F. Nassani, A. A. Basaeed, A. Dwaima, M. K. Alsaadi and H. Odah, "Dengue Fever in

Adults, a Retrospective Study,” *Am. J. Intern. Med.*, vol. 4, no. 6, pp. 93–100, 2016. [5] J. W. Young-EunNa, “Identification and expression patterns of two TRPV channel genes in antennae and Johnston’s organ of the dengue and Zika virus vector mosquito, *Aedes aegypti*,” *J. Asia. Pac. Entomol.*, vol. 19, no. 3, pp. 563–569, 2016. [6] U. H. Zaid T. Salim, “Frequency-based detection of female *Aedes* mosquito using surface acoustic wave technology: Early prevention of dengue fever,” *Microelectron. Eng.*, vol. 179, pp. 83–90, 2017. [7] S. Ahmad, M. Asif, M. Majid and M. Yasir, “Geographical Information System based approach to monitor Epidemiological disaster: 2011 Dengue fever outbreak in Punjab, Pakistan,” *Int. J. Adv. Comput. Sci. Appl.*, vol. 7, no. 5, pp. 18–24, 2016. [8] C. Sundaravadivelan and M. N. Padmanabhan, “Effect of biosynthesized silver nanoparticles from filtrate of *Trichoderma harzianum* against larvae and pupa of dengue vector *Aedes aegypti* L,” *Environ. Sci. Pollut. Res.*, vol. 21, no. 6, pp. 4624–4633, Mar. 2014. [9] M. G. Teixeira, E. S. Paixão, M. da C. N. Costa, R. V. Cunha, L. Pamplona, J. P. Dias, C. A. Figueiredo, M. A. A. Figueiredo, R. Blanton, V. Morato, M. L. Barreto and L. C. Rodrigues, “Arterial Hypertension and Skin Allergy Are Risk Factors for Progression from Dengue-to-Dengue Hemorrhagic Fever: A Case Control Study,” *PLoS Negl. Trop. Dis.*, vol. 9, no. 5, p. e0003812, May 2015. [10] O. Simon, S. Billot, D. Guyon, M. Daures, E. Descloux, A. C. Gourinat, N. Molko and M. Dupont-Rouzeyrol, “Early Guillain–Barré Syndrome associated with acute dengue fever,” *J. Clin. Virol.*, vol. 77, pp. 29–31, Apr. 2016. [11] M. Krutikov, K. El Bouzidi, M. Turner, R. Bailey and E. Nastouli, “Dengue rapid diagnostic tests: How reliable are they in a UK clinical setting?” *J. Infect.*, vol. 71, no. 6, p. 685, Dec. 2015. [12] M. Khurram, W. Qayyum, S. J. ul Hassan, S. Mumtaz, H. T. Bushra and M. Umar, “Dengue hemorrhagic fever: Comparison of patients with primary and secondary infections,” *J. Infect. Public Health*, vol. 7, no. 6, pp. 489–495, Nov. 2014. [13] R. Oktarianti, K. Senjarini, T. Hayano, F. Fatchiyah and Aulanni’am, “Proteomic analysis of immunogenic proteins from salivary glands of *Aedes aegypti*,” *J. Infect. Public Health*, vol. 8, no. 6, pp. 575–582, Nov. 2015. [14] L. B. Carrington, M. V. Armijos, L. Lambrechts, C. M. Barker and T. W. Scott, “Effects of Fluctuating Daily Temperatures at Critical Thermal Extremes on *Aedes aegypti* Life-History Traits,” *PLoS One*, vol. 8, no. 3, p. e58824, Mar. 2013. [15] F. Baldacchino, F. Bussola, D. Arnoldi, M. Marcantonio, F. Montarsi, G. Capelli, R. Rosà and A. Rizzoli, “An integrated pest control strategy against the Asian tiger mosquito in northern Italy: a case study,” *Pest Manag. Sci.*, vol. 73, no. 1, pp. 87–93, Jan. 2017. [16] Y. H. Ye, S. F. Chenoweth, A. M. Carrasco, S. L. Allen, F. D. Frentiu, A. F. van den Hurk, N. W. Beebe and E. A. McGraw, “Evolutionary potential of the extrinsic incubation period of dengue virus in *Aedes aegypti*,” *Evolution (N. Y.)*, vol. 70, no. 11, pp. 2459–2469, Nov. 2016. [17] F. Nasar, R. V Gorchakov, R. B. Tesh and S. C. Weaver, “Eilat virus host range restriction is present at multiple levels of the virus life cycle,” *J. Virol.*, vol. 89, no. 2, pp. 1404–18, Jan. 2015. [18] S. Ahmad, M. Asif, R. Talib, M. Adeel, M. Yasir and M. H. Chaudary, “Surveillance of intensity level and geographical spreading of dengue outbreak among males and females in Punjab, Pakistan: A case study of 2011,” *J. Infect. Public Health*, no. 2 November, pp. 16–30, 2017. [19] R. Lowe, X. Rodo, C. Barcellos, M. S. Carvalho, C. A. S. Coelho, T. C. Bailey, T. E. Jupp, D. B. Stephenson, G. E. Coelho, R. J. Graham and W. M. Ramalho, “Dengue epidemic early warning system for Brazil,” 2015. [20] Q. Zhu, T. Liu, H. Lin, J. Xiao, Y. Luo, W. Zeng, S. Zeng, Y. Wei, C. Chu, S. Baum, Y. Du and W. Ma, “The spatial distribution of health vulnerability to heat waves in Guangdong Province, China,” *Glob. Health Action*, vol. 7, no. 1, p. 25051, Dec. 2014. [21] M. N. Anish, P. B. Dhanish and R. Sridharan, “SWOT-AHP analysis in medical tourism area of Kerala,” *Int. J. Soc. Syst. Sci.* vol. 9, no. 3, p. 256, 2017.

An Optimistic Research on Geographical Flow and Dengue Intensity Among Female in Lahore, Pakistan



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Abstract: Today, dengue disease is a growing problem around the globe, especially in tropical nations. It is a contagious viral illness that spreads from one person to another via the female *Aedes aegypti* mosquito. Its outburst quickly depletes the financial and human resources. The majority of nations with weak technical substructure are incapable to effectively combat these diseases. The use of a Geographical Information System (GIS) to create thematic maps using epidemiological data is a clever technique. In this research study, we used the ArcView instrument to display information about female's patients affected by the 2011 dengue outbreak. In Punjab Province, Dengue fever afflicted about 7,000 females over 37 epidemiological weeks beginning in March 2011 up to December 2011. Our research identified the geographic distribution and severity of dengue fever among females in Punjab province of various ages. Conserving human and financial resources can help administrative authorities and health departments raise future consciousness and take timely preventative actions.

Keywords: Dengue Illness, Geographical Information System, *Aedes Aegypti*, Health surveillance, Dengue Outbreak

1.1 INTRODUCTION: A global communicable disease called dengue fever (DF) afflicted 3.6 billion people across 125 nations in the tropics and subtropics [1]. Dengue fever comes in three different forms, including Dengue Fever (DF), Dengue illness, Dengue Fever (DHF), and Dengue Shock wave Syndrome Fever (DSS), with symptoms reaching from a typical fever to severe flow of blood from the nose and gums [2]. These three forms are categorised by the World Health Organization as mild, moderate, and severe dengue. Since DHF and DSS are severe types of dengue fever, they are linked to the majority of dengue virus-related fatalities. It was an unsettling situation for the Malaysian government when the number of Dengue cases per 100,000 people rose from 44.3/100,000 in 1999 to 181/100,000 in 2007[3]. When the female *Aedes aegypti* mosquito injects the dengue virus into a human, the patient develops a temperature greater than 38.5 °C, coupled with annoyances, unsettled stomach, and joint pain [4]. Due to their robust immune systems, people who have the dengue virus sometimes aren't aware that they have dengue fever. Most patients recover without any issues during this stage, which lasts for 3 to 7 days [5]. While two-thirds of the population exists in the region where acute Dengue Fever is most prevalent, 10,000 casualties often result from the disease each year. Even in the clinical stage, there are currently no licenced antivirals for dengue fever [6]. According to estimates, 500,000 people have DHF, 50 million people have contracted dengue fever, and require hospitalisation everywhere [7]. A high body temperature, a flu-like disease, vomiting, headaches, and bleeding from the gums, nose, and mouth are among the mild to severe symptoms of dengue fever. Viral incubation lasts from three to fourteen days [8]. The patient's body temperature quickly increases to 40°C but their pulse rate remains modest. Fits and other concerns are sustained by the temperature for 2–7 days [9]. Although there is no proven treatment or vaccination, taking the most crucial action to take is to take safeguards. due to the virus. To prevent dehydration, the patient should drink liquids [10]. To portray geographic information in thematic maps, geographic information systems are utilised to collect, organise, and store that information. It can be used in a number of industries, including hypsography, hydrography, transmission, waste management, irrigation, and agriculture [11], where spatial information is required. Data can be represented in various layers on the same theme map, and the user can execute the necessary layers, whether they are one layer or many levels. GIS plays a significant role in the creation of any communicable disease monitoring system. Administrative authorities and governmental organisations can be well aware of any outbreak in advance in order to prevent any difficult situations. [12]. GIS can be used to fight communicable illnesses in the future and lessen the financial and human toll.

2.1 LITERATURE REVIEW: Developed in 2014 [10], the "GIS-based Dengue surveillance systems with Google internet real-time charting" Thematic mapping of the Indian map demonstrated the prevalence of dengue cases in India in 2012. Geographical areas are displayed using a variety of colours to signify the severity of Dengue cases, with vertical bars representing casualties. One inch of a bar represents 100 casualties; light grey indicates fewer than 25 Dengue patients, and

reddish-brown indicates the maximum level of severity. Dengue patients' longitudinal and latitudinal addresses are gathered on-site using a GPS device with a typical precision of roughly 100 metres. Multiple regressions are utilised in this model to reveal connections between variables about dengue fever breeding grounds and transmission. 2014 saw an unusually high incidence of dengue fever illnesses in several Brazilian towns. Most towns and cities have tropical or subtropical climates which encourage dengue to thrive in crowded areas throughout the warm, humid, and rainy seasons. Some characteristics such as virus flow, human vulnerability, and mosquito abundance, are important in dengue outbreaks. A few months in advance, dengue epidemics could be predicted using climate data. A big gathering of more than 3 million spectators from around the world and Brazil used this model to forecast the threat of dengue during the 2014 World Cup in Brazil [14]. As a public health professional, mathematician, and meteorological consultant, a collaboration with three departments was urgently created for the construction of a prediction model. Several months before the event, data from these authorities were added to the proposed model as periodic meteorological forecasts and epidemiological data, and the findings were presented in a way that stakeholders could easily understand. The scenario showed that all twelve metropolises were at low risk, but that the north eastern cities of Natal, Recife, and Fortaleza had the highest likelihood of an outbreak. The health ministry and local authorities benefited from this early warning system to properly implement and control measures three months before the world cup event. Publicity was sent out with early cautions to tourists visiting Brazil. Compared to the long-term distribution average, this model did well in all twelve of the host cities for the world cup, particularly in the northeast. Using a geographic information system, Honduras in Central America created maps and estimates for Dengue and Chikungunya in 2015. This research study's thematic mapping was created using the GIS Kosmo Desktop programme. In all, 19289 instances of dengue and 85386 cases of chikungunya were testified in 2015, with a medium of 726 dengue patients and 1460 chikungunya patients per week. The 25th and 27th weeks, respectively, were the maximum patient registration slots. The projected national patient rates for dengue and chikungunya were 224.9/100,000 and 995.6/100,000 patient roles respectively [15]. Epidemiological charts created by decision-making establishments using GIS to help them take act for the anticipation and management of a illness that still causes significant problems in the nation. In 2016, a Malaysian analytical tool for determining dengue risk called the Analytical Hierarchy Process (AHP) with GIS was employed. A medical database was managed and organised in a hierarchical structure for this research project. When the consistency percentage was less than 0.1%, relative weights of the components were determined within a tolerable range [16]. Findings from the Dengue fever risk region based on the AHP provided important information on different risk tiers. The research study's useful findings can improve public health initiatives. As part of an attempt for efficient control and prevention, a spatial analytical method using GIS is applied to observation tactics of Dengue fever and additional transmissible diseases.

3.1 STUDY ZONE AND DATA GATHERING: The sixth furthestmost populous nation in the world, Pakistan has a thriving agriculture sector. It consists of four provinces, the most populous of which, Punjab, is the subject of our study. It has a total size of 205,344 km² and a population of 101.4 million. Punjab has five rivers running through it, making it a fertile agricultural region. It is dispersed across 36 boundaries that are managed. We used information gathered from every district hospital in Punjab in 2011 for our research project. It is a compilation of over 6700 female patient records from district hospitals, 87% of which are from Lahore, the capital of Punjab. The data set contains information about stage of development, sex, city rank, address, IgM, and IgG



Figure 01: Study Zone of Punjab

Our study zone, Punjab, the maximum populous area in the nation, is depicted in Figure 1. With resources for agriculture, textiles, and sports, it serves as Pakistan's financial



Geographical Pattern and Intensity of Dengue Virus among Females in April

1. Figure 04: April's geographic pattern and intensity

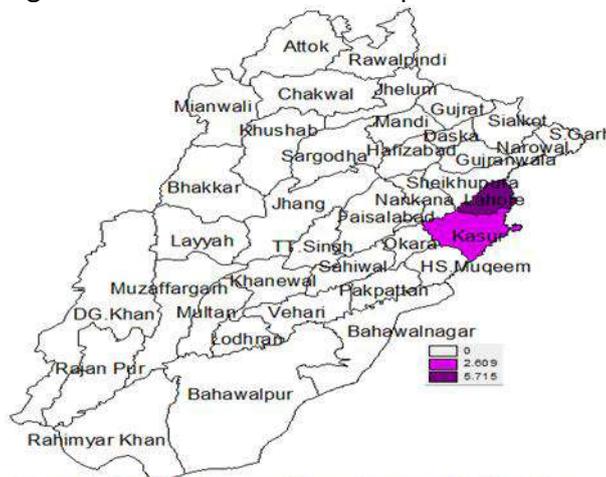
Figure 04 depicts the distribution and severity of the dengue virus in April. Except for Lahore, the whole province of Punjab is a dengue-free zone. There is no change in the geographic pattern between this and the previous theme map, although the intensity is a little lower. Due to the environment altering, *Aedes aegypti* activity is limited in April due to the heat. As a result, dengue has returned to its den to await favourable meteorological conditions



Geographical Pattern and Intensity of Dengue Virus among Females in May

2. Geographical Design and Strength in May, Figure 05

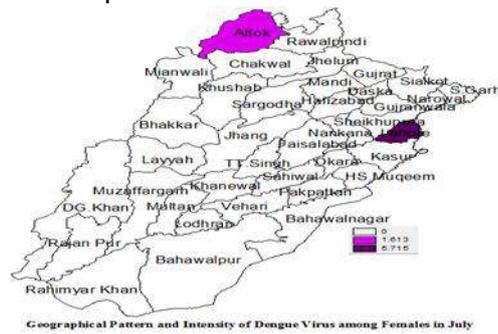
Figure 05 depicts the distribution and severity of dengue fever in May. Thematic maps show that although the geographic pattern has been continuous since March, intensity fluctuations may still be seen because it is still the same as in March. May is heading into increased heat, giving the virus a slim chance to spread.



Geographical Pattern and Intensity of Dengue Virus among Females in June

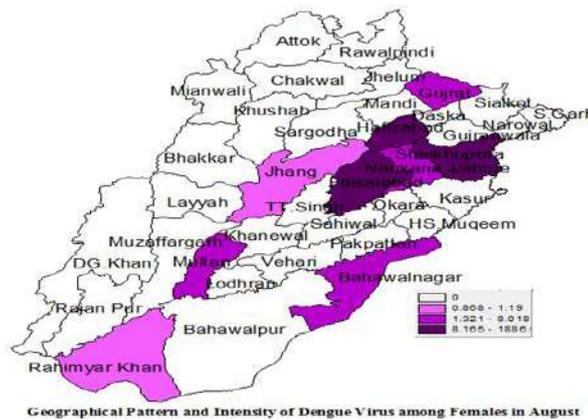
3. Figure 06: Intensity and Geographical Pattern in June

Figure 06 depicts the distribution and severity of dengue fever in June. Thematic mapping demonstrates how Kasur, a neighbouring city, is now influenced by Lahore. In Punjab, Lahore and Kasur are now geographically significant areas, while the remainder of the administrative regions is tranquil.



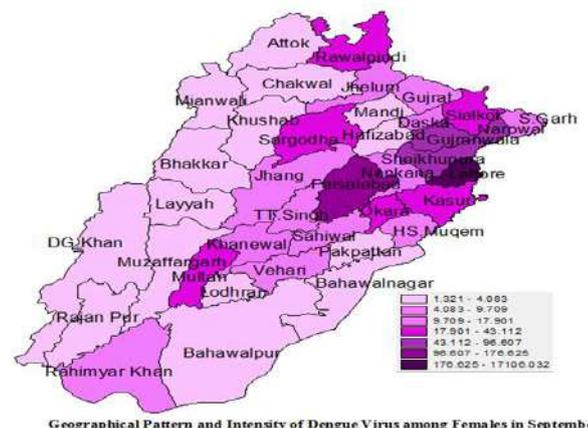
4. Geographical Pattern and Intensity in July, Figure 7.

Figure 07 depicts the distribution and severity of dengue fever in July. The dengue virus is currently travelling from Lahore to Attock and ending in Kasur. A female patient brought the dengue virus to Attock; otherwise, the mosquito's range is 2–3 kilometres. Patients being transported or a container carrying dengue larvae are the main causes of dengue spreading. Lahore has always been the consistent, influential geographic area on previous thematic maps. As June and July in Pakistan are the hottest months, keep Dengue actions to a minutest.



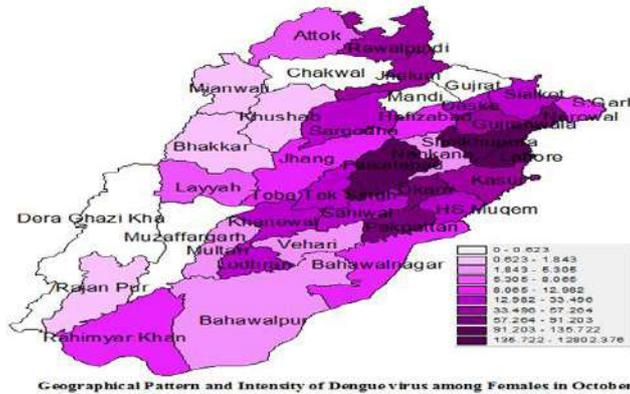
5. Figure 08: August's geographic design and intensity

Figure 08 depicts the distribution and severity of dengue fever in August. The epidemiological landscape of 26% of the province's geographic region altered this month. Due to climatic change, August is the beginning of the monsoon season, which causes temperatures to drop and humidity levels to soar. These conditions generate the ideal atmosphere for dengue fever to carry out its actions. Dengue is depicted in four levels, the first of which shows that 74% of the world's landmass is dengue free; the second sheet shows that the city of Jhang and RYK are experiencing low-levels dengue attacks. Multan, Nankana, and Bahawalnagar are highly visible in the third layer. The fourth layer reflects hotspots and locations of the greatest intensity, including Hafizabad, Sheikhupura, Faisalabad, and Lahore.



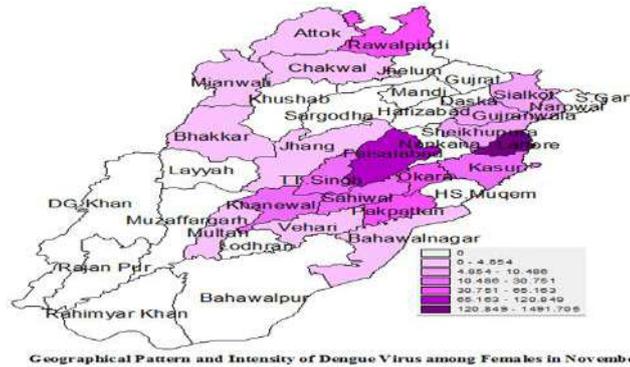
6. Figure 09: September's geographic design and intensity

Figure 09 depicts the distribution and severity of dengue fever in September. There is no Dengue-free zone, the entire theme of the map is affected, and an abrupt Dengue outbreak spread throughout the entire region. Thematic map's current status is divided into seven categories. 40% of the earth's surface is marginal, 29% is low, 17% is high, and 14% is a hotspot area at the highest level. Lahore, Sheikhupura, Narowal, and Faisalabad were hotspot locations in September



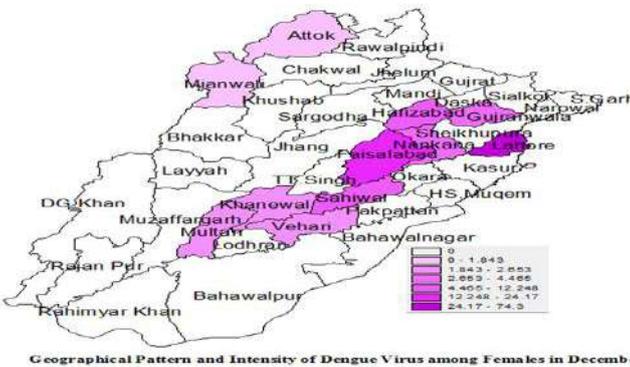
8. Figure 10: October's Geographical Pattern and Intensity

Figure 10 depicts the distribution and severity of dengue fever in October. Only five cities, or 13% of the whole region, are free of dengue, while dengue is present in varying degrees in other geographic areas. With, Sheikhupura, Faisalabad, Lahore, Okara, Pakistan, Jhelum, and Rawalpindi, hotspots cover 18% of the earth's surface. Here, 37% of the geopolitical region is at a high level, while 28% is at a marginal level. The intensity in Lahore, Sheikhupura, Rawalpindi, and Faisalabad remains constant.



9. Figure 11: November's geographic pattern and intensity

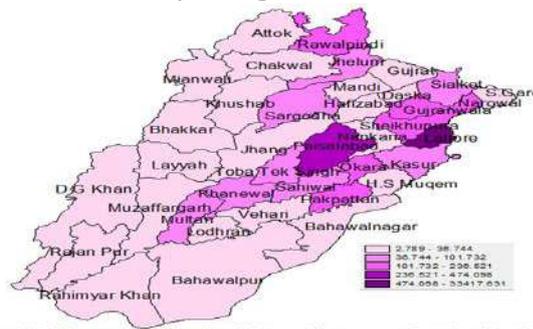
Figure 11 depicts the distribution and severity of the dengue virus in November. The epidemiological situation is improving as shown by this themed map. The temperature has considerably decreased this month, which limits Dengue activities. Currently, 50% of the earth's surface is dengue-free 15% at a low-slung level and 7% at a higher level of intensity are reflected through a 28% geographic region at the marginal level. Here are three hotspots' cities like Rawalpindi, Lahore, and Faisalabad.



10. Figure 12: December's geographic design and intensity

Figure 12 depicts the distribution and severity of dengue fever in December. The temperature is below 10°C throughout this month, and dengue activity stops. Compared to the previous theme map, the epidemiological condition is improved and

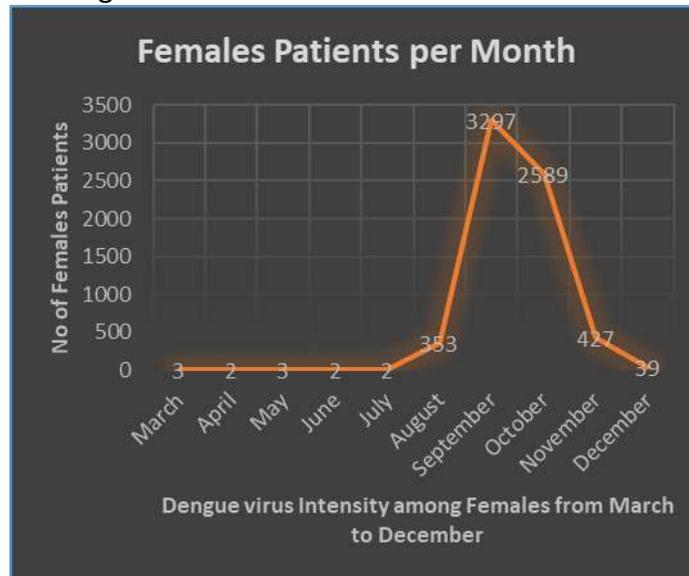
under control. Currently, 71% of the region is a dengue-free zone, 5% of it is marginal, 18% of it is little, and just 6% of it is showing high strength. Only 2 places, Lahore and Faisalabad, are hotspots. One thing is clear: Lahore continues to appear on all thematic maps and is constantly identified as a hotspot region



Geographical Pattern and Intensity of Dengue Virus among Females, March to December

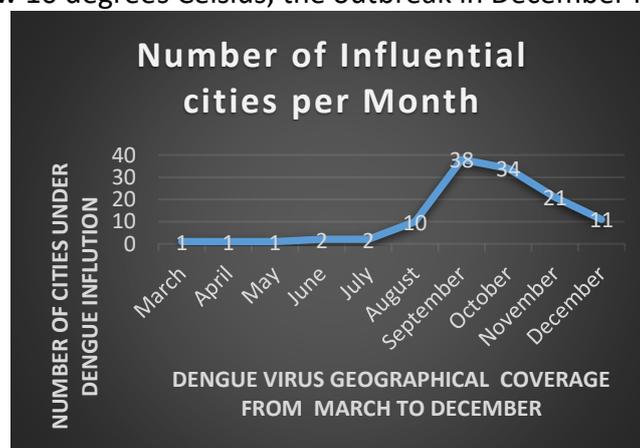
11. Geographical Pattern and Intensity in Figure 13 April through December

Figure 13 depicts the dengue virus' pattern and strength from that the month of March to almost December. It is an instance of 37 epidemiologic weeks with female's patient who were registered. No administrative zoon was dengue-free because the outbreak affected the whole geographic territory of Punjab. In it, 27% of the geographic area is still marginal, 33% is low, 26% is high, and 14% are hotspots at the highest level.



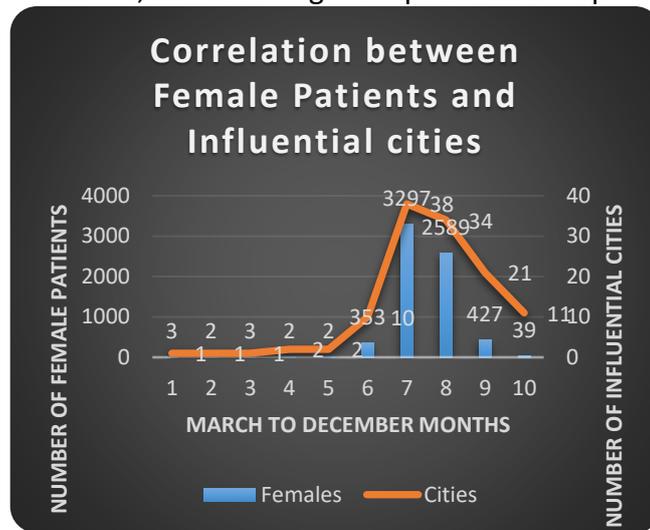
12. Figure 14 shows the prevalence of the dengue disease amongst women from March to December

Figure 14 displays several female patients broken down by month. From March to July, we can see that only a few patients arrive each month. The beginning of August coincides with a period of monsoon rain, which creates an ideal environment for the Dengue virus. There is an outbreak from August to November that is increasing the number of female patients. Due to Dengue's inability to function below 10 degrees Celsius, the outbreak in December is at its peak.



13. Dengue virus in Figure 15. Females' geographic distribution from March to December

Figure 15 displays several significant geographic areas in terms of months. Concerning months, significant cities' trend is nearly the same as that of a lot of Female patients. Like the previous graph, the number of significant cities from March to July is not more than two. Cities with a lot of influence grow quickly as August begins and continue through November. In the Punjab region, there are 38 distinct districts, all of which gain importance in September.



14. Figure 16 shows the relationship between influential cities and female patients

Figure 16 represent a strong correlation of 0.93 between female's patient and influential cities. It reveals an optimistic pattern, from August to December, between female patients and powerful cities. There are no odds of an epidemic before or after this session.

3.2.2 RESULT AND DISCUSSION: According to this study, this outbreak affected 7,000 female patients, and 86% of them were from the country's main city of Lahore, according to the research reports. Beginning in March and continuing through July, the virus was constrained to Lahore and a few other places since the weather and humidity did not support Dengue activity. When the temperature is too high (above 45 degrees Celsius) or too low (below 10 degrees Celsius), dengue stops working. Between the number of registered patients and the number of significant Punjabi districts, a substantial correlation of 0.93 was found. Occasionally, an outbreak will begin in Lahore and spread to neighbouring cities in Punjab. Dengue virus spread from Lahore to neighbouring cities was caused by the transportation of patients moving from one location to another. Because mosquitoes can only fly a maximum distance of 3 kilometres. Dengue outbreaks are seen to follow a seasonal pattern, beginning in August and lasting until December. The months of September and October saw the majority of the devastation. In September, Dengue fever spread to every area. Lahore, Sheikhpura, Faisalabad, and Rawalpindi became the outbreak's hotspot cities. Only in Lahore, there were 707.68 patients registered on average every week from August to November.

REFERENCES: [1] S. S. Sam, S. F. S. Omar, B. T. Teoh, J. Abd-Jamil and S. Abubakar, "Review of Dengue Hemorrhagic Fever Fatal Cases Seen Among Adults: A Retrospective Study," *PLoS Negl. Trop. Dis.*, vol. 7, no. 5, pp. 1–7, 2013. [2] L. Villar, G. H. Dayan, J. L. Arredondo-García, D. M. Rivera, R. Cunha, C. Deseda, H. Reynales, M. S. Costa, J. O. Morales-Ramírez, G. Carrasquilla, L. C. Rey, R. Dietze, K. Luz, E. Rivas, M. C. Miranda Montoya, M. Cortés Supelano et al., "Efficacy of a Tetravalent Dengue Vaccine in Children in Latin America," *N. Engl. J. Med.*, vol. 372, no. 2, pp. 113–123, Jan. 2015. [3] J. E. Sam, T. S. Gea and A. W. Nasser, "Deadly intracranial bleed in patients with dengue fever: A series of nine patients and review of the literature," *J. Neurosci. Rural Pract.*, vol. 7, no. 3, pp. 423–34, 2016. [4] K. Nakano, "Future risk of dengue fever to workforce and industry through the global supply chain," *Mitig. Adapt. Strategy. Glob. Chang.*, pp. 1–17, Mar. 2017. [5] F.-Z. Xiao, Y. Zhang, Y.-Q. Deng, S. He, H.-G. Xie, X.-N. Zhou and Y.-S. Yan, "The effect of temperature on the extrinsic incubation period and infection rate of dengue virus serotype 2 infections in *Aedes albopictus*," *Arch. Virol.*, vol. 159, no. 11, pp. 3053–3057, Nov. 2014. [6] G. R. Medigeshi, R. Kumar, E. Dhamija, T. Agrawal and M. Kar, "N-Desmethylclozapine, Fluoxetine, and Salmeterol Inhibit Postentry Stages of the Dengue Virus Life Cycle.," *Antimicrob. Agents Chemother.*, vol. 60, no. 11, pp. 6709–6718, Nov. 2016. [7] N. Afreen, I. H. Naqvi, S. Brook, A. Ahmed, S. N. Kazim, R. Doha, M. Kumar and S. Parveen, "Evolutionary Analysis of Dengue Serotype 2 Viruses Using Phylogenetic and Bayesian Methods from New Delhi, India," *PLoS Negl. Trop. Dis.*, vol. 10, no. 3, p. e0004511, Mar. 2016. [8] Y. H. Ye, S. F. Chenoweth, A. M. Carrasco, S. L. Allen, F. D. Frentiu

A. F. van den Hurk, N. W. Beebe and E. A. McGraw, "Evolutionary potential of the extrinsic incubation period of dengue virus in *Aedes aegypti*," *Int. J. Org. Evol.*, vol. 70, no. 11, pp. 2459–2469, Nov. 2016. [9] A. Nisalak, H. E. Clapham, S. Kalayanaroj, C. Klungthong, B. Thaisomboonsuk, S. Fernandez, J. Reiser, A. Srikiatkachorn, L. R. Macario, J. T. Lessler, D. A. T. Cummings and I.-K. Yoon, "Forty Years of Dengue Surveillance at a Tertiary Pediatric Hospital in Bangkok, Thailand, 1973–2012.," *Am. J. Trop. Med. Hyg.*, vol. 94, no. 6, pp. 1342–7, Jun. 2016. [10] L. Thomas, A. Cabie and R. Teyssou, "Dengue Shock Syndrome or Dehydration? The Importance of Considering Clinical Severity When Classifying Patients with Dengue," *Clin. Infect. Dis.*, vol. 58, no. 7, pp. 1038–1039, Apr. 2014. [11] M. Palaniyandi, P. H. Anand, R. Maniyosai, T. Mariappan and P. K. Das, "The integrated remote sensing and GIS for mapping of potential vector breeding habitats, and the Internet GIS surveillance for epidemic transmission control, and management," *J. Entomol. Zool. Stud.*, vol. 4, no. 2, pp. 310–318, 2016. [12] M. O. Lwin, S. Vijaykumar, V. S. Rathnayake, G. Lim, C. Panchapakesan, S. Foo, R. Wijayamuni, P. Wimalaratne and O. N. N. Fernando, "A Social Media Health Solution to Address the Needs of Dengue Prevention and Management in Sri Lanka.," *J. Med. Internet Res.*, vol. 18, no. 7, p. e149, Jul. 2016. [13] M. Palaniyandi, "Need for GIS-based dengue surveillance with Google internet real-time mapping for epidemic control in India," *Int. J. Geomatics Geosci.*, vol. 5, no. 1, pp. 132–145, 2014. [14] R. Lowe, X. Rodo, C. Barcellos, M. S. Carvalho, C. A. S. Coelho, T. C. Bailey, T. E. Jupp, D. B. Stephenson, G. E. Coelho, R. J. Graham and W. M. Ramalho, "Dengue epidemic early warning system for Brazil," 2015. [15] L. I. Zambrano, M. Sierra, B. Lara, I. Rodríguez Núñez, M. T. Medina, C. O. Lozada-Riascos and A. J. Rodríguez-Morales, "Estimating and mapping the incidence of dengue and chikungunya in Honduras during 2015 using Geographic Information Systems (GIS)," *J. Infect. Public Health*, 2016. [16] N. C. Dom, A. H. Ahmad, Z. A. Latif and R. Ismail, "Application of geographical information system-based analytical hierarchy process as a tool for dengue risk assessment," *Asian Pacific J. Trop. Dis.*, vol. 6, no. 12, pp. 928–935, 2016.

Examination of Digital Transformation in Terms of Generations and Some Socio-Demographic Variables

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Abstract: In this research conducted in Konya industrial enterprises, it was aimed to measure the generations and other socio-demographic variables of the digital transformation of the employees. It was analyzed whether the responses of the respondents to the scale differ according to their demographic characteristics. Research data were obtained from employees working in hydraulic, machinery and metal industry enterprises in Konya by convenience sampling method. For this purpose a questionnaire was applied to 400 participants, and 292 data were used in the analysis for various reasons. For the purpose of the research, descriptive statistics, normality tests, reliability analysis, one-way analysis of variance (ANOVA) and T test were performed. While significant differences were found in the digital transformation perceptions of the employees according to the generations and educational status variables, there was no difference in the perceptions of digital transformation according to whether the employees were managers or not. A significant difference was found in the digital transformation perceptions of the employees according to the type of manager.

Keywords: Digital Transformation, Employees

INTRODUCTION: Digital signals are ground-breaking. Every new event starts with the closing of an era and causes a new era to begin. Sometimes there are inventions because of a war, sometimes a necessity and sometimes a necessity. Faster and more active use of information in business processes; Intensive use of information technologies to increase money, time and quality of life has accelerated digital transformation. Capturing and managing digital transformation has become the agenda of today's businesses. While it has become an important issue what digital transformation is and who will bring it to businesses, domestic and foreign resources have shed light on many uncertainties about digital transformation and digital leadership. Digitalization shows itself in the industrial sector as well as in every field. Today, many businesses use digitalization, digital channels.

1. CONCEPTUAL FRAMEWORK:

1.1. Digital Transformation: The development of internet, information and production technologies necessitates innovative developments for the global market and the continuous variability of products and services. Businesses and businesses keep

up with today's age, where technology offers innovations, in order to ensure permanence in the sector, to maintain economic progress, to add value to their values, to compete in the global market with products and services. With the digital transformation, the concepts of production, service, service and consumer are renamed and a new generation economy and lifestyle is formed. Businesses and businesses that have started to manage the transformation are aware of the need to learn something new and improve themselves every day. It is known that the first important change in the social progress process and working life in the history of humanity started with cultivating the land. In agricultural communities, where production is made with uncomplicated techniques and non-modern equipment, the importance given to work has a certain importance in the agricultural sector, while the situation is in the opposite direction in non-agricultural activities. In this period, those produced within the scope of business relations are considered as goods related to the land (Çetin Güler, 2003: 18-45). Factors of production before the industrial revolution; man, earth and animal consisted of the triple cycle. The sectors on the agenda consisted of agriculture, animal husbandry and blacksmithing. Before industry, the social configuration consisted of producers and consumers. With the development of the Industrial Revolution, the beginning of the transformations began to change its effect in the field of production. The discovery of power sources for the industrial era began in the 18th century, when mechanization began to gain importance in the world. It has created radical changes in production and economic structure. The developmental stages of the industrial revolution were collected in 4 stages. During Industry 1.0 there are two radical changes that the history of humanity has experienced since its existence. The first of these changes while it was the agricultural revolution that took place in the year 8 thousand, it is seen that the second one is the industrial revolution that started in the 18th century and directed the majority of the people engaged in agriculture to the production of services and products (Metin, 2019). The collection of the population in small settlements, the production method, the workshop type, and the fact that the production factor was labor are the characteristics of that period. The equipped production approach has left its place to the machine understanding. With the invention of the steam engine, the industrialization process was entered. With the revolution that took place, machines began to replace human labor in production. With the successive establishment of factories, machines producing identical products ensured sustainability in production activities on a regular basis. With industrialization, the opening of new workplaces where machines, which are substitutes for production based on human power, are used, has increased. The fact that they receive allowances in return for their work in these workplaces has revealed the working class (Altan, 2009: 45). At the industry 2.0 period, after the invention of steam engines, the new era was influential in the automotive sector, with the new era, studies on electricity began and important steps were taken for new inventions. With the invention of internal combustion engines, petroleum began to be used as an energy source in machines. Automobiles started to be produced with the mass production line established by Henry Ford in 1903 (Ak, 2018: 10-11). An unforgettable real industrial revolution is still considered the turning point of manufacturing. The existence of steel production has led to innovations in the context of technology. The variation of railways has given an impetus to economic life. The fact that oil and its allies brought innovations to the economy began to develop in the automotive field. The 1973 oil crisis was an event that ended the second industrial revolution. The activities that took place in the industry 3.0 period of nuclear power and the automation industry led to advances in the fields of atomic energy-related investigations, high-level research, advanced computer-based information systems, small-electronic operational systems and cyber networks (Kagermann et al., 2013). The emergence of technological systems and robots in production activities ensured the continuation of the rapid development of the 3rd industrial age and the new era was started. In the Industry 4.0 era, businesses aimed to survive and be more effective in the competitive environment created by the digital transformation that affected the world, to ensure their sustainability and to maintain their position in the sector. Industrial revolutions lead to the change of economy and society by adapting digital technologies, computer networks, software and internet developments in many areas of human life. In this process of change, it turns to low-cost and high-quality products or services. In production systems, connecting equipment, machines and systems to each other, analyzing data, determining new parameters and processes is accepted as the fourth industrial process. In this context, Industry 4.0 or Industrial Internet is defined as the Internet of objects, machines, computers and people in the literature (Özsoylu, 2017: 41-64). While employees are self-directed until the industry 4.0 period, robots will start to be included in their teammates with the digital transformation, and they will experience ebbs and flows between their personal experiences and the demands of the digital world from time to time (Kagermann et al., 2013: 53). In the end, employees may experience loss of control in the face of digital transformation, alienation from the working environment and work (Nuroğlu & Nuroğlu, 2018b).

2. METHODOLOGICAL FINDINGS:

2.1. Purpose and Method of Research: The research was created to determine the digital transformation and digital leadership perceptions of employees in hydraulic, machinery and metal industry enterprises in Konya according to demographic variables. The population of the research was determined as 5000. 400 questionnaires were distributed to the employees. As a result of the analysis, the questionnaires with missing answers were not taken into consideration, and 292 questionnaires were evaluated. The questions asked with the questionnaire technique were created with a 5-point Likert-type. Employees participating in the research were informed about the study subject. They were reminded that all information would be kept confidential, the study was conducted for scientific purposes, and they were informed about sharing their true thoughts. The codes of the answers given by intergenerational employees mean 1) Strongly Disagree, 2) Disagree, 3) Partially Agree, 4) Agree, and 5) Totally Agree. The Informatics Leadership Scale, which includes 18 statements developed by Ulutaş and Arslan (2018), was used to determine the perception of Digital Leadership. In order to determine the perceptions of digital transformation, a 5-point Likert-type scale was used by Nadeem et al. (2018) based on different studies (Gudergam & Mugge, 2017; Jafarzadeh, et al., 2015; Kane et al., 2016; Lansiti & Lakhani, 2014; Svahn, Mathiassen & Lindgren, 2017) which was composed of 12 statements and evaluated as 1) I totally disagree, 2) I disagree, 3) I partially agree, 4) I agree, and 5) I totally agree. The adaptation study of the scale into Turkish was carried out by Sağlam (2019).

2.2. Findings of the Research: The results of the normality test of the data are shown in Table 1.

Table 1: Normality Test

	Skewness	Kurtosis
Digital Transformation	-,783	,516

In the relevant literature, it is stated that the data are normally distributed if the skewness and kurtosis values of the variables are between -1.5 and +1.5 (Tabachnick and Fidell, 2013: 83). Accordingly, the perception of digital transformation is between -1.5 and +1.5 and the data is normally distributed.

Demographic Findings: Individuals working in industrial enterprises in Konya and performing different occupational groups participated in the research (n=292). As can be seen in Table 2, the demographic characteristics of the employees participating in the research are as follows: 23 (7.8%) of the participants are female and 269 (91.5%) are male. When the age ranges of the participants participating in the research are observed, it is seen that the generation Baby Boomers generation with the lowest rate of participation is 3 people (1%), while the highest rate of participation is Y generation with 131 people (44.6%). Of the participants, 235 (79.9%) were married and 57 (19.4%) were single. Looking at the education levels of the participants, there are 147 employees (50%) with the highest Associate and Bachelor's degrees, and 11 (3.7%) employees with the lowest postgraduate education. When the working time of the employees in the enterprise is examined it is seen that the working period of 187 employees is less than 3 years, while 29 employees have been actively involved in the enterprise for 8 or more years. 9.9% of the participants work in this company. The status of the employees in the workplace, 244 people (83%) are not managers, while 48 (16.3%) people work as managers. 8 people (2.7%) working as managers in the enterprise are working in the upper-level management, 39 people (16.7%) are middle level managers and 22 (7.5%) are lower-level managers.

Table 2: Frequency and Percentage Analysis of Demographic Findings

Demographic Features	N	%
Gender		
Female	23	7,8
Male	269	91,5
Generation		
Baby Boomers	3	1
X generation	49	16,7
Y generation	131	44,6
Millennium generation	43	14,6
Z generation	66	22,4
Marital Status		

Married	235	79,9
Single	57	19,4
Educational Status		
Primary and Secondary education	134	45,6
Associate degree and Undergraduate	147	50
Master's Degree	11	3,7
Operation time in the business		
less than 3 years	187	63,6
between 3 and 7 years	76	25,9
8 years and more	29	9,9
Position		
Employee	244	83
Manager	48	16,3
If you are an Administrator		
Senior Manager	8	2,7
Middle Level Manager	39	14,6
Sub-Tier Manager	22	7,5

Reliability Test: The Cronbach's Alpha coefficient is the most widely used method for testing reliability. The alpha value depends on the mean correlation between the items in a scale and shows the internal consistency of the scale. Since the scales measure a certain structure, it shows that the items that make up the scale have a positive correlation with each other. The low value of the Cronbach's Alpha coefficient (closer to 0) indicates that the variables are not intrinsically related. A Cronbach's Alpha coefficient between 0-60 and 0-70 indicates that the scale is usable. A Cronbach's Alpha coefficient greater than 0-70 indicates high internal consistency (Tabachnick and Fidell, 2013). As seen below, in the study on SSPS Cronbach's Alpha is calculated as $\alpha \geq .9$ for both scales. The values of the scales used in the study, the Cronbach's alpha coefficient for digital transformation is 96%, and the Cronbach Alpha (CA) values are; excellent ($0.90 \leq \alpha$), good ($0.70 < \alpha < 0.90$), acceptable ($0.60 \leq \alpha < 0.70$), poor ($0.50 \leq \alpha < 0.60$), and acceptable ($\alpha < 0.50$) (Kılıç, 2016). These results show that the scale has acceptable internal consistency (İnal & Günay, 2013).

Table 3. Cronbach's Alpha Values of the Scales

Variables	Item Nu.	Cronbach's Alfa
Digital Transformation	12	0,96

Difference Tests According to Demographic Variables: Whether the responses of the respondents to the scale differed according to their demographic characteristics were tested with the t-test for two-category variables and with one-way anova analysis for variables with more than two categories. If there is a statistically significant difference after the Anova analysis, there are many types of multiple comparison tests in order to determine in which categories they occur. Scheffe test was used to determine the differences between digital transformation by age groups.

Tablo 4: Digital Transformation Evaluation by Marital Status

Factors	Married (N=235)		Single (N=57)		P
	\bar{x}	Std. d.	\bar{x}	Std. d.	
Digital Transformation	3,5	0,97	3,5	0,82	,695

According to the t-test results, there is no significant difference in terms of digital transformation in terms of the marital status of the employees. ($p < 0.05$). Digital transformation perceptions of married and single people working in the business are 3.5. According to the t-test result, there is a significant difference in terms of digital leadership in terms of marital status of employees ($p < 0.05$).

Table 5: Digital Transformation Evaluation by Gender

Factors	Female (N=23)		Male (N=269)		P
	\bar{x}	Std. d.	\bar{x}	Std. d.	

Digital Transformation	3,30	0,87	3,53	0,95	,262
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According to Table 5, there is no difference between digital transformation according to the gender of the employees. While the digital transformation average of women is 3.30; The difference between them is 3.53. Although the difference between them is not statistically significant, the average of women is lower than that of men.

Table 6. Digital Transformation Evaluation by Generations

Factors	Baby Boomer Gen. (N=3)		X Gen. (N=49)		Y Gen. (N=131)		Millennium Gen. (N=43)		Z Gen. (N=66)		P
	\bar{x}	Std. d.	\bar{x}	Std. d.	\bar{x}	Std. d.	\bar{x}	Std. d.	\bar{x}	Std. d.	
Digital Transformation	2,66	1,154	3,24	0,82	3,48	0,92	3,37	1,38	3,90	0,51	,001

According to Table 6, it is seen that there is a significant difference in digital transformation perceptions of employees according to generations. While the digital transformation perceptions of the Z generation are (3.90), the Y generation (3.48), the Millennials (3.37), the X generation (3.24), the Baby Boomers' digital transformation perception is (2.66).

Table 7. Evaluation of Digital Transformation by Generations Multiple Comparison (ANOVA)

Factors	Generations	Difference	P	Significant Difference	
Digital Transformation	Baby Boomer Gen.	X Gen.	-,57823	,892	No difference
		Y Gen.	-,82188	,675	
		Millennium Gen.	-,70543	,801	
		Z Gen.	-1,24242	,269	
	X Gen.	Baby Boomers Ge	,57823	,892	There is a significant difference between generation X and generati
		Y Gen.	-,24365	,647	
		Millennium Gen.	-,12720	,979	
		Z Gen.	-,66419*	,006	
	Y Gen.	Baby Boomers Ge	,82188	,675	No difference
		X Gen.	,24365	,647	
		Millennium Gen.	,11646	,972	
		Z Gen.	-,42054	,061	
	Millennium Gen.	Baby Boomers Ge	,70543	,801	No difference
		X Gen.	,12720	,979	
		Y Gen.	-,11646	,972	
		Z Gen.	-,53700	,068	
	Z Gen.	X Gen.	1,24242	,269	There is a significant difference between Generation Z and Generati
		Y Gen.	,66419*	,006	
		Millennium Gen.	,42054	,061	
		Baby Boomers Ge	,53700	,068	

As can be seen in Table 7, while a difference was observed in the digital transformation perceptions of employees according to some generations, there was no difference between some generations. There is no significant difference between Baby Boomers generation, Y generation and millennial generation with other generations (as there is no $P < 0.05$). There is a significant difference between Generation X and Generation Z, and between Generation Z and Generation Y.

Table 8. Digital Transformation Evaluation According to Educational Status

Factors	Primary and Secondary Education (N=134)	Associate degree and Undergraduate (N=147)	Master's degree (N=11)	P
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	\bar{x}	Std. d.	\bar{x}	Std. d.	\bar{x}	Std. d.	
Digital Transformation	3,13	0,90	3,77	0,84	4,72	0,46	,000

In Table 8, it is seen that there is a significant difference in the digital transformation perceptions of the employees according to their educational status according to the anova test ($p < 0.05$). While the sensitivity of master's graduates to digital transformation (4.72), associate and undergraduate graduates (3.77); the digital transformation perceptions of primary and secondary education graduates are (3,13). Digital transformation perceptions of employees with a master's degree are higher than those with other education degrees. It is seen that there is a significant difference in digital leadership perceptions according to the educational status of the employees according to the anova test ($p < 0.05$). While the digital leadership perceptions of those with a master's degree (2.90) are the digital leadership perceptions of primary and secondary school graduates (2.72); associate degree and undergraduate graduates (1,86). Digital leadership perceptions of employees with a Master's degree are higher than those with other education degrees.

Table 9. Digital Transformation and Multiple Comparison Evaluation by Educational Status (ANOVA)

Factors	Educational Status		F	P	Significant Difference
Digital Transformation	Primary and Secondary Education	Ön Lisans ve Lisans	-,64118*	,000	There is a significant difference
		Master's degree	-1,59294*	,000	
	Assoc. degree and Undergraduate	Primary and Secondary Education	,64118*	,000	There is a significant difference
		Master's degree	-,95176*	,002	
	Master's degree	Primary and Secondary Education	,18521	,886	There is a significant difference between master's graduates and primary/secondary education graduates
		Assoc. degree and Undergraduate	1,04515*	,022	

As can be seen in Table 9, according to the results of the Scheffe test, there are significant differences in the digital transformation perceptions of the employees according to their educational status. According to this, there is a significant difference in the digital transformation perceptions of primary and secondary education graduates compared to associate/undergraduate ($p = .000$; $f = -.64118$) and Master's degree ($p = .002$; $f = -1.59294$) graduates. There is a significant relationship between primary/secondary education graduates ($p = .000$; $f = .64118$) and graduate graduates ($p = .002$; $f = -.95176$) in the digital transformation perceptions of associate and undergraduate graduates. Also, there is a significant relationship between primary/secondary education ($p = .000$; $f = 1.59294$) graduates and associate/undergraduate ($p = .002$; $f = .95176$) graduates in digital transformation perceptions of master's graduates.

Table 10. Digital Transformation Evaluation According to Being a manager or Not

Factors	Employee (N=244)		Manager (N=48)		P
	\bar{x}	Std. d.	\bar{x}	Std. d.	
Digital Transformation	3,53	0,89	3,41	1,16	,422

According to the results of the Anova test, there is no difference in the perceptions of status-oriented digital transformation ($p > 0.05$). While the digital transformation perception of the employees is 3.53, the digital transformation perception of the executive staff is 3.41. The digital transformation perception of the employees is slightly higher than that of the managers.

Table 11. Digital Transformation Multiple Comparison Evaluation by Manager Type (ANOVA)

Factors	Manager Type	Covariance established executive level	N	P	F	Significant Difference
Digital Transformation	Senior Manager N=8	Middle Level Manager Sub-Tier Manager	39	,021	,46154*	There is a significant difference between top-level managers and middle-level managers.
	Orta Kader Yönetici N=39	Senior Manager Sub-Tier Manager	8	,021	-1,46154*	There is a significant difference between middle-level managers and upper-level managers.
	Alt Kader Yönetici N=22	Senior Manager Middle Level Manager	8	,647	-,63636	No difference
			39	,085	,82517	

As seen in Table 11, there is no significant difference in digital leadership perceptions according to the type of manager. When the digital transformation perceptions of the employees are evaluated among the management groups; there is a significant difference between the middle-level manager groups and the other managerial groups of senior managers. Likewise, there is a significant difference between middle-level manager groups and upper-level managerial groups.

Table 12. Digital Transformation by Operation Time in Business

Factors	Less than 3 Years (N=187)		Between 3-7 Years (N=76)		8 and More Years (N=29)		P
	\bar{x}	Std. d.	\bar{x}	Std. d.	\bar{x}	Std. d.	
Digital Transformation	3,61	0,91	3,23	0,96	3,62	1,01	,011

As a result of the analysis of variance, there was no statistically significant difference between the working hours of the employees and their perceptions of digital transformation ($p>0.05$). When the working time is examined, the perception of digital transformation of employees less than 3 years is (3,61), the perception of digital transformation of employees between 3 and 7 years is (3,23), the average of those who work for 8 or more years is (3,62).

Table 13. Digital Transformation Multiple Comparison Evaluation by Operation Time in Business (ANOVA)

Factors	Duration	Covariance established run times	N	P	F	Significant Difference
Digital Transformation	Less than 3 years N=187	Between 3-7 years	76	,013	,37813	No difference
		8 and more years	29	1,000	-,00572	
	Between 3-7 years N=76	Less than 3 years	187	,013	-,37813*	There is a significant difference between those who work between 7 years and less than 3 years
		8 and more years	29	,173	-,38385	
	8 and more years N=29	Less than 3 years	187	1,000	,00572	No difference
		Between 3-7 years	76	,173	,38385	

As can be seen in Table 13, there is a significant difference between those who work for 3-7 years and those who work less than 3 years.

than 3 years in digital transformation perceptions according to working time in the enterprise.

3. CONCLUSION, EVALUATION, DISCUSSION AND RECOMMENDATIONS: Digital technologies are rapidly starting to lead to the adoption of businesses. Successes and failures in the digitalization process have brought a new voice to the literature. The phenomenon of digitalization is no longer a choice. It has become an absolute necessity for use by businesses. Leaders who are busy in adapting workflow applications to digital will choose the right implementation method to achieve strategic goals. In the research conducted in Konya industrial enterprises, it was desired to measure the perceptions of employees on digital transformation and digital leadership according to demographic variables. According to the t-test results, there is no significant difference in terms of digital transformation in terms of marital status of employees ($p < 0.05$). Although there is no statistically significant difference between the digital transformations of the employees according to their gender, the average of women is lower than that of men. It is seen that there is a significant difference in the digital transformation perceptions of the employees according to the generations. The digital transformation perceptions of the Z generation have a higher average than other generations. It is seen that there is a significant difference in the digital transformation perceptions of the employees according to their educational status according to the anova test ($p < 0.05$). Digital transformation perceptions of employees with a master's degree are higher than those with other education degrees. According to the results of the Anova test, there is no difference in perceptions of status-oriented digital transformation ($p > 0.05$). As a result of the analysis of variance, there was no statistically significant difference between the working hours of the employees and their perceptions of digital transformation ($p > 0.05$). In the research conducted by Gamze Arkan in 2021 on the impact of digital transformation on employee satisfaction; 55.8% are female, 44.2% are male, 64.9% are single, 35.1% are married, and when the age ranges are examined, it is seen that people between the ages of 26-35 are in the majority (%45.7). Persons aged between 18-25 constitute 24.9% of the sample, persons aged between 36-41 constitute 18.9% of the sample, and persons over the age of 42 constitute 10.6% of the sample. 57.4% of the participants are undergraduate graduates, and the majority of the rest are associate degree and post graduate graduates. Total working times have been compiled at certain year intervals. Less than 1 month 4.9%, between 1-2 years 7.5%, between 3-5 years 36.2%, 6-10 years 20.4% and people with more than 10 years of work experience were analyzed to make up 15.1% of the sample. In line with the examinations on the normality distribution for digital transformation, it has been determined that the data are normally distributed and parametric test applications are continued. In addition, the kurtosis value of the digital transformation view scale group was -0.209 and the skewness value was -1.027. Considering the judgments consisting of 12 statements in the digital transformation scale, the reliability of scale and scale dimensions was calculated, and since the reliability values are 0.90, it shows that it is highly reliable for the research. As a result, it has been determined that demographic characteristics have positive effects on digital transformation perceptions (Arkan, 2021: 60-69). Altuntaş (2018) has determined that the use of technological products is not enough for businesses to realize digital transformation in order to be successful, and a rate of 18% is required to have a strong leader. Güney examined the diseases and addictions that will emerge with the digital transformation in 2019. Artüz stated that there is a significant difference in the individual performance perception of the learning-organization relationship between digital leadership practices in the banking sector in 2020. Tutkunca (2020) underlined the concept of digital transformation in terms of businesses and underlined the inclusion of businesses in their implementation policies in existing research. When the literature is examined, very limited information and resources have been reached about digital transformation and digital leadership, which appear as a new value. More studies are needed to better express the concepts of digital transformation and digital leadership. In this way, its acceptability in social sciences will be an increasing value.

REFERENCES: Abbatiello, A., Knight, M., Philpot, S., & Roy, I. (2017). Rewriting the rules for the digital age: 2017 Deloitte Global Human Capital Trends. UK: Deloitte University Press. Ak, U. (2018). Endüstri 4.0 uygulamalarının makine verimliliğine etkisi ve beyaz eşya üretim sektöründe bir uygulama. Yüksek Lisans Tezi, İstanbul Teknik Üniversitesi Fen Bilimleri Enstitüsü İstanbul. Akdemir, A., Konakay, G., & Demirkaya, H. (2014). Y kuşağının kariyer algısı, kariyer değişimi ve liderlik tarzı beklentilerinin araştırılması. Muğla Sıtkı Koçman Üniversitesi İktisadi ve İdari Bilimler Fakültesi Ekonomi Ve Yönetim Araştırmaları Dergisi, 2 (2), s. 11-42. Akdemir, M., Kılınc, U. (2014). Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi C.24, S.4, s.793-811. Alan, H. & Köker, A. R. (2021). Stratejik Liderlikten Dijital Stratejik Liderliğe: Kavramsal ve Kuramsal Bir Tartışma. Türkiye Siyaset Bilimi Dergisi, 4 (2), 235-252. Retrieved from <https://dergipark.org.tr/tr/pub/tsbder/issue/65092/962146>. Altan, Ö. Z. (2009). Sosyal Politika Dersleri, (3. Baskı), Anadolu Üniversitesi Yayınları, Eskişehir. Çetin Güler, E. (2003). Değişen Bilgi Teknolojilerinin İnsan Kaynağı Üzerine Etkileri

(Yayınlanmamış Doktora Tezi). Ege Üniversitesi Sosyal Bilimler Enstitüsü. Ghufron, G. (2018). Revolusi Industri 4.0 Tantangan, Peluangdan Solusi bagi Dunia Pendidikan. In Seminar Nasional dan Diskusi Panel Multidisiplin Hasil Penelitian dan Pengabdian Kepada Masyarakat. Görçün, Ö. F. (2017). Dördüncü Endüstri Devrimi Endüstri 4.0, 2. bs., İstanbul, Beta. Kagermann, H., Wahlster, W., & Helbig, J. (2013). Recommendations for Implementing the Strategic Initiative Industrie 4.0 Final report of the Industrie 4.0 Working Group, National Academy of Science and Engineering, Frankfurt. Metin, S. (2019) İşletmelerin dijital dönüşüm (endüstri 4.0) farkındalık ve algı düzeyinin değerlendirilmesi: Elazığ OSB örneği (Doktora Tezi) Fırat Üniversitesi Sosyal Bilimler Enstitüsü, Elazığ. Nuroğlu H., Nuroğlu H. H. (2018). Endüstri 4.0'ı Türkiye'nin dış ticareti için bir fırsat penceresine dönüştürmek. Yönetim ve Ekonomi Araştırmaları Dergisi, 16, 329-346. Ordu, A., & Nayır, F. (2021). Dijital Liderlik Nedir? Bir Tanım Önerisi. E-International Journal of Educational Research, 12(3). Özmen, Ö. N., Eriş, E. D., & Özer, P. S. (2020). Dijital Liderlik Çalışmalarına Bir Bakış, Süleyman Demirel Üniversitesi, İktisadi ve İdari Bilimler Fakültesi Dergisi, 25(1), 57-69 Özsoylu, A. F. (2017). Endüstri 4.0. Dergipark Çukurova Üniversitesi İktisadi İdari Bilimler Fakültesi Dergisi, 21 (1), 41-64. Şimşeker, M., & Ünsar, S. (2008). Küreselleşme süreci ve liderlik. 3 (9), s. 1029-1045. Toduk, Y., & Gande, S. (2016). Whats next in Turkey? A new leadership model for connected age, In Amrop Leadership Series, 1-41 Tabachnick, B. G., & Fidell, L. S. (2013). Using Multivariate Statistics. 6th ed. Boston: Pearson, p. 113. Ulutaş, M., & Arslan H. (2018). Bilişim liderliği ölçeği: bir ölçek geliştirme çalışması. Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi, 47 (47), s. 109-118.

Synthesis of Carbon Microsphere from Inedible Crystallized Date Palm Molasses: Influence of Temperature and Residence Time



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Abstract: In this work, carbon microspheres (CM) were prepared by hydrothermal carbonization (HTC) of inedible crystallized date palm molasses. The effects of temperature and residence time on the prepared materials were studied. Experiments were carried out at different temperatures (180, 200, 230, and 250 °C) and residence times (2 – 10 h). It was found that the temperature had the greatest influence on the mass yield of the CMs. At a temperature of 180 °C and a reaction time of < 2 h, no solid products were observed. The highest yield was found to be 40.4 % at a temperature of 250 °C and a residence time of 6 h. The results show that the CMs produced were ~5-9 μm in diameter. The results also show that the largest diameter of the CMs (8.9 μm) was obtained at a temperature of 250 °C and a residence time of 6 h. However, if the residence time is extended beyond 6 h at 250 °C, the CMs fused and lose their spherical shapes.

Keywords: Inedible Crystallized Date Palm Molasses, Hydrothermal Carbonization, Carbon Microspheres, Temperature, Residence Time, Yield

1.0 Introduction: Micro-sized carbonaceous materials have promising applications in many fields, including carbon fixation, water purification, fuel cell catalysis, energy storage, bioimaging, drug delivery, and gas sensors (Hu et al., 2010; Abbas et al., 2018). In particular, there is considerable interest in the production of colloidal carbon microspheres (CMs) of various sizes by hydrothermal carbonization (HTC). Such products are similar to coal derived from the geological process of "coalification" beneath the Earth's surface, which occurs through the conversion of natural carbon-containing compounds under high pressure and temperature (Titirici et al., 2008). HTC is a process in which biomass is treated in a closed aqueous system at temperatures of 180-250 °C and self-generated pressure to produce solid materials known as hydrochar (Sevilla and Fuertes, 2009a). In general, hydrothermal CMs can be easily produced at relatively low temperatures and pressures by digesting low-cost available organic precursors such as saccharides (glucose, sucrose, and fructose) or biomass. This approach is straightforward, cost-effective and environmentally friendly. In addition to utilizing biomass waste to produce useful microparticles, this approach offers a unique carbon sequestration technology by removing carbon derived from plant material from the short-term carbon cycle. HTC of various types of saccharides has been studied by a number of researchers. Cai et al., (2018) synthesized CMs from glucose at 130 °C for 12 h in the presence of aluminium chloride. Qi et al., (2018) successfully obtained CMs from glucose at 180 °C for 10 h. Demir-Cakan et al., (2009) synthesized CMs from glucose at 190 °C for 16 h in the presence of acrylic acid. Li et al., (2011) investigated the effects of various parameters on the preparation of CMs from glucose, including glucose concentration (0.3–0.5 mol/L, 50 mL), reaction temperature (140–210 °C), and residence time (3-7 h). The results showed that temperatures between 180 and 190 °C and a reaction time of 4–5 h were suitable for the formation of CMs. Interestingly, they found that at a reaction time of 7 h, the produced material melted and formed peanut-like and other irregular shapes. Sanchez-Sanchez et al., (2020) synthesis of CMs based on tannin–sucrose mixtures using different pH (2 to 8) and temperatures (160, 180 or 200 °C). The results showed that the yield of CMs increased with increasing pH. While, increasing the temperature from 160 to 200 °C slightly decreased the yield of CMs. Furthermore, the results revealed that the addition of more sucrose resulted in smaller microspheres, which was due to the increased number of spores produced by the HTC of sucrose. Sulistya et al., (2020) prepared CMs from sucrose with citric acid at 190 °C and for 6 h. Bedin et al., (2018) concluded that the optimal conditions for obtaining CMs from sucrose are at a temperature of 194 °C, a time of 1197 minutes (≈ 50 h), and a sucrose concentration of 0.85 mol/L. Zhao et al., (2017) and Shi et al., (2021) obtained CMs from HTC of sucrose at 180 °C with reaction times of 12 h and 24 h, respectively. Zhang et al., (2012) used fructose as a starting material for the synthesis of CMs using HTC at temperatures ranging from 150 °C – 190 °C for various periods of time up to 48 h. Findings revealed that the average size and the quantity of the CMs increased with increasing temperature and reaction time. Jung et al., (2021) studied the growth and formation rates of CMs prepared from fructose at 200 °C and 20-180 min reaction time using HTC with three additive salts, namely KCl, CaCl₂ or FeCl₃. The results indicated that the particles achieved stable particle size at longer reaction times, regardless of the added salts. Ryu et al., (2010) found that the carbon productivity from these sugars was very low, for instance the yields of the solid products derived from xylose and fructose were only 3.2%. It was reported that the temperature for the onset of HTC of sugar such as glucose, sucrose, and fructose (~160–170 °C) is lower than for cellulose (Sevilla and Fuertes, 2009a; Sun and Li, 2004). This is

attributed to a high degree of structural complexity, which is thought to affect the mechanism of HTC (O'sullivan, 1997; Falco et al., 2011). However, in another study, solid carbon spheres were not obtained at temperatures lower than 180 oC (Li et al., 2011). Li et al., (2011) found that temperatures below 180 oC were most likely insufficient to break down the major components of sugar and no solid products were formed. In contrast, a solid product is formed at a temperature of ≥ 180 oC (Li et al., 2011). This may indicate that temperatures between 180 oC and 250 oC are suitable for the formation of the solid products. Nevertheless, it is worth noting that the use of high temperatures with sufficient reaction time may lead to the formation of secondary char, which dominates the mechanisms of hydrochar formation (Wang et al., 2018). Date palm (*Phoenix dactylifera* L.) is the most important harvest plant in Saudi Arabia. There are more than 31 million palm date trees in Kingdom of Saudi Arabia, making the Kingdom the second largest producer of dates in the world, produce about 1.07 million tons of dates per year (Taghizadeh-Alisaraei et al., 2019). Large quantities of these produced dates are wasted due to long storage periods and improper storage. Therefore, many date producers' resort to turning them into molasses. Date molasses or date syrup has a shelf life of about two years if stored under suitable conditions. After this period, it begins to crystallize and becomes inedible and must be discarded. Date molasses consists of large amounts of reducing sugars. Glucose and fructose are the two main components of sugar in date molasses (El-Sharnouby et al., 2014). "Sukkari" type palm trees account for the largest proportion in the Kingdom of Saudi Arabia. The fruits of these trees contain glucose (51.80%), fructose (47.50%) and a small amount of sucrose, fucose and galacturonic acid (Siddeeg et al., 2014). Therefore, crystallized and inedible palm molasses (waste molasses) were used in this study and converted to CMs due to their high contents of glucose and fructose. In the study, we also investigated the effect of temperature and residence time on the formation and production rate of CMs.

2.0 Materials and Methods:

2.1 Raw Material and Chemicals: Crystallized, inedible, expired molasses was obtained from a local market in Riyadh. Deionized water was used for the HTC process and for washing the solid samples. Absolute ethanol (99.9%) was purchased from Sigma-Aldrich, USA, and used for final washing of the solid samples.

2.2 Hydrothermal Carbonization: A typical synthesis was carried out according to our previous work as follows (Al-Awadi et al., 2022): 4 g of molasses was dissolved in 25 mL of deionized water and stirred for 2 h with a magnetic stirrer. Samples were then placed in Teflon-lined autoclave reactors (PARR, 4744 general acid digestion vessel – 45 mL) for HTC. The digestion vessels were tightly sealed and heated in muffle furnace at different temperatures (180 – 230 °C) for different times (2 h and some samples up to 48 h). The digestion vessels were removed from the muffle furnace and allowed to cool for about 12 h. The solid product of molasses HTC was obtained by filtration of the dark coloured liquids and washed several times with distilled water and absolute ethanol. The recovered moist products were dried in an oven at 80 °C for 24 h. Subsequently, the obtained final products were stored in a desiccator. The yield of the product was expressed as the final weight of the dry product. Percent yield was expressed using equation 1:

$$Yield = \frac{W_c}{W_o} \times 100 \quad (1)$$

where, W_c and W_o are the weight of the final dry product (g) and the weight of the dry raw material (g), respectively. Scanning electron microscopy (SEM), Tuscan VEGA II LSU (Tuscan USA Inc.) was used to analyse the surface morphology of the products.

3.0 Results and Discussions:

3.1 Product Yield: The yield of converting the palm date molasses to products are summarized in Table 1. The obtained products were designated as "MO-X-Y", where "X" represented the HTC temperature and "Y" for residence time. The experiments showed that solid products are not formed when the reaction temperature and residence time are less than 180 °C and 2 h, respectively. At these conditions, the colour of the product from the hydrothermal process was brown and went through the filter paper without retaining solids. This result agrees well with the work of Li et al. (2012), who could not obtain CMs from glucose at 180 °C and residence times of less than 2 h. An increase in temperatures and residence times leads to an increase in yield values. It is worth noting that a low temperature (e.g., 180 °C) and a low residence time (e.g., 2 h) produce only a very small amount of CMs with a production rate of 3.6%. Increasing the residence time from 2 to 30 h leads to an increase in CM production to 36%. Increasing the residence time beyond 30 h does not increase the production rate, as can be seen at 36 h (Table 1). It is clear that the production rate has decreased from 36% to 33%. From this table, it can be seen that the highest CM production rate (40.4%) was achieved when the temperature was raised to 250 °C and the

residence time was 6 h. Hoekman et al. (2011) found that for genocellulose, yield decreased from 69.1% to 50.1% when the temperature was increased from 215 °C to 255 °C. The results of this work are consistent with the findings of Hoekman et al. (2011) when the temperature was increased from 230 °C to 250 °C for 8 h. However, these results are not consistent with lower residence times (e.g., 4 and 6 h). Figures 1 and 2 show the effect of temperature and residence time on the CMs yields. It is evident from Figure 1 that for residence time of 8 h, increasing the temperature increases the yield up to a certain point and then gradually decreases. Figure 2 reveals that the yield decreases with increasing residence time.

Table 1: Yield of the samples

Sample	Yield (%)	Particle diameter (mm)
MO-180-2	3.6	4.8
MO-180-4	7.3	5.6
MO-180-6	16.8	5.8
MO-180-8	25.0	6.3
MO-180-10	27.3	6.5
MO-180-12	29.7	6.9
MO-180-16	31.9	7.0
MO-180-20	33.7	7.2
MO-180-24	35.7	7.3
MO-180-30	36.0	7.6
MO-180-36	33.5	7.8
MO-200-2	10.9	6.5
MO-200-4	14.6	7.1
MO-200-6	28.5	7.5
MO-200-8	34.3	7.8
MO-200-10	33.7	7.9
MO-230-2	20.1	7.4
MO-230-4	32.1	7.8
MO-230-6	33.5	8.1
MO-230-8	33.1	8.2
MO-230-10	32.9	8.4
MO-250-2	31.8	7.8
MO-250-4	33.4	8.3
MO-250-6	40.4	8.9
MO-250-8	30.8	No CMs
MO-250-10	27.7	No CMs

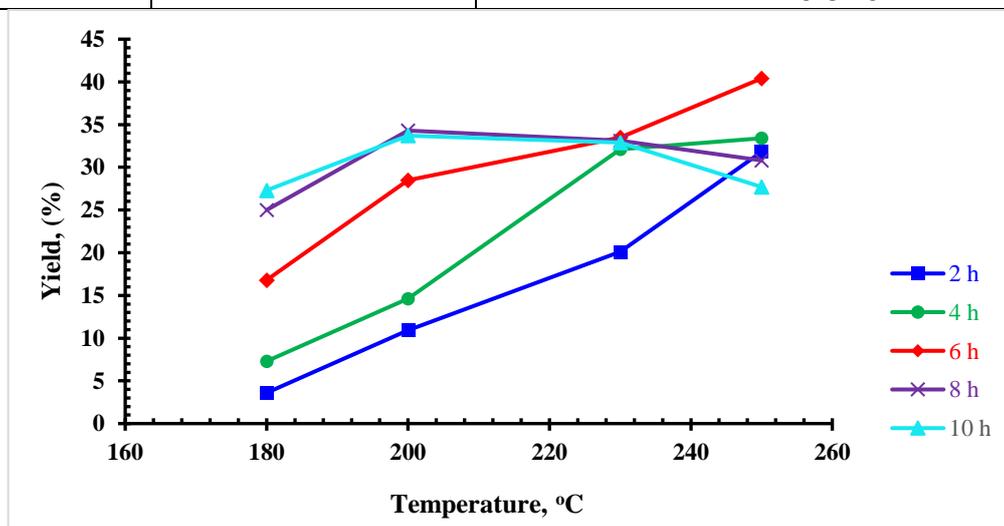


Figure 1: Effect of temperature on the CMs yields obtained from date molasses

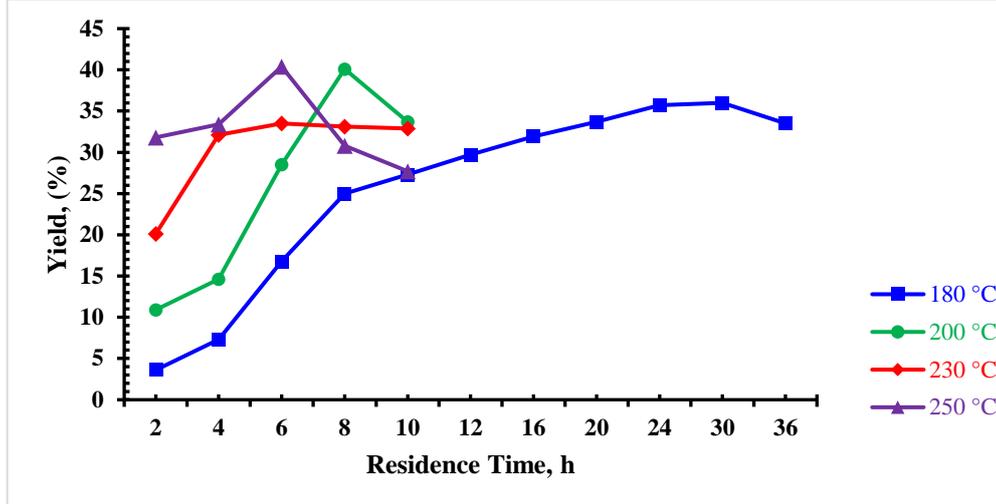
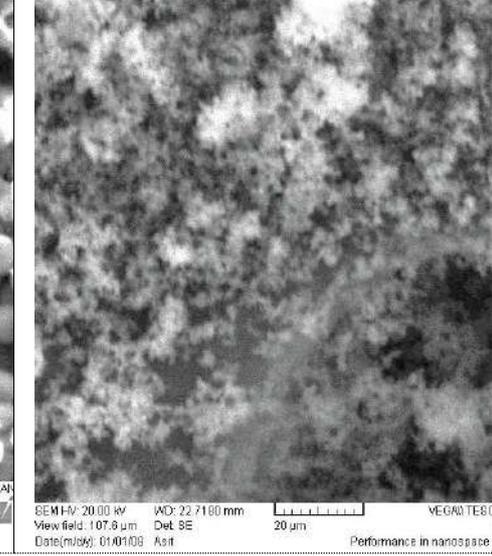
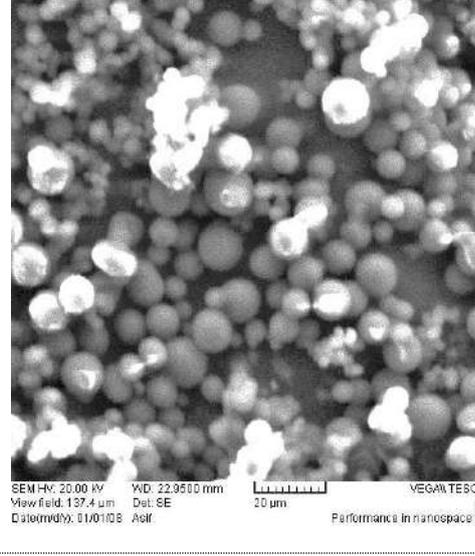
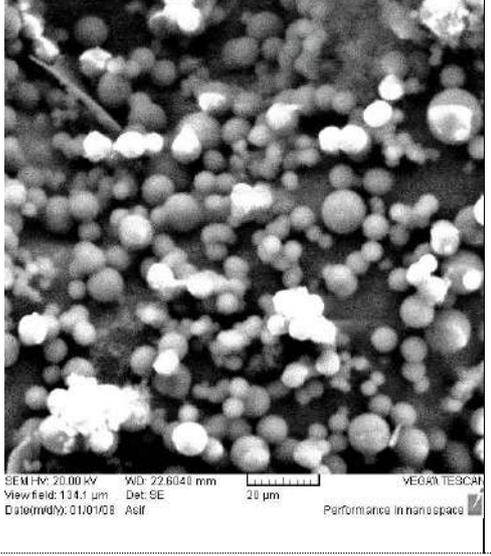
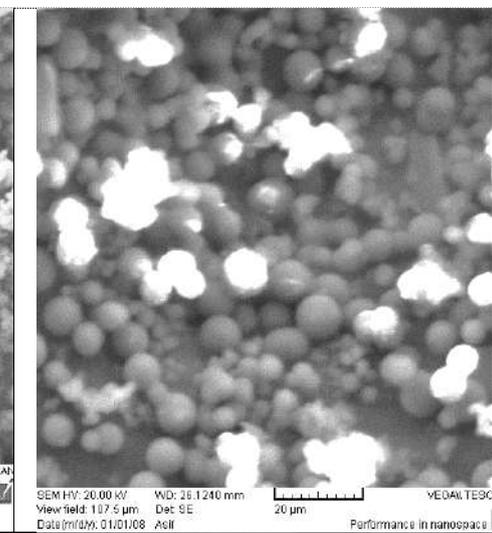
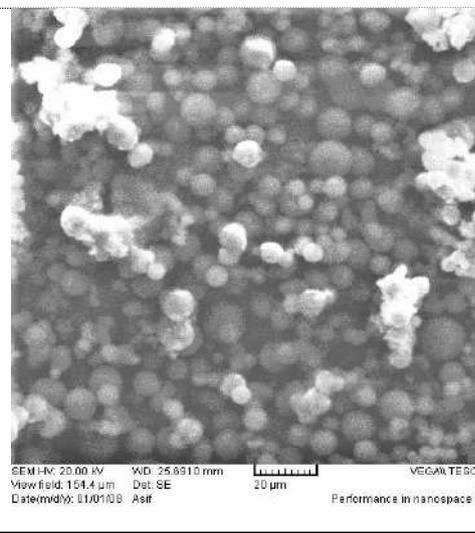
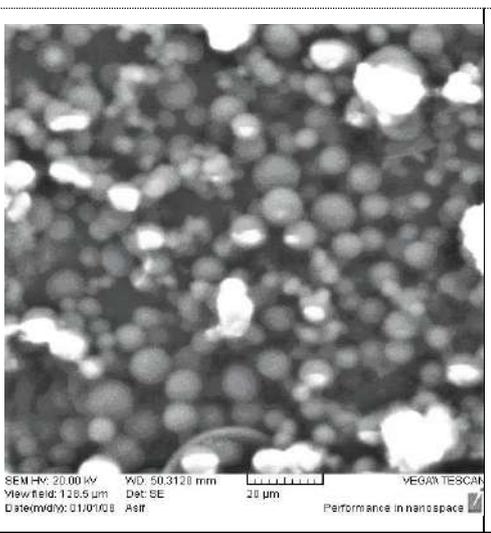
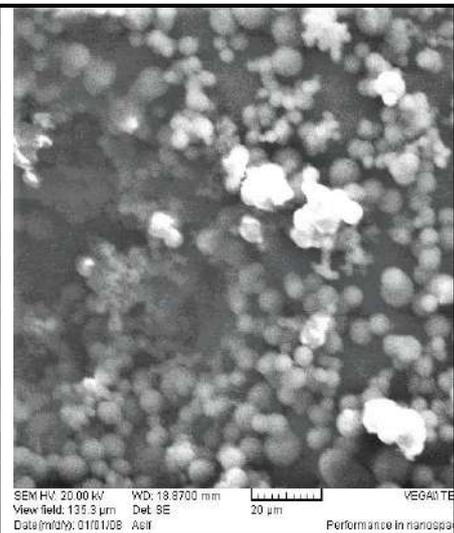
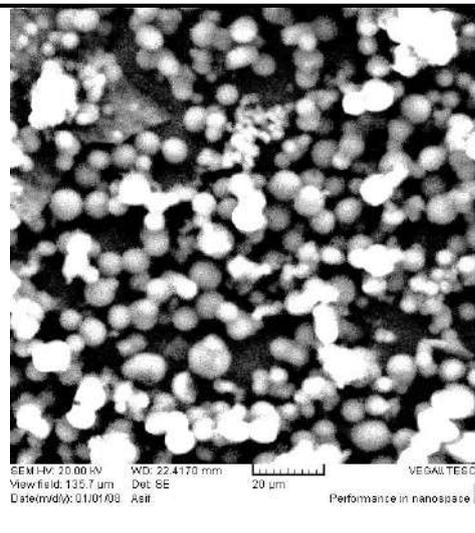
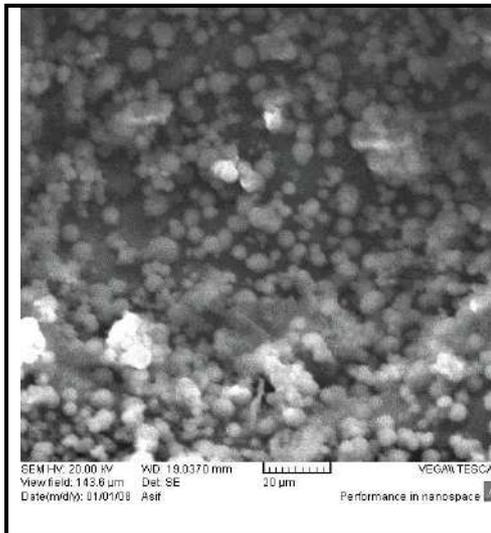


Figure 2: Effect of residence time on the CMs yields obtained from date molasses

3.2 CMs Formation: SEM images of the CMs taken at different temperatures and residence times are presented in Figure 3. Figure 3a shows that small CMs developed and dispersed on the surface for the molasses sample at 180 °C and 2 h. If the residence time is increased, e.g., from 2 to 36 h, visible and large CMs are formed. The structure and the shape of the microspheres are very identical to those obtained from glucose by other researchers (Titirici et al., 2008; Li et al., 2012; Qi et al., 2015). Table 2 and Figures 4a and 4b show the effects of temperature and residence time on the diameter of CMs. An increase in temperature promotes the formation of CMs as can be seen in Figure 4a. These results are comparable to those reported in other previous work for glucose (Titirici et al., 2008; Li et al., 2012; Qi et al., 2015). However, at a temperature of 250 °C and a residence time of 8 h or more, CMs tend to fade and decay (Figure 3i). This could be due to the fact that high temperatures and long residence times lead to the formation of secondary char (Wang et al., 2018). ImageJ software, freely available at <http://imagej.nih.gov/ij/> was used to measure the diameter of CMs at various temperatures and residence times. The material formed consists of few agglomerates of carbonaceous microspheres ~5-9 μm in size. This result agrees with the findings of Sevilla and Fuertes (2009a), who synthesised CMs with a diameter of ~2-10 μm from cellulose at temperatures of 220-250 °C and a residence time of 2-4 h. The results are in some agreement with the findings of Ryu et al. (2010), who obtained CMs with a diameter of 1-4 μm from monosaccharides at a temperature of 170 °C and a reaction time of 12 h. It is evident that when the residence time was increased from 2 to 36 h at 180 °C, the diameter increased from 4.8 to 7.8 μm. Moreover, when the temperature was increased from 180 to 250 °C, the diameter of the CMs gradually increased and the shape of the spheres became more visible. The largest diameter was obtained at a temperature of 250 °C and a residence time of 6 h. These results indicate that a temperature between 200 and 250 °C and a residence time of 6 to 8 h are optimal to obtain acceptable production rate of CMs with regular shapes. This observation is consistent with other glucose derived CMs (Li et al., 2012). Although the results obtained in this work are somewhat consistent with those obtained by Li and his team for glucose, there are some differences regarding the non-aggregation of microspheres under all conditions used in this work. Li et al. (2012) concluded that at temperatures of 180-230 °C and a reaction time of 7 h, most microspheres aggregated.



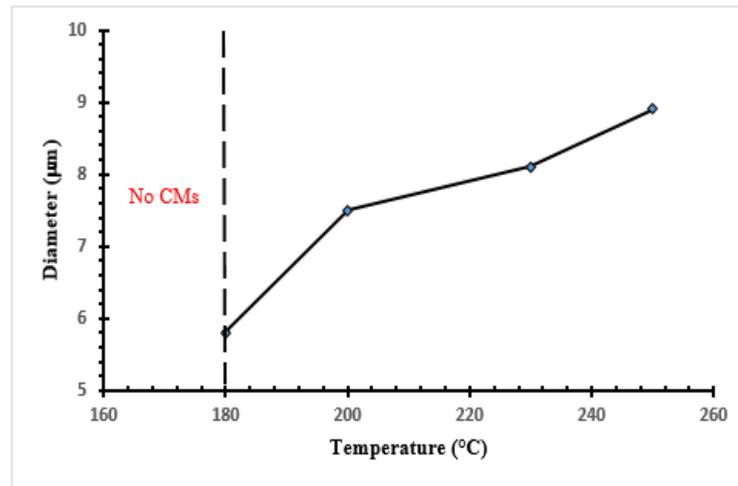


Figure 4a: Effects of temperature on the size of CMs (residence time = 6 h)

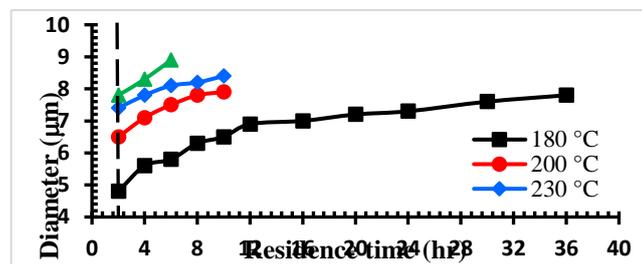


Figure 4b: Effects of residence time on the size of CMs.

3.0 Conclusion: HTC of inedible crystallized date palm molasses was conducted at various temperatures (180 –250 °C) and residence times (2 – 10 h). This study revealed that solid products did not form at 180 °C and a reaction time less than 2 h. The highest yield of the CMs, 40.4% obtained was at a temperature of 250 °C and a residence time of 6 h. However, increasing the residence time from 6 to 8 h at 250 °C resulted in a decrease in the production rate. The study also demonstrated that temperatures between 200 and 250 °C and a residence time of 6 to 10 h are optimal to obtain acceptable production rates of CMs with regular shapes. It was found that the diameters of the produced CMs were in the range of ~5-9 µm. The largest diameter (8.9 µm) was obtained at 250 °C and 6 h of residence time.

References: Abbas, A., Mariana, L.T. and Phan, A.N., 2018. Biomass-waste derived graphene quantum dots and their applications. *Carbon*, 140, pp.77-99. Al-Awadi, A.S., El-Harbawi, M., Algarawi, A., Alalawi, A., Alrashed, M.M. and Yin, C.Y., 2022. Synthesis of carbon microspheres via hydrothermal carbonization of Sabal palms (*Sabal palmetto*) biomass for adsorption of methylene blue. *Biomass Conversion and Biorefinery*, pp.1-11. Bedin, K.C., Cazetta, A.L., Souza, I.P., Pezoti, O., Souza, L.S., Souza, P.S., Yokoyama, J.T. and Almeida, V.C., 2018. Porosity enhancement of spherical activated carbon: Influence and optimization of hydrothermal synthesis conditions using response surface methodology. *Journal of environmental chemical engineering*, 6(1), pp.991-999. El-Sharnouby, G.A., Aleid, S.M. and Al-Otaibi, M.M., 2014. Liquid sugar extraction from date palm (*Phoenix dactylifera* L.) fruits. *Journal of Food Processing and Technology*, 5(12), pp.1-5. Falco, C., Baccile, N. and Titirici, M.M., 2011. Morphological and structural differences between glucose, cellulose and lignocellulosic biomass derived hydrothermal carbons. *Green Chemistry*, 13(11), pp.3273-3281. Hoekman SK, Broch A, Robbins C. Hydrothermal carbonization (HTC) of lignocellulosic biomass. *Energy Fuels* 2011; 25:1802–10. Hu, B., Wang, K., Wu, L., Yu, S.H., Antonietti, M. and Titirici, M.M., 2010. Engineering carbon materials from the hydrothermal carbonization process of biomass. *Advanced materials*, 22(7), pp.813-828. Li, M., Li, W. and Liu, S., 2012. Control of the morphology and chemical properties of carbon spheres prepared from glucose by a hydrothermal method. *Journal of Materials Research*, 27(8), pp.1117-1123. O'sullivan, A.C., 1997. Cellulose: the structure slowly unravels. *Cellulose*, 4(3), pp.173-207. Qi, X., Liu, N. and Lian, Y., 2015. Carbonaceous microspheres prepared by hydrothermal carbonization of glucose for direct use in catalytic dehydration of fructose. *RSC advances*, 5(23), pp.17526-17531. Ryu, J., Suh, Y.W., Suh, D.J. and Ahn, D.J., 2010. Hydrothermal preparation of carbon microspheres from mono-saccharides and phenolic compounds. *Carbon*, 48(7)

pp.1990-1998. Sanchez-Sanchez, A., Braghiroli, F.L., Izquierdo, M.T., Parmentier, J., Celzard, A. and Fierro, V., 2020. Synthesis and properties of carbon microspheres based on tannin–sucrose mixtures treated in hydrothermal conditions. *Industrial Crops and Products*, 154, p.112564. Sevilla, M. and Fuertes, A.B., 2009a. The production of carbon materials by hydrothermal carbonization of cellulose. *Carbon*, 47(9), pp.2281-2289. Sevilla, M. and Fuertes, A.B., 2009b. Chemical and structural properties of carbonaceous products obtained by hydrothermal carbonization of saccharides. *Chemistry–A European Journal*, 15(16), pp.4195-4203. Shi, J., Tian, X.D., Li, X., Liu, Y.Q. and Sun, H.Z., 2021. Micro/mesopore carbon spheres derived from sucrose for use in high performance supercapacitors. *New Carbon Materials*, 36(6), pp.1149-1155. Siddeeg, A., Zeng, X.A., Ammar, A.F. and Han, Z., 2019. Sugar profile, volatile compounds, composition and antioxidant activity of Sukkari date palm fruit. *Journal of food science and technology*, 56(2), pp.754-762. Sulistya, E., Hui-Hui, L., Attenborough, N.K., Pourshahrestani, S., Kadri, N.A., Zeimaran, E., Razak, N.A.B.A., Amini Horri, B. and Salamatinia, B., 2020. Hydrothermal synthesis of carbon microspheres from sucrose with citric acid as a catalyst: physicochemical and structural properties. *Journal of Taibah University for Science*, 14(1), pp.1042-1050. Sun, X. and Li, Y., 2004. Colloidal carbon spheres and their core/shell structures with noble-metal nanoparticles. *Angewandte Chemie*, 116(5), pp.607-611. Taghizadeh-Alisaraei, A., Motevali, A. and Ghobadian, B., 2019. Ethanol production from date wastes: Adapted technologies, challenges, and global potential. *Renewable Energy*, 143, pp.1094-1110. Titirici, M.M., Antonietti, M. and Baccile, N., 2008. Hydrothermal carbon from biomass: a comparison of the local structure from poly- to monosaccharides and pentoses/hexoses. *Green Chemistry*, 10(11), pp.1204-1212. Wang, T., Zhai, Y., Zhu, Y., Li, C. and Zeng, G., 2018. A review of the hydrothermal carbonization of biomass waste for hydrochar formation: Process conditions, fundamentals, and physicochemical properties. *Renewable and Sustainable Energy Reviews*, 90, pp.223-247. Zhang, M., Yang, H., Liu, Y., Sun, X., Zhang, D. and Xue, D., 2012. Hydrophobic precipitation of carbonaceous spheres from fructose by a hydrothermal process. *Carbon*, 50(6), pp.2155-2161.

Science and Technology Applied to Public Security in Brazil



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Abstract: Crime and violence have increased considerably in several Brazilian states and Latin American countries in recent decades, leaving politicians, managers, academics, and representatives of civil society in a growing search for the causes and potential solutions to this serious problem. This paper presents how the government of Ceará state in Brazil has used science and technology to prevent and combat crimes from a systemic perspective, in which public security is seen as the result of action from various spheres, institutions, and powers. From this perspective, the Evidence-Based Public Security (EBPS) coordinated by the Superintendence of Research and Strategy in Public Security (SUPESP) has added scientific and technological perspectives that contextualize the Ceará initiative concerning the national scenario to reduce criminal indicators and generate a sense of security.

Keywords: Scientific Evidence, Technology, Public Security, Crime Reduction, Prevent Violence

1. Introduction: Crime and violence have increased considerably in several Brazilian states and Latin American countries in recent decades, leaving politicians, managers, academics, and representatives of civil society in a growing search for the causes and potential solutions to this serious problem, as mentioned in (Chettiar, 2015; Dantas, 2022a, Dantas, 2022b; Nogueira, 2019a; UNODC, 2019). As a case study, it will be used the state of Ceará in Brazil. Ceará is the fifth largest Brazilian state with 9,187,103 inhabitants, and a 148,886 km² territorial area. Evidence-Based Public Security (EBPS) consists of the use of evidence, scientific methods, and technologies applied in the formulation of public security policies, guidelines, models, and strategies to prevent violence and reduce crime (Baron, 2018; Eller, Brian & Scott, 2018; Farrell, Kathryn & Robert, 2019; Marchionni & Samuli, 2019; Minkman, Van Buuren & Bekkers, 2018). EBPS also takes into account the Public Management by Results (PMR), a methodology applied by the secretariat of planning and management in Ceará, aimed at choosing priorities to be defined for the year of management (Ceará, 2017). The PMR applied at EBPS involves planning, balance, transparency, and control, where the prioritized objectives inform public agents and society about the objective results proposed by public management, to encourage continuous improvement in the process of transparency, decision-making, and public policy management. In the public security scenario, the state of Ceará has an organization - Superintendence of Research and Strategy in Public Security (SUPESP) – to implement the EBPS. SUPESP uses scientific quantitative shreds of evidence, such as criminal indicators, criminal spot indicators, criminal socio-economic maps, criminal models, sociodemographic and territorial studies, geospatial studies, public security strategies, and technologies for developing actions to prevent violence and combat crime. The framework involving EBPS management seeks to reduce costs for society and commits the state to the satisfaction of citizens. It is a model in which government is a means and not an end in itself (Baron, 2018; Ceará, 2017; Nogueira, 2019c). Thus, this paper presents how the government of Ceará state in Brazil using the application of EBPS has prioritized the management of science and technology to prevent and combat crimes from a systemic perspective, in which public security is seen as the result of governmental actions from various spheres, institutions, and powers.

2. Science and Innovation: Public security is a multifaceted issue that involves several actors, scientific models, technologies and management processes to have a successful outcome (Nogueira, 2019a; Nogueira, 2019b). In this context, the fundamental requirements for implementing a successful violence prevention and reduction program identified must take into account several criteria. In a general sense, the relevance of the innovative practice using EBPS is given by the criteria described below: (I) Innovation, since it is a pioneering good practice in the implementation of public security policies and the creation of new actions to solve problems that exist in combating crime and reducing violence, notably evidenced through criminal indicators, static and dynamic panels using business intelligence, socio-economic criminal maps, criminal models, geospatial studies, automatized crime-fighting technologies. (II) Evaluation and competitiveness, since the practical application of the EBPS has already shown a great improvement in terms of the population's sense of security, verifiable through criminal indicators, highlighting the following: intentional lethal violent crimes (also called ILVC - the sum of the crimes of intentional homicide, femicide, bodily harm followed by death, and robbery followed by death); violent crimes against property (also called VCAP - the sum of all crimes classified as robbery, except robberies involving death); theft (the act of subtracting, for oneself or others, someone else's movable property); sexual crimes (comprises all crimes of rape, rape of a vulnerable person, and sexual exploitation of a minor); seizure of narcotics (the sum of all seizures of marijuana, crack and cocaine, whether in cases of trafficking or use). Therefore, the application of EBPS promotes great advances due to all the criminal indicators used to measure the results of public security policies, including results obtained by statistics that use quantitative and qualitative scientific methods (Minkman, Van Buuren & Bekkers, 2018; Supesp, 2022). (III) Replicability since it is obtained and interpreted according to the quantitative scientific method; therefore, subject to repetition by other public security agencies and police forces in locations other than where it was originally carried out. Furthermore, it is worth noting that Brazilian states have high levels of crime compared to developed countries (Nogueira, 2019a; UNODC, 2019) thus, EBPS can be a good reference practice for implementation in other states or countries that have similar challenges. All data collected and results obtained using EBPS follow the Brazilian legislation (Brazil, 2019a; Brazil, 2019b; Brazil, 2019c; Brazil, 2021).

(IV) Sustainability, given that good practice has the capacity to tackle structural problems of public security in all Brazilian states that trigger permanent changes, presenting a rational use of the resources available to state public management. EBPS also strengthens the formulation of public security policy, enabling focused action based on a scientific study of criminal data and the use of a criminal spot (also known as a hot spot, heat map, or micro territory) instead of action based on

subjectivism or “guessing”. In this way, the action focused on hot spots for specific types of crimes, on the days and times of the week with the highest incidence of that criminal offense, it is possible to have efficient use of human, financial, and material resources. (V) Equity, since EBPS can positively impact citizens, directly, through strategies, police operations, and actions related to crime reduction in neighbourhoods, cities, and across the state, rising the sense of security in society (Ministry of Justice and Public Security, 2020). Like sustainability, equity can be seen in the news published in the press. In a strict sense, EBPS as developed by SUPESP provides consistent data collection systems, which ensure a constant flow of reliable information, which is routinely analysed and evaluated to support the strategic, tactical, and operational planning of the public security forces, as well as make it possible to combine PMR strategies with transparency and accountability.

3. Disruptive Technologies: In order to facilitate the collection, analysis, and interpretation of scientific evidence from EBPS by decision-makers in the area of public security, SUPESP created and/or improved several disruptive technologies in partnership with the Information Technology Coordination (ITC) at Secretariat of Public Security and Social Defence (SPSSD), Ceará Research Foundation (FUNCAP), and Ceará Federal University (UFC), as presented in Nogueira (2021). - Intelligent video surveillance system (AGILIS): this technology works to identify motor vehicles that have been used in criminal practices or that have a connection with someone in conflict with the law using interactive maps, images, icons, and various information available to users. Used by the Military Police, Civil Police, Military Fire Brigade, Forensic Institute, and SUPESP agents.



Figure 1: Intelligent video surveillance system (AGILIS)

- Advanced Command Portal (ACP): this technology is a multifunctional advanced command and control application for mobile devices such as cell phones. Used by the Military Police, Civil Police, Military Fire Brigade, Forensic Institute, and SUPESP agents to make online queries on offenders and crimes in real-time.

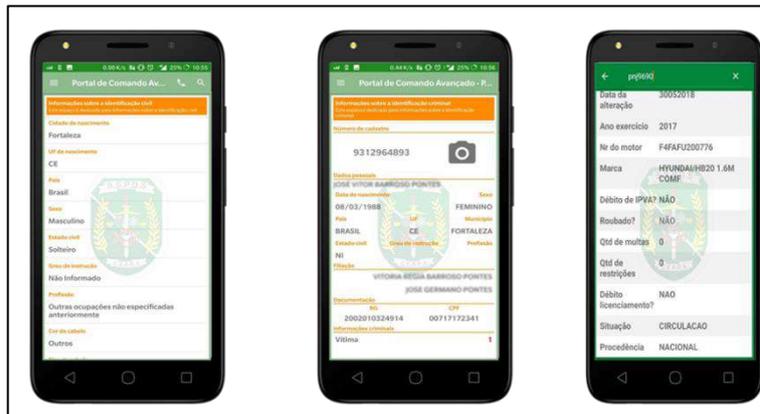


Figure 2: Advanced Command Portal (ACP)

- Big Data (CEREBRUM): this technology is a big data platform with business intelligence that integrates several databases and knowledge bases to support strategic decisions. Used by the Military Police, Civil Police, Military Fire Brigade, Forensic Institute, and SUPESP agents.



Figure 3: Big Data CEREBRUM

- Technological System for Territorial Monitoring of Security Units (STATUS): it is a technology composed of a strategic computerized system that works on the prevention and repression of violence with a focus on the space-time dimension, i.e., hot spots directing actions to micro territories that vary according to the type of crime, day of the week, and time of day. This system is specific for managers and decision-makers of the Military Police, Civil Police, Military Fire Brigade, Forensic Institute, and SUPESP high command officers since it aims to optimize human, material, and financial resources in a strategic way.

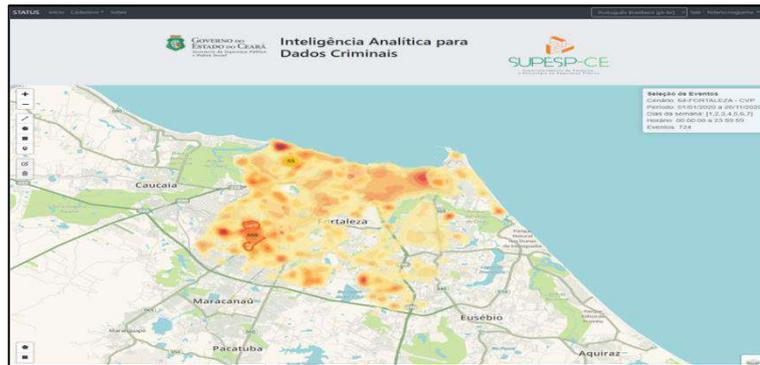


Figure 4: Technological System for Territorial Monitoring of Security Units (STATUS)

- Record of Tactical Operations and Security Actions (ROTAS): it is a technology using an automatized system that works on monitoring and control of all public security vehicles. This system has several functionalities such as the presentation of tracked vehicles and real-time visualization of each occurrence on a map, electronic fencing, and dynamic & statistical reports. This system is used by representatives of Integrated Security Operations Coordination (CIOPS) involving several agencies Military Police, Civil Police, Military Fire Brigade, Forensic Institute, State Civil Defence Coordination, Municipal Guard of Fortaleza, Fortaleza Transit and Citizenship Authority, Civil Protection and Defence, Mobile Emergency Care Service and Secretariat of Penitentiary Administration.



Figure 5: Record of Tactical Operations and Security Actions

- Operational Georeferencing System (SIGO): this technology is a platform with the spatialization of MFP units and fire hydrants, enabling the ideal routing for accidents and fire hydrants, including information on current traffic. Used by representatives of the Military Fire Brigade and Integrated Security Operations Coordination.

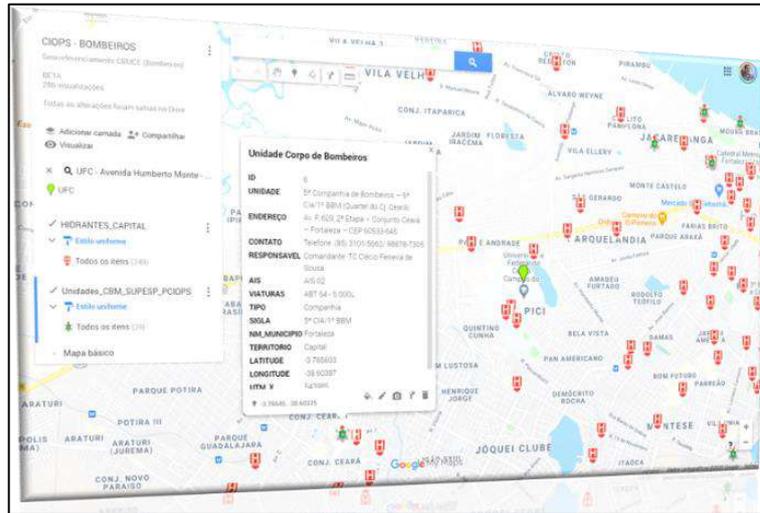


Figure 6: Operational Georeferencing System (SIGO)

4. Results: Evidence-based public security is applied following the management by results and has presented effective practices for preventing violence and reducing crime rates, bringing a better perception of security for the population of Ceará state, its capital Fortaleza, and metropolitan regions. According to Supesp (2022), several positive results have already been achieved, worth mentioning the following: •18.3% reduction of intentional lethal violent crimes in Ceará during the year 2021 (January to December);• 28.0% reduction of intentional lethal violent crimes in Fortaleza during the year 2021 (January to December);•26.8% reduction of intentional lethal violent crimes in cities that are part of the Metropolitan Region of Fortaleza during the year 2021 (January to December);• 10.8% reduction in violent crimes against property in Ceará during the year 2021 (January to December);• 12.3% reduction in violent crimes against property in Fortaleza during the year 2021 (January to December);• 16.1% reduction in violent crimes against property in cities that are part of the Metropolitan Region of Fortaleza during the year 2021 (January to December);• Reduction of 9.3% in vehicle theft in Ceará during the year 2021 (January to December); •Reduction of 16.3% in vehicle theft in Fortaleza during the year 2021 (January to December). • 20.3% reduction in vehicle theft in cities that are part of the Metropolitan Region of Fortaleza during 2021 (January to December); • 28.6% reduction in cargo theft in Ceará during the year 2021 (January to December); •Reduction of 37.8% in cargo theft in Fortaleza during the year 2021 (January to December); •Reduction of 11.8% in cargo theft in cities that are part of the Metropolitan Region of Fortaleza during the year 2021 (January to December).

5. Lessons Learned: Some questions emerge based on the application of evidence-based public security management and need answers for them. What were the main barriers found in the development of EBPS in Ceará-Brazil? The main barriers found in the development of the innovative practice using EBPS were: 1. Resistance to change 2. Lack of understanding of the importance of innovation 3. Lack of development of an innovation-oriented culture 4. Too much bureaucracy 5. Lack of integration and alignment 6. Lack of resources How these barriers were overcome? All barriers have been overcome by public security agencies in Ceará, as follows: 1. Think outside the box: Insights of creative solutions with the support of internal and external governmental institutions to attract human, material, and financial resources. Main practice implemented: use of the Chief Scientist Program. This program aims to use applied research developed at universities to solve complex problems and demands of public security agencies. The solutions are managed systematically and gradually through the introduction and application of scientific knowledge using innovation, dissemination, and transfer of technology in the modernization and improvement of public policies and decision-making. 2. Managing risks: Investing in innovation always generates risks; thus, disruptions may not go the way it was planned. Main practice implemented: adopted the risk management plan created by SUPESP reduced the chances of the implementation going wrong. 3. Measuring the results: Even if the financial return does not come in the short term, measuring and showing the results increases the belief in innovation. Main practice implemented: use of key performance indicators and evaluation tools. These tools based on indicators and automated monitoring and control systems are aimed at choosing priorities to be defined for operational, tactical, and strategic management actions. 4. Investing in engagement: Employees engaged through organizational culture can better help to implement innovation. Main practice implemented: conduct periodic weekly meetings with police officers from all public security agencies.

6. Conclusions: The initiative to apply EBPS management becomes an innovative action since it is a pioneering good practice in order to implement public security policies and create new mechanisms and thoughts to solve problems that exist in the fight against crime and reduction of violence. The scientific elements of evidence in the government of Ceará were applied through criminal indicators, static and dynamic data panels, hot spot maps, socio-economic criminal maps, criminal models, disruptive technologies; sociodemographic and territorial studies, and geospatial studies. SUPESP when outlining strategies using EBPS seeks quantitative and qualitative indicators capable of justifying, with measurable results, the performance of public agencies taking into account the public management by results as a model in which the public sector in the state of Ceará starts to adopt a posture of efficient use of resources. Therefore, as demonstrated in previous sections, science and technology are applied following the EBPS and have presented effective practices for preventing violence and reducing crime rates, bringing the population of Ceará in Brazil a better perception of security as well as better resource management.

References: Baron, J. (2018). A brief history of evidence-based policy, *The Annals of the American Academy of Political and Social Science* 678.1, pp. 40-40. Brazil (2021). Decree 10,822. 28th September 2021, Establishes the national plan for public security and social defence 2021-2030. (In Brazilian Portuguese). Brazil (2018a). Decree 9,489. 30th August 2018. Regulates within the scope of the Union, Law 13,675, 11th June 2018, to establish rules, structure, and procedures for the execution of the national policy on public security and social defence. (In Brazilian Portuguese). Brazil (2018b). Decree 9,630. 26th December 2018. Establishes the national plan for public security and social defence and takes other measures. (In Brazilian Portuguese). Brazil (2018c). Law 13,675. 11th June 2018. Regulates the organization and functioning of the agencies responsible for public security; creates the national public security and social defence policy (PNSPDS); institutes the single public security system (SUSP). (In Brazilian Portuguese). Ceará. (2017). Pact for a pacific Ceará, vol. 1, 2 & 3, Fortaleza: Ceará Government. Chettiar, I. M. (2015). The many causes of America's decline in crime, *The Atlantic*, Retrieved from <https://www.theatlantic.com/politics/archive/2015/02/the-many-causes-of-americas-decline-in-crime/385364/>. Dantas, R. F. (2022a). Violence and urban vulnerabilities: theory of restrictive ambience, dilemmas: *Journal of Conflict and Social Control Studies*, pp. 277-302. Dantas, R. F. (2022b). Urban violence and public governance: theory of restrictive ambience strategies for security and prevention policies, Curitiba: CRV. Eller, W.S., Brian, J. G., & Scott, E.R. (2018). *Public administration research methods: Tools for evaluation and evidence-based practice*. Routledge. Farrell, J., Kathryn, M., & Robert, B. (2019). Evidence-based strategies to combat scientific misinformation, *Nature climate*, pp. 191-195. Marchionni, C., & Samuli, R. (2019). What is mechanistic evidence, and why do we need it for evidence-based policy? *Studies in History and Philosophy of Science*, pp. 54-63. Ministry of Justice and Public Security (2020). How does the unified public security system work (SUSP). Retrieved from www.justica.gov.br/seus-direitos/elaboracao-legislativa/projetos/susp (In Brazilian Portuguese). Minkman, E., Van Buuren, M. W., & Bekkers, V. J. J. M. (2018). Policy transfers routes: an evidence-based conceptual model to explain policy adoption. *Policy Studies*, pp. 222-250. Nogueira, J. H. M. (2019a). Global crisis management. Seattle: Amazon Inc. Nogueira, J. H. M. (2019b). Hermeneutic phenomenological research: a qualitative view from the crisis. In proceedings 2019 WEI International Academic Conference on Humanities and Social Sciences, Harvard Faculty Club/USA. Nogueira, J. H. M. (2019c). Understanding public security crisis in Brazil a view from insiders: a phenomenological and contemporary approach. *International Journal of Arts and Sciences (IJAS)*. vol.1, pp.15 - 25. Nogueira, J. H. M. (2021). *Public security 4.0: technology and innovation in the fight against crime*. São Paulo: Fonte Segura. Supesp (2022). Statistics. Retrieved from https://www.supesp.ce.gov.br/painel_dinamico/. UNODC (2019). Global study on homicide. Retrieved from www.unodc.org/unodc/en/data-and-analysis/global-study-on-homicide.html.

Modeling Sales Person Performance Based on Sales Data Clustering

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Abstract— The case study in this research is a company in Indonesia. Currently, the company needs to assess the performance of sales person, but it does not have yet criteria for classifying the sales person's performance. The research purpose was developing sales person performance model based on sales data clustering. The research is adopted CRISP-DM framework. As the result, the proposed model is connected with the prior sales order database. The model grabs multidimensional features and classification data label from the database. The multidimensional features were formulated through Kohonen SOM clustering evaluation result with the value of quantization error was 0.95 and topographic error value was 0.13. The best multidimensional features are product, transaction, and monthly price. It can be concluded that the multidimensional combination is considered capable of representing sales person performance. Therefore, it can be used as base criteria or features in classification. The contribution of the research is built a new model of sales person performance for the company.

Keywords— Intelligent System, sales data analytics, sales person performance, multidimensional clustering, self-organizing map

I. INTRODUCTION: Pattern recognition in sales data can be used in the business world. Pattern recognition can be used as a basis in determining a sales strategy. One part of pattern recognition is clustering. Clustering will form groups of objects with similar patterns [1]. By looking at the patterns created, it can be easier to understand market developments. Pattern recognition consists of four main models, namely detection, clustering, classification and identification. Clustering and classification are often confused so that the main difference is whether there is a class that is the key to grouping. In clustering, groups are created without any class rules (unsupervised). While classification has class rules that are used as the basis for grouping. Data clustering, cluster analysis, segmentation analysis, taxonomy analysis or unsupervised classification is a method that used to create groups of objects or clusters, namely groups of similar or similar objects [1]. Clustering makes it possible to form groups of customers who have similar buying habits based on transaction history. Several studies that have implemented clustering in business are among others [2-16]. It is very important to segment customers because it allows marketers in decision-making to better tailor marketing efforts to different subsets of audiences in terms of sales promotion, and development strategies [5]. In addition to customer clustering, product clustering can also be done based on transaction data [6]. Transaction data consists of a group of data with various data types, so it is important in the data clustering algorithm to carry out data normalization stages that affect the clustering results. Some business objectives are carried out through clustering. Research [7-12] used clustering for sales forecasting purposes. Research [3,4,13] used clustering for the purpose of customer segmentation. There are also studies [6, 13,14] utilized clustering for product segmentation. Meanwhile research [15] for clustering sales agent turnover and research [16] conducted investigations on stock market prediction, sales forecasting and market segmentation. Table 1 described the dimension that was used on the clustering in sales data. There are several types of clustering algorithms, including hierarchical clustering, fuzzy clustering, center-based clustering, search-based clustering, graph-based clustering, grid-based clustering, density-based clustering and other algorithms [1]. Various traditional clustering algorithms have been implemented including the K-Means algorithm and its combination used by [7,12,13,24,25]. Hierarchical clustering and its combination are used by [8,25]. In intelligent systems, the Self Organizing Maps (SOM) algorithm can be used in the clustering process. SOM is an unsupervised neural network algorithm created by Kohonen. SOM is widely used in multidimensional data clustering [26-29]. Besides SOM, there is also a Genetic Algorithm used by [2].

Table I. Clustering Dimensions on Previous Research

Dimension	Research
Product	Research [17-19]
Price	Research [20-21]
Product and Price	Research [22]

Product, Category, Profit/Price	Research [23]
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The case study in this research is a company in Indonesia that territorially has 7 regions which oversee 61 regions. Each region has sales unit that has target in different territories and market segments. Based on interviews and observations, so far sales data storage is done through a centralized system. The available reporting features have not been able to display in detail according to the needs of the operational level. The Business Service Sales Unit in Bali region is already built a website that collect the sales order data in operational level. But both the systems did not have analytics report features yet. Every week the company held a sales evaluation that need many analytics information from the sales data. Currently the company needs to assess the performance of sales person, but the company does not have yet criteria for classifying the sales person's performance. Therefore, this research needs to develop a model that can determine the dimensions that will be used in sales data classification for assessing the performance of sales person. Previous studies have not discussed yet about sales person performance based on sales data clustering. The novelty of this research is using the sales data for making sales person performance clustering and found the model for the company. The research problem was how is the model of sales person performance based on sales data clustering? The research purpose was developing sales person performance model based on sales data clustering. This research was part of big research entitled Sales Analytics Dashboard with Multidimensional Performance Based Clustering and Smart Early Warning for Recognizing Market Pattern.

II. METHODOLOGY: The research object was the sales person performance model based on sales data clustering. The research time was conducted in July-October 2022. The research case study was a company in Bali Indonesia. The mixed method approach that is shown in Fig. 1 was implemented in this research. The research framework adopted from CRISP-DM (Cross Industry Standard Process for Data Mining) that consisted of 6 stages, namely: (1) business understanding, (2) data understanding, (3) data preparation, (4) modeling, (5) evaluation, and (6) deployment. The business understanding and data understanding stages were conducted by qualitative descriptive approach. The data collection techniques used were observation, in-depth interview, documentation studies and focus group discussion (FGD). The data preparation stage is related to all activities that had purposes to construct the dataset in order to be used in the model. The modeling stage is consisted of clustering process, cluster evaluation, and formulation of the best dimensional combination. Clustering process was conducted by Self Organizing Map (SOM) method that built with Python. The evaluation was done with purpose of model validity that was conducted by transferability, confirmability, credibility test and also dependability test. The transferability and credibility test were done by triangulation model that assessed the data with some different techniques among others observation, in-depth interviews and also FGD. The audit process by the experts is conducted to the model for the confirmability and dependability test. Finally the deployment stage will be done on the future step as the continuation of the big research entitled Sales Analytics Dashboard with Multidimensional Performance Based Clustering and Smart Early Warning for Recognizing Market Pattern.

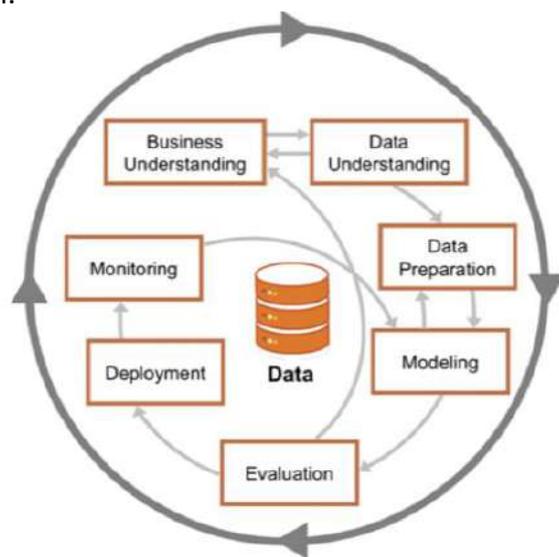


Fig.1. Research Framework Adopted from CRISP-DM [30]

SOM is a competitive learning mechanism. Kohonen SOM is an unsupervised Neural Network (NN) which is widely used to project high-dimensional data points into lower-dimensional space as shown in Fig. 2. Through the learning phase, each

node or neuron competes with the others to get closer to the input data point. In the end, the map is constructed in this manner that similar input data points are grouped together.

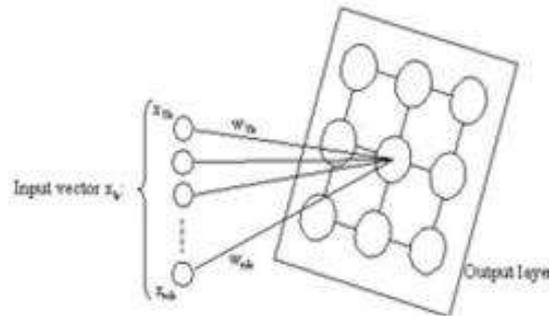


Fig.2. Self-Organizing Map Topology

The SOM algorithm creates a low-dimensional matrix in the form of a lattice map where each cell is considered a neuron. Each such neuron has a weight vector of the same size as one of the input data points. This matrix is used to evaluate the distance of each input vector in the dataset from the weight of each cell. At the beginning of the training phase, a random initial initialization process is carried out on the weights used. Then, iteratively and for each data point, the nearest neuron, namely the neuron with the smallest distance to the data point, is found and is referred to as the Best Matching Unit (BMU). The BMU weights are updated, as well as the neighboring BMU neuron weights are also updated. The process is then continued with all data points during training. At the end of the training phase, each data point is assigned to a gridmap SOM cell. Similar inputs are grouped together around neighboring cells [29,31].

III. RESULT AND DISCUSSIONS: A. Business Understanding: The Business Service Unit Manager were the key resource person in the interview. Observations and documentation studies are carried out on the internal system of the business service unit, sales data and required reports. This first phase focuses on understanding goals and needs on the business side. This understanding is then converted into knowledge in determining data mining objectives. Based on the interview, the manager gave the sales person a weekly target counted by the number of transaction and also the total monthly revenue. The manager had to assess the performance of sales person, but had not have yet criteria for classifying the sales person's performance. The business objectives were to find out the multidimensional criteria for the sales person's performance after that find out the sales person performance pattern. Which sales person should improve or maintain their performance. Based on the observation, the sales data was organized on mysql database with website under wordpress. It made possible to grab the sales data and used it for clustering. Documentation studies also gave more knowledge for the research to develop a new model for assessing the performance of sales person. In line with the business goal, so the goal of data mining process was to formulate the best dimensional combination for sales person performance through sales data clustering.

B. Data Understanding: This phase is done by collect initial data, describe the data, explore data and verifying the data quality. The sales data is shown by meta data view in Fig.3. On sales data year 2019-2021, there was 33 fields with 5008 rows of raw data that can be used in clustering. Based on business understanding result and the sales data fields in Fig.3 there were 5 candidates of clustering dimensions for assessing sales person performance. The candidates were AM that stands for sales person, product, transaction, status that stands for instalment status, and bulanan that stands for monthly price. Fig.4 is an example of visualization for showing sales person performance based on the number of transactions. Fig. 4 visualized from one dimension perspective. This research needs to make a new model that use multidimensional clustering for assessing the sales person performance

Name	Type	Name	Type	Name	Type
am	varchar(2000)	lastbulanan	int(11)	end	date
alamat	varchar(255)	pic	varchar(255)	wdt_ID	int(11)
koordinat	varchar(255)	email	varchar(255)	tanggalinput	date
odp	varchar(255)	nipnas	varchar(255)	tanggalclose	date
segmen	varchar(2000)	ca	varchar(255)	noorder	varchar(255)
product	varchar(2000)	ba	varchar(255)	inputer	varchar(2000)
jumlah	int(11)	sa	varchar(255)	transaksi	varchar(2000)
satuan	varchar(2000)	quote	varchar(255)	status	varchar(2000)
paket	varchar(2000)	agreement	varchar(255)	namacustomer	varchar(255)
otc	int(11)	sid	varchar(255)	filekfs	varchar(2000)
bulanan	int(11)	startkontrak	date	keterangan	text

Fig.3. Meta Data View of The Sales Data

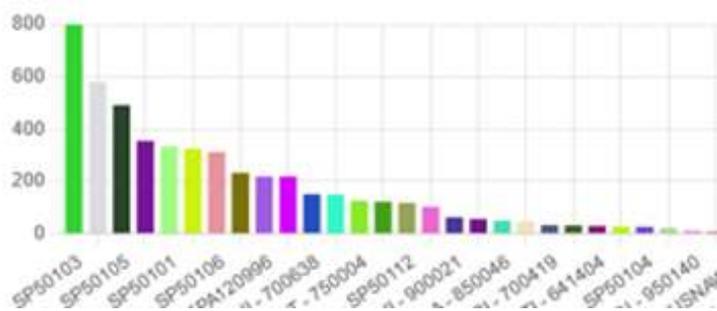


Fig.4. The Visualization of Sales Person Performance Based on The Number Transaction

C. Data Preparation: The data preparation phase is all activities that was done to create the final dataset. The raw data was selected, cleaned, constructed, integrated and reformatted. The dataset will be entered into the model created. Because of the purpose to find the best combination of dimension, this phase prepared 14 forms of dataset that will be used on clustering processes. The dataset forms can be seen in Table II.

TABLE II. DATASET FORMS

Name	Number of Features	Features Representation
Dataset 1	42	the number of transactions for product 1-27, the number of transactions for transaction 1-9, and the number of transactions for status 1-5.
Dataset 2	36	the number of transactions for product 1-27, the number of transactions for transaction 19
Dataset 3	27	the number of transactions for product 1-27
Dataset 4	32	the number of transactions for product 1-27, and the number of transactions for status 1-5.
Dataset 5	14	the number of transactions for the type of transaction 1-9, and the number of transactions for status 1-5.
Dataset 6	9	the number of transactions for the type of transaction 1-9
Dataset 7	5	the number of transactions for status 1-5.
Dataset 8	5	sales person, product, transaction, status, monthly price
Dataset 9	4	sales person, product, transaction, monthly price
Dataset 10	3	sales person, product, monthly price
Dataset 11	5	sales person, product, transaction, status, monthly price
Dataset 12	4	sales person, product, transaction, monthly price

Dataset 13	3	sales person, product, monthly price
Dataset 14	3	product, transaction, monthly price

D. Modelling: The steps on modelling phase are consisted of clustering process, cluster evaluation, and formulation of the best dimensional combination. Clustering process is done using the Self Organizing Map (SOM) method. SOM is a very useful neural network for data visualization and analysis. To evaluate the quality of the feature map produced by SOM, two indicators can be used, namely the quality of learning and the quality of projections. Learning quality indicators are determined by measuring quantization error (QE). Projection quality indicators are determined through topographical error (TE) measurements. If the QE and TE values are small, then the feature map will be rated with good quality [32]. Evaluation of clustering according to reference [32] is done by calculating the quantization error and topographic error first and then conducting a small group discussion to determine the best dimension. The clustering stage is implemented with the python programming language. Based on [33] it is stated that the Python programming language is reliable for data analysis and interactive, computational exploration and data visualization. Python provides great functionality for handling mathematical statistics, and scientific functions. In this research, the Python libraries used are numpy, pandas, matplotlib, MiniSom. The clustering program was carried out with dataset on Table II. Determination of the size map on the SOM is in accordance with the documentation in the MiniSom library, namely to adjust the size of the grid in reducing dimensions, the grid must contain $5 \cdot \sqrt{N}$ neurons where N is the number of samples in the data set to be analyzed [34]. Based on the cluster evaluation results in Table III and IV, there were four combinations of dimensions that have the best QE and TE values, namely the dimensions on dataset 3, dataset 6, dataset 12, and dataset 14.

TABLE III. CLUSTER EVALUATION PART I (SIZE MAP 5X5, LEARNING RATE 0,5)

No of Samples	Dimension	Dataset	q_error	t_error
27	42	Dataset 1	3.43	0.27
27	36	Dataset 2	2.29	0.23
27	27	Dataset 3	0.482	0.15
27	32	Dataset 4	0.86	0.42
27	14	Dataset 5	2.54	0.38
27	9	Dataset 6	0.83	0.04
27	5	Dataset 7	0.43	0.35

One of the results of the clustering is shown in Fig. 5. The cluster with many members was the cluster for extension and new installation transactions with the type of product that was the target of sales.



Fig.5. Clustering Results with Features namely Product, Transaction and Monthly Price

TABLE IV. CLUSTER EVALUATION PART II

No of Sample	Size Map	Learning rate	Dataset	q_error	t_error
1734	20x10	0,5	Dataset 8	2.52	0.23
1734	14x15	0,5	Dataset 8	2.28	0.34
1734	17x12	0,5	Dataset 8	2.66	0.43
1517	15x13	0,5	Dataset 9	2.29	0.483

1517	19x10	0,5	Dataset 9	2.29	0.13
1510	15x13	0,5	Dataset 10	1.74	0.24
1510	19x10	0,5	Dataset 10	1.59	0.27
1734	20x10	0,7	Dataset 11	2.33	0.35
1734	14x15	0,7	Dataset 11	1.98	0.37
1734	17x12	0,7	Dataset 11	2.19	0.23
1517	15x13	0,7	Dataset 12	2.85	0.10
1517	19x10	0,7	Dataset 12	1.99	0.32
1510	15x13	0,7	Dataset 13	1.39	0.41
1510	19x10	0,7	Dataset 13	1.29	0.28
1517	15x13	0,7	Dataset 14	0.66	0.26
1517	19x10	0,7	Dataset 14	0.95	0.13

The last part of modelling phase in this research is formulation of the best dimensional combination. The best dimensional combination that was used in sales data clustering was dataset 14. Dataset 14 is consisted of product, transaction and monthly price with a map size of 19x10 and a learning rate of 0.7. Based on the previous stages result, the model of sales person performance for this research was designed as shown in Fig.6. The model is connected with the prior sales order database. Then from the database, the model grabs the data and make dataset with features namely: (1) product, (2) transaction, and (3) monthly price. The multidimensional features depend on the best dimensional combination result on formulation stage. Beside the multidimensional performance dataset, the model also grabs the label of classification for labelling the sales person performance on the next step. Finally, the dataset and data label will be used in assessing sales person performance by sales person classification as shown in Fig 6.



Fig.6. The model of sales person performance based on sales data clustering

E. Evaluation: The proposed model is validated using a triangulation technique by examining the data that has been obtained through in-depth interviews, observation, and also FGD. In addition, an audit process is also conducted. The observation process was conducted on the prior website. The observation process is done by examining the data grabbing process. In-depth interviews were carried out with sales manager as the business owner. The next step was an FGD that involving the sales person and the sales manager. A user acceptance test (UAT) prepared for the FGD, the participants filled out the UAT form and validated the proposed model. The result of the observation and interview was indicated that the proposed model has met the business goal. In line with the result of the FGD that the participants agreed and stated that the model is valid to be deployed. Therefore, the triangulation model concluded that the proposed model was valid and agreed to be implemented. The proposed model has been presented to the experts from Politeknik Negeri Bali and DIKSI Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi Indonesia. The presentation is carried out for the audit process and got valid result for it.

IV. CONCLUSIONS AND FUTURE WORK: The model of sales person performance based on sales data clustering was conducted by research framework that adopted from CRISP-DM framework. The model is connected with the prior sales order database. The model grabs multidimensional features and classification

data label from the database. The multidimensional features were formulated through Kohonen SOM clustering evaluation result, among others: (1) product, (2) transaction, and (3) monthly price. It can be concluded that product, transaction and monthly price was the best dimensional combination that are considered capable of representing sales person performance. Therefore, it can be used as base criteria or features in classification. For future work, the research can continue with the deployment stage by integrating the model into sales analytics dashboard, so the dashboard will be completed by early warning of sales person performance. **ACKNOWLEDGEMENT:** Gratitude is dedicated to DIKSI Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi Indonesia who has funded this research and PT Telkom Indonesia (Persero) Tbk Witel Denpasar who are willing to guide us in the implementation of research, and also Politeknik Negeri Bali which gives full permission and support for this research.

REFERENCES: [1] C Gellweiler and L Krishnamurthi, Editorial: How Digital Innovators Achieve Customer Value, *Journal of Theoretical and Applied Electronic Commerce Research*, vol.15, no.1, 2020. [2] Guojun, Gan, Chaoqun Ma and Jianhong Wu. (2007). *Data Clustering: Theory, Algorithms, and Applications* (ASA-SIAM Series on Statistics and Applied Probability, Series Number 20). United States: Society for Industrial and Applied Mathematics. [3] Holý, Vladimír, Ondřej Sokol and Michal Černý. (2017). Clustering Retail Products Based on Customer Behaviour. *Applied Soft Computing*. [4] Seret, Alex, Thomas Verbraken and Bart Baesens. (2014). A new knowledge-based constrained clustering approach: Theory and application in direct marketing. *Applied Soft Computing* 24, 316-327. [5] Manjunath, Yoga Suhas Kuruba, Rasha Kashef. (2021). Distributed Clustering Using Multi-Tier Hierarchical Overlay Super-Peer Peer-to-Peer Network Architecture for Efficient Customer Segmentation. *Electronic Commerce Research and Applications*. [6] Aktaş, Asmin Alev, O. Tunali and A. T. Bayrak. (2021). Comparative Unsupervised Clustering Approaches for Customer Segmentation. 2nd International Conference on Computing and Data Science (CDS), pp. 530-535, doi: 10.1109/CDS52072.2021.00097. [7] Peker, S., A. Kocyigit and P.E.Eren. (2018). A Methodology for Product Segmentation Using Sale Transaction. *MIPRO*, vol 3, pp.1249-1253. [8] Daia, Wenseng, Yang-Yu Chuang and Chi-Jie Lub. (2015). A clustering-based sales forecasting scheme using support vector regression for computer server. *Procedia Manufacturing* 2, 82 – 86. [9] Dai, Hongyan, Haoyang Yu, Qing Xiao and Weihua Zhou. (2019). A Clustering-based Sales Forecast Method for Big Promotion Days in O2O On-Demand Retailing. *Proceedings of the 2019 IEEE IEEM*. [10] Loureiro, A.L.D., V.L. Miguéis and Lucas F.M. da Silva. (2018). Exploring the use of deep neural networks for sales forecasting in fashion retail. *Decsup*. [11] Seraphim, B. Ida, Lavi Samuel Rao and Shiwani Joshi. (2018). SURVEY ON CUSTOMER CENTRIC SALES ANALYSIS AND PREDICTION *Proceedings of the International Conference on Inventive Computation Technologies (ICICT)*. [12] Mu, Shengdong, Yuanyuan Wang, Fengyu Wang and Lidia Ogiela. (2021). Transformative computing for products sales forecast based on SCIM. *Applied Soft Computing* 109. [13] Van Steenbergen, R. and Mes, M. (2020). Forecasting demand profiles of new products. *Decision Support Systems*, 113401. [14] Pramono, Pradnya Paramita, Isti Surjandari and Enrico Laoh. (2019). Estimating Customer Segmentation based on Customer Lifetime Value Using Two-Stage Clustering Method. 2019 16th International Conference on Service Systems and Service Management (ICSSSM). [15] Jain, A.K. (2010). Data clustering: 50 years beyond K-means. *Pattern Recognition Letters* 31, 651-666. [16] Vallea, Mauricio A., Gonzalo A. Ruz b and Víctor H. Masías. (2017). Using Self-Organizing Maps to Model Turnover of Sales Agents in a Call Center. *Applied Soft Computing*. [17] Li, X., Yin, Y., Manrique, D.V., and Bäck, T. (2021). Lifecycle forecast for consumer technology products with limited sales data. *International Journal of Production Economics*, 239, 108206 [18] Mu, S., Wang, Y., Wang, F., and Ogiela, L. (2021). Transformative computing for products sales forecast based on SCIM. *Applied Soft Computing*, 109, 107520 [19] Lu, C. (2014). Sales forecasting of computer products based on variable selection scheme and support vector regression. *Neurocomputing*, 128, 491-499. [20] Wang, C. (2022). Considering economic indicators and dynamic channel interactions to conduct sales forecasting for retail sectors. *Computers & Industrial Engineering*, 165, 107965. [21] Park, S., Han, E., Kim, J., and Lee, E. (2016). Factors influencing the difference between forecasted and actual drug sales volumes under the price–volume agreement in South Korea. *Health Policy*, 120, 8, 867-874 [22] Vallés-Pérez, I., Soria-Olivas, E., Martínez-Sober, M., Serrano-López, A.J., Gómez-

Sanchís, J., and Mateo, F. (2022). Approaching sales forecasting using recurrent neural networks and transformers. *Expert Systems with Applications*, 201, 116993 [23] Ensafi, Y., Amin, S.H., Zhang, G., and Shah, B. (2022). Time-series forecasting of seasonal items sales using machine learning – A comparative analysis. *International Journal of Information Management Data Insights*, 2, 1, 100058. [24] Mardiantien, Crisnanda Rahmita, Imelda Atastina and Ibnu Asror. (2020). Product Segmentation Based On Sales Transaction Data Using Agglomerative Hierarchical Clustering and FMC Model, 2020 3rd International Conference on Information and Communications Technology (ICOIACT). [25] Yoseph, Fahed and Markku Heikkilä. (2019). A Clustering Approach for Outliers Detection in a Big Point-of-Sales Database. 2019 International Conference on Machine Learning and Data Engineering (iCMLDE). [26] Márquez, David G., Abraham Otero, Paulo Félix and Constantino A. García. (2018). A novel and simple strategy for evolving prototype based clustering. *Pattern Recognition* 82, 16–30. [27] Tiwari, R., Srivastava, S., and Gera, R. (2020). Investigation of Artificial Intelligence Techniques in Finance and Marketing. *Procedia Computer Science*, 173, 149. [28] Dewi, K. C. and A. Harjoko. (2010). Kid's song classification based on mood parameters using K-Nearest Neighbor classification method and Self Organizing Map. 2010 International Conference on Distributed Frameworks for Multimedia Applications, Yogyakarta, pp. 1-5. [29] Zhou, Na, Jin Tian and Minqiang Li (2021). Online recommendation based on incremental-input self-organizing map. *Electronic Commerce Research and Applications*, Volume 50, 101096. [30] R. Wirth, "CRISP-DM : Towards a Standard Process Model for Data Mining," *Proc. Fourth Int. Conf. Pract. Appl. Knowl. Discov. Data Min.*, no. 24959, pp. 29–39, 2000, doi: 10.1.1.198.5133. [31] Neisari, A., Rueda, L., and Saad, S. (2021). Spam review detection using self-organizing maps and convolutional neural networks. *Computers & Security*, 106, 102274. [32] Ozcalici, M. and Bumin, M. (2020). An integrated multi-criteria decision-making model with Self-Organizing Maps for the assessment of the performance of publicly traded banks in Borsa Istanbul. *Applied Soft Computing*, 90, 106166. [33] Tu, L. A. (2019). Improving Feature Map Quality of SOM Based on Adjusting the Neighborhood Function. In A. Almusaed, A. Almssad, & L. T. Hong (Eds.), *Sustainability in Urban Planning and Design*. IntechOpen. <https://doi.org/10.5772/intechopen.89233> [34] <https://github.com/JustGlowing/minisom/blob/master/minisom.py>

High-Efficiency Smart Water Meter Connectivity with LoRa-Based

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Abstract—Internet of Things or what we call IoT is an advanced technology that can connect a hardware device so that it can be controlled remotely using an internet connection. Along with the development of

technology which has now reached 4.0 where all equipment can be controlled or monitored via the internet, with this technology, Automatic Meter Reading (AMR) was created for PDAM (Regional Drinking Water Company) which can be monitored via the website by customers. by using LoRaWAN technology to transmit data that is read by sensors so that users can find out how much water is used every day. LoRaWAN which is connected to a module that contains sensors to read water deit will send data to the Antares server then from the server it will be pulled to the Laravel website dashboard.

Keywords: Internet of Things, PDAM, LoRaWAN

1. Introduction: Lora as known as Long Range Wide Area with physical proprietary radio communication and low-power wireless network protocol. LoRa was invented began in 2009, that's happen when Niccolas Sornin and Olivier Seller as a France aimed at developing a long range with low-power modulation technology. Currently, the need for technology to be interconnected is very high. However, connectivity to be interconnected has high power consumption, therefore that argument must collaborate low-power consumption with high efficiency. LoRa is used to transmit data from the LC sensor, which works continuously with a specific interval. In Indonesia LoRa frequency as a gateway was established by PT Telkom Indonesia Tbk in 2019. They also provide Antares LoRaWAN as a cloud for data storage so that can be able to easily get and post data to the server. Water can be said one of the highest consumptions elements, therefore the management of water is needed. Water management can control water effectively and efficiently. So, the water meter required technique updates to improve water management. The LC sensor will get the analog sensor which will be converted to a digital signal. The digital signal will be processed and sent to Antares as a cloud server with LoRa medium. With that scheme, water management can be better and integrated.

2. RELATED WORK: Water is very important for human life and the smart implementation of classical or mechanical techniques is expected to improve [1] the water meter system without regard to the inherent techniques. Because existing mechanical technique has many drawbacks e.g., fraud, latency, efficiency, and wastage of manpower. Moreover, mechanical techniques can affect the errors in high-pressure and unsatisfiable water quality. By contrast, electronic water meters [2] can real-time monitor the water meter reading from a long distance and even remotely water reading as control management. However, electrical water meters [3] still have many lacks e.g., high-power consumption, high cost, immature technology, and not being fully standard well. Therefore, water reading technique updates required based on IoT are purposed to improve the water management control [4] with a new integrated system. This system with LoRa [5] as wireless medium also has low-power consumption and long-range and wide area coverage. LPWAN (Low Power Wide Area Network) is a network that is used for long distance communication which is about 15km. LoRaWAN communication itself uses different frequencies to each region, Asia has AS923 frequency and Indonesia uses AS923-2. This network has several advantages including low power consumption, low operating costs and can carry out two- way communication and is an open-source device so anyone can use this device. The type of device used in this study is RFM95W/96W/98W. [6]. Antares is an Internet of things (IoT) platform developed by PT. Telekomunikasi Indonesia tbk. Antares itself is internationally recognized and has a OneM2M certificate, which means that Antares can connect various Internet of Things devices. In the Antares platform itself, apart from storing data, there are many documentations that have been provided, so when we want to learn about Antares, we don't have to worry because it has been provided by Antares. [7]. RMF95W feature with LoRaTM modem that provides ultra- long range spread spectrum communication and high interfer- ence immunity while minimising current consumption. [8].

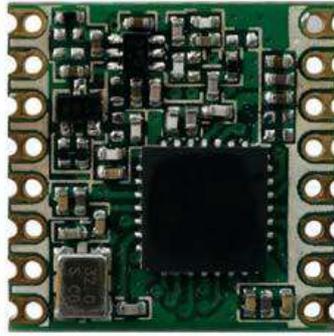


Fig. 1: RFM95W Board

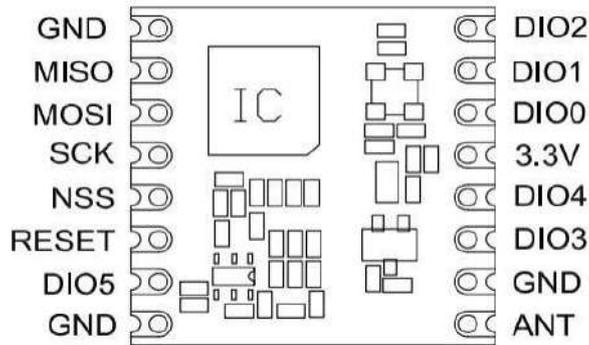


Fig. 2: RFM95 Pin Diagram

The table I based on datasheet [9]

number	Name	Type	Description
1	GND	-	Ground
2	MISO	O	SPI Data output
3	MOSI	I	SPI Data input
4	SCK	I	SPI Clock input
5	NSS	I	SPI Chip select input
6	RESET	I	Reset trigger input
7	DIO5	I/O	Digital I/O, software configured
8	GND	-	Ground
9	ANT	-	RF signal input/output
10	GND	-	Ground
11	DIO3	I/O	Digital I/O, software configured
12	DIO4	I/O	Digital I/O, software configured
13	3.3V	-	Supply Voltage
14	DIO0	I/O	Digital I/O, software configured
15	DIO1	I/O	Digital I/O, software configured
16	DIO2	I/O	Digital I/O, software configured

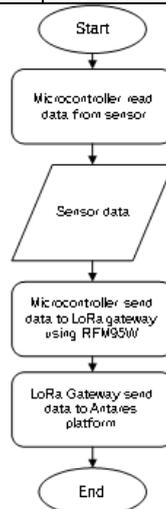


Fig. 3: Uplink flowchart

To make it easier to read the data communication system, a flow chart is made as shown below: 1) Sending Data from Sensors to Antares: The microcontroller will read the sensor data then after the data is read the microcontroller will send data via LoRa data connection with RFM95W type to be sent to the Antares server,

the delivery flow is as shown below. 2) Pulling Data from Server to Dashboard: After the data is successfully sent to the Antares server then the data will be sent using Node JS and will be displayed on the dashboard using React JS, the flow is like the diagram below.



Fig. 4: Fetching data with react

3. EXPERIMENTAL CONFIGURATION: In designing a communication device, it is necessary to configure the pins in accordance with the communication path, therefore in this study using RFM95W with the following pin configurations: Form the test with 20 samples in every frequency from (921- 922.6) MHz the optimal configuration for Spreading Factor (SF) is 12, 125 for Bandwidth (BW), and 5 for Correction Rate (CR). Expected before you must already have Antares account if don't have an account yet then register via <https://antares.id>. After that make it an applications and devices in the application menu. After so appearance like picture below, and then our will set LoRa with method click LoRa set button on the right top.

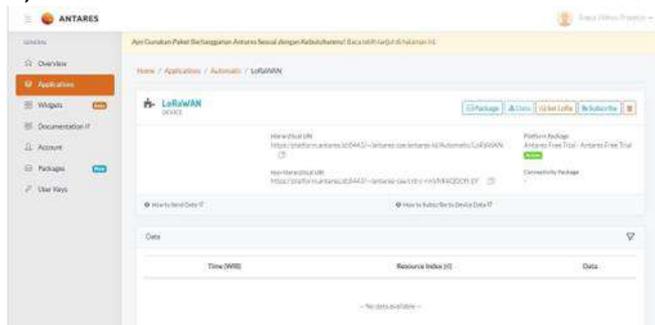


Fig. 6: Device Image

Then setting LoRa Device Class with choose Class A then LoRa Activation Mode with type ABP and ABP Parameters become Inherit. Do not forget for keep the code contained in the Application EUI, Network Session Key and Application Session Key you can copy on notepad. Code already our save just now useful for connect Lo- RaWAN module with Antares so that the data sent by the module will stored on a device that has our make in Antares.

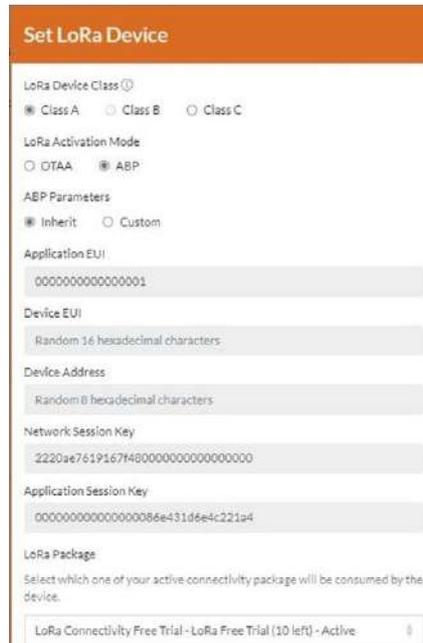


Fig. 7: Device Image

4. EXPERIMENTAL RESULT: A. Frequency Test: Frequency Optimization with 20 sample ranges (921.2 - 922.6) MHz.

UN FREQUENCY																					
921.2		921.4		921.6		921.8		922		922.2		922.4		922.6		n					
SNR	SN	SNR	SN	SNR	SN	SNR	SN	SNR	SN	SNR	SN	SNR	SN	SNR	SN						
0.00098	5.3	-112	0.01182	4.2	-112	0.01114918	6.5	-108	0.01841	16	-108	0.01174	-13	-111	0.011039	25.5	-108	0.02028	-14.5	-108	1
0.00097	5.3	-112	0.01091	4.5	-111	0.01117897	6.2	-108	0.01086	-14.4	-109	0.010914	-14.2	-107	0.011050	16	-108	0.010282	-14.8	-109	2
0.0208	6.8	-113	0.01068	5	-112	0.02049588	5.8	-109	0.010486	13.4	-107	0.010709	-18	-109	0.010269	26.5	-107	0.010263	-15.8	-109	3
0.04078	-7	-112	0.01065	5	-109	0.02048002	-7.2	-109	0.020417	-14.4	-107	0.01108	-14.8	-108	0.020404	15	-107	0.010476	-15.5	-109	4
0.00095	5.5	-113	0.01079	3.2	-111	0.01114989	6.8	-109	0.01082	15.5	-107	0.01098	-14.5	-109	0.010939	14.2	-109	0.010487	-15.5	-109	5
0.00117	5.5	-112	0.01028	4.2	-111	0.01146176	5.5	-108	0.01081	15.2	-109	0.020251	-14	-109	0.011095	14.2	-109	0.01028	-14.8	-109	6
0.00117	5.2	-114	0.01038	6	-110	0.01100574	-7.2	-107	0.01081	14.4	-108	0.01088	-12.2	-108	0.010955	12.2	-107	0.010403	-13.8	-109	7
0.00095	6.5	-113	0.01028	5	-111	0.01146181	-10	-108	0.01084	-12.4	-109	0.020264	-14	-108	0.011044	12.5	-109	0.01036	-12.8	-109	8
0.00095	5.5	-113	0.01063	-7.8	-111	0.01146187	5.8	-107	0.01141	11.5	-109	0.01094	-16	-107	0.011497	16	-105	0.01022	-13.2	-107	9
0.00095	5.2	-113	0.01066	4.5	-109	0.01119520	6.5	-109	0.01083	11.2	-109	0.010227	-15.2	-109	0.011027	15	-107	0.010488	-14	-109	10
0.00095	6.8	-113	0.01038	6.2	-109	0.01046347	6	-109	0.01033	-12.5	-109	0.010308	-16	-109	0.011462	14	-107	0.01036	-13.2	-109	11
0.00078	-7	-113	0.01062	6	-109	0.01100146	6.2	-109	0.01042	11.8	-107	0.01097	-14.5	-109	0.011084	12.2	-107	0.01028	-14.2	-109	12
0.00097	-8	-113	0.01028	5	-109	0.01125446	5	-108	0.01033	14	-108	0.01028	-14	-109	0.010307	14.8	-108	0.010442	-14.5	-109	13
0.00093	4.8	-113	0.01066	7	-111	0.01046274	5.5	-107	0.01033	-11.4	-108	0.01096	-16	-109	0.011085	14.8	-107	0.010269	-15	-109	14
0.00088	5.2	-113	0.01022	5	-111	0.01125476	-10	-108	0.01042	11.8	-109	0.01092	-14.8	-108	0.011079	14.2	-108	0.010353	-13.2	-109	15
0.00077	-8	-112	0.01048	6.5	-109	0.01119476	5.2	-108	0.020248	13	-109	0.01094	-14.8	-111	0.01011	15.5	-109	0.010259	-13.2	-111	16
0.02248	-5	-106	0.02044	3.2	-111	0.02046447	13.5	-108	0.01087	11.2	-108	0.010101	-15	-108	0.010135	15	-107	0.010388	-14	-108	17
0.00092	4.8	-113	0.01032	4.8	-112	0.01070362	5.2	-107	0.010374	11.5	-111	0.01087	-15.8	-109	0.010307	14.5	-107	0.010322	-13.2	-108	18
0.00095	3.2	-112	0.01033	7	-111	0.01070635	5.2	-109	0.01085	-11.2	-109	0.01094	-12.8	-109	0.010194	14.5	-107	0.010382	-15.8	-109	19
0.02028	3.2	-112	0.01035	5.8	-110	0.01095207	5.8	-105	0.01047	-5.8	-110	0.01028	-11.5	-107	0.020476	15.8	-108	0.020346	-15	-107	20
0.02009	5.675	-111	0.02011	5.265	-114.3	0.0202046	8.955	-110.8	0.02009	15.40	-108.8	0.02040	-14.555	-108.4	0.0204	14.75	-107.26	0.02026	-11.05	-108.46	

Fig. 8: Frequency Test ranges (921.2 - 922.6) MHz

1) Delay Optimization: The average results of delay optimization from frequency (921.2 - 922.6) MHz with 20 samples.



Fig. 9: Frequency to Delay Test

2) SNR Optimization: The average results of Signal to Noise Ratio (SNR) optimization from frequency (921.2 - 922.6) MHz with 20 samples.

system,” in 2021 IEEE International Conference on Consumer Electronics and Computer Engineering (ICCECE), 2021, pp. 301–305. [2] C. P. H. J. Li X J, “Design and implementation of a self-powered smart water meter,” in *Sensors*, vol. 19, no. 19, 2019, p. 4177. [3] C. Li, Y. Su, R. Yuan, D. Chu, and J. Zhu, “Light-weight spliced convolution network-based automatic water meter reading in smart city,” *IEEE Access*. [4] A. M. Manoharan and V. Rathinasabapathy, “Smart water quality monitoring and metering using lora for smart villages,” in 2018 2nd International Conference on Smart Grid and Smart Cities (ICSGSC), 2018, pp. 57–61. [5] Y. Li, X. Yan, L. Zeng, and H. Wu, “Research on water meter reading system based on lora communication,” in 2017 IEEE International Conference on Smart Grid and Smart Cities (ICSGSC), 2017, pp. 248–251. [6] M. Kazimierczuk and J. Jozwik, “Implementasi modul komunikasi lora rfm95w pada sistem pemantauan listrik 3 fasa berbasis iot,” *Circuits and Systems, IEEE Transactions on*, vol. 13, no. 1, pp. 17–21, jun 2021. [7] “Divisi digital service, “antares — reliable iot platform,” pt telekomunikasi indonesia,” visited on jul. 18, 2022. [Online]. Available: <http://www.antares.id/docs.html> [8] “Rfm95w feature the loratm long range model hoperf,” visited on jul. 19, 2022. [Online]. Available: <https://www.hoperf.com/modules/lora/RFM95.html> [9] “Hoperf, “hoperf rfm95w,” visited on jul. 18, 2022. [On-line]. Available: <https://www.hoperf.com/data/upload/portal/20190801/RFM95W-V2.0.pdf>

The Quark Flavor Violating Higgs Decay in the MSSM

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Abstract: The Standard Model [1] of particle physics is currently the most impressive achievement of high energy physics and provides best fundamental understanding of the phenomenology of particle physics. This highly elegant theory attempts to categorize all the subatomic particles into groups according to their respective charges and describes how they interact through fundamental interactions [2]. All the matter is made of particles, and these particles interact with each other by exchanging other particles associated with the fundamental forces. The basic grains of matter are Fermions [3] and the force carriers are Bosons [4]. The names of these two classes refer to their spin or angular momentum. Fermions are the particles that make up matter and Bosons are particles that mediate force. Within the family of Fermions, there are two types of particles, Quarks [5] and Leptons. Quarks make up sub-atomic particles, which come in six varieties (u d t b c s) and Leptons are massive particles, which are also six. Quarks combine to make Hadrons, which are either Baryons [6] or Mesons [7], depending on the quark combination. Protons and neutrons are the Baryons, that make up the atomic nuclei [8] which come together with electrons from Leptons family to form atoms, which then form molecules and all of the matter, we see every day. On the other hand, we also have the force carrier particles or messenger particles, called the Bosons. These are the gluons, the W/Z bosons, the photons and hypothetical gravitons. Although the Standard Model of particle physics is an extremely successful and remarkable theory, it is far from being a complete description of the universe as some phenomena are not explained in it like gravitation [8], dark matter [9], neutrino mass [10] and hierarchy problem [11]. Because of this lack physicists try to invent extension of the Standard Model [12]. One popular extension of Standard Model is called Super symmetry. Minimal Super Symmetric Standard Model (MSSM) [13] considers only the minimum members of new particle states and new interactions consistent with phenomenology. Super symmetry is not a theory, it is a principle, that a theory might have. Super symmetry treats forces and matter identically, then any theory with this property is said to be Super symmetric. Super symmetry pairs boson with fermions; therefore, every Standard Model particle has a partner that has yet to be discovered. Super symmetry is a possible candidate for undiscovered and seen as an elegant solution to many current problems in particle physics, if confirmed correct. As MSSM, itself is not directly experimented. But we consider an indirect way, for that; we get Higgs decay [14], which is supposed to be a good hint. The branching ratio [15] in SM can be at most 10^{-7} , too small to have a

chance to detection. We may expect several orders of magnitude increase of the branching ratio in MSSM as compared to the SM result and if we find it out experimentally, we can get indirect confirmation for MSSM [16].

References: Perkins, D. H. Introduction to High-Energy Physics, 2d Ed. Reading, MA: Addison-Halzen, F., and A. D. Martin. Quarks and Leptons. New York: Wiley, 1984. Y. Nambu, Scientific American (November 1976); K. Johnson, Sci. Am. (July 1979); C. Rebbi, Sci. Am. (February 1983). A. Curiel, M. Herrero and D. Temes, Phys. Rev. D 67 (2003) 075008 [arXiv:hep-ph/0210335]. An extensive bibliography on the quark model, and useful commentary, is given by O. Frauenfelder, H., and E. M. Henley. Subatomic Physics. Englewood Cliffs, NJ: Prentice G. Goldhaber et al., Phys. Rev. Lett. 37, 255 (1976); I. Peruzzi, Phys. Rev. Lett. 37, Gottfried, K., and V. F. Weisskopf. Concepts of Particle Physics. Oxford Oxford University H. Nilles, Phys. Rept. 110 (1984) 1; H. Haber and G. Kane, Phys. Rept. 117 (1985) 75; R. Barbieri, Riv. Nuovo Cim. 11 (1988) J. K\"ubbeck, M. B\"ohm and A. Denner, Comput. Phys. Commun. 60 (1990) 165; T. Hahn, Comput. Phys. Commun. 140 (2001) 418 [arXiv:hep-ph/0012260]. M. Basile et al., Nuovo Cimento Lett. 31, 97 (1981). M. Conversi, E. Pancini, and O. Piccioni, Phys. Rev. 71, 209 (1947). M. Jacob and P. Landshoff, Sci. Am. (March 1980). M. Perl et al., Phys. Rev. Lett. 35, 1489 (1975). See also M. Perl and W. Kirk, Sci. Am. (March 1978). Many of the classic papers (including the original unpublished one by G. Zweig) are reprinted in D. B. Lichtenberg and S. P. Rosen, eds., Developments in the Quark Theory of Hadrons (Nonantum: Hadronic Press, 1980). R. Brandelik et al., Phys. Lett. B70, 132 (1977). R. E. Marshak and H. A. Bethe, Phys. Rev. 72, 506 (1947). S. Bejar, F. Dilme, J. Guasch and J. Sola, JHEP 0408 (2004) 018 [arXiv:hep-ph/0402188]. T. Hahn and C. Schappacher, Comput. Phys. Commun. 143 (2002) 54 [arXiv:hep-ph/0105349]. The program and the user's guide are available via. W. Greenberg, Am. J. Phys. 50, 1074 (1982). www.feynarts.de

Implication of Land Use Conversion on Environmental Quality in Abuja City

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Abstract: This study is aimed at assessing the implication of land use conversion on environmental quality in phase 1 of Abuja city. A total of 1240 respondent and 30 government officials participated in the interview session. The spatial and temporal characteristics were shown with the original Land use prepared in 1980 and the reviewed land use maps showing areas of various land use conversion in the study area. Three forms of environmental deterioration namely waste generation, traffic volume and land use conversion were studied in relation to population growth in Federal Capital Territory. The Spearman correlation indicated that there is a strong relationship between population growth and traffic generation at 0.741 (74.1%) significance level. Also, there is a strong relationship between population growth and land use conversion at 0.897 (89.7%) and there is a strong relationship between population growth and waste generation at 0.940 (94.0%) significance level. The study reveals the factors responsible for land use conversion to include population growth, high rent returns, accessibility, high land value, rapid growth and high rent returns which leads to traffic congestion, overcrowding, waste generation, poor aesthetic quality of the environment and insecurity. Past government efforts were appraised and possible corrective efforts in improving the standard and quality of social facility is suggested. Provision of infrastructure in the other phases of the capital city and satellite settlements to attract people away from the city Centre, effective development control mechanism, and stiffer fines introduced with guidelines and public enlightenment and feedback mechanism. Others include review of the land use conversion approval order and public participation in the implementation of these plans, establishment of a litigation unit to enforce law and regulations concerning land use conversion in the city.

Keywords: Environmental Quality, Land-Use Conversion, Master-Plan, Population Growth, Urban Land-Use

Climate Change and Livelihood Strategies in Bayelsa State, Nigeria



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Abstract: The vulnerability of climate change on farming and fishing livelihood in Bayelsa State, Nigeria was analysed using a cross sectional household survey and multi-staged sampling techniques to sampled 200 farmers and 200 fishers from three Local Government Areas and twelve communities. The sampled respondents had good perception of climate change with majority 92.75 percent relating it to increasing daily temperature. Among the perceived impact of climate change on farming livelihood in the study area, decreased quantity and quality of crop yield with mean values of 3.75 was perceived to be of the highest effect of climate change by the sampled farmers while for fishing livelihood, it was increasing difficulty of access/increasing distance to fishing ground (3.72). The most favoured on-farm adaptation strategy by farmers was changing of planting time (92.5%) and livelihood diversification for off-farm livelihood diversification (95%) while fishers also preferred to diversify their livelihood sources to non-fishery activities (93.5%). Both farming and fishing livelihood were found to be moderately vulnerable to climate change impact with overall livelihood vulnerability index of 0.392 and 0.390 as well as -0.086 and -0.089 for the approach index respectively.

Keywords: Adaptation, Global warming, Farmers, Fishermen, Mitigation

Effluents Discharge from Refinery and Petrochemical Company and its Effects on Water Bodies in Nigeria

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Abstract: The purpose of this research was to examine how effluents from Kaduna Refinery affect the quality of water along the river Rido. Primary source of data includes laboratory analysis of water samples, in situ measurements, photography, observation and field sheet was used to record information of samples collected from the field. The World Health Organization and Standards Organization of Nigeria Safety Standards for Potable Water data were also used to interpret water quality while Food and Agricultural Organization guidelines was used to determine its suitability for irrigation in the area. The study collected 17 samples comprising of five control samples at interval of 1 kilometer from each other before the point of discharge of effluents from refinery and 12 samples after the point of discharge at interval of 1 kilometer every sampling month. The transient method was used to determine sampling points along the river. The water samples were taken at two different periods; raining and dry seasons. The physicochemical parameters of water samples were determined using the standard analytical methods of analysis as recommended by Association of Analytical Chemists. The parameters determined were temperature, pH, total suspended solids, total dissolved solids, turbidity, conductivity, alkalinity, dissolved oxygen, biochemical oxygen demand, sulphate, phosphate, nitrate and chloride. The metals determined in the water samples were As, Cd, Cu, Cr, Fe, Mn, Ni, Hg, Pb and Zn. The

findings reveal that the concentrations obtained for physiochemical parameters were all higher than those obtained for the control samples in both dry and wet seasons. The concentrations obtained for these metals showed that Hg was not detected in any of the water samples analysed in both dry and wet seasons. Therefore, the general irrigation water quality parameters values are within the standard guidelines recommended by the regulators and are fit for irrigation.

Keywords: Effluents, Irrigation, Water Quality, Physicochemical, Heavy Metals

Impact of Climate Change on Rural Communities in Nigeria

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Abstract: This study analysed the impact of climate change on farming and fishing livelihood in Bayelsa State, Nigeria with the aim of determining the perception of farmers and fishers on climate change vulnerability on their livelihood. The study adopted cross sectional household survey and multi-staged sampling techniques to sampled 400 (200 farmers and 200 fishers) respondents from three Local Government Areas and twelve communities. Data for the study was obtained through the use of questionnaire and structure interviews which were analysed. The sampled respondents had good perception of climate change with majority (92.75%) relating it to increasing daily temperature. Among the perceived impact of climate change on farming livelihood in the study area, decreased quantity and quality of crop yield with mean values of 3.75 was perceived to be of the highest effect of climate change by the sampled farmers while for fishing livelihood, it was increasing difficulty of access/increasing distance to fishing ground (3.72). The most favoured on-farm adaptation strategy by farmers was changing of planting time (92.5%) and livelihood diversification for off-farm livelihood diversification (95%) while fishers also preferred to diversify their livelihood sources to non-fishery activities (93.5%). Both farming and fishing livelihood were found to be moderately vulnerable to climate change impact with overall livelihood vulnerability index (LVI) of 0.392 and 0.390 as well as -0.086 and -0.089 (for IPCC-LVI approach) respectively. Despite exposure to flood and climate variability, social network remained the most important causal factor that explained farming and fishing livelihood vulnerability in the region by impacting negatively on adaptive capacity due to poor interpersonal relationship among the fishers and farmers. This paper therefore recommends that both farmers and fishers are advised to collaborate with one another, form associations or join existing relevant one as this would help them adapt to or cope with the impact of climate change on their livelihood through giving of all forms of assistance and sharing of information which will enhance their adaptive capacity.

Keywords: Adaptation, Climate Change, Farmers, Fishers, Livelihood

The Protective Role of Cardamom Pods, Lime Fruit and Frankincense Resin on Alloxan-Induced Diabetic in Albino Rabbits

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Abstract: This study was designed to assess the beneficial effect of aqueous extract of cardamom pods (*Elettaria cardamomum*), lime fruit (*Citrus aurantifolia*), and frankincense resin (*Boswellia sacra*) on diabetes-associated testicular injury in the rabbits. **Methods:** In this study, 30 New Zealand rabbits were randomly divided into ten groups; each of which contained 3 rabbits: a negative control group (untreated group), a positive control group; eight experimental groups in which aqueous extract of cardamom pods, lime fruit and *Boswellia sacra* were administered once daily, at two concentrations (500 mg/kg and 250 mg/kg) for 14 days. Testicular damage was

evaluated by histological examination and serum oxidative stress was also determined. Results: Induction of diabetes in the present study caused a reduction in GSH activity as compared with the control group. However, an increasing tendency in GSH levels was observed in diabetic rabbits treated with lime and cardamom (CEE; 500 mg/kg) compared to diabetic animals, although it didn't reach statistical significance. Additionally, the morphological testicular alterations observed in diabetic groups were significantly improved after treatment with Citrus aurantifolia and Elettaria cardamomum (CEE) as compared to the control group Conclusion: The usage of the plant components thought-out this study (Elettaria cardamomum, Citrus aurantifolia, and Boswellia sacra) showed that CEE aqueous extract improves diabetes-induced oxidative damage in rabbit's testis.

Keywords: Albino Rabbits, Alloxan, Citrus Aurantifolia, Boswellia Sacra, Elettaria Cardamomum, Testis

Optimization Of Passive Transit Signal Priority for El-Raml Tram, Alexandria, Egypt

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Abstract: Signal control mode is currently the most common control mechanism for urban road intersections, given that the signal timing method has the greatest impact on the traffic efficiency at road intersections [1]. Therefore, this paper presents an optimized passive transit signal priority (TSP). a novel algorithm for TSP is presented and tested using Alexandria's Tram as a case study for the current tram in Alexandria, Egypt using traffic signals, traditional passive signal priority strategies considered the equality of intersection cycle length, this is required to ensure that green begins at the same time at the upstream and downstream intersections. However, in our method, the optimization of the (TSP) and each individual intersection timing scheme can be optimized concurrently. In this work we propose a novel passive signal priority with average per vehicle delay minimization as a goal, a meta-heuristic algorithm genetic algorithm Based on the highway capacity manual (HCM2000) the mathematical optimization model is formulated. A set of restrictions have been set up to imply efficiency and safety for the resulting optimal TSP. To demonstrate the proposed method's efficiency, we use another efficient optimization algorithm "Pattern search algorithm" to compare the resulting cycle length and phasing timing in each junction. The results show that the tram headway must be a multiple of 107 seconds according to the genetic algorithm or a multiple of 118 according to the pattern search algorithm and the objective function is nearly the same for the two algorithms (40-42 sec), also the optimized green split for each intersection as will be shown the paper.

Keywords: Transit Signal Priority, Optimization, Genetic Algorithms, Pattern Search, Control Delay

Identification, Detection and Phylogenetic Analysis of RPO30 Gene of Sheeppoxvirus in Morocco

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Abstract: Smallpox in small ruminants is a highly contagious skin disease that is reportable by the World Organisation for Animal Health (OIE). It is caused by a virus belonging to the genus Capripoxvirus, one of the eight genera of the subfamily Chordopoxvirinae and the family Poxviridae, composed of three important pathogens the virus Sheeppox (SPPV), the virus Goatpox (GTPV) and Nodular Contagious Dermatitis Virus (LSDV), which cause disease in sheep, goats and cattle respectively [1]. The usual classification criteria for Capripoxvirus are based on the animal species from which the viruses were isolated. However, recent research has shown that some strains of SPPV and GTPV could infect both sheep and goats [1,2]. Therefore, the hypothesis of strain identification based on the host animal species from which the strain was first isolated is not valid [3]. Therefore, our study this study was conducted to study outbreaks of ovine smallpox in different regions in Morocco, to develop molecular methods for the detection and isolation of circulating smallpox virus in sheep, sequencing and phylogenetic analysis to elucidate the genetic kinship of these viruses. In addition, it describes the relevance of the homologue of the RPO30 gene of the Vaccinia virus, coding for the 30 kDa RNA polymerase subunit for genotyping and designing a PCR test to differentiate SPPV from GTPV strains based on the presence of 21 nucleotide deletion found exclusively in SPPV strains.

Keywords: Phylogenetic Analysis, Capripoxvirus, RPO30 Gene, GTPV, SPPV, Sheeppoxvirus

References: [1] Diallo A., V. G. (2007). Genus Capripoxvirus. In: Mercer A.A., Schmidt A., Weber O. (eds) Poxviruses. Birkhäuser Advances in Infectious Diseases. Birkhäuser Basel, pp 167-181. [2] Bhanuprakash V., V. G. (2010). Pox outbreaks in sheep and goats at Makhdoom (Uttar Pradesh), India: evidence of sheeppox virus infection in goats. *Transbound Emerg. Dis.*, 57: 375-382. [3] Lamien CE, L. G. (2011). Use of the Capripoxvirus homologue of Vaccinia virus 30 kDa RNA polymerase subunit (RPO30) gene as a novel diagnostic and genotyping target: development of a classical PCR method to differentiate Goat poxvirus from Sheep poxvirus. *Veterinary microbiology*, 149(1-2):30-9.

Identification of Hepatitis A and Norovirus I and II in Berries by Real Time PCR



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Abstract: In recent years, viruses have been increasingly recognized as a major cause of foodborne illness worldwide. There has been an increase in published data on virus epidemiology over the past decade. Foodborne viral infections are usually caused by enteric viruses and these infections are spread by viral particles excreted in the stool or vomit of infected people. Norovirus (NoV) and hepatitis A virus (HAV) are the two most overt causes of viral foodborne illness. They are transmitted by the faecal-oral route. Foodborne transmission is therefore the result of contamination of food by infected water or handling by infected people (Kohli et al., 2005). Fresh fruits, vegetables and bivalve molluscs pose a high risk of contamination from foodborne viruses, as these products normally undergo little or no processing and can be contaminated at any stage, from pre-harvest to post-harvest (Albert, 2011). A recent international standard method for screening food for norovirus and hepatitis A is a milestone. ISO 15216-2:2020 (ISO, 2020) is a protocol that first extracts viral RNA from food matrices. It is for this purpose that this work will be devoted to the search for the presence or absence of Hepatitis A viruses and Norovirus GI and GII in red fruits as well as bivalve molluscs in Morocco. To achieve this goal, the development and validation of a new sample preparation method for the extraction of viral RNAs using an extraction kit. Then, the detection is done by a molecular technique based on the use of real-time RT-PCR using an amplification kit obtained by master mix/Master Mix.

Keywords: Red Fruits, Hepatitis A, Bivalve Molluscs, Norovirus GI and GII, RT-PCR

References: - ISO 15216-2: 2020 Microbiology of the food chain — Horizontal method for the detection of hepatitis A virus and norovirus by the real-time RT-PCR technique — Part 2: Detection method - KOHLI E., BON F., BALAY K., POTHIER P. Les calicivirus humains, une cause majeure de gastro-enterites aigue. *Virologie*, 2005, 9, 93-106. - Albert. Norovirus and Hepatitis A virus in shellfish, sft fruits and water, *Archimer*, 2011

The Word of power in Education



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Abstract: Power: The idea of power has lain more completely neglected in education studies than in any another discipline that is of fundamental social interest. Power and employment are intricately connected, yet complex concepts which can have profound implication on the experience of both Teacher and students in the classroom, School leaders set the tone and direction for what happens in classrooms. When all educators are on the same page for learning, they work toward a more interconnected school community. An attempt to present briefly

some important aspects of energy-education as an emerging discipline is made in this paper. Suggestions concerning the evolvement of an effective approach for energy-education at all levels have also been made. I think that teaching-by-examples is an awesome and empowering method. Instead of a universal principle given by some authority a way to solve a problem is suggested I think that the advantages of sharing examples are too big and the available material too few to ignore the unused potential in sharing more of our designs and thus educating each other in a way which is instructive as well as empowering for the learners. As computer programs become more widespread, computer programming becomes an increasingly relevant skill, and many political bodies are recognizing this fact. It is a combination of disciplined mental habits, attitudes of endurance, and essential soft skills. Conclusions: No Conflict.

Keywords: Energy Education, Curriculum Development, Developing Countries

An Investigation into the Thickness Dependence of the Magnetoresistance Effect in R.F Sputtered, RF biased 82%Ni-Fe Thin Films for Magnetic Field Sensor Applications



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Abstract: The paper describes the result of thickness dependence of Radio-frequency (R.F) sputter deposited 82%Ni-Fe magnetic thin films with thicknesses ranging from 300 Å to 1 μm upon anisotropic magneto resistance ($\Delta\rho$) and magneto resistance ratio ($\Delta\rho/\rho$) that could produce magnetic field sensors with near optimum magneto resistivity for device applications. For high magneto resistance ratio, the film processing demand that both magnetic parameters (anisotropy field, coercive force and magnetostriction) and sputter deposition parameters (substrate temperatures, substrate bias potential and sputter gas pressure) be optimized. It has been shown previously () that for 1000 Å thin films, the most useful radio-frequency sputtered 82%Ni-Fe films could be produced at 200°C-250°C moderate substrate temperatures, -100 V substrate bias potential and 10 mtorr sputter gas (argon) pressure. These values are applied for the deposition of films processed throughout this investigation. The results of investigating show that for 82% Ni-Fe alloy, the measured magneto resistance ratio is dependent upon the thickness of the films via mainly the resistivity of the films. The maximum magneto resistance effect was observed in 1μm thick films with -100V r.f induced substrate bias and 200 °C substrate temperature. Further it is observed that Sputtered films deposited under similar conditions of vacuum and substrate temperature show superior Magneto resistive properties when compared with vapour-deposited films provided that an r.f bias potential of approximately -100V maintained in the production of films.

Keywords: Magnetic Thin Films, R.F. Sputtering, Film Thickness, Anisotropic Magneto Resistance, Magneto Resistance Ratio, Magnetic Field Sensor

Passengers' Experience in Underground Metro Stations: The Impact of Spatial Characteristics

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Abstract: Underground metro stations, which have the potential to relieve the city by reducing noise, improving air quality, and providing higher efficiency of the land use, significantly contribute to the urban development of several contemporary metropolises. Their subsurface locations, however, cause many concerns predominantly related to the personal experience of their users. The underground environment may evoke fears and anxieties, disturb cognitive and physiological reactions, and affect personal safety. This paper examines to what extent the spatial characteristics specific to underground metro stations influence the passenger experience measured by the subjective indicators of comfort and safety. The research combines survey data collected among 1400 users with spatial data obtained from space syntax analyses and field investigations of 28 non-transfer underground metro stations in Warsaw, Poland. Based on the results of a multiple regression analysis, a set of spatial features affecting user comfort and safety were identified. The results indicate that passengers' experience is shaped by the number of architectural characteristics of metro stations as well as their accessibility, and position in the city and in the neighbourhood. The most influential architectural features include the configuration of the concourse level followed by the geometry of the platform hall and the use of art elements. Based on the results presented in the paper, potential design strategies that could improve users' experience are proposed and discussed. The recommended approaches provide important information for designers to enable improvement of the existing and better design of new underground metro stations.

Keywords: Underground Metro Station, Urban Context, Architecture, Comfort, Safety, Regression

Securing The Rail Environment: Evaluation, Implication and Mitigation of Criminal Incidences

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Abstract: The performance of the rail sector globally is being challenged by several security threats to the rail infrastructure. South Africa has the eleventh largest rail network globally, with a total rail footprint of 22,298 km and track distance of 30,400 km. However, the country's State of Safety Report identified a set of criminal or security incidents confronting the rail sector. This set of criminal incidences have escalated in the past two decades, having a deleterious effect on infrastructure, economy, social life, and the environment. This study quantitatively assessed the nature of these identified criminal incidences in terms of frequency, severity, and incidence location, and also, determined the implications and mitigating actions to prevent or reduce the occurrence of these incidences. Applying literature review and questionnaire survey to characterise these incidences, the results established both asset theft and vandalism as the most occurring criminal incidences. Also, the current measures being used to combat these criminal incidences were found to be inadequate. The most effective measure to combat cable theft and vandalism was regulatory. This study adds to the existing knowledge and is beneficial to the government, operators, policy makers, academics and other related industry stakeholders in designing and developing security policies around the impacts and mitigating measures identified.

Keywords: Rail Environment, Criminal Incidences, Security, Mitigation, South Africa

Impact of Infotainment on Purchase Intention, Word of Mouth and Irritations; Moderated by Quality of Advertisement & Mediated by Customer Experience

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Abstract: One of the major encounters to the conventional attempts of audience reach is emerging trend of infotainment. Infotainment encounters the conventional TV genres by combining two main features of television that is information and entertainment. To establish the efficacy of infotainment as an information genre, there is a need to conduct further researches in this area. A comparative analysis on the quality of advertisement and concept of infotainment with conventional advertisement find useful to test whether infotainment is in fact more informative than traditional approach of advertising products to customers. This study contributed to the body of knowledge with regards to infotainment construct particularly by gauging its impact on word of mouth, purchase intention as well as its moderation and mediation via quality of infotainment advertisement and customer experience respectively. The study was exploratory, descriptive and carried out hypotheses testing on the collected responses via self-administered questionnaires. Questionnaires sent to the required respondents through online Google Docs application as well as hard copies of the questionnaire were given to respondents through personal contacts. Preacher & Hayes method of analysis was adopted in the study to analyze the relationship of the considered variables.

Keywords: Infotainment, Quality of Advertisement, Customer Experience, Word of Mouth, Purchase Intention, Irritation

Experimental and theoretical studies: Biochemical properties of honey on type 2 diabetes



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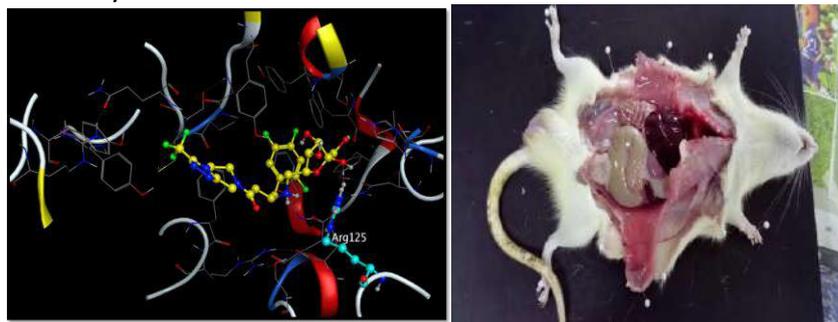
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Abstract: Honey is primarily composed of sugars: glucose and fructose. Depending honey, it's either fructose or glucose predominates. More the fructose concentration and the less the glycemic index (GI) is high. Thus, changes in the insulin response shows a decrease of the amount of insulin secreted at an increased fructose honey. Honey is also a compound that can reduce the lipid in blood. Several studies on animals, but which remain to be checked in humans, have shown that the honey can have interesting effects when combined with other molecules: associated with Metformin (a medicine taken by diabetics), it shows the benefits and effects of diabetes preserves the tissue; associated ginger, it increases the antioxidant activity and thus avoids neurologic complications, neuropathic. Molecular modeling techniques are widely used in chemistry, biology and the pharmaceutical industry. Most of the currently existing drugs target enzymes. Inhibition of DPP-4 is an important approach in the treatment of type 2 diabetes. We have chosen for the inhibition of DPP-4 the following molecules: Linagliptin (BI1356), Sitagliptin (Januvia), Vildagliptin, Saxagliptin, Alogliptin and Metformin (Glucophage) that are involved in the disease management of type 2 diabetes and added to honey. For this, we used software Molecular Operating Environment. A Wistar rat study was initiated in our laboratory with a well-studied protocol; after sacrifice according to international standards and respect for the animal. This theoretical approach predicts the mode of interaction of a ligand with its target. The honey can have interesting effects when combined with other molecules, it shows the benefits and effects of honey preserves the tissue, it

increases the antioxidant activity and thus avoids neurologic complications, neuropathic or macrovascular. The organs especially the kidneys of Wistar shows that the parameters to renal function let us conclude that damages caused by diabetes are slightly perceptible than those observed without the addition of a high concentration of fructose honey.



Theoretical approach & Wistar rat study

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Study of Lani₄fe Compound Elaborated by Mechanical Alloying and Use it as Novel Batteries

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Abstract: In this paper, we have studied the electrochemical properties of the LaNi₄Fe compound obtained by mechanical alloying (MA) for two durations 5 and 10 h. The properties of hydrogen absorption/desorption in the material are studied by using several characterization methods namely: The cyclic voltammetry, chronoamperometry and electrochemical impedance spectroscopy. Impedance spectra from experiments was used to characterize the electrochemical processes that occur at the interface of the electrode-electrolyte. The electrochemical mechanism at the electrode interface of a NiMH battery has been modelled using a Ni-MH battery electrode. The proposed circuit characterizes the processes occurring at the hydride electrode interface. For both grinding times, the values of the diffusion coefficients of hydrogen in β phase (10% state of charge) are smaller than those found in α phase (100% state of charge). This is explained by the fact that the sites available for hydrogen absorption are less numerous in β than in α phase. The resistance of the low frequency loop

decreases when the SOC increases from 10 to 100%, this is explained by the fact that the insertion of hydrogen into the material causes an expansion of material and also increases the contact between the particles and consequently the material becomes a good conductor. The double layer capacitance values obtained range between 272 and 750 μF .

Keywords: Batteries Ni–MH, Mechanical Alloying Chronopotentiometry, Hydrogen Diffusion Coefficient, Electrochemical Impedance Spectroscopy, Chronoamperometry

Validating the Psychometric Properties of Mental Health Literacy Scale among Filipino University Students

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Abstract: Mental health issues are predominant especially with our situation being at the midst of pandemic. Due to the marginal studies about mental health literacy, there are research gaps in terms of psychometric properties of available mental health literacy scales in the Philippines. The researchers aimed to close the gap through evaluating the psychometric properties of Mental Health Literacy Scale (MHLS) by Dr. Matt O’Conner (2019). About 820 Health and Science College students in Davao del Sur, Philippines were the participants of this research. This quantitative study used Cronbach Alpha to test the reliability of the scale. Moreover, it used factor loadings, model fit indices and confirmatory factor analysis to test the validity of the scale. This validation study found out that four out of six subscales of MHLS are reliable ($\alpha = .852, .800, .867, .896$) and the remaining two subscales were ($\alpha = .366$ and $.347$). Despite of that, the overall Cronbach Alpha was 0.780 that makes the questionnaire considered to be reliable. Furthermore, confirmatory factor analysis found out that the six factors model that was introduced by the previous studies was invalid due to low factor loading items. Therefore, it was modified by deleting three items with factor loading lower than .40 to pass the model fit indices. Due to the limitations of the study, researchers had recommendations to further establish the MHLS in a Filipino setting.

Keywords: Mental Health Literacy Scale, Psychometric Properties, Mental Health Literacy, Confirmatory Factor Analysis, Filipino College Students

Micro Biogeochemical Factors Responsible for Arsenic Mobilization and Isolation of Heavy Metal Hyper-Tolerant Bacterium from Irrigation Well Water



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Abstract: Groundwater is commonly used for drinking and irrigation purposes throughout South-East Asia, notably in Bengal Delta Plain (West Bengal and Bangladesh). In major part of Bengal Delta Plain (BDP) shallow aquifer (<50 m) groundwater has been used for irrigation during paddy cultivation. Nevertheless, in BDP, the summer paddy (boro) has been produced with large scale groundwater development (up to 90%). Present study focuses on arsenic mobilization in shallow irrigation well, with analysis of water quality as well as related geochemistry of the multi-depth (15-42 m) irrigation wells. The results suggest that the groundwater is usually anoxic with high amount of dissolved redox elements (arsenic (As) and iron (Fe)), where the iron concentration is in higher scale (mgL⁻¹) and arsenic is in relatively lower scale (µgL⁻¹). Low amount of nitrate, sulphate and Dissolved Oxygen is present in the groundwater of irrigation wells. High concentration of alkaline earth metals calcium (Ca) and magnesium (Mg) along with high alkalinity suggests that carbonate dissolution (calcite and dolomite) is the most important mineral dissolution process in the shallow aquifer. The factor analysis reveals that the co-relation between arsenic (As) and iron (Fe) is positive and strong ($r^2=0.716$). High chloride ion concentration in some of the wells indicates towards local anthropogenic influence (leakage of sewage) in the shallow aquifer. The study further reveals the presence of microbial community (faecal coliforms) in the monitored irrigation wells with high chloride ion concentration. The presence of faecal coliforms further confirms the role of anthropogenic activities (sanitation, open dumping, organic carbon source and faulty construction of wells). Some irrigation wells with non-permissible arsenic concentration harbour arsenic resistant bacteria, which is also hyper-tolerant to iron (Fe²⁺). Scanning electron microscopy and 16S rDNA sequencing identified this bacterium to be *Enterobacter* sp., which is also capable of biotransformation of as (III) to as (V). The study also indicates the influence of anthropogenic activities on natural processes, increasing the reducing environment of the shallow aquifer (reduction of iron bearing minerals (oxides/hydroxides/oxyhydroxide)) and release of arsenic (As) in the groundwater.

Keywords: Groundwater, Arsenic, Hydrochemistry, Irrigation, Faecal Coliform, Arsenic Hyper-Tolerant Bacteria

Climate Change and Livelihood Strategies in Bayelsa State, Nigeria



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Abstract: The vulnerability of climate change on farming and fishing livelihood in Bayelsa State, Nigeria was analysed using a cross sectional household survey and multi-staged sampling techniques to sampled 200 farmers and 200 fishers from three Local Government Areas and twelve communities. The sampled respondents had good perception of climate change with majority 92.75 percent relating it to increasing daily temperature. Among the perceived impact of climate change on farming livelihood in the study area, decreased quantity and quality of crop yield with mean values of 3.75 was perceived to be of the highest effect of climate change by the sampled farmers while for fishing livelihood, it was increasing difficulty of access/increasing distance to fishing ground (3.72). The most favoured on-farm adaptation strategy by farmers was changing of planting time (92.5%) and livelihood diversification for off-farm livelihood diversification (95%) while fishers also preferred to diversify their livelihood sources to non-fishery activities (93.5%). Both farming and fishing livelihood were found to be moderately vulnerable to climate change impact with overall livelihood vulnerability index of 0.392 and 0.390 as well as -0.086 and -0.089 for the approach index respectively.

Keywords: Adaptation, Global Warming, Farmers, Fishermen, Mitigation

Hybrid Manufacturing; Integration of Additive Technologies for Competitive Production of Complex Tools and Products

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Abstract: During the last decade, the development in metallic material additive manufacturing (formerly also known as Rapid Manufacturing, RM or Rapid Tooling, RT) has brought this technology from niche applications and short run tooling to be a competitive method capable of producing complex geometries in industrial grade materials, such as for example injection moulding tool inserts with integrated conformal cooling system. However, while the geometric complexity has little, or no, affection the price or production time in additive manufacturing, this is neither a cheap or particularly “rapid” manufacturing technology. CNC milling is by comparison cheaper and more rapid for basic geometries, but the production time and cost of manufacturing increases with geometric complexity and the amount of material removed. On the other hand, there are strong limitations on the geometric complexity that is possible to produce by CNC milling. This paper presents an approach to exploit the combined benefits of each, additive and subtractive, manufacturing technology and integrate these into a hybrid manufacturing solution. This will be demonstrated by the development of a hybrid

manufacturing cell which is a combination of a powder bed additive manufacturing metal system and a 5-axis milling machine with the primary objective of producing injection moulding tooling inserts, however the principle should be applicable for a variety of different types of products.

Keywords: Hybrid Manufacturing, Metal Powder Bed Additive Manufacturing, Machining

The Effect of Self-Efficacy and Facilitating Conditions on Behavioural Intention of Surveyors' Toward Practice: Model Evaluation



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Abstract: This study tends to examine the direct impact of moderating variables on behavioural intention to surveying practice. It further aims to assess the moderating role of self-efficacy on facilitating conditions to behavioural intention to practice. A total number of 84 questionnaires were processed for the analysis with responses coded for the SmartPLS software format. As a rule of thumb, item reliability, construct reliability and validity have a threshold value of 0.7 and above. The average variance extracted (AVE) should be 0.5 or higher. The model fit result shows that model was within cut-off value of less than 0.08 as proposed by (Hu & Bentler, 1999), a SRMR value of 0.073 was reported. The result from the reliability and validity test shows that tests are adequate with the structural analysis showing the self-efficacy is a very important variable, which explains over 70% of intention to practice and 48% of perceived behavioural control. Consequently, the study reveals that behavioural intention to practice surveying depends on the self-efficacy of the practitioner.

Keywords: Self-Efficacy, Intention, Latent Variables, SmartPLS, Practice

Religion in a Scientific Age



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Abstract: The relationship between religion and science is the subject of continued debate in philosophy and theology. To what extent are religion and science compatible? Are religious beliefs sometimes conducive to science, or do they inevitably pose obstacles to scientific inquiry? The interdisciplinary field of “science and religion”, also called “theology and science”, aims to answer these and other questions. It studies historical and contemporary interactions between these fields, and provides philosophical analyses of how they interrelate.

Keywords: Buddhism and Science, Limitation, Learned Ignorance, Beyond Science, Science Without Religion

Impact of Nanotechnology on the Development of Common Wheat Cereal Plants *Triticum Aestivum*

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Abstract: Advent of nanotechnology sees their properties evolve depending on their size of the nanoparticles they contain, so thanks to their very specific structural characteristics are used in the manufacture of plant protection products, drugs and textiles, especially in many fields, which suggests the possibilities for revolutionary technological advances. The manipulation of matter at the nanometre scale opens new doors and endless possibilities in many fields of technological development. Therefore, increased production of nanomaterials poses a significant hazard because they will be released into the environment. So, in the present study, we considered it important to focus on the accumulation and phytotoxicity of iron oxide nanoparticles (Fe_2O_3) and zinc oxide (ZnO) and development of plant species in this case soft wheat *Triticum aestivum* L. For this purpose, we followed the development of these seeds exposed to increasing concentrations of nanoparticles across several parameters, as well as an analysis of metals (zinc and iron) produced by AAS method in the roots and leaves. Our results illustrate an increase in osmo-regulatory molecules proline, Sucres, glycine bétaine, in addition, the histological study highlights anomalies characterized by tissue damage in the leaves and roots, as well as an accumulation of metals (iron and zinc) with a significant translocation of their transfer into the roots compared to wheat leaves. Therefore, due to their small size and high reactivity, nanoparticles negatively affect plant development and could thus induce the production of potentially toxic reactive oxygen species (ROS) at the cellular level.

Keywords: *Triticum Aestivum*, Fe_2O_3 , ZnO , Nanoparticles, Oxydatif Stress, Bio Markers, Phytoaccumulation, SAA

Anti-Aging and Rheological Properties Effects of Silver Nanoparticles on Modified-Agbabu Natural Bitumen

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Abstract: Nigeria has one of the largest deposits of bitumen around the world which could be explored to facilitate quality road transportation in the country, to assist other parts of Africa and attract foreign exchange investment. Raw bitumen however used in road pavement construction, exhibited shortened durability due to oxidative degradation resulting in premature road construction faults. Consequently, we investigated the modification of Agbabu natural bitumen (ANB) with silver nanoparticles (AgNPs) to enhance the resistance of the modified bitumen to oxidative stress; to give road pavement elongated service life; to avoid road fault induced accidents. The raw ANB was purified to form the base and then modified with silver nanoparticles (AgNPs) using melt blend technique. Portions of 1.5, 3.0, and 4.5 wt.% of AgNPs were used to modify the purified ANB. Subsequently, long-term aging was thermally simulated on the base and silver nanoparticles modified base samples at 60 oC. The functional groups variation in the aged and unaged samples were investigated using Fourier Transform Infrared (FTIR) Spectrometric Analysis, their physicochemical and rheological properties analyzed with Oscillating Disc Rheometer (ODR) to study the effects of AgNPs on aging of the samples. The appearance of new peaks at 1797 cm⁻¹, 1217 cm⁻¹, 1300 cm⁻¹ and 1097 cm⁻¹ on the FTIR spectrum of the AgNPs modified base indicated that AgNPs was incorporated into base. Moreover, sulphoxide peaks at 1031 cm⁻¹ disappeared completely while the area of carbonyl peak at 1693 cm⁻¹ decreased progressively with increase in the amount of AgNPs incorporated into the base. The ODR test revealed that, the AgNPs modified samples improved resistance to fatigue cracking and rutting at lower and higher road pavement temperatures, respectively compared to unmodified base sample. Thus, we reported AgNPs as suitable modifier for improving the durability of bitumen in pavements.

Keywords: Carbonyl Index, Oscillatory Disc Rheometer, Oxidative Degradation, Silver, Nanoparticles, Modifiers, Sulphoxide Index

An Integrated Charging/Discharging Management Mechanism for Electric Vehicles and Unmanned Aerial Vehicles

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Abstract: The global greenhouse effect and air pollution problems have been getting deteriorated in recent years. The power generation in the future is expected to shift from fossil fuels to renewables, and many countries have also announced the ban on the sale of vehicles powered by fossil fuels in the next few decades, so as to effectively alleviate the global greenhouse effect and air pollution problems. In addition to electric vehicles that will replace traditional fuel vehicles as the main ground transportation vehicles in the future, drones have also gradually been widely used for military and civilian purposes recently. The recent literature estimated that drones will become the major means of transport for goods delivery services before 2040, and the development of passenger drones will also extend the traditional human ground transportation to low-altitude airspace transportation. In recent years, the literature has proposed the use of renewable power supply, battery swapping and charging stations to refill the battery of electric vehicles and drones. However, the uncertainty of renewable power generation cannot guarantee the stable power supply of electric vehicles and drones. It may even be very possible that a large number of electric vehicles and drones need to be charged during the same period, causing congestion in charging stations or battery swapping facilities and delaying the arranged schedules of electric vehicles and drones. Although studies have proposed to employ moving electric vehicles along with wireless charging technology to provide electricity to electric vehicles and drones with urgent needs, the charging schemes are still oversimplified and have many restrictions. In addition, different charging options, such as charging stations and battery exchange services, as well as wireless charging for moving electric vehicles and drones, should be provided to fit the individual need of each electric vehicle and drone. In view of this, this study attempts to meet the mission characteristics and needs of various electric vehicles and drones by providing adaptive routing and charging/discharging plans to individual electric vehicles and drones, and reduce the power load of the renewable power generation during the peak period as well. A series of simulations for the proposed adaptive routing and charging/discharging mechanism was run to evaluate its performance of the proposed work. The experimental results exhibited the effectiveness of proposed work.

Keywords: Electric Vehicle, Drone, Route and Charging Planning, Aata Mining, Machine Learning, Optimization

A Novel Quantum Resistant Cryptography Algorithm for Secure Data Transfer

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Abstract - Encrypting and decrypting data is a fundamental part of modern life. The user's privacy and security are of the utmost importance whenever they engage in any kind of financial or nonfinancial transaction or service online. A user-defined principal- and encryption- and decryption-key based encryption paradigm is proposed here. Here, an entirely novel and very effective approach was used to encrypt the user data. Logic gates are used as a tool. For the purpose of protecting sensitive information, we develop a new method of encrypting and decrypting that makes use of custom logics. The two major categories of cryptographic algorithms, symmetric and asymmetric, are distinguished by their respective sets of characteristics. In order for symmetric, or secret-key, algorithms to encrypt and decrypt communications between two parties, the parties must first share a secret piece of information (the key). Due to the presence of a hidden piece of shared information, secret-key algorithms are highly computationally efficient. Due to this, the bulk of encrypted communications use symmetric approaches. In contrast, public-key (or asymmetric) algorithms presuppose the existence of challenging number-theoretic problems that enable the generation of public (for encryption) and private (for decryption) keys (decryption). The proposed paper presents a novel encryption and decryption strategy that is quantum secure even against random quantum attacks. The performance of the proposed

approach is validated against some of the famous state of the art algorithms.

Keywords: Quantum Cryptography, Data Security, Privacy, Logic Gates, Encryption, Decryption, Public and Private Keys

Acetone Detection by Functionalized Carbon Nanofibers

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Abstract. This article proposes a new sensing material made from carbon nanofibers (CNF) that were first functionalized with a carboxyl group before being further modified with an amide functional group. At room

temperature, this sensing material was used to detect acetone gas. Fischer Esterification was used to create modified CNF with dodecylamine as the functionalizing reactant. FT-IR analysis was used to confirm the attachment of the carboxyl and amide functional groups to the modified CNF. As per the results of the characterization, CNF was successfully modified with the carboxyl and amide functional groups, as evidenced by the presence of new peaks in the FT-IR spectra. The modified CNF was then dropped cast onto IDT and placed in a customised chamber with an electrical feedthrough occupied with outlet/inlet gas. The resistance of modified CNF upon injection of ammonia gas was monitored with a digital multimeter and compared with the resistance of pristine CNF. Based on the result, modified CNF showed a better response and higher sensitivity than pristine CNF at room temperature. The resistance of modified CNF to acetone gas injection was measured using a digital multimeter and compared to the resistance of pristine CNF. Result shown that, modified CNF performed better and had higher sensitivity than pristine CNF at room temperature.

Investigations on the methods used in Energy Consumption, Prediction and Optimization for sustainable urban cities – A Systematic Literature Review (SLR)

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Abstract— Almost half of the world's population live in cities and urban areas since 2014. Due to the rapid growth of urbanization over the past decade, challenges arise in sustaining the urbanization process in terms of energy consumption. Energy consumption prediction and optimization is a widespread issue that is of interest to many scientists and engineers. The prediction and optimization processes are based on economic and non-economic indicators, which may be obtained using linear and nonlinear statistical methods, mathematical algorithms and simulation models. These methods may include intelligent solutions such as Genetic Algorithm, Fuzzy Regression and Neural Networks. This paper investigates the current methods used in energy consumption forecasting and optimization specifically for sustainable urban cities. The outcome of the paper will disclose the shortcomings of the current methods.

Study of Urban Heat Island in Yogyakarta City Using Local Climate Zone Approach



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Abstract: Yogyakarta urban area has increased significantly for the past ten years and altered physical and ecological features. The UHI phenomenon is a significant climate hazard because it affects more than 50% of the

population who live in the city. This study aims to evaluate the effects of LCZ zones on temperature and humidity in Yogyakarta Urban Area. This study uses the LCZ classification to spatially compare thermal characteristic and explain how UHI affected by land use and building geometry. The LCZ method specifically uses classification based on land use/land cover. Observation of the LCZ was done by using sampling method in four scattered areas within Yogyakarta. Hourly record of temperature and relative humidity are variables used for quantifying UHI magnitude. The results of this study are as follows, distribution maps of LCZ classes, daily temperature and relative humidity, and UHI magnitude. There are three LCZ classes found in Yogyakarta urban area, they are LCZ 3, LCZ 5, and LCZ 6. The LCZ variables which affect temperature and relative humidity are building heights, width of street canyons, and land use. The biggest thermal difference is Δ LCZ3-LCZ5 and Δ LCZ3-LCZ6, which happened during 8 a.m to 12 a.m and 4 p.m – 8 p.m in the evening. Small UHI magnitude (< 2 K) is found affected by small difference in morphology and fabric. Medium UHI magnitude (2 – 5 K) is mostly caused by large difference in fabric and small difference in morphology.

Keywords: Urban Heat Island, Local Climate Zone, Yogyakarta Urban Area

Change Management



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Abstract: Every organization that is engaged in technological as well as non-technological innovation will transform itself into a successful organization. At the extreme ends of the innovation process – generation and implementation of ideas – organizations and their managers need to develop an effective and effective Change Management Strategy to be effective and effective in managing that change. Professionals and stakeholders are frequently asked to develop attitudes and personal skills for change implementation, as well as a technical understanding of how to use change management tools. This article will discuss the challenges that Organizations and owners of businesses face when implementing change. Well-known theories and literature will also be discussed to shed light on the importance of change management in organizations. Many organizations face a need for change in their daily operations, but their outlook for change differs. The main purpose of this research is to critically evaluate the effect on corporate goals and objectives from the organizational viewpoint of view of change and change management. It focuses on a factor that can cause internal or external changes, which determines the kind of change and the performance of organizations in different countries. It also sheds light on the concepts and applications of change management and different models of change. From 2019 to date all the countries of the world experience a great change to the pandemic that leads to depression and economic meltdown but many still find a way to get out of this and when many designs strategies to be out of this, this is a simple analogy of change both in the private and public sector of the world

Keywords: Corporate Goals, Change Management, Organizational Change, Organizational Performance

Plant Based Formulation for Aphid (*Aphis craccivora* Koch.) Control: Non-Chemical Approach and Environmental Sustainability



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Abstract: Background: The cowpea (*Vigna unguiculata*), an annual herbaceous food legume is damaged by various insect pests of which cowpea aphid (*Aphis craccivora*) causes damage to the tender leaves of the plant and reduces its yield. Two plant-based formulation (prepared in the Chemistry Laboratory) viz. Polygonum hydropiper floral parts and Tobacco (*Nicotiana tabacum*) leaf, were used for its environmentally sound management.

Methods: For preparing wettable powder formulation from Polygonum and tobacco the different ingredients are required viz. china clay, silica gel, wetting agent, dispersing agent etc. Physico-chemical analysis was done for preparation of accurate Wettable Powder formulation.

Results: Cowpea aphid is very important insect pest to cause damage the tender leaves of the plant. From the overall observations it was revealed that imidacloprid (Confidor 17.8 SL) @ 1.0 ml/3L was found the most effective treatment against aphids giving more than 80 % control followed by tobacco (50 WP) @ 8 g/ L of water (more than 70 % control), fipronil (Regent 5% SC) @ 2.5 ml/L of water and Polygonum (50 WP) @ 8 g/ L of water (more than 65 % control both). Tobacco and Polygonum are bio-pesticides; plant-based formulation and may be used as alternative of chemical pesticides. These natural resources may be utilized properly as bio-pesticides. Botanicals, having less or no hazardous effects on bio-agents, human health and the environment, and thus can be incorporated in sustainable agriculture. The quality parameters of WP (50%) formulation were satisfactory as per the FAO specifications in terms of wet sieved test, wettability, foaming and suspensibility performed on the 0-day and also after 15th day at room temperature, at 65° C and at freezing temperature conditions. Imidacloprid and fipronil both are highly toxic synthetic chemical insecticide, so there is every possibility to contaminate vegetables with the toxic chemicals. In this research an attempt has been made to replace chemical pesticides by phyto-pesticides.

Keywords: Bio-Pesticides, Vegetables, Organic Cultivation, Resource Management, Eco-Friendly

Competitive Intelligence and SMES Performance in the Post Covid-19 Era in Osun State, Nigeria



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Abstract: The COVID-19 pandemic affected all spheres of life including small and medium scale business in the world and in Nigeria. This effect was caused by the imminent lockdown and shutdown of business places which affected the whole economic. In a bid to rejuvenate a sector that is known to be the backbone of any economy, there is need to put in strategic effort. Many studies have been done on SMEs performance in the literature but the role of competitive intelligence on SMEs performance especially in the post covid-19 era is scarce in the literature. This gap in the literature prompted this present study to examine the role of competitive intelligence on SMEs performance in the covid-19 era. The study adopted a descriptive survey and a purposive sampling technique was used to select 94 respondents. A structured questionnaire was used to collect primary data for this study. Data were analysed using descriptive, mean, frequency and percentage with the aid of the SPSS-Version 24. Result revealed that there was significant positive relationship between Marketing intelligence and SMEs performance ($r = .33^{**}$, $p < .05$). There was significant positive relationship between business intelligence and SMEs' performance ($r = .54^{**}$, $p < .05$). The study concluded that marketing and business intelligence influence SMEs performance in the post-covid-19 era. Based on this conclusion, the study recommends that SMEs CEOs, and managers should put up strategic mechanism that can be used to position market and business Intelligence in a way that it will improve SMEs performance in the COVID-19 Era.

Keywords: Competitive Intelligence, Smes Performance, Post Covid-19

Corporate Entrepreneurship and Employees' Productivity



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Abstract: The study examined the relationship between corporate entrepreneurship and employee's productivity. The study adopted a primary data. A total number of one hundred and eighty-nine (189) participants ranging from 20-50year were selected using convenience sampling technique. A structured questionnaire was used to collect data in this study. Two hypotheses were tested using zero-order correlation. Result showed that there was significant positive relationship between creativity and employee productivity in manufacturing organisation $r(187) = .53$, $p < .05$). There was significant positive relationship between Pro-activeness and employee productivity in manufacturing organisation $r(187) = .50$, $p < .05$. The study concluded that dimensions of corporate entrepreneurship (creativity and pro-activeness) are important determinants of employee productivity among workers. It was recommended that organisation level of corporate entrepreneurship should be vigorously geared towards being consistently innovative, act proactively and continually renew its process to improve performance and compete favourably in the global markets

Keywords: Corporate Entrepreneurship, Employee's Productivity

Influence of Telesales on the Customer's Patronage among the Customer of Airtel Telecommunication in the Ilorin Metropolis



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Abstract: Telesales, because of its association with technology, is a well-known and popular marketing strategy in the modern world of the fourth industrial revolution. Telesales has aggressively added value to marketing techniques. The role of telesales on customer patronage is still given less attention to in the literature. This present study examines the role of telesales on customer patronage in Ilorin Metropolis. Primary data through the use of questionnaire was used to collect data from 100 respondents aged 19 years -70 years using a convenient sampling technique. The result found that there was a significant positive relationship between telesales and customer patronage ($r = .43^{**}$, $p < .05$). The study concluded that telesales plays a role on customer patronage. The study therefore recommended that Telesales as a marketing strategy should be inculcated by management of airtel telecommunication to improve customer patronage.

Bioengineering with Thermostable Exoshells



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Abstract: The expression and stabilization of recombinant proteins is fundamental to basic and applied biology. We have engineered a thermostable exoshell (tES) to improve both stabilization (Nat Comms, 2017), production (Nat Comms, 2021) and storage (Pharmaceutics, 2021) of recombinant proteins. tES provide steric accommodation and charge complementation to macromolecular substrates in the molecular weight range of 1 kilodalton to 68 kilodaltons improving functional in vitro folding by up to 100-fold. tES stabilize the internalized proteins making them resistant to proteases and denaturants. tES can mediate cellular uptake of internalized proteins, thus providing direct protein transduction for bioactive enzymes. A recent therapeutic application of rationally engineered protein nanoparticles for the treatment of breast cancer (ACS nano, 2022) and oral delivery of macromolecules (Int. J. Mol. Sci., 2022) will be presented.

Change Management



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Abstract: Every organization that is engaged in technological as well as non-technological innovation will transform itself into an organization. At the extreme ends of the innovation process – generation and implementation of ideas – organizations and their managers need to develop an effective and effective Change Management Strategy to be effective and effective in managing that change. Professionals and stakeholders are frequently asked to develop attitudes and personal skills for change implementation, as well as a technical understanding of how to use change management as a tool. This article will discuss the challenges that Organizations and owners of businesses face when implementing change. Well-known theories and literature will also be discussed to shed light on the importance of change management in organizations. Many organizations face a need for change in their daily operations, but their outlook for change differs. The main purpose of this research is to critically evaluate the effect on corporate goals and objectives from the organizational viewpoint of view of change and change management. It focuses on a factor that can cause internal or external changes, which determines the kind of change and the performance of organizations in different countries. It also sheds light on the concepts and applications of change management and different models of change. From 2019 to date all the countries of the world experience a great change to the hand of pandemic that leads to depression and economic meltdown but many still find a way to get out of this and when many designs strategies to be out of this, this is a simple analogy of change both in the private and public sector of the world

Keywords: Corporate goals, Change Management, Organizational Change, Organizational Performance

Super-Resolution Reconstruction by Using Various Wavelet Transforms

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Abstract: High-resolution image reconstruction is a powerful image-processing technique that reconstructs a high-quality image from a set of low-resolution images. These low-resolution images are usually blurred, degraded and shifted. There is great demand for high-resolution or high-quality images. Instruments such as large space telescopes and magnetic resonance imaging scanners require high-quality imaging sensors to obtain high-resolution images for data analysis or research. To obtain a high-resolution image, we can use a high-quality imaging sensor that contains a large number of sensor arrays per unit area or we can increase the size of the imaging chip. However, manufacturing such a high-quality imaging sensor is very expensive and time consuming. It is not cost effective to frequently replace an imaging sensor for one that provides higher-resolution images. High-resolution image reconstruction is thus a useful tool for extracting information from low-resolution images and applying mathematical or statistical techniques to that information to reconstruct a high-quality image. Thus, high-resolution image reconstruction uses existing instruments to obtain a better-quality image. In this project, we will investigate the relationship between the reconstructed high-resolution image and the observed

low-resolution images. We believe that the reconstructed high-resolution image contains much useful information and data that are not used during the reconstruction. Our aim is to find an effective method for extracting this information from the reconstructed high-resolution image and use it to increase the quality of the reconstructed image. Moreover, we will investigate the feasibility of using different wavelet transforms to carry out the reconstruction.

Rapid Virtual Infrastructure Development for Low-Budget Establishments

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Abstract: An Information Technology (IT) infrastructure is an assembly of technical entities that forms the IT platform of an establishment. A virtual infrastructure (VI) provides the same capabilities as the physical resources, but with software, so that these virtual resources may be allocated quickly, across multiple systems, and adjusted as per the business needs. By replacing the physical hardware with simulators, emulators, and hypervisors, a VI, using Virtual Machines (VMs), can help businesses with budget restrictions, including start-ups and nonprofit shops. They will realize greater resource utilization, flexibility, scalability, and cost savings. These benefits are usually beneficial for small establishments that require reliable infrastructures but cannot afford to invest in expensive physical resources. In addition, IT infrastructure virtualizations enable these shops to be more competitive in the ever-changing marketplace where continuous enhancement and updates are needed to stay operational. The vast amount of technology options available, along with the continuous real time updates necessary to keep them current, invariably handicaps these organizations with resource restrictions and impacts their profitability. Established firms with better resources regularly capitalize on this fact and drive these small shops out of business or absorb them to improve their own market presence. This research introduces the tools and design practices that would allow low-budget firms to use VIs, become competitive, stay current, and operate efficiently. Customer relations may also be improved with flexible web-based monitoring and notification systems, and user-friendly Graphical User Interfaces (GUIs). Using the Rapid Virtual Infrastructure Development (RVID) methodology, this research further describes the integration of multiple technologies, including the Cloud platforms and Artificial Intelligence (AI) capabilities, to provide customizable real-time scalable infrastructure to low-budget establishments.

Keywords: AI, Cloud, Emulator, GUI, Hypervisor, RVID, Simulator, VI, VM

Importance of Occupant Behaviour for Better Pro-environmental Decisions

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Abstract: Several recent studies have revealed that while nearly half of the building's energy consumption is related to building envelope characteristics and utilised equipment, the remaining crucial half is influenced by building occupant behaviour. Therefore, building occupant energy consumption related behaviour can either

significantly improve the energy efficiency of buildings or simply makes the whole process inefficient. Consequently, in achieving energy conservation goals, focusing purely on technological advancements without considering building occupant's energy related behaviour will not be adequate. As reported by number of researchers in the past decade, the most highlighted gap in the literature is related to understanding the underlying social norms and priorities as well as the behaviours of households when approaching to modification of thermal comfort to increase energy efficiency and sustainability in their homes. Accordingly, there is a lack of research that covers thoroughly the different aspects of occupant behaviour as well as the latest developments in this field. The need for data collection and interpretation on building occupant behaviour in relation to thermal energy consumption has been explicitly highlighted in current literature. To address this need, this study, has investigated the nature of occupant behaviour leading toward an intention to modify thermal comfort so as to appreciate the possibility of reducing energy consumption in residential buildings. In doing that, a conceptual framework that presents the relationships between the elements of occupant behaviour has been proposed. Data from different households located in three densely populated suburbs of Sydney Metropolitan area have been collected for the online survey. Based on the results of data analysis and interpretation in this study, it has become apparent that efforts should be made to enhance environmental awareness of the building occupant in order to make improvement on occupant intention to act pro-environmental and eventually increase occupant pro-environmental behaviour toward an intention to modify thermal comfort as a possible means to reduce energy use in existing residential buildings.

Keywords: Environmental Awareness, Existing Residential Buildings, Pro-Environmental Decisions, Occupant Behaviour

Utilization of Waste Biomass in Support of the Circular Economy



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Abstract: Carbon-based materials have a wide range of applications such as in energy, environment, agriculture, medical science, and electronics. Unlike coal and charcoal, biomass is a renewable and sustainable resource that can be used to produce biocarbon materials such as biochar and hydrochar. In this study, the influence of the production methods on the physicochemical properties and potential applications of the resulting biocarbon materials were investigated. Accordingly, four different thermochemical methods, namely, dry methods (torrefaction at 270 °C and slow pyrolysis at 500 °C) and wet methods (hydrothermal carbonization HTC at 210 °C and hydrothermal liquefaction HTL at 270 °C) were investigated for the production of biochar and hydrochar from spent coffee grounds (SCG), respectively. The carbonization degree of SCG by the four production methods was in the order of slow pyrolysis > HTL > HTC ≈ torrefaction, providing either, a significant or a slight difference in energy properties, elemental composition, morphology, and surface functionality among the resulting biocarbon materials. The study results showed that slow pyrolysis biochar was suitable for energy applications due to a similar fuel ratio and higher heating value (HHV) to semianthracite coal. For agricultural applications, biochar obtained from torrefaction or slow pyrolysis can be employed to ameliorate acidic soils while hydrochar obtained from HTC with the highest surface area and porosity would benefit soil quality by improving water holding capacity and microorganism diversity. In regard to environmental applications, HTC hydrochar was more suitable for wastewater remediation owing to its porous structure, relatively high specific surface area, and total

pore volume. In summary, the obtained results are expected to contribute to decision-making for introducing sustainable waste management of SCG and exploring applications of carbon-based materials in a diversity of areas.

Using Lightning Data to Reconstruct the Thunderstorm Climatology for the Bangkok Metropolitan Region

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Abstract: An algorithm was developed to identify thunderstorms using global lightning detection network data. The time and distance between successive lightning strokes was evaluated to reconstruct thunderstorm tracks. Over 5.4 million lightning strikes were used to identify more than 52,000 thunderstorms that occurred between 2016 - 2020 in the Bangkok Metropolitan Region. Results suggest that while May contains the most thunderstorms, October contains the most lightning strokes. Evidence also suggests October and November thunderstorms produce far more lightning than those occurring in any other month. Developing thunderstorm climatologies using a lightning tracking algorithm and lightning detection network data was found to be useful for determining the spatial and temporal distribution of events in the region.

The Task-Based Approach: A Teaching Practicum Analysis in An Efl Brazilian Context



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Abstract: The present article aims to discuss and analyze, under the light of the task-based approach (e.g., ELLIS, 2003; SKEHAN, 1996; NUNAN, 2004), one intervention proposal of “Estágio Supervisionado II”/ Supervised Practicum II from a group of students of the English Teaching Program Letras, Língua Inglesa e suas Literaturas – at UNEB (Bahia State University, Campus IV - Jacobina, Brazil) of the year of 2021. The research was developed through the analysis of several workshop materials and teaching (practicum) trainee productions (class plans, workshop proposal, webpage and padlets, activities, workshop’s Instagram, final reports) proposed and made available by English (as a foreign language (EFL)) teachers-to-be. The main goal was to identify whether any proposals were aligned with the task-based language teaching (TBLT) approach (and if so, verify which task characteristics were predominant in them), and how they integrated digital technologies, considering their implementation happened during the COVID-19 pandemic. The TBLT approach emphasizes pedagogical work focused on the student and the use of language for communication (ELLIS, 2003) that allows for more meaningful and dynamic learning (TREVISOL, 2019). Therefore, an investigation of Practicum productions — which may be linked to the language teaching approach with tasks — is relevant to know the different types of activities that could be done in the foreign language classroom. Though we had previously analyzed a total of four (4) Practicum intervention works, here we delve deeper into one of them: “Lightning, oficina de microcontos mais rápidos que a luz”. This workshop aimed to explore the practice of reading and writing with the “micro-conto” (microstory) genre – based on the task-based language approach – with the purpose of developing lexicon through creative writing. Regarding Lightning, the teachers of the workshop claim that TBLT made it possible for them to work with a free and diverse audience (ranging in age from fourteen to twenty-five), in addition to placing the student at the center of the proposal's development. Also, it gave students the opportunity to participate in tasks whose main purpose was the development of writing skills (through fiction) in the English language. The final products of the workshop were nine “micro-contos” (short stories) produced by the students. The teachers explained in the final report that they could perceive the reflection of the theoretical material used during the writing of the stories and that the goal of exploring creativity through writing while using the English language was satisfactorily fulfilled. Overall, then, it could be noticed that tasks have been present in these initial experiences of future English teachers at the context investigated. Furthermore, this teaching methodology may also favor students' writing engagement, encourages them to be significantly involved in the task and it may perhaps even increase their motivation for learning English.

Cognitive Hypnotic Psychotherapy



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Abstract: Cognitive Hypnotic Psychotherapy is a unifying approach to psychotherapy that uses hypnosis (hyper-suggestibility) as a base to seamlessly integrate all major approaches to psychotherapy i.e., Cognitive, Behavioural, Humanistic and Psychodynamics with techniques from Metaphors, Mindfulness, Guided meditations and NLP. The approach is based on the understanding that problems are multi-layered. One needs to

work with a combination of these layers to be able to create lasting change. These layers include 1. Clearly defining the problem 2. Understanding and exploring the desired outcomes 3. Dysfunctional behaviours 4. Unhelpful thoughts, physical feelings and emotions 5. Limiting beliefs, conflicting values 6. Secondary gains or positive intention 7. Suppressed emotions, traumas, repressed memories. Since different approaches to psychotherapy work with different layers in different ways, integrating them into one holistic process provides us with the opportunity to comprehensively work with an issue quickly and effectively. More details about the approach along with case studies detailing the application of this approach can be found here.

Evaluations of Ion Conductivity and Ion Selectivity According to Nafion/PVDF TRFE Blending Ratio

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Abstract: The ion exchange membrane is a separation membrane for water treatment and is a material that can effectively remove ionic substances contained in water through electricity. In recent years, interest is growing as it is being used as a core material in the development of various eco-friendly energy processes. Accordingly, various efforts have been made to improve the physical properties of the ion exchange membrane. In particular, blending other polymers with good physical properties is an easy and effective method. However, when the ion exchange membrane is blended with other polymers, the conductivity is expected to decrease as the ratio of the ion exchange membrane decreases. In this study, conductivity and selectivity were evaluated by mixing Nafion and PVDF-TrFE, which are the most widely used ion exchange membranes in the market, in various ratios. As a result, there was no significant difference in ion selectivity, but a significant difference in conductivity. To analyze the cause, the ion exchange capacity of the mixed membrane for each ratio was evaluated and the correlation with the conductivity was confirmed. These results are expected to be utilized in the study of optimizing the mixing ratio to improve the physical properties of the ion exchange membrane.

Keywords: Ion exchange membrane, nafion, PVDF-TrFE, Polymer blending

A Checklist and Nativeness Assessment (Native and Non- Native) of Angiosperm Flora in Schools of Naga City, Philippines

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Abstract: The current status of taxonomy focusing on littoral microinvertebrates in lakes still remains unexplored. Lake Taal, which is known to be the third largest lake in the Philippines have such unique qualities due to its geological, geographical and limnological features. The lake comprises vast extent of flora and fauna which provides major biodiversity significance. To address key questions and broaden our knowledge of the rich biota and its importance found in a prehistoric volcanic lake, the spatial diversity and distribution of microinvertebrate fauna in the littoral zones of Lake Taal was explored. Sediment corers were obtained from various locations in the littoral zones of the lake, and the sediments were sieved and separated according to various mesh sizes to separate the organisms collected. In total, 4,187 individuals were collected from 23 sampling sites. These were identified morphologically and were found to be members of Phylum Nematoda, Order Isopoda, Class Ostracoda, Class Insecta, Phylum Mollusca, Order Amphipoda, Phylum Rotifera, Order Decapoda, Phylum Annelida. The following were identified to the genus and species level: *C. cornuta*, *C. sphaericus* cf., *F. chathamensis*, *P. Brehmi*; and a new record of *Simocephalus* sp. Species diversity was expressed using Shannon-Wiener's diversity index (H') and Simpson's Index. Species distribution was mapped using Diva-GIS mapping software. Results show that specimens belonging to Phylum Nematoda dominated the microinvertebrate fauna collected (68.59%) while the Copepoda were a distant second (13.69%). These results suggest that the diversity and distribution of microinvertebrates in different areas of the lake are greatly influenced by the physical characteristics of the ecosystem as influenced by water quality parameters and conditions in the lakeshore. As previous studies on Lake Taal biodiversity have focused on more "charismatic" taxa (i.e., fishes, gastropods, zooplankton and phytoplankton), these results further increase knowledge on taxonomy regarding the species that inhabit the lake.

Keywords: Biodiversity, Freshwater, Lake Taal, Microinvertebrates

Matter, Materials, and Metallurgy



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Abstract: This paper discusses two important elements of material that construct the atmosphere, namely quasi-material and quasi-thing. The purpose of this research is to increase awareness of the existence of quasi-materials and quasi-things in affecting the human sense and forming the atmosphere. It is argued that the existence of quasi-materials and quasi-things is important as both elements could shift focus in designing material from form-based into amorphic, immateriality. This study utilized cases as precedents of atmospheric architecture, which is analyzed for every quasi-material and quasi-thing that plays role in the construction of the atmosphere. As findings, this study shows how each of these elements works to build up a particular atmosphere. The findings from the precedent analysis revealed that some quasi-materials such as light can be manipulated either by using casual types of media or through sophisticated instrumentations to produce specific quasi-things. This research proves that the materiality of architecture could be pursued through immateriality with the appearances of quasi-materials and quasi-things in the making of the atmosphere.

Keywords: Atmospheric matter, Quasi-material, Quasi-thing, Human sensory, Materiality

Evaluation of Dependence with Asymmetric Models on a Real Dataset

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Abstract: Copulas are a frequently used tool in the literature to model dependent variables. In reality, it is also important whether they are symmetric or asymmetric when modeling data, in addition to dependence. In this context, asymmetric copulas are also a topic of recent interest. On the other hand, Spearman and

Kendall's correlations are used to measure the dependence between symmetric variables, while directional dependence measures are used for non-symmetric variables. This study aims to obtain directional dependence measures for some asymmetric copula functions. Two approaches to constructing asymmetric bivariate copulas are considered here. These are the asymmetric model created by independent copulas and Archimedean copulas and the model that takes into account the linear convex combinations of Archimedean copulas. This study obtains firstly the parameter values corresponding to different Spearman correlations for Archimedean copulas and asymmetric copulas derived from them. Then, the proposed asymmetric copulas are simulated using these parameter values. Finally, using the data obtained from the simulation, parameter estimates for each model are made, and directional dependence measures are found. Furthermore, the study's methodology is applied to a real data set with an asymmetric structure, and the results are interpreted.

Keywords: Dependence, Asymmetry copula, Archimedean copula, Directional dependence.

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