Journal of Engineering and Technology for Industrial Applications

ISSN 2447-0228

June 2023

Volume 09 / No 41

Editor-in-Chief: J. C. Leite

www.itegam-jetia.org

ITEGAM - JETIA ISSN 2447-0228 Online
Journal of Engineering and Technology for Industrial Applications (JETIA)

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Publication Information:
ITEGAM-JETIA (ISSN 2447-0228), (online) is published by Galileo Institute of Technology and Education of the Amazon on a every two months (February, April, June, August, October and December).

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Directory

ITEGAM - JETIA
ISSN 2447-0228 Online
Journal of Engineering and Technology for Industrial Applications (JETIA)

ITEGAM-JETIA. v.9, n.41. June of 2023. Manaus - Amazonas, Brazil. ISSN 2447-0228 (ONLINE)
https://www.itegam-jetia.org

SUMMARY

Journal of Engineering and Technology for Industrial Applications

ISSN ONLINE: 2447-0228

ITEGAM-JETIA

Manaus, v.9 n.41, p. 4-14. May/June, 2023

DOI: https://doi.org/10.5935/jetia.v9i41.858

RESEARCH ARTICLE OPEN ACCESS

ASSESSMENT OF CRITICAL CLAIMS AND THEIR IMPACTS ON THE CONSTRUCTION INDUSTRY OF NIGERIA

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ARTICLE INFO

Article History
Received: May 09th, 2023
Accepted: June 27th, 2023
Published: June 30th, 2023

Keywords:
Claims,
Claim Management,
Construction projects,
Impacts,
Disputes.

ABSTRACT

The construction projects are hardly completed on schedule and budget, and poor claims and dispute management are among the factors responsible for this performance issue. Critical claims in construction remain unresolved by negotiation and understanding between the parties but end up in advanced dispute resolution techniques. Quantity Surveyors are experts in contract administrations and are involved in all the stages of the construction projects, have not been given adequate attention in construction claim management studies. This study assesses the perception of Quantity Surveyors on the Critical claims and their impact on construction project delivery in Nigeria. The snow sampling technique was used to administer the structured questionnaire. With a Cronbach's alpha coefficient of over 0.80, the gathered data were analysed using mean score analysis and the Mann-Whitney H test. It was found that the critical claims in construction are payment-related claims (mean=4.92; SD=0.2780), contractual claims (mean=4.55; SD=0.8837), change claims (mean=4.54; SD=0.8423), extra work claims (mean=4.43; SD=0.9974), delay claims (mean=4.36; SD=1.1683), and different site condition claims (mean=4.36; SD=1.0826). Also, the major impacts of claims in construction project delivery are delays in project completion cost overrun, poor quality of work, the adversarial relationship among parties, loss of profits, and loss of job opportunities. Effective contract administration and management are central to claim management and events capable of causing drawbacks to the progress of the work should be avoided by the contracted parties.

I. INTRODUCTION

The construction sector influences and accelerates economic growth and development, and thus, is described as the 'prime mover' and 'mainstay' of countries [1-2]. The construction industry is one of the core economic engine sectors that drive the economy, create jobs, promote new investment, and contribute to GDP and national economies globally [3-5]. However, construction projects globally are hardly completed on schedule and budget because of conflicts arising from the divergent goals and expectations of the clients, consultants, contractors, and subcontractors in the construction business environment [6-7, 3]. Each of these parties attempts to attain their own goals and anticipations to maximise their benefits. Furthermore, construction projects are complex, with multiple stakeholders, documents, and contract conditions. These heighten the possibilities of disputes, contradicting interpretations and opinions about designs and construction, and confrontational attitudes which often lead to delays and disruption a common occurrence in construction [8-9,7,10], and increased claims and disputes.

Claims in construction projects are inevitable in construction because of clients' sophistication and dynamic desires for additions and changes, a complex new standard, and technological advancement [3]. The demand or assertion of a party

for additional payment and/or time due to default in the contract or actions/inactions of a party is known as a construction claim [7]. Due to the high cost and time impact of construction claims on the successful delivery of construction projects, effective claims management is unavoidably critical in construction project management, and this should span the life cycle of the projects if effective claims management is to be achieved [11, 7]. Construction claims and disputes happen in a project sponsored by a private entity as well as those funded by public organisations. It occurs regardless of whether the project has small or large funding, and the experiences of the key stakeholders cannot stop claims from occurring. Thus, no project is shielded from potential claims [3]. Construction claims arise from disagreement from different sources between the client and the contractors, and it could be a claim for delays, acceleration, change order or extra works, site conditions, damages, defects, force majeure, cost overruns, non-payment, loss of labour productivity, among other. How well claims are managed, defines how successful the project will be regarding time, cost, and quality performance [10].

While the approaches to claim management varies from country to country as evident in previous studies. The claims in the construction industry have attracted a lot of attention from researchers and academics both locally and at the international level. For example, internationally, studies such as [12-19] exists. In the Nigerian context, studies such as those [20-24] exist. However, none of these studies has been centred on the views of Quantity Surveyors. Quantity Surveyors are experts in contract administration and are involved in all the stages of construction projects. Their work goes beyond the traditional role of preparing Bills of quantities and has evolved into other socialist areas of construction relevant and beyond. According to [25], the quantity surveyor's role is multi-disciplinary and cannot be confined to a particular role because of the dynamics in the construction industry of today. Certain claims cannot be resolved by mutual understanding and negotiation between the parties involved. These claims evolve into disputes that might only be resolved through advanced dispute resolution methods. Examples of these claims according to [26] are payment-related claims, change claims, contractual claims, and damages, among others. This implies that these categories of claims impact the project baselines the more. Therefore, flowing from this knowledge, this study assesses the perception of Quantity Surveyors on the Critical claims and their impact on construction project delivery in Nigeria.

This study will add to the existing studies on construction claims. It will equip the young and new entrants of Quantity surveyors and their construction experts with the knowledge of the major claims in construction and the consequences of poor management of claims. This will enable strategies towards ensuring that these issues are avoided or minimised in constriction.

II. LITERATURE REVIEW

II.1 CLAIMS IN CONSRUCTION AND THEIR IMPACTS

To avoid delays and the costly impact of disputes that might lead to litigations. Common claims were identified to guide the contractors in understanding commercial claims that evolve from construction contracts. According to [26], most other construction claim types are settled by mutual understanding as well as by negotiation between the parties. However, there are some that are most frequent and hardly get settled. These claims lead to disputes and a resolved through advanced dispute-resolution approaches. These claims are payment-related claims, change claims, delay claims, extra work claims, contractual claims, the difference in pricing and measuring claims, different site condition claims, acceleration claims, damage claims, and contract termination claims.

In the Kingdom of Bahrain, [27] found that the topmost important types of construction claims are delay claims, claims from changes and extra works, fluctuation claims on construction materials prices, claims resulting from differences in site conditions, contract ambiguity claims and claims due to acceleration. Variations, delays by contractors and poor site investigation prior to bidding are the main cause of claims in construction projects in the UAE [28]. In Bangladesh and India, payment delays were recognised as the critical cause of claims in construction projects [26, 29]. Similarly, [30] absence of finance and untimely payments cause delays to construction projects, and this gives rise to claims in Iran. claims such as contract ambiguity claims, delay claims, acceleration claims, change claims, extra work and variation claims, price acceleration claims, change of work order claims, differing site conditions claims, damage claims, loss of profit claims, and wrongful withholding of deposits claims; are regarded as counterclaim as they are prepared by the opposing party to counter claimant claims [31]. According to [26], these claims cannot be resolved by mutual understanding and negotiation between the parties, they most time end in advanced disputes resolution approaches.

Change of work: request for change in work is a common claim in the construction sector. A request for change could lead to disagreement between the contractor and the clients n what constitutes the scope of the contract or not. Once a project has started, a change of work constitutes extra that must be claimed by the contractor [26, 32-33].

Damage claim: construction activities can lead to construction claims where damage is made to the commercial site or adjacent property, which results in the client suffering some property damage. The client can claim damage from the contractor [26, 32-33].

Injuries: In a construction site, the accident is one of the common occurrences which give rise to claims. The argument for a claim is the non-adherence to safety standards. The impact of the accident could be on the project's progress as well as on the workers or bystanders [32].

Acceleration of schedule: this type of claim emerges when the contractors are demanded to proceed with the work above the agreed budget at the bidding stage, to stay on schedule. A disagreement on what the extra cost covers is the source of this type of claim [26, 32-33].

Change in site conditions: There are statements of the site conditions covered in the contract at the time of bidding. If they are substantially different from the actual conditions on site, it might have an impact on the difficulty level of the work execution, and this can cause delays and extra costs and other resources. Sometimes, the actual conditions may not be encountered on the construction site. These situations give rise to claims of site conditions by either the contractor or the client [32-33, 26].

Construction defects: defects identified after the works have been completed are sources for a claim by the client. Errors from work not properly executed can cause damage to the building or property, and the client must claim for the cost implications from the contractor claim [32].

Delay claims: When a project is completed after its planned scheduled completion date, such a project is said to be delayed. This is a common situation in construction contacts [10]. Delays lead to financial and productivity losses, and they can result from situations that are beyond the control of the contractors or even the

clients or their agents. Earthquakes, tsunamis, and the Covid-19 pandemic are typical situations outside the contractors' control that delayed a lot of projects globally [32-33].

Contractual Claims: These are claims that arise from the contract itself, and they include disagreement over responsibilities and/or liability is omitted from the contract. Poorly written contracts have been blamed for contractual claims [26, 33].

The difference in Pricing and Measuring Claims: at the end of the construction stage, measurements are taken on-site and if there is disagreement regarding this, disputes might arise. Sometimes, the difference in the prices of some materials between the contractors and clients might give rise to pricing and measuring claims. Extra work and changes are known to create some discrepancies in pricing [26].

Contract ambiguity claims: In the preparation of contract documents and bid offers, mistakes and errors are common [33]. These mistakes can take diverse forms ranging from computational errors, written errors, assumption mistakes, poor concept understanding and dual interpretations. Errors emanating from contractors' viewpoints in bidding and setting such as errors in the estimation of project completion time, materials, workforce, and equipment. Ignoring legal matters or facts and other essential contract requirements would naturally give way to legal consequences [34].

Contract termination: termination of the contract prior to the start of work on site is a ground for claims for loss of profit by the contractors. A claim can also be made for the difference between the anticipated cost of the work and the contract price. If termination occurs after work has started, the contractor is entitled to recover losses as well. The full contract price is claimed where the work is completed in line with the contract provisions before termination occurred. However, recovery and liability under a terminated contract vary [26].

Claims in the construction industry have been blamed for a lot of issues among which are disruption of the progress of work and delays in project completion, cost overrun, diversion of resources, adversarial relationships, among parties strained relationships, loss of control over outcomes, among others [31]. [23] and [35] posit that contractual claims have led to losses of better project performance regarding time and cost. These have triggered the call for effective claim management in the construction sector. Claims from change orders cause delays in the project schedule, cost increases, loss, and reduction in productivity of labour, and poor quality of work. Furthermore, delayed claims can cause the need for an extension of equipment cost, idle equipment and labour, wastage, and resource escalations, increase in supervision and overheads, loss of profits and loss of job opportunities [31].

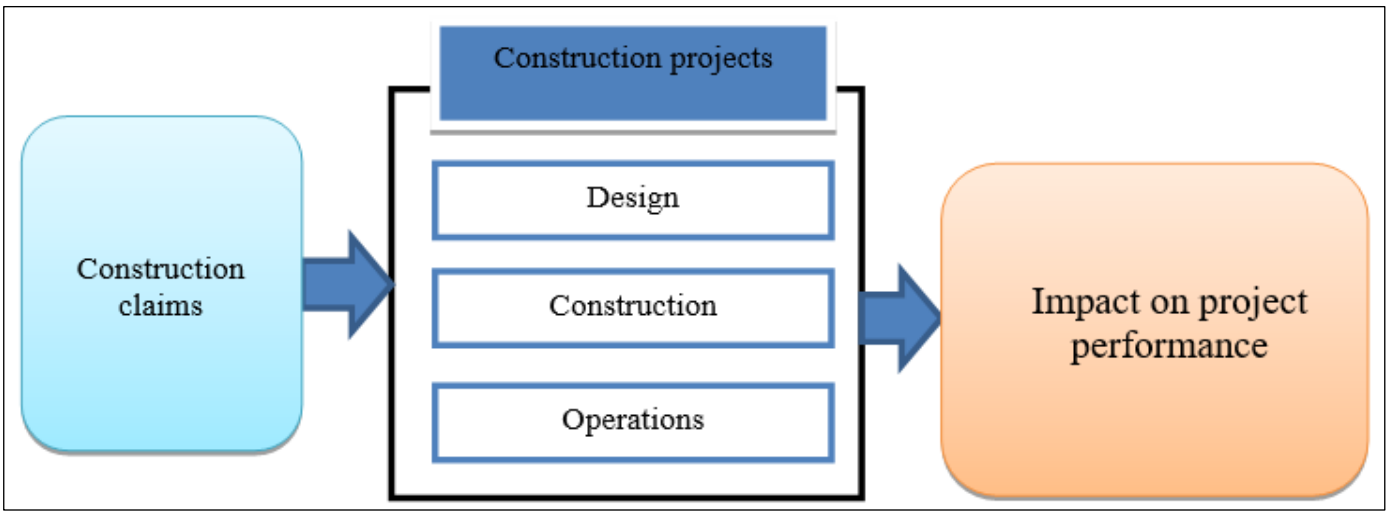

Figure 1: Relationhsip between construction claims and impact on projects.
Source: Authors, (2023).

II.2 CLAIM MANAGEMENT PRACTICES

In the construction industry, no construction contract is claim-proof [32], however, some measures of precaution can be taken either at pre- or post-construction stages to minimise the impact claim on project baselines. In a commercial contract, construction claims can be avoided by well-written contracts, good record-keeping, and better construction safety practices [32]. [36] identified the need to be careful and realistic in bid pricing and negotiations. Negotiating a contract requires careful management of the contract language with regards to claims, having sound knowledge of the contract and how they are managed, and not allowing claims to linger till the end of the project, these are the main claims management practices for better project performance and working relationships in the construction sector.

Well-written contracts: the most issue that emanates in construction are hidden in the terms and conditions of a contract. Clear contract terms and conditions are helps to protect parties from legal claims. Therefore, communication is a key to resolving issues in construction businesses efficiently. A good contract is an embodiment of good communication and should be fair in the allocation of risks across all the contracting parties. This help to reduce the risks and emergence of disputes. Construction claim consultants are essential in designing a contract that protects from all forms of adverse situations. Claims experts would include vita clauses that would protect the contractors or clients from unanticipated legal issues [32].

***Be realistic in your bid*:** the high level of competition and the need to secure a contract every business year is one of the driving forces for low bid submission [36]. The traditional systems also made this worse in that projects are awarded based on the lowest bid award. Unrealistic own bids for jobs would have an impact on the success of the project, as the eve of uncertainties and shoddy work to make profits will be high. This breed disputes and

claims at the end or as the work progresses. The contractors should be realistic with their pricing to improve contractual outcomes will less pressure from claims. Unforeseen events like Majeure and other unknown hazards may give ground for genuine claims, and the client might be open to comprise with the contractor in resolving any claims that aroused. Reasonable contact price and contingency can help minimise the effect of claims on a construction site [32].

***Good Project Record Keeping*:** construction project is complicated in that so many activities and tasks are executed simultaneously. There are even the tendencies to be distracted and confused during construction because of the high volume of activities and different data and information that are created. This leads to a lot of information and data being generated that need to be recorded and managed properly. Proper recording and keeping of construction site activities mean that communication can be effective, and dispute resolution can be made easier [32].

Construction Safety Practices: is the contractors' primary responsibility to protect workers from danger and the property from damage during construction delivery. Having a sound safety programme in place is vital to keep safety-related issues down and minimised the high level of injuries and fatalities inherent in construction [32].

[36] posit that the success of a construction project is dependent on how well cooperated parties such as the consultants, contractors and clients managed their relationships. A major impact of disputes in project implementation is on costs and time. Disputes and problems evolve from conflicting opinions among stakeholders that border on surrounding project design and construction. Without an efficient dispute and claims management process, disputes will be in continuous occurrence.

[37] argued that construction projects can still be successful with regards to the objectives of being within cost, time, quality, safety, better environmental performance, and stakeholders' satisfaction, and still be subjected to claims during the delivery period. The central thing is the management of claims processes which are (i) proper identification, (ii) notification of claim events, documentation and/or quantifications, presentation and resolutions as shown in figure 2.

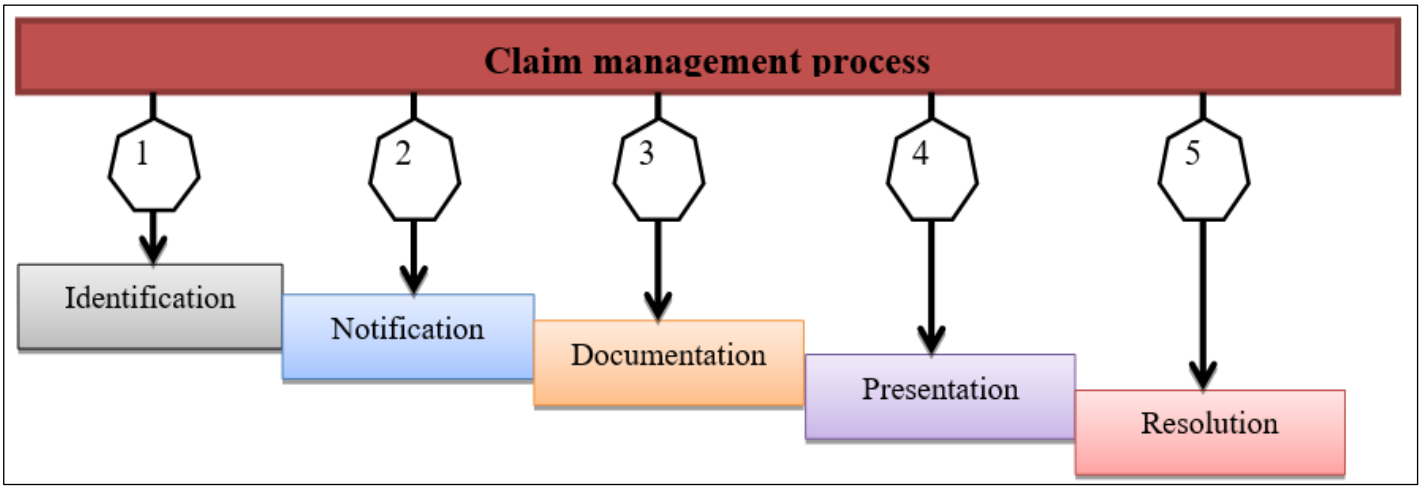

Figure 2: Claim management process.
Source: Modified from [37].

III. MATERIALS AND METHODS

The well-structured questionnaire was adopted for this study as the tool for data collection from Quantity Surveying organisations in Imo state, Nigeria. The questionnaire is suitable for this study as it is easy and simple to use and provided quantifiable data at a relatively shorter duration [39]. The use of a questionnaire in this study followed the approach of previous related studies [39, 24, 10]. The questionnaire was developed following a critical review of extant studies. The instruments for data collection (e.g., questionnaire) are formed after relevant literature that borders on the main subject of a study are reviewed [5]. Quantity Surveyors (QSs) are critical in the delivery of construction projects; this is because they are involved across the entire production and supply chains of the projects. According to [40], "*Quantity surveyors are involved in all phases of a facility's lifecycle such as feasibility, design, construction, extension, refurbishment, maintenance, and demolition".* The QS has accumulated lots of information and experience to be a better contract administrator and claim expert. Quantity surveyors engaged by private and public organisations were considered in the study.

The questionnaire was designed into three sections. The first section gathered data on the background information of the participants as well as their level of involvement in claim management processes. The second section garnered responses on the critical claims in construction, and the lastly, the third section collected data on the impact of claims in the construction industry. The questions in the second and third sections were based on a 5-point Likert scale, where 5 is the highest scale, while 1 is the lowest. To be considered for the study, the participants must have at least 5 years of working experience, be engaged by either private or public organisations, experienced contract administration, and lastly, must be working within the study area as at the time of this survey. It was, however, impracticable to obtain the database of QSs who met these sample section criteria, this informed the use of the snowball sampling technique. The snowball sampling technique is '*respondents-driven'* [5], as it is dependent on referrals and has the capability to increase the sample size [41]. The study adopted both hardcopy and Google form questionnaires. The electronic administration of the questionnaire was initiated to

enable qualified audiences who are 'difficult-to-reach' to participate [5, 42], and to reduce the impact of hardcopy papers on our forest, as it is an eco-friendly means of survey [42-43].

After the survey period of thirteen weeks, 84 usable questionnaires (hardcopy = (28)33.33% & softcopy= 56(66.67%)) were obtained, and these were adjudged satisfactory for the analysis. The data gathered on the background information of the participants and their level of involvement in claim management processes were analysed using frequencies and percentages. While those collected on critical claims in construction, and impact of claims in the construction industry were analysed using the mean score and Mann-Whitney U test. The mean score was used to rank the variables based on their relative mean weights. Mann-Whitney U test was used to determine the significant difference in the opinion of the participants from different organisational groups and the variables in which their views differ. Prior to these analyses, the research instrument reliability was established using Cronbach's alpha test which returned an alpha value greater than 0.80 as seen in Table 1 below. This shows good quality and high reliability of data.

Table 1: Reliability Evaluation.

Cases		N	%	Cronbach's Alpha	N of Items
Case 1: Critical claims in construction	Valid	84	100	0.894	14
	Excluded[a]	0	0		
	Total	84	100		
Case 2: Impact of claims on the construction industry	Valid	84	100	0.807	15
	Excluded[a]	0	0		
	Total	84	100		

Source: Authors, (2023).

IV. ANALYSIS, RESULTS AND DISCUSSIONS

IV.1 BACKGROUND INFORMATION OF RESPONDENTS

The general information of the respondents is shown in fig. 3(a) to 3(e) below. About 63.10% of the sampled respondents work in private sector organisations and 36.9% are employees of the public sector organisations (fig. 3a). In terms of the responsibilities/position in the organisations, 27.38% are procurement managers, 22.62% are project managers, 15.48% are Principal/Managing partners of their firms, and the least among the participants are senior estimators (9.52%) (fig. 3b). The distribution of the years of the experience of the participants show that those that have spent 11-15years are more (34.52%), followed by those within the range 5-10years, then 15-20years (20.24%) and 16.67% of them have spent about year 21years and above (fig. 3c). The educational information shown that those with HND are 17.86%, PGD (16.67%), B.Sc/B.Tech (36.90%), MSc./M.Tech. (27.38%), and PhD (1.19%) (fig. 3d). Finally, from (fig. 3e), the participants are chattered quantity surveyors, as they are corporate members of the Nigerian Institute of Quantity Surveyors (NIQS).

From the background information of the participants, it can be drawn that they have the requisite experience and knowledge to aid this study. This is premised on the fact that they come from a different organisational background, are middle to top management in rank, have considerable experiences in practice, are educated and have the professional qualification to contribute meaningfully to issues bordering on claims and claims management in construction.

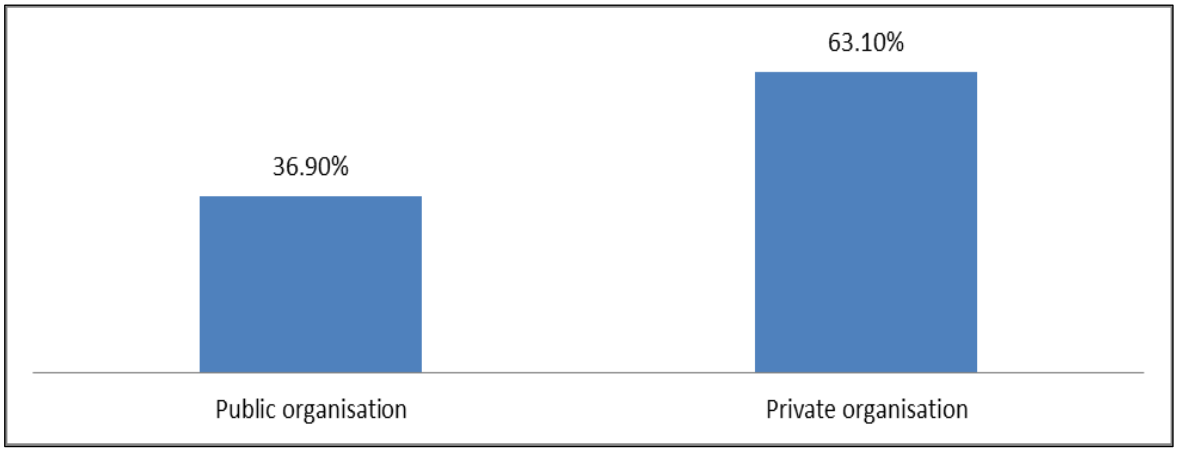

Figure 3 (a): Ownership of organisations.
Source: Authors, (2023).

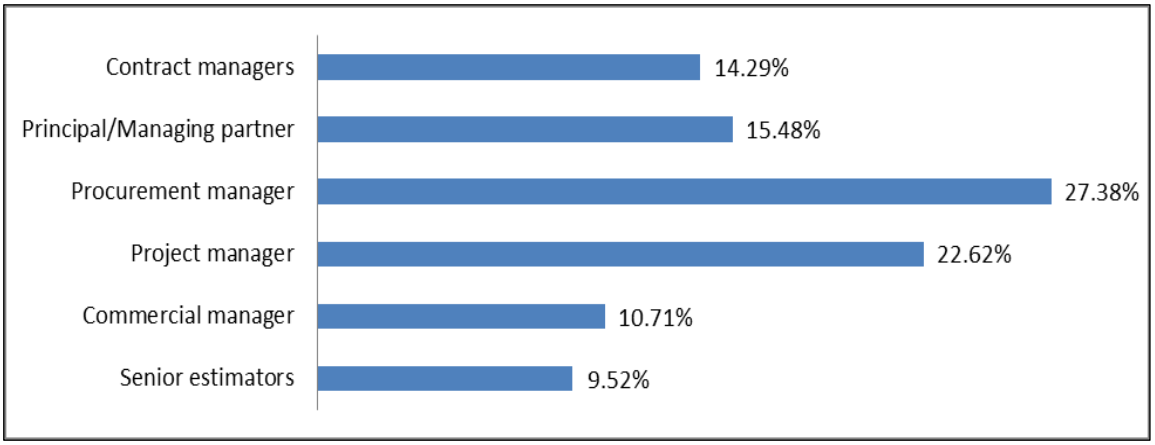

Figure 3 (b): Ranks/Responsibility.
Source: Authors, (2023).

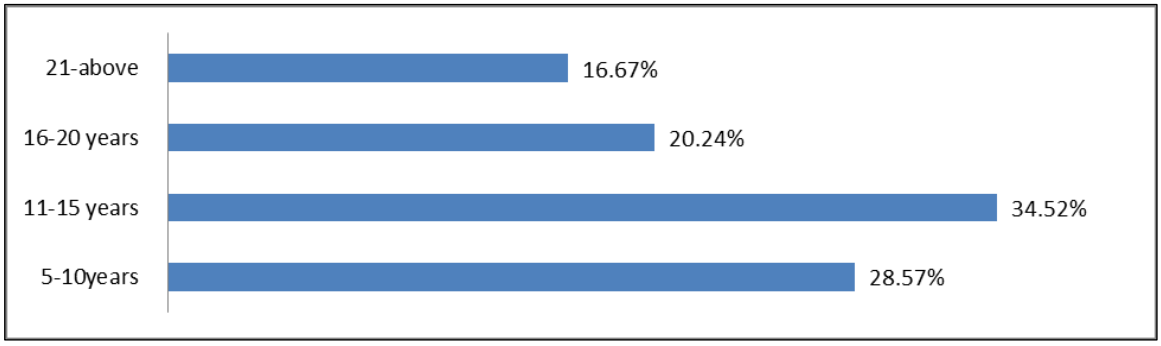

Figure 3 (c): Years of experience.
Source: Authors, (2023).

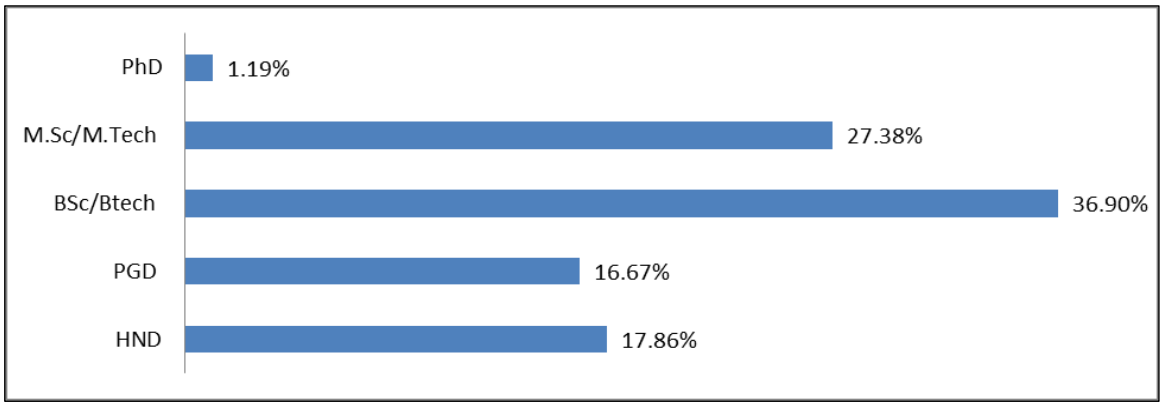

Figure 3 (d): Education qualification.
Source: Authors, (2023).

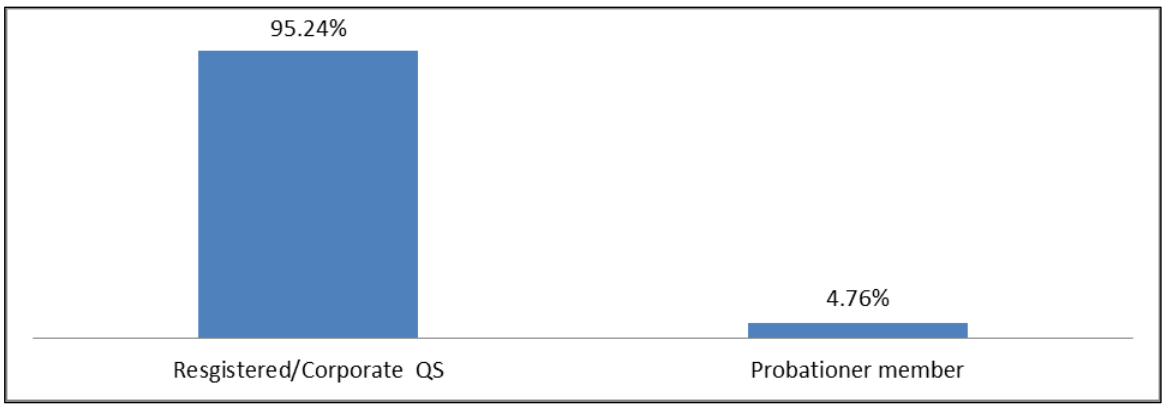

Figure 3 (e): Professional cadre.
Source: Authors, (2023).

IV.2 INVOLVEMENT IN CLAIM MANAGEMENT PROCESS

It can be seen from figure 4, that the participants have been involved in one claim management activity or the other. Interestingly, over 50% of them (i.e., 43(51.19%)) have been involved in the 5 claim management processes. 11(13.10%) of them have been involved in claim presentations, 10 (11.90%) have equally been involved in Documentation and Resolution, and 5(5.95%) have participated in the identification and notification of claims.

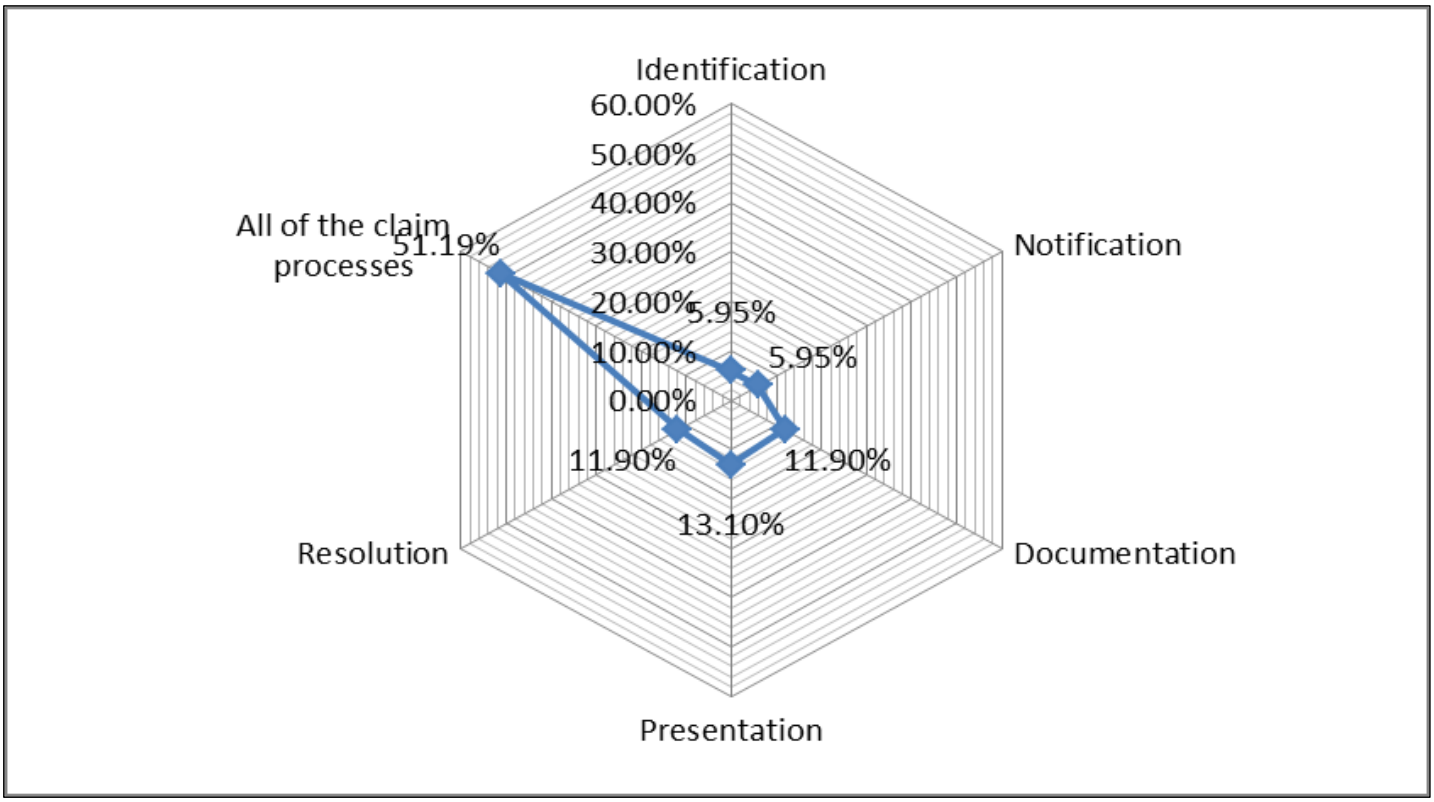

Figure 4: Involvement in claim management processes.
Source: Authors, (2023).

IV.3 CRITICAL CLAIM IN CONSTRUCTION

The results obtained from the analysis of the data collected on major claim types are shown in Table 2. From the table, the most critical claims in construction are payment related claims (mean=4.92; SD=0.2780), contractual claims (mean=4.55; SD=0.8837), change claims (mean=4.54; SD=0.8423), extra work claims (mean=4.43; SD=0.9974), delay claims (mean=4.36; SD=1.1683), and different site condition claims (mean=4.36; SD=1.0826). While the least ranked claims in construction are; loss of profit claims (mean=4.00; SD=1.5288), contract ambiguity claims (4.00; SD=1.4889), and fluctuation claims on construction materials prices (mean=3.94; SD=1.3385).

The assessed claims are all critical in construction regardless of the relative mean weighting of these claim types. This is based on the weight of the maximum mean of 4.92 (98.33%), the minimum mean score of 3.94 (78.81%), and the average mean score of 4.33 (86.50%). The result obtained in this section is in support what have been reported in previous studies [26-28, 29-31]. Delay in payment is the leading cause of claims and disputes in construction projects [30, 26]. Claims related to extras, changes and disparity inside conditions were found to be among the critical claims in construction [31, 27]. These claims, according to [26], are less likely to get resolved by mutual agreement and negotiation; they usually end up in court.

To establish if a significant difference exists between the participants from the public organisations and those from the private organisations, The Mann-Whitney U test was performed, and the significant p-value obtained is greater than the 5% significant level in 12(85.71%) of the variables. This implies the convergence of opinion and ranking patterns of the variables by the respondents. Therefore, no significant difference exists between the participants from the public organisations and those from the private organisations regarding the critical claims in construction. However, 2(14.29%) of the assessed variables show a significant statistical difference as the p-value obtained is less than the 0.05 level of significance. Thus, this implies that the participants' view differs in the way these variables were ranked. The variables are contract termination claims (Z=-4.462; P-value=0.000) and loss of profit claims (Z=-5.228; P-value= 0.000). This divergent view observed could be attributed to the different levels of experience of the participants, and the level of care exercised by the organisations in handling certain types of claims. However, there is need for a further reflection on the contract termination claims and loss of profit claims.

Table 2: Critical claims in construction.

S/N	Major Claims in Construction	Mean	SD	SEM	Rank	Mann-Whitney Test		
						Z	P-value	Decision
1	Payment related Claims	4.92	0.2780	0.0303	1st	-0.778	0.441	Accept
2	Change Claims	4.54	0.8423	0.0919	3rd	-0.696	0.487	Accept
3	Delay Claims	4.36	1.1683	0.1275	5th	-0.984	0.344	Accept
4	Extra work Claims	4.43	0.9974	0.1088	4th	-1.065	0.283	Accept
5	Contractual Claims	4.55	0.8837	0.0964	2nd	-1.718	0.086	Accept
6	The difference in pricing and measuring Claims	4.23	1.1858	0.1294	11th	-0.218	0.827	Accept
7	Different site condition Claims	4.36	1.0826	0.1181	5th	-1.879	0.060	Accept
8	Acceleration Claims	4.33	1.1651	0.1271	8th	-1.208	0.227	Accept
9	Damage Claims	4.32	0.7940	0.0866	9th	-1.006	0.314	Accept
10	Contract termination Claims	4.35	1.0354	0.1130	7th	-4.462	0.000*	Reject
11	Loss of profit Claims	4.00	1.5288	0.1668	12th	-5.228	0.000*	Reject
12	Wrongful Withholding of Deposits Claims	4.24	1.2952	0.1413	10th	-1.610	0.107	Accept
13	Contract ambiguity claims	4.00	1.4889	0.1625	12th	-1.360	0.174	Accept
14	Fluctuation claims on construction materials prices	3.94	1.3385	0.1460	14th	-0.769	0.442	Accept

*p-value (Sig.) <0.05; SEM= standard error mean; SD = standard deviation.

Source: Authors, (2023).

Furthermore, the overall Mann-Whitney U test in Table 3 shows that there is no significant statistical difference between the perception of the quantity surveyors from the public sector organisations and those from the private sector organisations. This is premised on the p-value of 0.219 which is greater than 0.05.

Table 3: Mann-Whitney U Test.

		N	Mean Rank	Sum of Ranks	Z	P-value
Respondents Group	Public organisation	31	32.69	1013.50	-1.518	0.219
	Private organisation	53	48.24	2556.50		
	Total	84				

Source: Authors, (2023).

IV.4 IMPACT OF CONSTRUCTION CLAIMS ON PROJECT DELIVERY

Claims in construction impact the performance of the projects, the data collected on these were analysed and shown in Table 4. The top 5 major impacts of claims in construction project delivery are; delays in project completion (mean=4.93; SD=0.4044), cost overrun (mean=4.73; SD=0.9982), poor quality of work (mean=4.58; SD=0.7947), adversarial relationships among parties (mean=4.44; SD=0.8829), loss of profits (mean=4.42; SD=1.0204), and loss of job opportunities (mean=4.42; SD=1.0437). While the least ranked impact of claims on construction projects are diversion resources (mean=4.11; SD=1.2802), strained relationships (mean=4.11; SD=1.1925), loss and reduction in productivity of labour (mean=4.11; SD=1.3445), wastage and resources escalations (mean=4.11; SD=1.3445) and increase in in supervision and overheads (mean=4.02; SD=1.4477)

Notwithstanding the relative mean scores of these variables, they are a significant impact on claims in construction project delivery. This is premised on the maximum mean score of 4.93 (98.57%) obtained, the minimum mean score of 4.02 (80.48%), and the average mean score of 4.33 (86.68%). The finding in this section support what has been reported in previous studies [26, 31, 35, 23]. The impact of the claim cut across and goes beyond the parties and the projects, their companies suffer too. The project suffers from injurious delays as key deliverables would not meet their planned delivery dates, the entire project will be delayed, and the entire project will experience budget overrun. A larger proportion of the project profits will be lost, the relationship between the parties would be disrupted and derailed, and contractors may not be engaged by the client in future projects [31, 35].

The Mann-Whitney U test carried out to determine whether a significant difference exists between the participants from the

public organisations and those from the private organisations, shows that all the 15 variables have their p-value to be greater than 0.05. This implies that the respondent opinion converged in 100% of the assessed variables. Thus, it can be concluded that there is no significant difference between the perception of the participants from the public organisations and those from the private organisations regarding the impacts of claims in construction.

Table 4: Impact of construction claims on project delivery.

S/N	Impact of construction claims	Mean score	SD	SEM	Rank	Mann-Whitney Test		
						Z	P-value	Decision
1	disruption of the progress of work	4.38	0.9682	0.1056	7th	-1.171	0.242	Accept
2	delays in project completion	4.93	0.4044	0.0441	1st	-1.341	0.180	Accept
3	cost overrun	4.73	0.9982	0.1089	2nd	-0.678	0.431	Accept
4	diversion resources	4.11	1.2802	0.1397	11th	-0.468	0.640	Accept
5	adversarial relationship among parties	4.44	0.8829	0.0963	4th	-1.109	0.275	Accept
6	strained relationships	4.11	1.1925	0.1301	11th	-1.521	0.128	Accept
7	loss of control over the outcome	4.26	1.1629	0.1269	8th	-0.175	0.861	Accept
8	loss and reduction in productivity of labour	4.11	1.3445	0.1467	11th	-0.193	0.847	Accept
9	poor quality of work	4.58	0.7947	0.0867	3rd	-0.810	0.406	Accept
10	loss of profits	4.42	1.0204	0.1113	5th	-1.061	0.277	Accept
11	loss of job opportunities	4.42	1.0437	0.1139	5th	-1.688	0.113	Accept
12	idle equipment and labour	4.21	1.1727	0.1280	9th	-0.592	0.554	Accept
13	wastage and resources escalations	4.11	1.3445	0.1467	11th	-0.193	0.847	Accept
14	extension of equipment cost	4.19	1.1562	0.1262	10th	-1.302	0.193	Accept
15	increase in supervision and overhead	4.02	1.4477	0.1580	15th	-1.361	0.173	Accept

Source: Authors, (2023).

IV.5 RESPONDENTS BACKGROUND DETAILS

Drawing from the major claims described above and the top impacts of claims in construction, figure was developed. It is obvious that the occurrence of claims in construction projects whether it occurred at the design stage, construction stage and/or the operation and maintenance stage, and they harm the success of the projects and the organisations or parties involved. Furthermore, these claims are the major claims in construction that are difficult to resolve, they end up going through more advanced dispute resolution techniques before they are resolved. These impact project performances concerning time, cost, quality, relationships, profits, and jobs as indicated in figure 5.

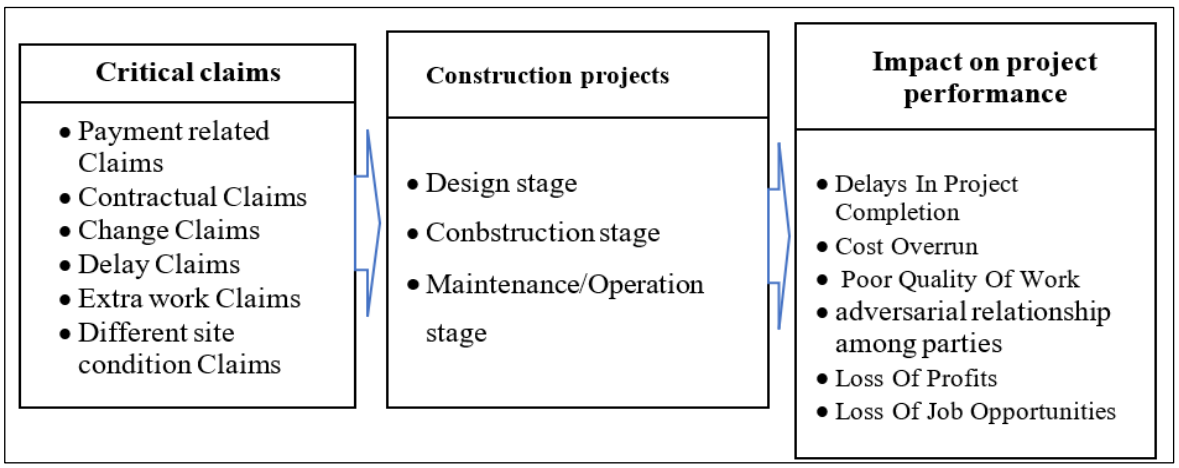

Figure 5: Impact of claims on construction Project.
Source: Authors, (2023).

V. CONCLUSIONS

This study set out to assess the perception of Quantity Surveyors on Critical claims and their impact on construction project delivery in Nigeria. The study utilised a structured questionnaire which was administered by the researchers in the study area using a snow sampling technique. The gathered data were analysed using mean score analysis and the Mann-Whitney U test, results were presented, discussed and a conclusion drawn.

The study found that the critical claims in construction that most times remained unresolved by mere negotiation and understanding between the parties, but most times end up in advance dispute resolution techniques are payment-related claims, contractual claims, change claims, extra work claims, delay claims, and different site condition claims. Also, the major impacts of claims in construction project delivery are delay in project completion, cost overrun, poor quality of work, adversarial relationships among parties, loss of profits, and loss of job opportunities. The perception of the participants from the public and private sector organisations was found to be in convergence, as there was no statistical difference in the view regarding the subject of this study. This was based on the outcome of the Mann-Whitney test.

Payment-related claims such as delay in payments, delay in the approval of payment due, and non-released of retentions, among others, have been blamed for many disputes and crises in the construction sector. Contractual claims, claims for authorised changes and other critical claim types are among the greatest cause of disputes between clients and contractors, and these have been the subject of a lot of litigation cases because they are oftentimes not resolved by the parties using the less expensive means of disputes resolutions. These claims end up being resolved using advanced techniques such as litigations, among others, which are time-consuming, expensive, and even disrupt the relationship that exists between the parties.

Normally, when such claims end in the courtrooms, resolutions or court orders are awarded to the winner and the loser is compelled to obey the order or awards. This could lead to strained and adversarial relationships. Another critical impact of claims in construction are that will delay the completion time of the project. This is true as most times the work would be put on hold while the case is ongoing. Ultimately, more costs will be incurred by the parties, leading to cost overruns. The contractors as well as the client will lose profits because of the extra and unplanned expenses. Workers might be sacked, leading to more job losses. Even the contractors will not get jobs from the clients again. Even when the work continues, quality might be affected, as the contractor struggles to cope with a shortage of funds, among other things.

Effective contract administration and management are all-encompassing. Every item or event that can cause drawbacks to the progress of the work should be avoided. It is the responsibility of the clients and their consultants to ensure that payment certificates, and valuations, among other payment-related matters, are attended to within the time stipulated in the contracts. Sanctioned extras works and changes should be paid for once they are discharged satisfactorily. This is to avoid claims related to changes and extras. Clients engaged-third parties should discharge their work diligently to avoid delays to the main contractor's work. Every source of delay should be avoided and if impossible, should be minimised. This will bring down the number of delay claims. Effective, details and adequate site surveys should be carried out to ensure that site conditions are properly documented and recorded for use by the parties. Quantity Surveyors have as one of their responsibilities to be called upon as expert witnesses in construction disputes; therefore, they should be trained on and be involved in the claim management activities and processes in the construction industry.

The implication of this study is that Contractors would be better informed on the difficult-to-resolved claims that have the most impacts on the project successes, his/her relationships, and organisations. This will enable him to engage experienced and well-equipped construction experts to help manage the projects to ensure that claims events are not traced to contractors' team ineffectiveness. The client should ensure that his representatives are doing their job effectively and efficiently to avoid defaults that will delay the projects and increase his expenses beyond what was planned for at the inception. Clients and their agents have a big role to play if a claim-free construction project is to be achieved. Furthermore, this study adds to the existing body of knowledge on construction claims in developing nations and Nigerian in particular. This study is, however, limited by certain factors such as geographical boundaries, sample size, sampling approach, and analytical method. These imply that care should be taken in generalising the findings. Future work should consider more states, and regions in Nigeria or even other emerging countries. The study should consider the use of interviews, and focus groups, in the coaction of data. This would provide robust data to compare results.

VI. AUTHOR'S CONTRIBUTION

Conceptualization: Dr. Reuben A. OKEREKE and Mohammed ZAKARIYAU.
Methodology: Dr. Reuben A. OKEREKE, Mohammed ZAKARIYAU and Uchenna AFONNE.
Investigation: Dr. Reuben A. OKEREKE, Mohammed ZAKARIYAU and Uchenna AFONNE.
Discussion of results: Dr. Reuben A. OKEREKE, Mohammed ZAKARIYAU and Uchenna AFONNE.
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Approval of the final text: Dr. Reuben A. OKEREKE, Mohammed ZAKARIYAU and Uchenna AFONNE.

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Journal of Engineering and Technology for Industrial Applications

ITEGAM-JETIA

Manaus, v.9 n.41, p. 15-31. May/June, 2023

DOI: https://doi.org/10.5935/jetia.v9i41.860

ISSN ONLINE: 2447-0228

RESEARCH ARTICLE OPEN ACCESS

DIRECTIONAL UWB ANTENNA FOR BREAST CANCER DETECTION

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ARTICLE INFO

Article History
Received: May 24th, 2023
Accepted: June 27th, 2023
Published: June 30th, 2023

Keywords:
Ultra-wideband (UWB),
Return loss,
Radiation Pattern,
Impedance Bandwidth,
Anechoic chamber.

ABSTRACT

A simple and compact ultra-wideband (UWB) antenna is presented. The proposed antenna is fabricated on a FR4 printed circuit board of a rectangular aperture. Two models of the proposed antenna are presented and the difference between the two models is the addition of an additional ground plane, added so as to obtain a uni-directional radiation pattern. The antenna consists of two ground planes, one serving as a reflector and a T-shaped excitation stub. The fundamental characteristics of the antenna such as impedance bandwidth, return loss and radiation pattern are obtained. The antenna is successfully designed, optimised and measured. The result shows that the proposed antenna achieves an impedance bandwidth of 4.2-10GHz with a return loss greater than 10dB, except in the band of 5.8-6.4GHz and 10-10.6GHz. Generally, the input impedance is not well matched at lower frequencies of 3.1-4GHz from both simulation and measured results. The measurement of the radiation pattern is performed in the anechoic chamber at frequencies of 3GHz, 4GHz, 5GHz and 6GHz. The designed antenna has a simple structure and compact size of 13 × 23 mm^2.

I. INTRODUCTION

Breast cancer is the most common non-skin related malignancy and the second leading cause of cancer death among women in the world [1]. The rate of mortality of women with cancer was very high about fifty years ago as there was no established method for early stage detection. Thousands of women die from the disease every year. Early detection is the best hope for reducing the serious toll of this disease until researchers uncovers a way to prevent breast cancer or cure the women with the disease.

Technological advancements has made the situation change, the first suggested technology for breast cancer detection was the X-ray imaging. It was proved to be the most effective tool for the early detection of breast cancer, though it has its own limitations. The major limitation is false positive results showing signs of cancer that are ruled out when further testing is carried out, this technology cannot actually detect which cancer would be harmful or less harmful, so therefore, all signs of cancer detected would be treated as malicious. This restraint is known as over-diagnosis [2]. Over the past decades, the investment in breast cancer research including early detection has increased significantly. Improved and new technologies are rapidly emerging and providing hope of early detection. The limitations of the use of X-ray mammography for breast cancer detection motivated the search for a better alternative and this alternative is the microwave imaging.

Ultra-wideband (UWB) is an attractive emerging technology for both wireless communications and microwave imaging. The Ultra-wide band technology is a technology completely based upon the radio waves for the sake of communication among small distances but at a very high rate or speed.

In 1980s, the Industrial Scientific Medicine (ISM) band for unlicensed wideband communication use was allocated by the Federal Communication Commission (FCC). A bandwidth of 7.5GHz, from 3.1-10.6GHz was allocated by the FCC to Ultra-wideband (UWB) applications [3]. Any signal that occupies at least 500MHz spectrum can be used in UWB systems; this is in accordance with the FCC's ruling which makes UWB not restricted to impulse radio any longer, it also applies to any technology that uses 500MHz spectrum and complies with all other requirements for UWB.

The major problem in UWB antenna design is how to obtain a large impedance bandwidth while maintaining a high radiation

performance. A bandwidth higher than 100% of the centre frequency is required in an Ultra-wideband system; therefore, an impedance matching is required throughout the bandwidth in the case of this project. The power loss due to reflections must be minimized since the transmission power is very low and this is the major reason why a miniaturised and compact antenna is needed.

Another problem to be addressed in this project is how to reduce the undesirable side effects of the image received and also ensure the design of the directional UWB antenna covers an immensely wide band, 3.1-10.6GHZ for indoor and handheld UWB applications, have an electrical small size and able to handle a moderate impedance match over the band for high proficiency.

My experiment was implemented using a microwave design software – CST microwave studio which was capable of transmitting or receiving UWB signals and can achieve a directional radiation pattern and a sufficient impedance bandwidth.

The rest of this paper is organized as follows: Section II provides a basic background to UWB Antennas together with published studies on how UWB Antennas are being developed and implemented. In section III, I present the methodology for the study as well as the simulation parameters. In section IV, I present and discuss the results obtained from the study, and finally, in section V, I conclude the study.

II. THEORETICAL REFERENCE

II.1 BACKGROUND STUDY AND RELATED WORKS

The present literature of directional UWB antenna is fast increasing in terms of development as a number of techniques are proposed for the improvement on microwave imaging. There are several antennas already designed for this purpose, like the compact coplanar waveguide-fed Ultra-wideband monopole-like slot antenna, low-profile directional UWB antenna for see-through-wall imaging applications, a miniaturized directional UWB antenna and many more.

[4] proposed a compact coplanar waveguide-fed UWB monopole-like slot antenna which comprises of a monopole-like slot and a CPW fork shaped feeding structure which is etched onto a FR4 Printed Circuit Board with a dimension of 26mm×29mm×18mm as shown in Figure 1.

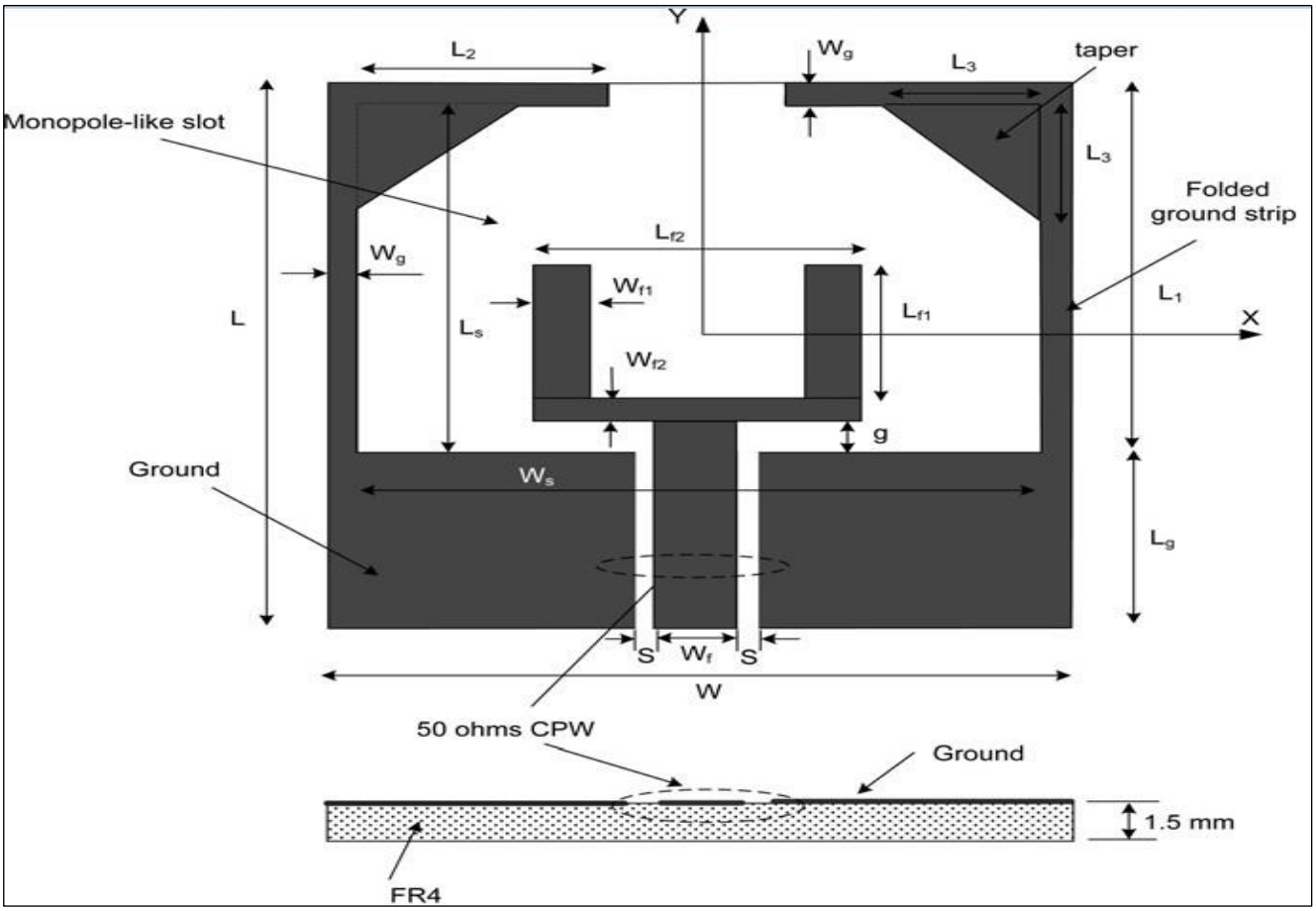


Figure 1: Geometry and Configuration of the Proposed Monopole-like Slot Antenna.
Source: [4].

Both the slot and the fork-shaped feeding structure were printed on the same side of a piece of FR4 substrate with a thickness of 1.5mm, a loss tangent of tan $\delta = 0.02$ and a relative dielectric constant of 4.4 positioned symmetrically with respect to the centreline of the slot. The use of a fork-shaped feeding structure is to obtain more efficient coupling between the feeding structure and the slot, which is significant for the achievement of an improved bandwidth of the slot antenna [5]. The radiation patterns of the antenna were measured at lower and higher frequencies. A good omni-directional radiation pattern in the H-plane was achieved at lower frequencies while a bi-directional pattern was obtained at higher frequencies due to the comparison of the spacing of the fork shaped stubs to the wavelength. The slot follows the shape of a corresponding planar monopole antenna. The ground plane of the monopole-like slot antenna is not closed compared to

the traditional wide slot antenna. The slot is enclosed by two ground layers with small breadth which makes the antenna small.

The proposed antenna was simulated using the CST Microwave studio based on Finite Integration Technique (FIT). The antenna was measured using HP8510 vector analyser and Orbit MiDAS 4.0 far-field antenna measurement system in a full anechoic chamber. The simulation and experiment showed that the proposed antenna achieves good impedance matching, stable radiation patterns, and consistent gain. A good accordance was established between the simulated and measured return loss, a bandwidth of 2.7-12.4GHz and a return loss of -10dB was achieved likewise a good accordance in terms of gain ($\theta = 0°$, $\phi = 0°$).

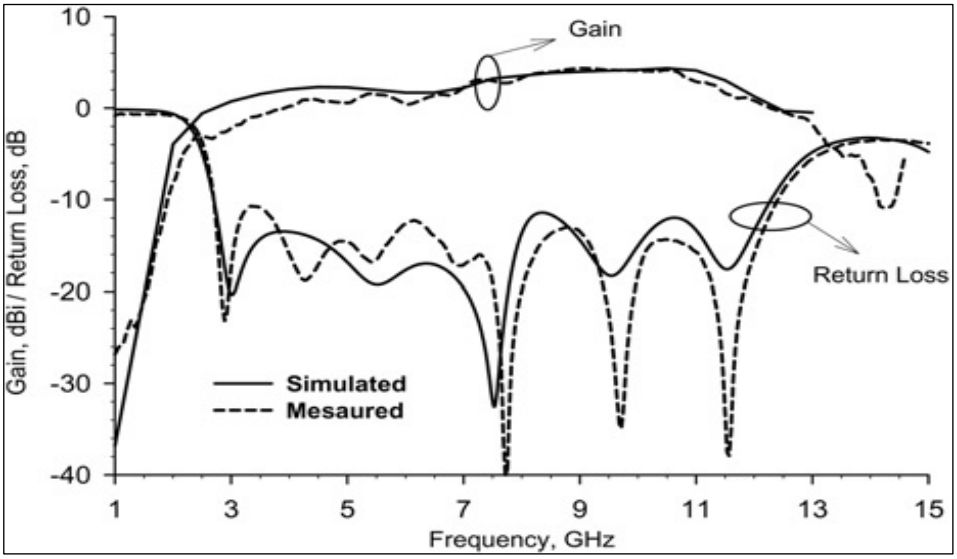
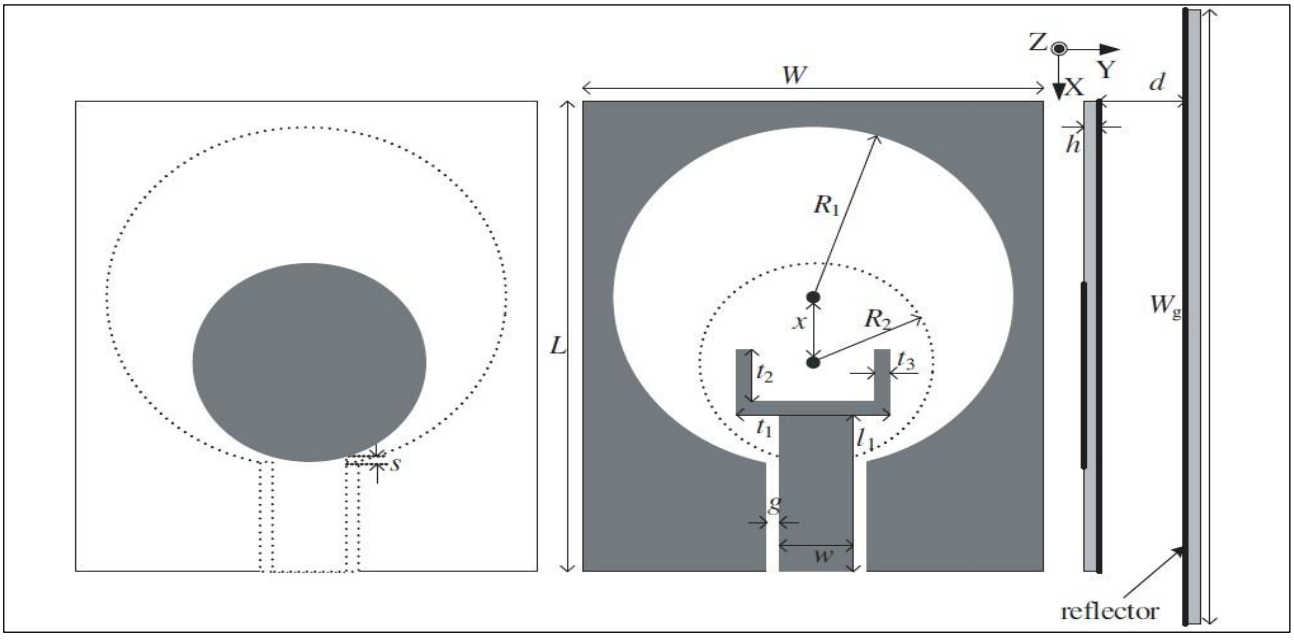


Figure 2: Simulated and Measured Return Loss as well as Gain at ($\theta = 0°$, $\phi = 0°$).
Source: [4].

In a parametric study carried out by [4-6], the impedance bandwidth of -10dB return loss was examined. It was found out that the width of the slot, W_S determines the operating band of the antenna and that the lower frequency edge of the operating bandwidth is the most easily affected to the length of the horizontal folded ground trips, L_2, whereas the higher frequency edge depends on the dimensions of the fork-shaped feeding stubs, L_{f1} and L_{f2}. The remaining parameters do not show significant effect on the impedance bandwidth but can be made effective to improve the impedance matching.

The authors in [6] presented a compact-size planar antenna with UWB bandwidth and directional pattern as shown in Figure 3. Three types of directional UWB Antennas were analysed. The antenna was fabricated on a Printed Circuit Board (PCB). In their design, there is a circular path on one side of the PCB and a slot-embedded ground plane with a fork-shaped feeding stub in the slot on the other side of the PCB. A reflector which was placed below the antenna was used to achieve a directional radiation pattern. Their aim was to examine novel designs of low cost and small antennas suitable for UWB through the wall imaging radar.



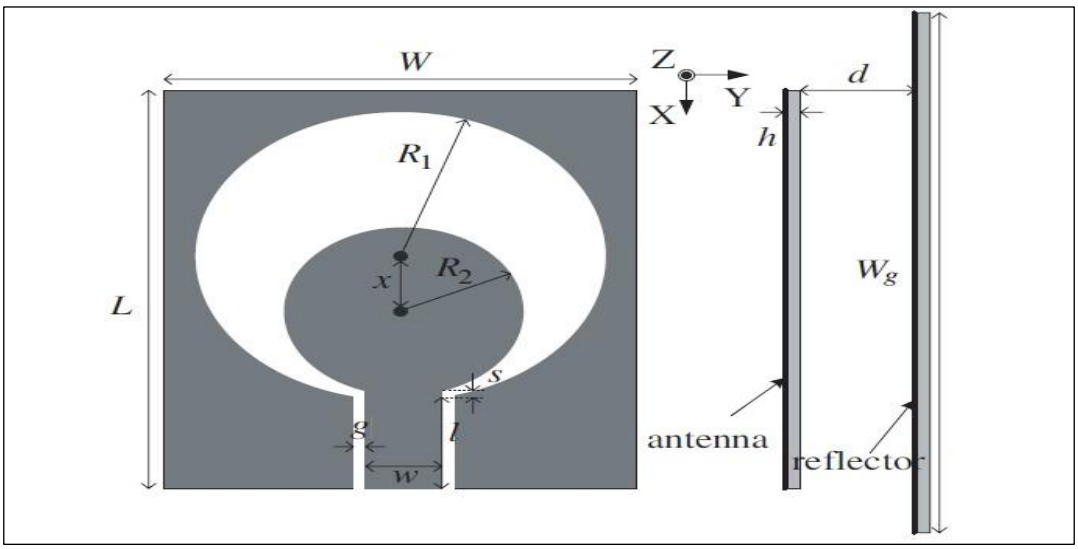
(a) Top layer (b) Bottom layer (c) Side view

Figure 3: Configuration of the Low Profile Directional UWB Antenna.
Source: [6].

Major challenges of the UWB antenna design was further analysed which are impedance matching, directional patterns, low distortion of pulses, compact size, low cost and high front to back ratio for the rejection of false alarms from the movement of the user holding the device. The main problem of the directional UWB antenna with a reflector is the thickness of the antenna, as the reflector usually needs to be located at a distance of a quarter wavelengths from the antenna, though, this would unfortunately affect the radiation efficiency and impedance matching of the antenna especially at lower frequencies band due to the small electrical distance to the reflector [7].

A new low profile antenna configuration was proposed so as to reduce the antenna's thickness, two reference antennas with directional patterns are used and comparison was carried out on the results [6], [7].There are 2 major ways of increasing the bandwidth of a slot antenna, the first one is the manipulation of the field distribution in the slot with a circular patch and the second way is the use of a circular slot and a fork-like stub for excitation [8].

The first way is illustrated in Figure 4 which was used as the Reference Antenna 1 and the second way was used as the Reference Antenna 2, this is shown in Figure 6.



(a) Front View (b) Side View

Figure 4: Configuration of UWB Reference Antenna with Reflector (Reference Antenna 1).
Source: [6].

The reference antenna 1 above makes use of a circular patch to manipulate the field distribution in the slot. The radiation pattern of this antenna is omni-directional in H-plane and bi-directional in E-plane. The reflector is added so as to achieve the directional patterns of the antenna. In this paper, the reflection coefficient was simulated in terms of the distance *d* between the antenna and the reflector and was plotted in a graph against the frequency. The result showed that the impedance matching of the antenna has been greatly affected by the reflector mainly at lowest frequencies compared to the original antenna without a reflector.

The outcome of the reflection coefficients at various distances between the reflector and the antenna is shown in Figure 5. It can be deduced from the Figure that at the lowest frequency for S_{11}< -10dB shifts from 6.7GHz to 5.8GHz when the distance increases from 12mm to 16mm, therefore, bringing about a huge antenna.

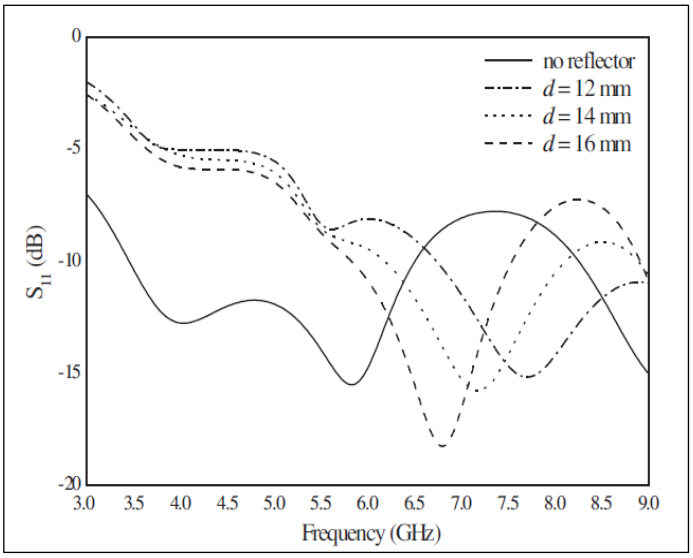
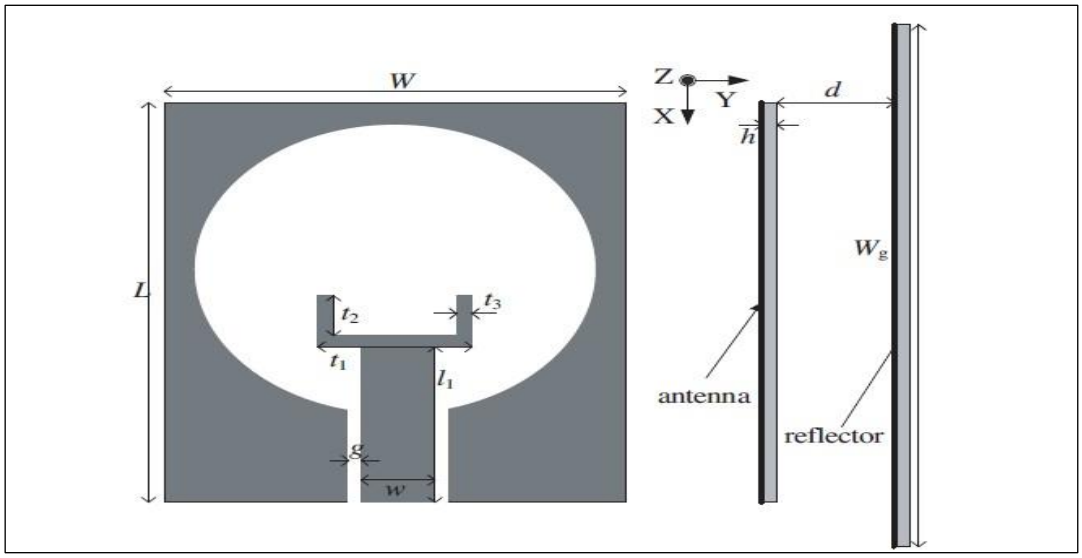


Figure 5: Simulated Return Losses in terms of *d* compared to the Case of no Reflector.
Source: [6].

The substrate used is the Duroid 5880 which has a dielectric constant of 2.2 and a thickness of 1.575mm. The frequency band of the designed UWB Antenna is from 4.5-8.5GHz. This type of antenna described is a Coplanar Waveguide (CPW) fed UWB slot antenna. The maximum value of *S* shouldn't be larger than the substrate thickness *h* [9]. Authors in [9] states that the slot aperture relatively depends on the lowest frequency.



(a) Front View (b) Side View

Figure 6: Configuration of Reference Directional UWB Antenna with Fork-shaped Stub (Reference antenna 2).
Source: [6].

The above referenced antenna 2 was also examined by authors in [6], the antenna is a UWB Slot Antenna excited by fork-shaped tuning stub and it was later compared to the reference antenna 1 which is the Coplanar Waveguide fed UWB Slot Antenna. Here the circular radiator was removed and replaced with a fork-shaped tuning stub. The feed line is described by parameter l_1 while the other dimensions are kept constant as the CPW Fed UWB Slot Antenna. The main reason for replacing the circular patch with a fork-shaped tuning stub is to obtain a large impedance matching. The same size of reflector added to the CPW fed UWB antenna was also added to this UWB Slot antenna so as to increase the directivity.

The reflection coefficient was also simulated in terms of the distance *d* between the antenna and the reflector and it was plotted on a graph against the frequency. The result gave a good performance of impedance matching at low frequency band although, the impedance matching was very poor at a high frequency band and it can be seen from the reflection coefficient graph in Figure 7 that the bandwidth of the antenna becomes narrower as the distance decreases [6-10].

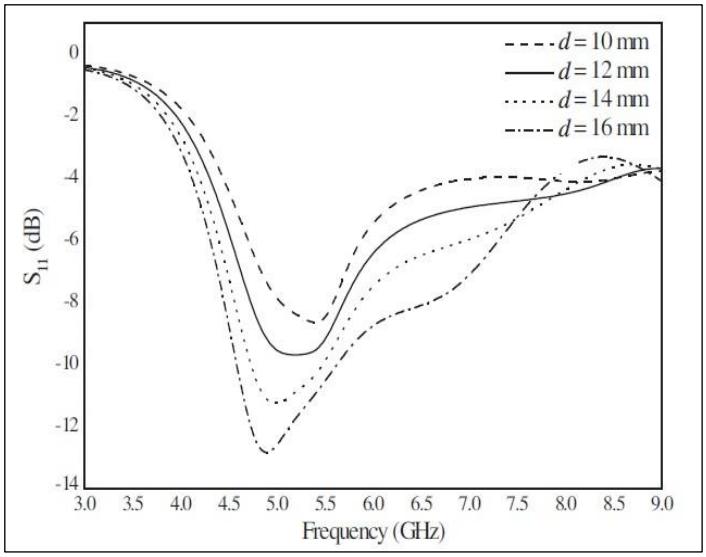


Figure 7: Simulated Return Losses in Terms of Distance *d*.
Source: [6].

After proper examination, it can be deduced that both antennas discussed have their shortcomings. The shortcoming of both reference antenna 1 and reference antenna 2 is that reference antenna 1 has a poor impedance matching at lower frequencies band while reference antenna 2 has a poor impedance matching at high frequencies band when the distance between the antenna and

the reflector is very small. A low profile antenna as shown in Figure 3 was designed by to eliminate the shortcomings of both reference antennas discussed earlier. The antenna was designed so as to cover both low and high frequencies band. This antenna was designed and compared to both reference antennas 1 and 2. When compared with Coplanar Waveguide fed UWB slot antenna, the slot ground and feed line are moved from top layer to bottom layer and the feed line has been changed to fork-shaped tuning stub. This antenna designed by [6] can also be seen as a the composition of UWB slot antenna excited by fork-shaped tuning stub which is the reference antenna 2 on bottom layer and a circular patch on top layer respectively. It was ensured that the reflector's dimension is the same for the three types of UWB antenna and the dimension of the radiator is the same as the coplanar waveguide fed UWB slot antenna.

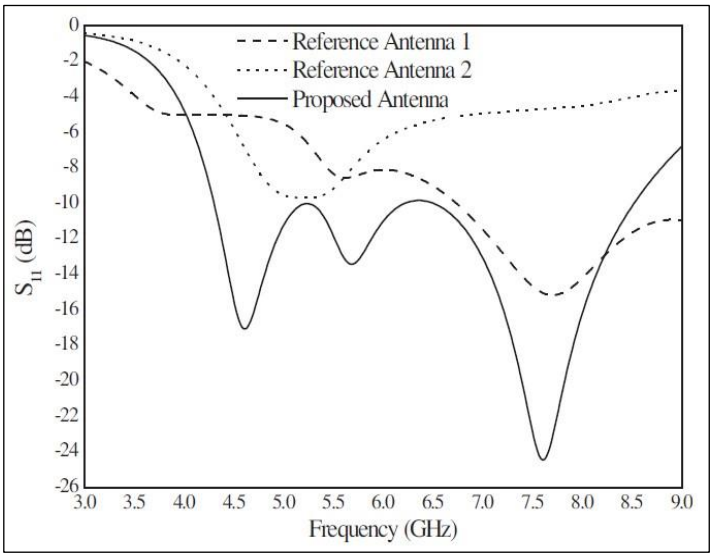


Figure 8: Simulated Reflection Coefficients among the three Types of Antenna.
Source: [6].

The simulated reflection coefficient among the three types of antennas as seen in Figure 8 shows that the proposed directional antenna has a better impedance matching at low frequency band when compared with the CPW fed UWB slot antenna (reference antenna 1) because of the separation of the slot ground plane on the bottom layer from the circular patch on the top layer and also seen to be improved at a high frequency band because of the circular patch added when compared with the Fork-shaped excited UWB slot antenna (reference antenna 2). In terms of the antenna gain, the proposed directional antenna has the same variation trend with the Fork-shaped excited UWB slot antenna over the whole frequency band. It has a higher gain than the fork-shaped excited UWB slot antenna because of the circular patch radiation. When compared with the CPW fed UWB slot antenna, the gain greatly improved from about 4GHz to 6GHz due to a good impedance matching.

The major challenge of the design of a compact coplanar waveguide-fed ultra-wideband monopole-like slot antenna earlier reviewed by [11] was the emission of energy as a result of back radiation which made it not completely unidirectional and this is the more reason why the author wouldn't be agreeing with this design and the author thought there should be possible ways of reducing the back radiation and a way to further improve the impedance matching of the antenna which made the author to further his research on how to achieve a unidirectional radiation over an Ultra-wideband frequency range and a way to improve the impedance bandwidth and reduce the back radiation.

Most of the UWB antennas presented so far exhibit radiation patterns similar to the acceptable monopole/dipole antennas. It is suspected that the antenna efficiencies will be degraded owing to omni-directional/bi-directional radiation when they are attached to the walls, metallic objects or the human body. To avoid the degradation on the antenna efficiencies, a directional UWB should be utilized which brought about the high desire for the development of a UWB antenna having directional radiation characteristics [4] - [11].

III. MATERIALS AND METHODS

The research approach adopted was based on literatures with the highest level of methods and developments. A descriptive and quantitative approach is used. The major challenge in most antenna design is the emission of energy as a result of back radiation which makes the system not completely directional. Ways to avoid this emission of energy were discussed in the background study section of this paper which is the use of a reflector.

III.1 ANTENNA DESIGN

The prototype antenna was developed using a Computer Aided Design software- CST Microwave studio. A general purpose 3D Electromagnetic simulator known as the transient solver (Time domain) is used for the simulation. This solver gives results such as the S-parameters, modes of the port, far-field measurements of the designed antenna and many more. The parameter sweep option of the time domain is used to obtain multiple results which make the parametric study easier.

There are different types of UWB antennas ready for use in literature for different UWB applications. The choice of a UWB antenna depends on the particular application for which it will be used. For instance, omni-directional UWB antennas are used in mobile communications whereas directional UWB antennas are the most preferred antennas in UWB radar applications. The focus of this project is to design an antenna capable of operating over the entire UWB frequency range allocated by the FCC in 2002 with good directional radiation pattern. A small, simple and compact UWB antenna was simulated and fabricated.

III.2 ANTENNA STRUCTURE

The proposed antenna was implemented with a low cost FR4 substrate with a dielectric constant $\varepsilon_r = 4.3$ and a thickness h =1.6mm. Two models were simulated; the components of the first model are ground plane, substrate, inner patch and an inner feeder. The only difference between the first and the second model is the addition of another ground plane to serve as a reflector so as to increase the directivity of the antenna. The antenna is made up of a rectangular aperture carved out from the ground plane of a printed circuit board (PCB) and a T-shaped stub for excitation. The antenna and the feeding structure are implemented on the same plane which makes the fabrication of the antenna cost effective and very easy. A micro-strip transmission line designed with characteristic impedance of 50Ω and a sub miniature connector was used for the termination during the measurement process. A compact aperture area of 13x23mm^2 is achieved. A quarter-wavelength is greater than the dimensions for the lowest UWB frequency (3.1GHz).

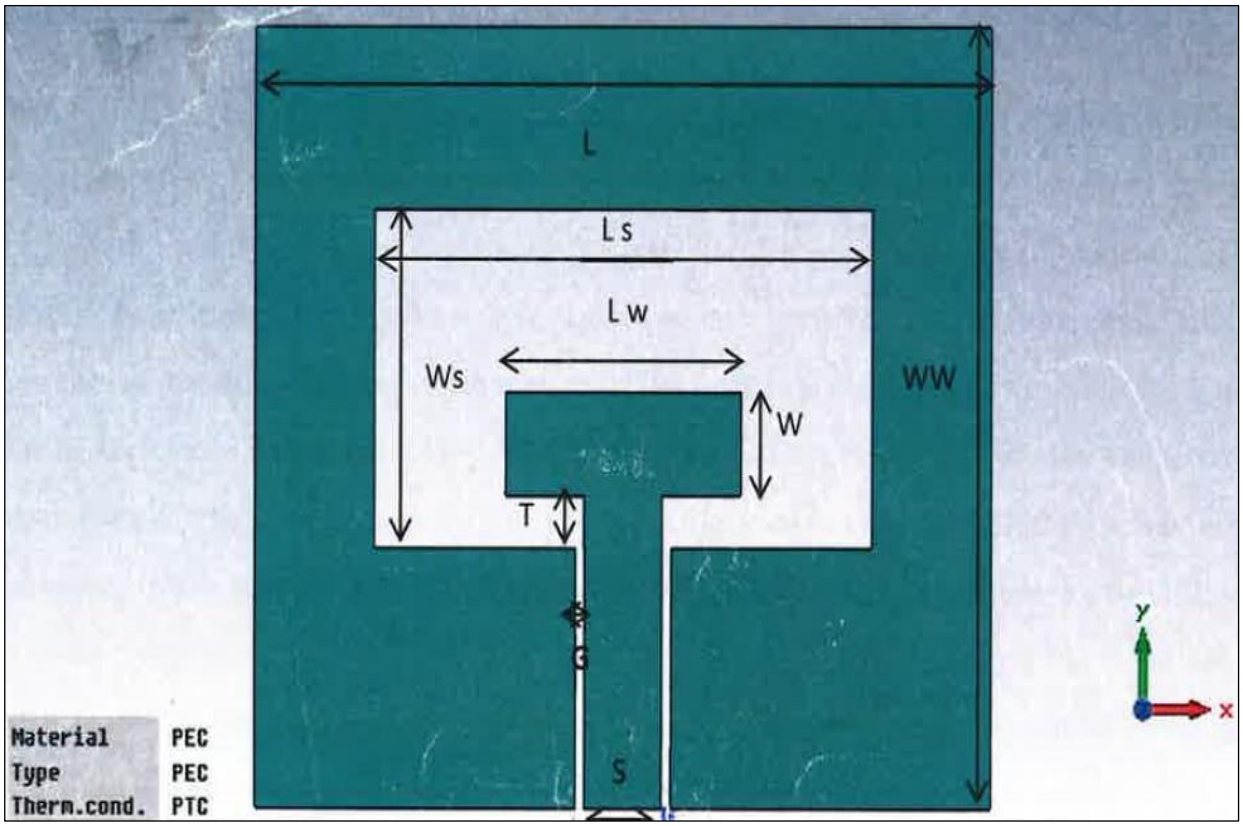


Figure 9: Geometry and Configuration of the Proposed Antenna.
Source: [10].

The geometry and configuration of the proposed antenna is shown in Figure 9. The length Lw, the width W, and the extrusion depth T are the only three parameters of the T-shaped stub [10]. The design parameters are Ws=13mm, Ls=23mm, T=2mm, W=4mm, L=34mm, WW=30mm, S=3.6mm, G=0.4mm, Lw=10.8mm, S1= 12, t_patch= 0 and t_sub=1.6mm. The dimension of the components was calculated. Table 1 shows the dimensions used for the components.

Table 1: Table showing the Dimensions used for the Components.

Components	**X_{min}**	**X_{max}**	**Y_{min}**	**Y_{max}**	**Z_{min}**	**Z_{max}**
Inner patch	-LW/2	LW/2	T	T+W	0	t_patch
Inner feeder	-S/2+G	S/2-G	-S1	T	0	t_patch
Substrate	-L/2	L/2	-S1	WW-S1	-t_sub	0
Ground	Xp(1)	Xp(2)	Yp(1)	Yp(2)	0	0

Source: Author, (2023).

A well designed model was obtained after using the above dimensions for the individual component. After that, a waveguide port was added to it before simulation commenced. The dimension of the port is shown in Table 2.

Table 2: Table showing the Dimensions of the Waveguide Port,

Port	X_{min}= -S/2-G-t_sub*3	X_{max} = S/2+G+t_sub*3	Z_{min}= -1.6-5	Z_{max}= 7

Source: Author, (2023).

Figure 10 shows the picture of the first model designed using CST microwave studio, ready for simulation.

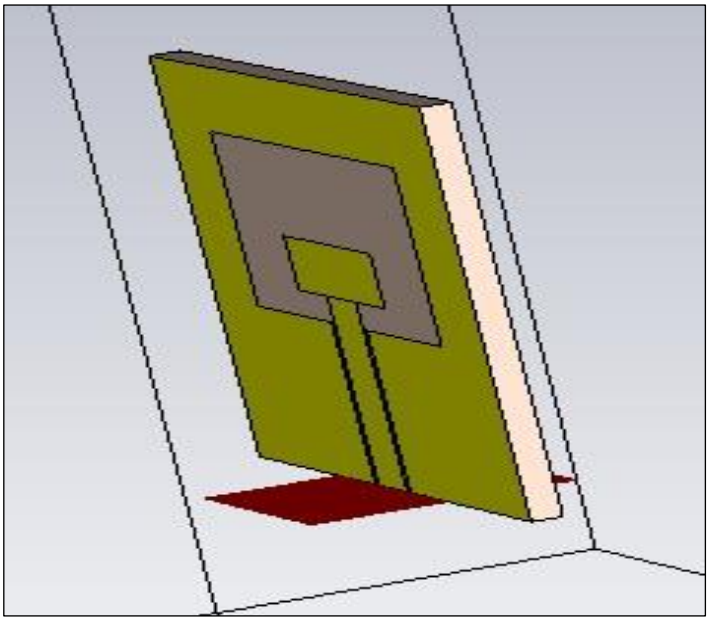


Figure 10: Designed Model of the Proposed Antenna with one Ground Plane.
Source: Author, (2023).

III.3 PARAMETRIC STUDY

The commercial simulation tool CST Microwave Studio is used in this research to perform the design and the optimisation process. The effect of parameters Lw, W, T, Ws and Ls on the input impedance is carried out using the parameter sweep option of the time domain solver. Figures 11 – 15 shows the effects of variation of the five parameters respectively.

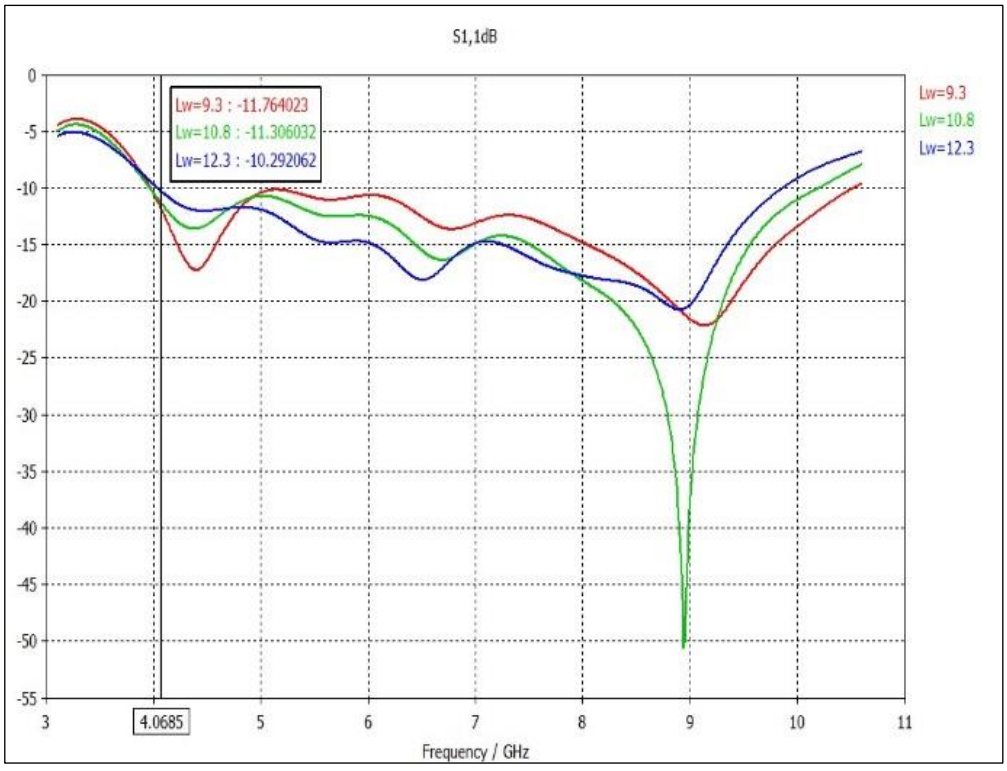


Figure 11: Effects of the Variation of Length Lw of the Antenna with one Ground Plane.
Source: Author, (2023).

The return loss of the proposed antenna with one ground plane when the length Lw was varied with comparison to the initial value of 10.8mm is shown in Figure 11. It can be seen from the S11 graph that the return loss at low frequencies 3.1-4.06GHz is higher than -10dB which implies a poor performance at that frequencies band but there is a decrease in the return loss at frequencies 4.06-5GHz, a greater decrease is observed at these frequencies band when the length is decreased to 9.3mm, but at higher frequencies

of 8.6-9GHz, the return loss decreases even more at the initial length of 10.8mm. Increase in return loss simply means that reflected power also increases while a decrease of the return loss means there is a better improvement of the system because of the low power reflected back due to impedance mismatch.

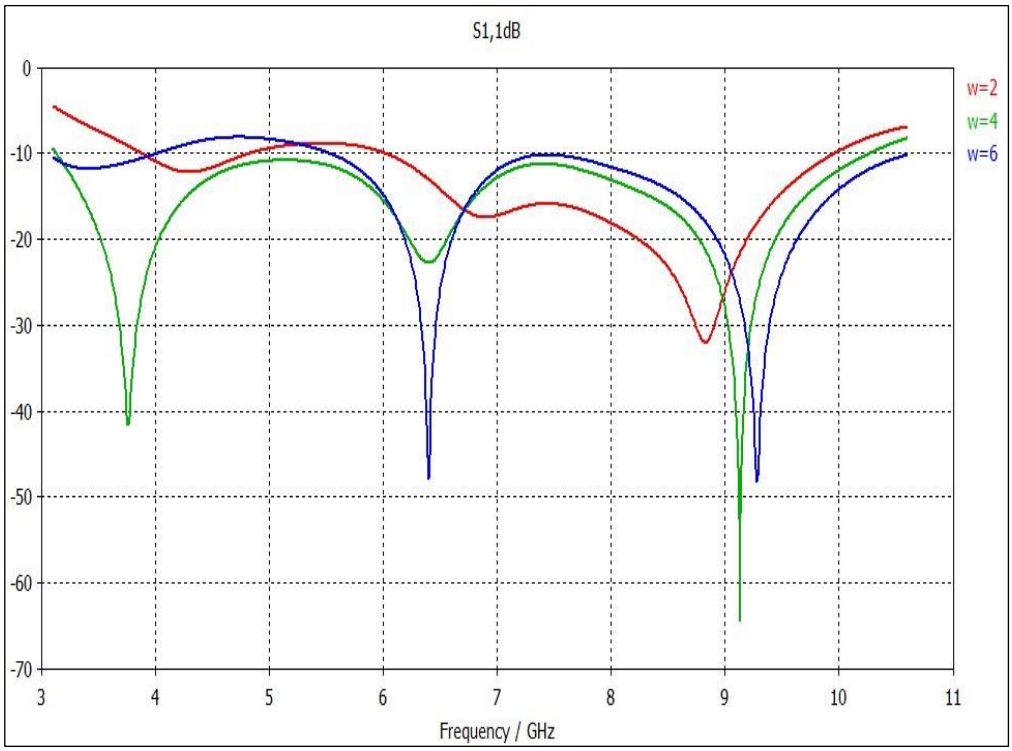


Figure 12: Effects of the Variation of Width W of the Antenna with one Ground Plane.
Source: Author, (2023).

The dimensions of other parameters still remain the same as Lw=10.8mm, L=34mm, Ls=23mm, WW=30mm, S=3.6mm, G=0.4mm, W=4, Ws=13mm and T=2mm. Figure 12 represents the return loss of the designed antenna with one ground plane when the width of the T-shaped was varied. The return loss increases at frequencies band of 3.1-6.4GHz and 9.2-10.6GHz when the width W was reduced by 2 compared to the initial width W=4, but it decreases between 8-9.2GHz. This increase means that the antenna transmits less power.

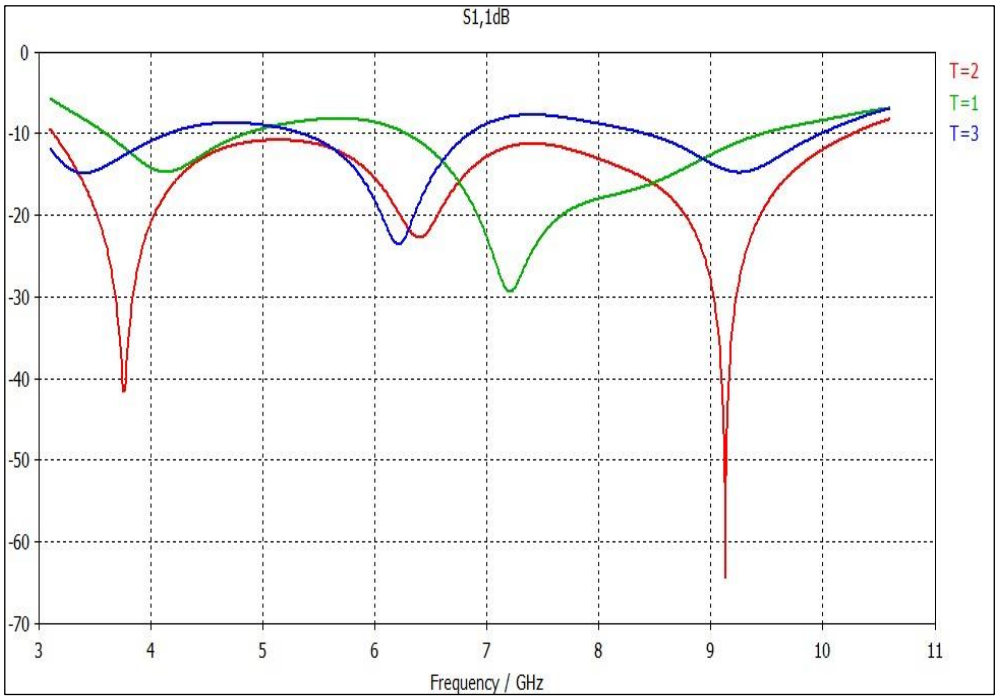


Figure 13: Effects of the variation of extrusion depth T of the antenna with one ground plane.
Source: Author, (2023).

Figure 13 shows the variation of the return loss when the extrusion depth T of the T-shaped of the proposed antenna with one ground plane was varied. This variation of T aggravated a big increase in the return loss between frequencies of 3.2GHz to about 6.5GHz and 7.3GHz to 10.6GHz but it decreases between 6.5GHz to 7.3GHz when T is reduced to 1mm. When T decreases, less power is being transmitted by the designed antenna.

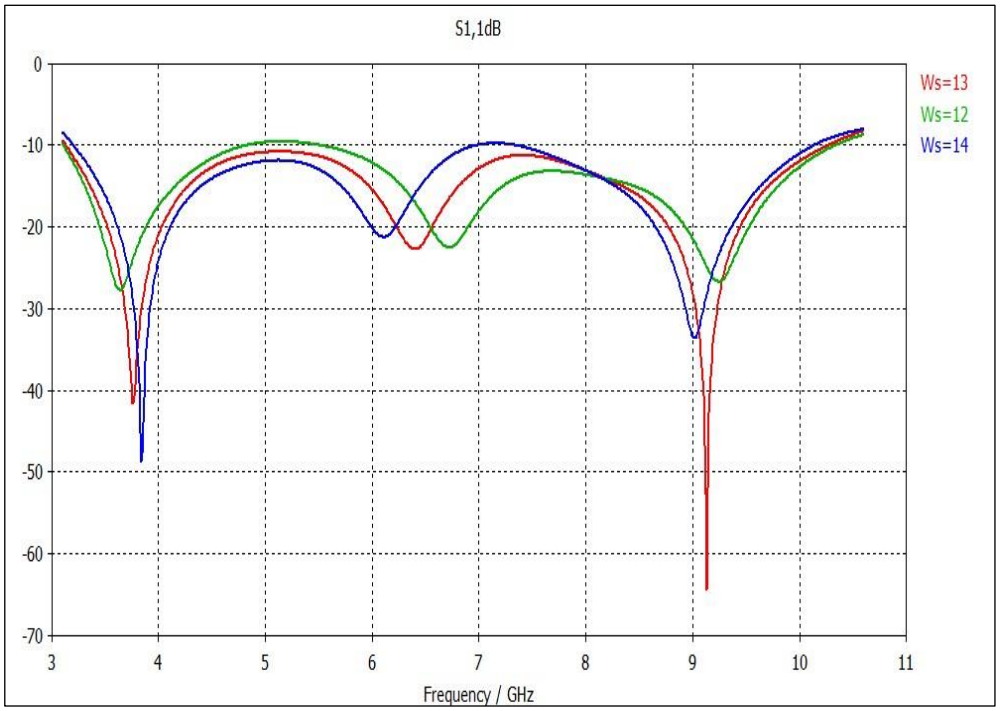


Figure 14: Effects of Variation of Width Ws of the Antenna with one Ground Plane.
Source: Author, (2023).

The dimension of other parameters were kept constant during this optimisation process. As seen in Figure 14, the return loss of the designed antenna when the length Ws was varied with comparison with the initial value of Ws=13mm seems better compared to other parameters varied earlier as S11≤ -10dB is maintained almost throughout the operating frequencies band. As the length Ws was reduced to 12mm, the return loss increases at 3.6GHz to 6.5GHz and at 8.2GHz to 9.2GHz but it decreases at starting frequency of 3.1GHz to 3.5GHz, middle frequencies of 6.5GHz to 8GHz and higher frequencies 9.3GHz to 10.6GHz. The decrease in the return loss means that the antenna is radiating a high percentage of its power between those frequencies band while the increase in the return loss brings about a good performance of the system as the antenna radiates less power at those frequencies band.

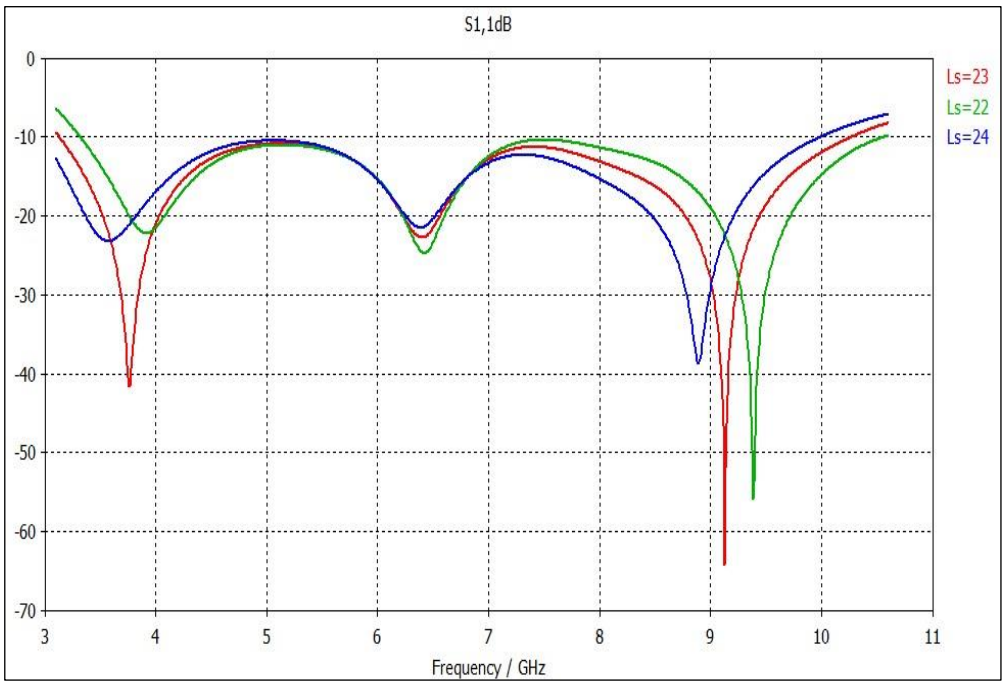


Figure 15: Effects of the Variation of Length Ls of the Antenna with one Ground.
Source: Author, (2023).

Figure 15 illustrates the effects of the variation of the aperture length of the antenna on the return loss of the system. The reduction of Ls to 22mm influences the middle frequencies band. At these frequencies band, the antenna radiates more power than the initial parameter of Ls=23mm. Increase of Ls to 24mm provokes an increase in the return loss at 3.6GHz to 6.2GHz.

III.4 RADIATION CHARACTERISTICS

An omni-directional radiation pattern is obtained from the simulation of the designed model with one ground (first model) as it radiates forward and backward when implemented at frequencies of 5GHz, 8GHz and 10GHz. Figures 16 – 18 shows the 3D plots of the radiation pattern of the first model of the proposed antenna at 5GHz, 8GHz and 10GHz respectively. It can be seen that there's more gain in the x-direction than the other directions and for all the three different frequencies, energy is more radiated at x-direction than in the y and z directions. Two notches can be seen along the Y axis where there is no radiation at all. At frequency of 5GHz, the realised gain is 3.31dB which can be seen in the x-plane in Figure 16, while a gain of 0.414dB and -22.9dB was achieved at y-plane and z-plane respectively.

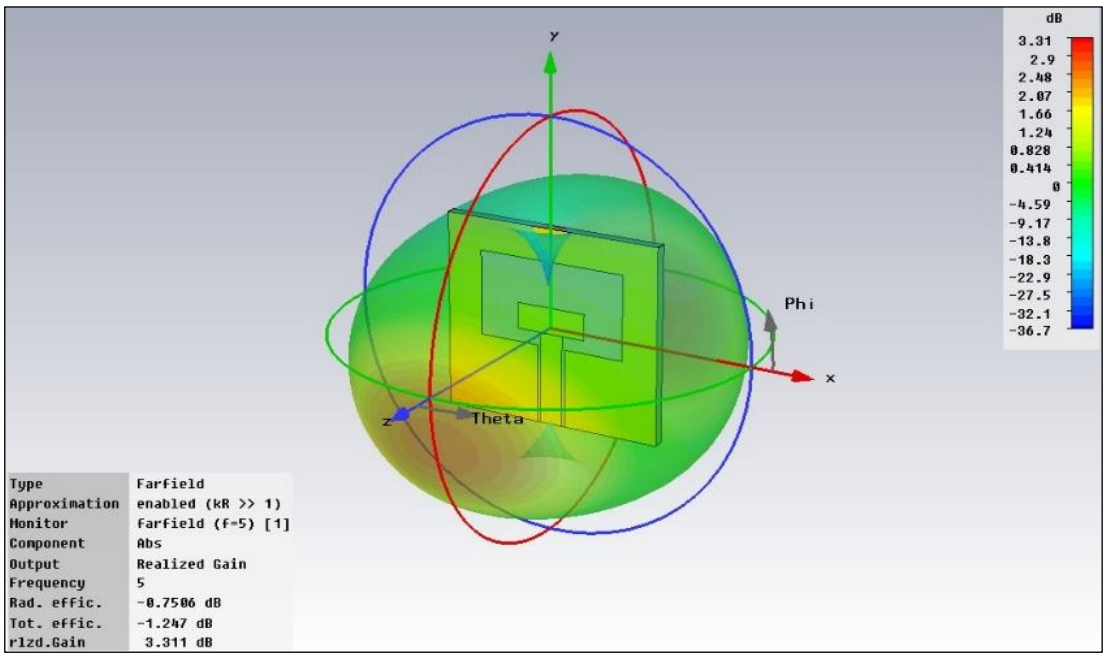


Figure 16: Radiation Pattern at 5GHz in 3D Plot.
Source: Author, (2023).

At the two other frequencies, that is, 8GHz and 10GHz, it can be seen that a realized gain of 3.362dB and 3.302dB was achieved as shown in Figures 17 and 18.

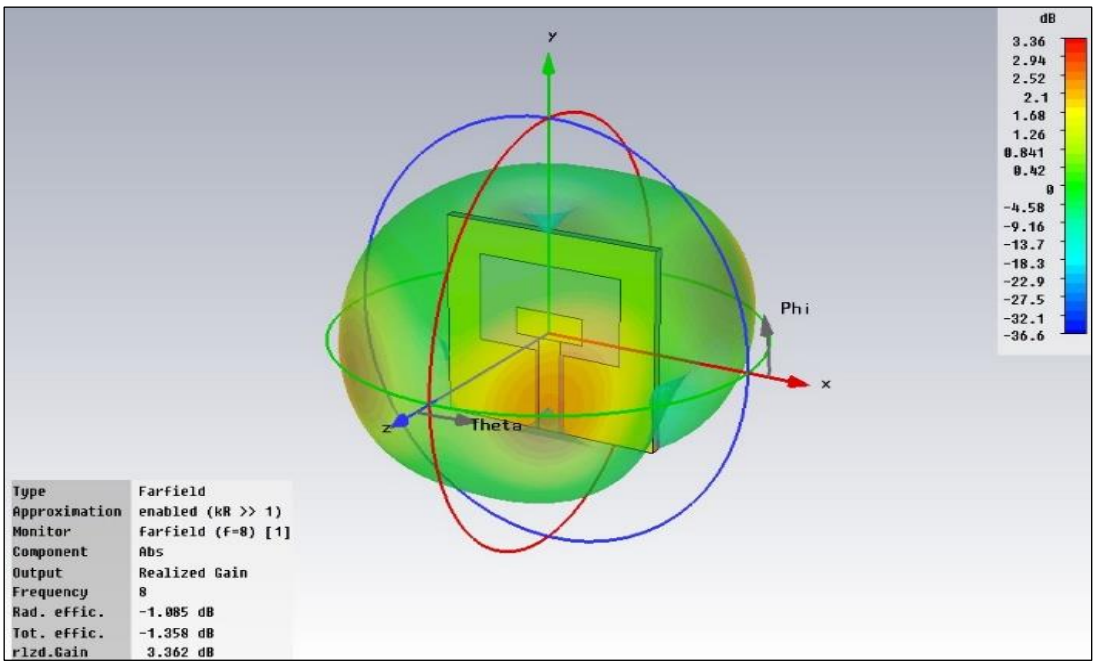


Figure 17: Radiation Pattern at 8GHz in 3D Plot.
Source: Author, (2023).

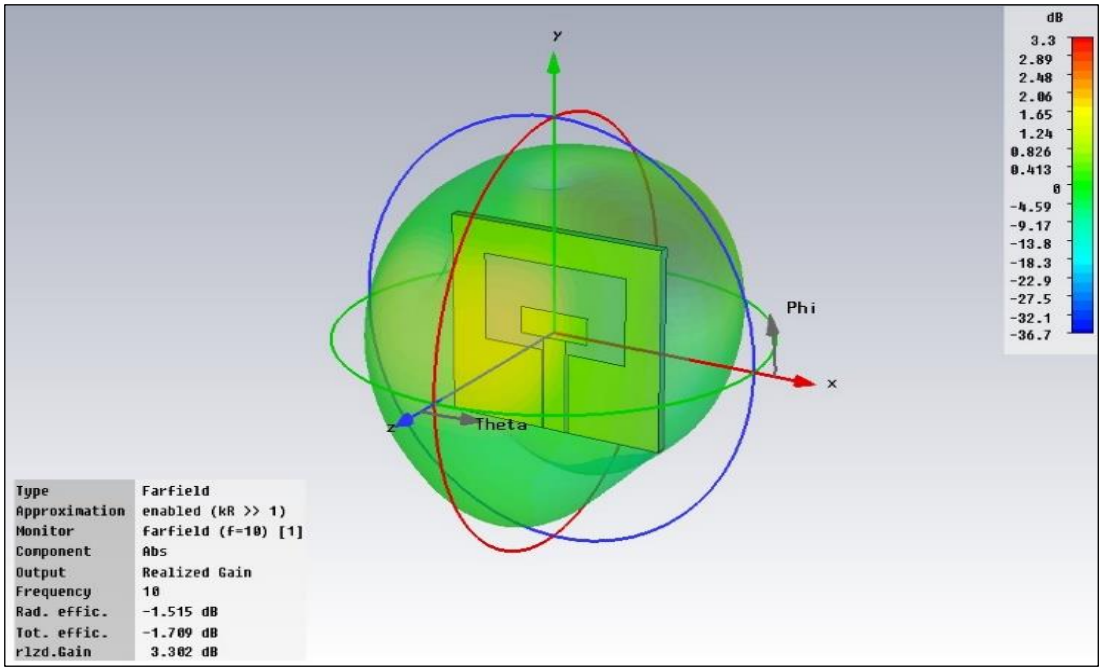


Figure 18: Radiation Pattern at 10GHz in 3D Plot.
Source: Author, (2023).

The first model was designed and simulated using the CST microwave studio; a parametric study was carried out so as to discover the effect of the parameters on the input impedance of the system likewise the radiation pattern. It can be seen that the antenna exhibits an omni-directional radiation pattern. A further experiment to achieve the aim of this research was further carried out by the author, which is to obtain a directional radiation pattern.

III.5 INVESTIGATIONS ON INPUT IMPEDANCE AND RADIATION PATTERN USING THE SECOND MODEL

Investigation was done using the second model which comprise of substrate, an inner feeder, inner patch, ground plane and an additional ground plane was added to it which serves as a reflector. The dimensions of the inner feeder, inner patch, substrate and the ground plane were kept constant as in the previous model while the dimension of the reflector was added. Table 3 shows the dimensions of the reflector where LF= 60mm, Lf_offset= 25mm and Wf= 60mm.

Table 3: Table showing the Dimensions of the Reflector.

Component	Umax	Vmin	Vmax	Wmin	Wmax
Reflector	Wf/2	-LF_offset	-LF_offset+LF	-df	df

Source: Author, (2023).

The starting point for this investigation after reviewing different literatures was to calculate the distance at which the reflector would be positioned to the substrate. This reflector was placed at a distance of a quarter-wavelength to the substrate. The value of the quarter wavelength was calculated using the formula:

$$\lambda = c/f \quad (1)$$

Where $c = 3 \times 10^8$m/s and f is the centre of the frequency band. Therefore,

$$f = \frac{3.1 + 10.6}{2} = 6.85GHz$$

$$\lambda = 3 \times 10^8 \div 6.85 \times 10^9 = 0.0437m$$

$$\text{Quarter wavelength} = \frac{\lambda}{4} = \frac{0.0437}{4} = 0.0109\text{m}$$

$$0.0109\text{m} = 10.9\text{mm}$$

This value is an estimated value of the quarter-wavelength at which the reflector was placed to the substrate as the effect of the substrate ($\varepsilon_r = 4.3$) is ignored. Figure 19 shows the picture of the model with the reflector ready for simulation.

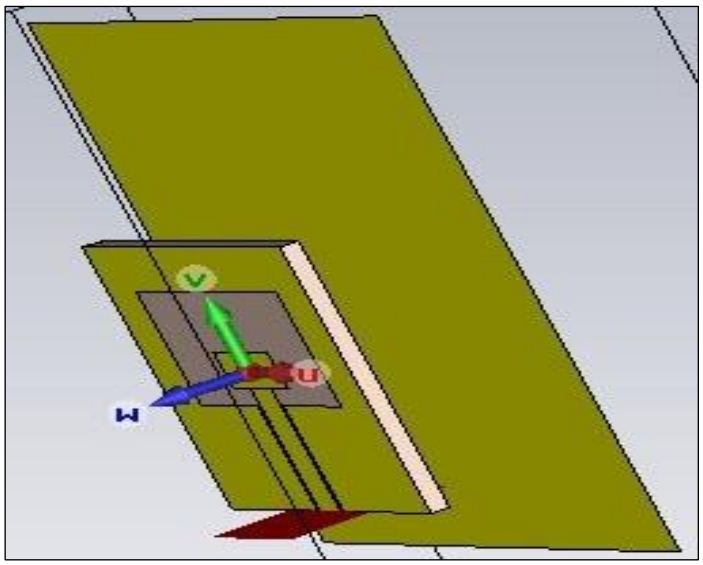


Figure 19: Picture of the Designed Model of the Proposed Antenna with a Reflector.
Source: Author, (2023).

The designed proposed antenna with reflector is now ready for the optimisation process. The effect of parameters Lw and Ws on the input impedance were carried out using the parameter sweep option of the time domain solver just as it was done in the case of the first model. Figures 20 – 21 shows the effects of the variation of the parameters.

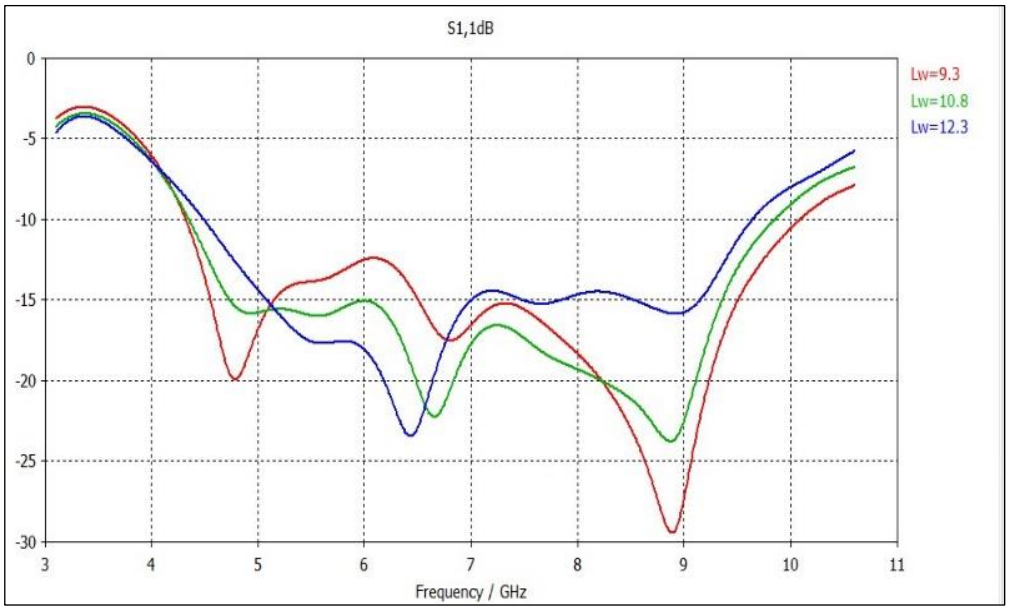


Figure 20: Effects of the Variation of Length Lw on the Model with Reflector.
Source: Author, (2023).

The dimension of other parameters are L=34mm, Ws=13mm, W=4mm, Ls=23mm, WW=30mm, S=3.6mm, G=0.4mm and T=2mm. As illustrated in Figure 20, it can be seen that the return loss at frequencies 5GHz to 6.5GHz decreases when the length Lw was increased to 12.3mm when compared with the initial length of 10.8mm and it increases at frequencies 6.5GHz to 10.6GHz. This increase of the return loss for the frequencies band 6.5GHz to 10.6GHz means that the reflected power increases while the decrease of the return loss at frequencies band 5GHz to 6.5GHz implies that there is a good improvement of the system because of the low power reflected back due to impedance mismatch. The antenna transmits less power between the frequencies band 6.5GHz to 10.6GHz. However, when Lw is reduced to 9.3mm, the return loss increases between 5.1GHz to 8.2GHz but decreases at lower frequencies band 4.3GHz to 5GHz and higher frequencies band 8.3GHz to 10.6GHz. Less power is reflected back at these frequencies, which bring about a good performance of the system.

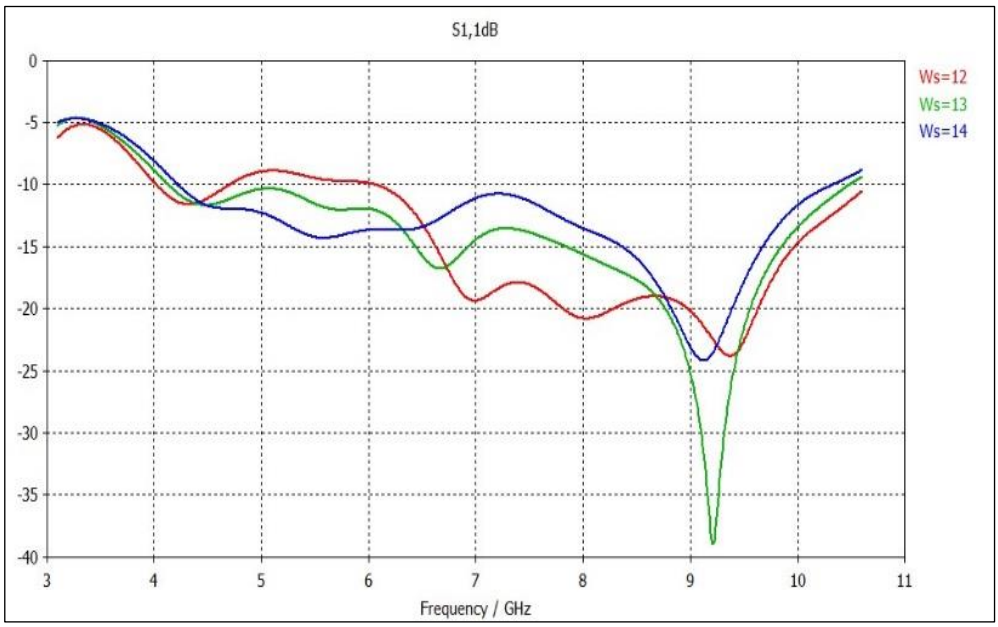


Figure 21: Effects of the Variation of Width Ws on the Model with the Reflector.
Source: Author, (2023).

When the width Ws was varied with comparison with the initial value of 13mm, it can be seen from the return loss plot in Figure 21 that there is an increase in the return loss at frequencies of 4.5GHz to 6.6GHz when the width was reduced to 12mm but it decreases at 6.7GHz to 8.7GHz. The decrease of the return loss means that the proposed antenna radiates a larger percentage of its

power between frequencies band 6.7GHz to 8.7GHz while less power is being transmitted but in the case of when the value of Ws was increased to 14mm, the return loss increases between the frequencies band 6.5GHz to 8.8GHz and 9.2GHz to 10.6GHz. The system is said to be improved when the return loss increases and the antenna radiates less power.

An overall better performance of the system is obtained as seen from the results obtained from the investigations on the second model (proposed antenna with a reflector) as carried out in the experiment. The reflection coefficients (S11) as a function of frequency for the proposed antenna with a reflector are illustrated in Figures 20 and 21. The antenna demonstrates good impedance bandwidth ($S_{11} \leq$ -10dB) from about 4GHz to 10.6GHz except in the case of when the width *W* of the T-shaped stub was varied. The radiation patterns of the two models were analysed and compared. A good directivity was achieved by the proposed antenna with a reflector compared to the one without a reflector.

IV. RESULTS AND DISCUSSIONS

The return loss of the proposed antenna is obtained using the network analyser. Proper calibration of the network analyser is necessary before measurement commences since the length of the feed-line changes significantly electrically as it sweeps the frequency from low to high. This calibration also helps in the elimination of all forms of errors such as errors from the cable and ports. The calibration was done using the calibration kits comprising the calibration tools such as Broadband load, Short load 053537 and Open load 053669. The frequency of interest was required for the measurement; the frequency band for the proposed antenna which is 3.1-10.6GHz was set by inputting 3.1GHz as the start frequency and 10.6GHz as the stop frequency. These three calibration tools named earlier are all 3.5mm she-male connector which was used to calibrate the device. The broadband load was the first tool used in calibrating the network analyser, followed by short load and then open load. The port 4 of the network analyser was used for the measurement; these tools were connected one after the other to the he-male connector of the port 4 of the network analyser to carry out the calibration. The Antenna under test was measured immediately the calibration sequence was completed.

A sharp curve at lower frequencies of 4.2-5.8GHz and higher frequencies of 8-10GHz can be seen from the return loss of the measured and simulated results respectively in Figure 22 This curve shows a decrease in the return loss which implies that the proposed antenna transmit higher percentage of its power at these frequencies while a very low power is reflected back. An increase in return loss is observed at frequencies of 5.8-6.4GHz from the measured result, at this point, the antenna transmits less power.

The simulated and the measured results do not completely agree with each other as it can be seen in Figure 22 showing the comparison between them. The system impedance bandwidth dropped from 6.6GHz to 5.8GHz from 4.2-10GHz with a return loss greater than 10dB, except in the band of 5.8-6.4GHz and 10-10.6GHz. This difference between the simulated and measured results might be caused by the fabrication and measurement inaccuracies of the prototype. Another reason for such disagreement could be being that the measurement was carried out in a non-controlled environment. A lump port of 50Ω considered being loss-less is fed to the simulated antenna which is hard to achieve in fabrication especially for low cost materials. Losses due to soldering of the SMA connector and also the microwave cable used for measurements could be another cause for this disagreement. Finally, another possible reason for such disagreement between the simulated and measured results could be as a result of cable currents which often have effects on the measurement results.

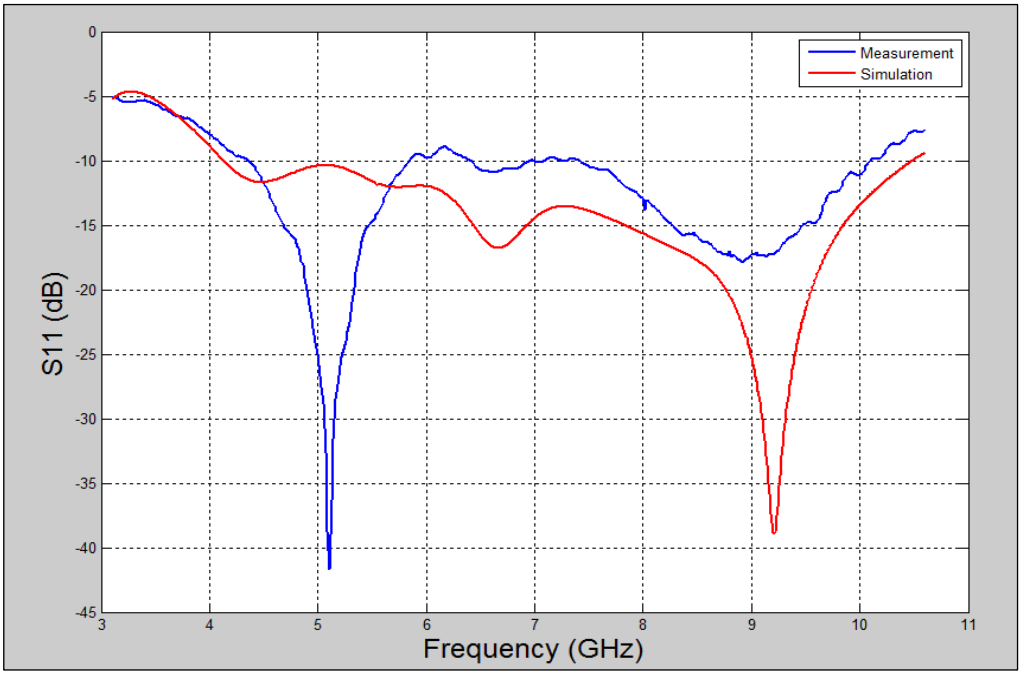


Figure 22: Return Loss of the simulated result with Comparison with the Measured Result.
Source: Author, (2023).

Figure 23 shows the measurement set up of the proposed antenna with reflector in the far-field anechoic chamber. The Antenna under test (AUT) which is the receiving antenna is separated by enough distance from the transmitting antenna so as to excite the designed operating environment. This distance separation is determined using this mathematical formula below;

$$R > \frac{2D^2}{\lambda} \qquad (2)$$

Where R is the separation distance between the transmitting and receiving antennas, D is the aperture of the antenna under test (AUT) and λ is the measurement wavelength. The frequencies at which the radiation pattern of the proposed antenna was implemented are 3GHz, 4GHz, 5GHz and 6GHz. At 360° theta, the far-field is better at 5GHz and best at 6GHz giving a good directional radiation pattern. At frequencies of 3GHz and 4GHz, the opposite is the case giving an omni-directional radiation pattern. The radiation pattern of the proposed antenna with reflector as measured in the far-field anechoic chamber is shown in Figure 24.

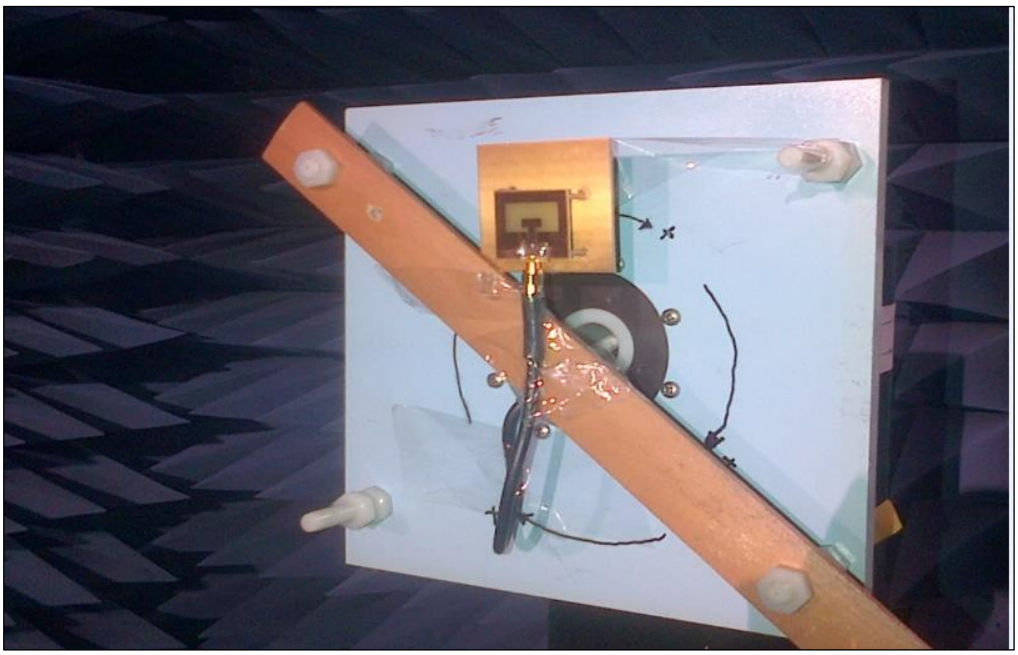


Figure 23: Measurement set-up of the Proposed Antenna with Reflector in the Anechoic Chamber.
Source: Author, (2023).

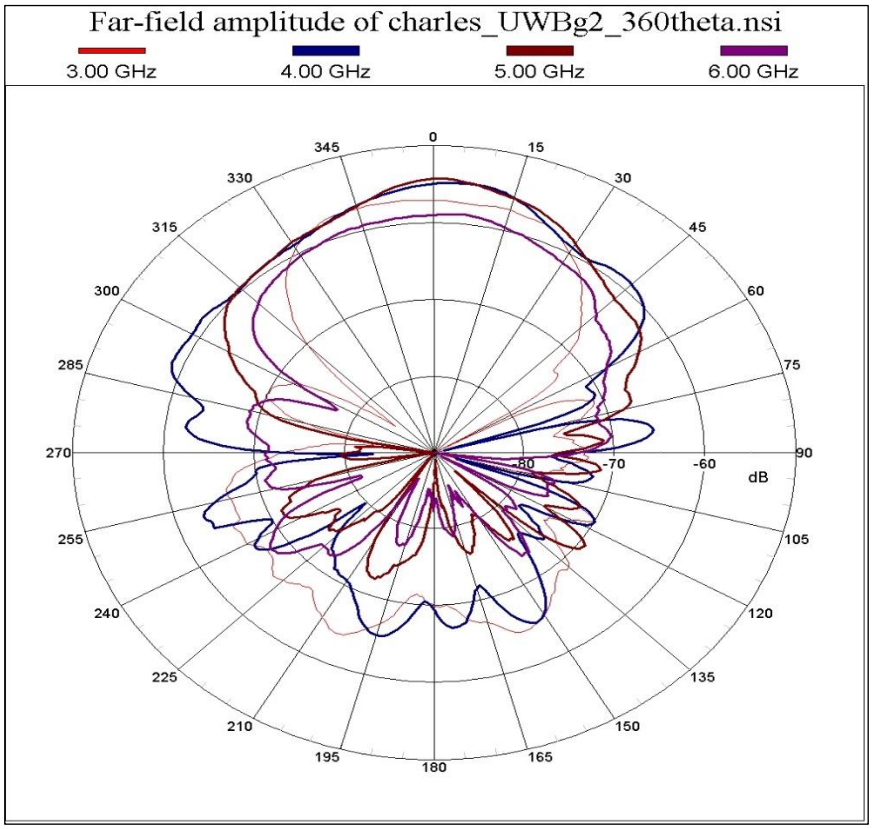


Figure 24: The Measured far-field Amplitude Radiation Pattern of the Proposed Antenna.
Source: Author, (2023).

The measured radiation patterns broadly agree with the simulated radiation patterns. An omni-directional radiation pattern is achieved at 3GHz and 4GHz while a directional radiation pattern is achieved at frequencies of 5GHz and 6GHz. The measured

radiation patterns are normalised patterns while the simulated radiation patterns are not normalised. Investigations were carried out to see if a better radiation pattern could be achieved at the frequencies of 3GHz and 4GHz.

The proposed antenna is printed on a FR4 printed circuit board. A 60x60mm^2 reflector was printed as well. The proposed antenna and the feeding structure are formed on the same side of the printed circuit board which makes the design easy and extremely low cost. The antenna was placed at a quarter-wavelength distance to the reflector. It is fed by a 50Ω micro-strip line and a SubMiniature version A (SMA) connector is used for the port which was carefully soldered to the antenna in the communication lab. The photograph of the antenna with a reflector is illustrated in Figure 25. The return loss of the antenna is measured using the network analyser while the far-field amplitude radiation pattern is measured in the anechoic chamber of the communication lab.

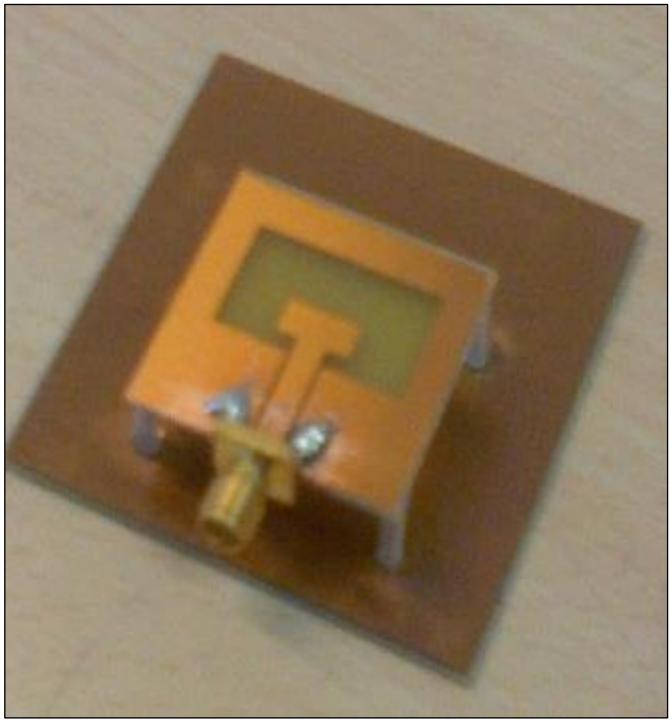


Figure 25: Photograph of the Proposed Antenna placed at a Quarter-wavelength Distance to the Reflector.
Source: Author, (2023).

V. CONCLUSIONS

In this study, a directional UWB antenna has been presented. Several types of UWB antennas have been analysed and the results compared. First and foremost, the background of the technology, applications and several techniques were discussed. Ways to avoid the major challenge in most antenna designs which is the emission of energy as a result of back radiation which makes the system not completely directional have been discussed. A commercial simulation tool known as CST Microwave Studio was used to carry out the design and the optimisation process. Two models were designed; the first model exhibits an omni-directional radiation pattern while the second model exhibits a directional radiation pattern except at frequencies of 3GHz and 4GHz. The directional radiation pattern is achieved as a result of the addition of another ground plane which serves as a reflector to the antenna. The antenna prototype is printed on a FR4 PCB with a specified overall dimension. The network analyser was used to measure the return loss of the fabricated antenna and the radiation pattern of the antenna was measured in the far-field anechoic chamber of the communication lab at 3GHz, 4GHz, 5GHz and 6GHz. Investigations were further carried out on how the directivity of the designed antenna can be improved at frequencies of 3GHz and 4GHz. This investigation was done by examining the effect of the size of the additional ground plane known as the reflector on the radiation pattern of the antenna using the simulation tool- CST Microwave Studio. Directional radiation patterns, except at 3GHz and 4GHz, impedance bandwidth of 4.2-10GHz with a return loss greater than 10dB, except in the band of 5.8-6.4GHz and 10-10.6GHz are realised. The measured and simulated results have also been compared. The simulation and measurement results of the proposed antenna show a good agreement in terms of the radiation patterns but do not completely agree in terms of return loss as an unexpected behaviour was exhibited by the Antenna under test (AUT) as seen from the measured result in Figure 22 which could be as a result of cable current.

VI. AUTHOR'S CONTRIBUTION

Conceptualization: Olayiwola Charles Adesoba.
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Investigation: Olayiwola Charles Adesoba.
Discussion of results: Olayiwola Charles Adesoba.
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Writing – Review and Editing: Olayiwola Charles Adesoba.
Resources: Olayiwola Charles Adesoba.
Supervision: Olayiwola Charles Adesoba.
Approval of the final text: Olayiwola Charles Adesoba.

VII. ACKNOWLEDGMENTS

The author wishes to thank Dr. Yi Wang for his support and guidance during the practical aspect of the research and also for allowing me to make use of the laboratories, without him, this

research wouldn't have been achievable. I would also like to appreciate my family for their love, support and words of encouragement each time I am on a research work.

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Journal of Engineering and Technology for Industrial Applications

ISSN ONLINE: 2447-0228

ITEGAM-JETIA

Manaus, v.9 n.41, p. 32-40. May/June, 2023

DOI: https://doi.org/10.5935/jetia.v9i41.862

RESEARCH ARTICLE OPEN ACCESS

EFFECT OF OPRAS ON EMPLOYEES' PERFORMANCE IN TANZANIA LOCAL GOVERNMENT AUTHORITIES: THE CASE OF MTWARA MUNICIPAL COUNCIL

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ARTICLE INFO

Article History
Received: May 30th, 2023
Accepted: June 27th, 2023
Published: June 30th, 2023

Keywords:
OPRAS,
Employee's Performance,
Local Government Authority.

ABSTRACT

This study examined the effect of Tanzania's Local Government Authorities' Open Performance Review assessment method on employees' performance in the case of Mtwara Municipal Council. Determining the impact of accuracy, objectivity, and feedback on employee performance were the three main goals of this study. The study adhered to the quantitative research methodology and was informed by the positivist research philosophy. It was carried out at the Mtwara District Council in the Mtwara Rural district using explanatory research research design. A sample of 102 people were selected from the research's participant population of 1094 Mtwara District Council employees and officials using a simple random selection procedure. multiple regeression analysis was ciarried to determine the relationship between the independent varianle (ORAS taregt seting on dependent variable (employees performance). Data was gathered through questionnaires, and the results were displayed in tables. Results indicated that respondents agreed that OPRAS was statistically significantly and posyively associated to employee performance. The study recomends that Local government managers should take seriously in setting Opras targets making sure they are acurate, objctive and always there should be feedback to employees.

I. INTRODUCTION

New public management (NPM) reforms have given rise to a global phenomena known as performance measurement systems (PMSs). Despite being widespread and well-established at this point, they have drawn criticism for both their design and their implementation [1]. According to [1], the trend of many, primarily Western, governments undertaking reforms to the administration of their various public sectors occurred between the late 1970s and the mid-1990s. Many of the reform measures that was undertaken under the pretext of new public management (NPM), which was underpinned by a mindset of "managerialism" and placed a heavy emphasis on enhancing public sector performance, integrated management techniques that are typically associated with the private sector.

The performance evaluation process gained popularity in the 1940s. Merit rating was initially used to back up an employee's compensation or earnings during the time of the Second World War [2]. The technique, which relied on material outcomes, paid higher output with higher pay or compensation, and vice versa. However, early researchers found that workers' levels of motivation for their occupations and performance varied even among those with almost comparable skills to work and compensation [3].

According to research conducted in Jordan [4], performance standards have a negative effect on employees' ability to perform their jobs in the banking industry in the south of the country. Employees in this industry prefer to work with more freedom while still adhering to established standards that could boost productivity.

According to [1], these reforms replaced the old collegial public sector management with a more professional style of

management, changing how the public sector operates from "administration" to "management". Competition, cost effectiveness, and operational prudence are examples of private sector company values that have evolved into guiding management concepts. The main factors influencing how public resources are allocated have changed from being based on the quest for greater effectiveness in the administration of the public sector to being based on ideals of equity or social justice. This promoted a more competitive climate where management for results was prioritized. An increasing focus on performance or a greater openness of that performance was one of the main effects of NPM reforms. In light of this, measurement systems for performance (PMSs) evolved into a crucial component of management reforms for the public sector and have since remained a crucial tool in managing the larger public sector [1].

Performance measurement has traditionally concentrated solely on financial metrics. Because organizations and the marketplaces in which enterprises compete are becoming more complex, studies conducted in the late 1980s demonstrated that historical financial data is insufficient to satisfy the PM in the modern economy [5]. This is because the correlation between financial reporting and shareholder value has decreased. Instead, non-financial elements such as client loyalty, satisfaction among workers, internal procedures, and an organization's innovations promote sustainable shareholder value [5].

The definition of a performance evaluation is still up for controversy, according to [5], despite the fact that much study has been done on the subject [6]. The definition of [7] that describes performance measurement (PM) as "the process of measuring how efficient and effectiveness of previously implemented actions" is stated by [8]. This definition emphasizes both efficacy and efficiency, but it doesn't say what to measure or why. The justification, with a focus on measuring the value that the company delivers to its consumers, provides greater advice to those involved in performance measurement [1]. "PM is assessing the effectiveness of an organization's management and the value it provides to customers and other stakeholders."

Employers, whether in the private or governmental enterprise/office, medium or big firms, typically try to achieve employee production to meet overall operational goals, according to [9]. Employers use a range of techniques and procedures to assess employee work performance in order to realize this. Performance appraisals are the name given to these measurement techniques. Some utilize multiple tools in addition to one, but smaller organizations frequently pick and employ the one tool that suits them the best. Employees must perceive these measuring systems as equitable and fair in order for them to be taken seriously. The tools that offer the greatest degree of impartiality should be chosen by people who use them. It's challenging to eliminate all or most subjectivity, although some methods are more conducive to objectivity than others [9].

The high school instructors of Kirinyaga West Sub County in Kenya agreed, according to [10] findings, that they are motivated if their work contribution is acknowledged; the chance for further education motivates them to put forth more effort; TSC offers teachers the chance for career advancement; TSC bases promotion on work performance; and TSC links work performance with rewards. This suggested that the use of rewards as a method of performance evaluation had a significant impact on how well secondary school teachers performed in Kirinyaga West Sub County.

Since the government opted to give up the confidential appraisal method, Tanzania, and the public service industry in particular, have used the OPRAS to monitor staff performance (President's Office Public Services Management, Dar es Salaam, 2011). This came after the government's announcement of the Public Service Transformation Program (PSRP) in 2000. Employer participation in goal-setting, implementation, monitoring, and review procedures is crucial, according to OPRAS, since it encourages personal responsibility and enhances openness and communication among management and staff. Therefore, introducing and operationalizing OPRAS is required of all Ministries, Autonomous Departments and Agency (MDAs), local governments (LGAs), and Regions. This is supported by laws and policies, which, among other things, enforce OPRAS adoption in the public sector. These include the legislation known as the Public Service Act (No. 8 of 2002), the Public Service Regulations (2003), and the Public Service Labor Policy (1999), all of which have been amended. Dar es Salaam, 2011: President's Office Public Service Management.

There are various performance measurement systems that have been developed over time during the course of attempting to improve organizations' performance [11]. Therefore, various organizations, including public organizations and agencies in Tanzania measure their employee performance using these performance measurement systems. Studies such as [12] study entitled "Employee's Performance Measurement Practices in Public Sector: A Case Study of Tanzania Electricity Supply Company Headquarter (Dar es Salaam)" and [13] paper "Measuring Performance in Public Sector Organizations: Evidence from Local Government Authorities in Tanzania" provide evidence of performance measurement on employees performance. However, these papers and research focus on measuring performance and not on the effects of these performance measurement systems on employees' performance. Additionally, it has been acknowledged by investigators like [14] in the paper titled Application of open performance assessment and evaluation framework in Tanzania that local government agencies suggested on the scheduling activities to be of both managers and staff members and that it should be carried out continuously. Thus, study is required to determine the impact of OPRAS on employees' performance in Tanzanian local government agencies, specifically in this particular instance of Mtwara Municipal Council.

II. LITERATURE REVIEW

II.1 THEORETICAL REVIEW

Through HR, businesses hope to achieve high and consistent performance [15]. One of the key elements in the logical and organized process of HRM is PA (Answers.com). In order to recruit and choose employees, train and develop current employees, and motivate and maintain a quality workforce through adequate and appropriate reward of their performance, information gathered during and at the conclusion of the PA process is necessary [2]. As a result, the HRM system may fail without a solid PAS founded on the principles of objectivity, accuracy, relevance, and feedback. The important human resource could be completely wasted as a result of this.

II.2 PERFORMANCE APPRAISAL

There are numerous ways to define performance appraisal, Performance appraisal is described as the formal rating and description of employees by their supervisors, which is typically done once a year. Additionally, management uses performance evaluation to detect and gauge employee performance in firms.

Additionally, performance evaluation helps workers identify their objectives, outlook, and motivation for completing the duties that have been allocated to them [16]. According to [17], performance refers to what management expect employees to produce in terms of outcomes, efforts, tasks, and quality under a certain period of time and under particular circumstances.

II.3 THE PROCESS OF PERFORMANCE APPRAISAL

In order to help managers and staff members plan, manage, evaluate, and realize enhancements in performance in the company with the purpose of accomplishing the desired organization goals, [18] defines open performance evaluation as an open, formal, and systematic method. This definition holds true for the entire investigation.

II.3.1 Performance Appraisal Importance

Financial success, productivity, quality of goods and services, customer happiness, and employee satisfaction are five key organizational outcomes that are impacted by the performance appraisal process. According to [19], successful performance leadership is defined as accomplishing financial as well as non-financial objectives while also enhancing customer service and process quality. Additionally, it is crucial for employees to feel that there is room for improvement in their job and that the assessments are fair in performance reviews [20]. The performance review process, awards, motivations, and growth have a negative influence on employees without fairness [21].

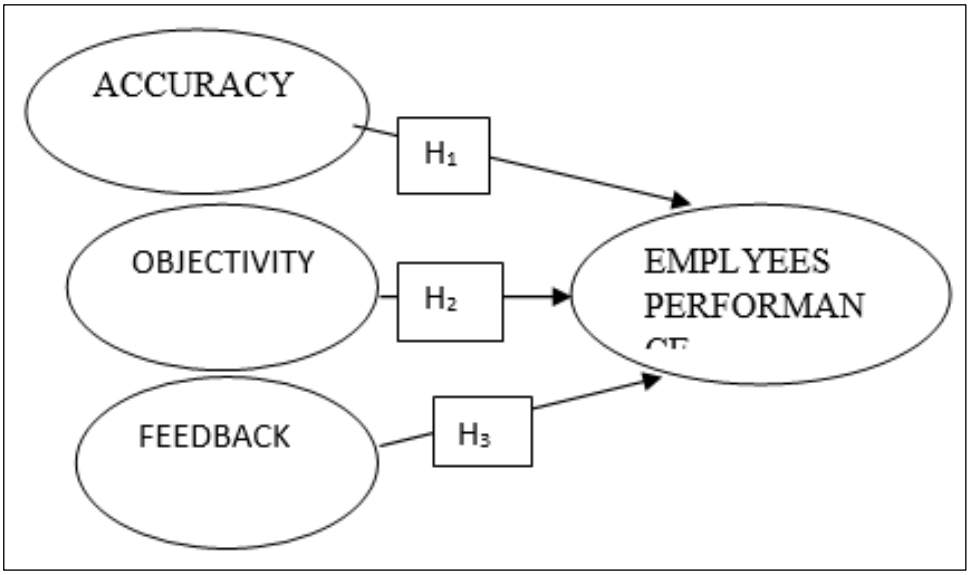

Figure 1: Conceptual Framework.
Source: Authors, (2023).

Hypothesis:

HI: There is a positive relationship effect between accuracy and employees performance.

H2: There is a positive relationship effect between objectivity and employees performance.

H3: There is a positive relationship effect between feedback and employees performance.

III. RESEARCH METHODS

The positivist research philosophy served as the basis for this investigation. Positivism, according to [22], supports the idea that derived knowledge can be utilized to demonstrate real comprehension (certitude or truth). Empiricism, which refers to confirmed positive facts or evidence gained by the senses, serves as the basis for positivism. Introspection and intuitive knowledge are not valued by the positivist philosophy.

This study used a quantitative research approach throughout the examination. Quantitative research is the process of acquiring and analyzing numerical data. It could be used to uncover patterns and averages, create theories, investigate causes, and extrapolate results to bigger groups. According to [23], precise measurements while mathematical, numerical in nature, and statistical analysis of the data gathered by means of surveys, questionnaires, and polls, as well as manipulating of previously gathered statistical information using computational approaches, are key components of quantitative research techniques.

A research approach based on case studies was used for this investigation. [24] asserts that case study research entails a thorough and in-depth consideration of a specific event, circumstance, the company, or social unit. A case is typically "an occurrence of some kind in a bounded context" with a defined time and space period. A case inquiry is a thorough analysis of a current issue in the light of practical knowledge. The case review is relevant, especially if the phenomenon's background is significant.

III.1 POPULATION

The entirety of the objects under inquiry constitutes the study population. Population is defined by [25] as any subject or subjects in all areas of study. Population refers to the total set of individuals, businesses, plants, or other objects who possess one or more traits that the study is interested in. The Mtwara District Council employs 1094 people. The following categories apply to these workers. There are 124 workers in the health sector, 788 teachers in elementary and secondary schools, 36 workers in agriculture and livestock, 11 workers in the workplace, 81 village executive officers, and 54 workers in administration. As a result, the participant population of the research be made up of all Mtwara district Council employees. The researcher, however, is not able to

conduct the study on the entire population that is specified. An employee sample was instead chosen and used for the purpose of inquiry.

III.2 SAMPLE AND SAMPLING TECHNIQUES

A "sample" is the overall number of participants who are chosen to participate in a study. Sampling is the method used to get the sample. According to [25], sampling is the process of choosing a portion of a total or aggregate on the basis upon which a decision or conclusion is formed about the aggregation or totality. In simple terms, it is the method of learning details about a whole population by looking at a small portion of them. For the purposes of the relevant investigations, researchers often frequently choose just a few objects from the universe.

The ten per cent (10%) of the population that was accessible made up the 109 participants in the study's sample, which was drawn from an estimated population of 1,094 people. According to Krishnaswami (2003), the sample size was thought to be sufficient and therefore representative. The author claims that a sample size of between 5% and 10% of the total accessible population is sufficient for data collection for a total population of between 1000 and 5000. Additionally, the formula below was applied to draw a sample from the population of 1094 employees.

$$n = \frac{NC^2}{C^2 + (N-1)e^2} \quad (1)$$

Where N= population of employees, 1094
C= coefficient of variation (assumed), 10%
n = sample 109
e= sample error (assumed), 1%

The population of the case region under investigation in this study ranges from 1000 to 5000. In order to reflect the entire population, 10% will be used.

Table 1: Sample.

S/No	Sector	Employees	Sample
1	Administration	54	5
2	Health	124	12
3	Primary and secondary	788	79
4	Agriculture and Livestock	36	4
5	Works	11	1
6	VEOs	81	8
Total		1,094	109

Source: Authors, Adapted of Mtwara District Council, (2022).

A basic form of random sampling involves selecting a part of a population at random. Using this method of sampling, each participant of the general population have a precisely equal possibility of being chosen. This sampling technique for probability requires only a small amount of prior population knowledge and is the simple to understand of all the ones available. It also only requires one random pick. Due to the randomization used, any research done with this sample ought to demonstrate a high level of validity internally as well as externally [25]. Simple random sampling is suggested because each employee will have an equal chance if being selected as a sample. The 100 respondents who did not hold managerial roles will be chosen at random to make up the sample.

III.2.1 Data Collection

According to [26], this is a strategy for gathering data that entails giving the subject a set of planned and structured questions to answer in writing. Data for this study will be gathered via a self-administered questionnaire. Respondents chose their responses from a sheet of closed-ended questions in this survey. The purpose was to facilitate the collection and processing of data. The researcher chose to employ this strategy to complete data collection quickly since this study takes a quantitative approach and because of the time allocated for data collection.

III.2.2 Data Processing and Analysis

Multiple linear regressions were employed in the investigation. The data was analyzed using several linear regression modes to demonstrate the relationship that currently exists between the independent and dependent variables. Each independent variable was expressed by a number of different factors; hence an average was calculated for each category of variables in order to represent the variable [27]. The relationship between OPRAS targets, on the one side as one of the independent characteristics; accuracy, objectivity, and feedback; and employee performance, on the other side as a variable that is dependent, was then expressed in the model. The generated data from the variables with a Likert scale were entered in SPSS and analyzed to create regression results demonstrating the connection between performance assessment systems and their influence on employee performance.

III.2.4 Regression Model

The model of the current study is of the form:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \varepsilon \quad (1)$$

Where;
$b_1, b_2, b_3, b_4 \ldots$ represent slopes,
X_1 Accuracy - AC
X_2 Represents Objectivity - OB
X_3 Represents Feedback - FB
Y represents employee's performance, and
ε Represents the error term.

The regression model was built using the same core presumptions of the model for linear regression, including linearity, independence of errors, equal variation of errors, and homogeneity of errors [28]. Linearity was checked by plotting each independent variable against the dependent variable while independence of errors was checked by using the scatter plot of residuals. Normality of errors was checked by looking at QQ-plots of sample quintiles as well as using histograms while the constant variance was checked using the residual box plots.

IV. FINDINGS

IV.1 PARTICIPANTS SAMPLE PROFILE

Gender, age, education level, and employee performance were the four demographic factors that were taken into consideration (Table 2). Female constituted the majority of all respondents. They constitute 2/3 of all participants leaving men trailing behind almost 30%. Respondent's age between 21-30, and 31 – 40 and those aged 60 were the majority of all participants' age groups; both have more than 40% of all participants. These were followed by 41-50 age groups who constituted 1/3rd of all

participants. The lowest score age group was 60 and above who clocked just 1% of all participants.

The employee education was observed, where by majority were bachelor graduates who command just above 1/3 of all participants, they are closely followed by diploma holder who scored 32.4. Master's degree holder was third scoring almost 1/5 of all participants. Training last were PhD holders who are just above 1 %

Experience shows that those employees who have been to work between 11- 15 years are the majority who have almost 1/3rd of all participants, followed by 6- 10 group who constitute 26 % of all participants. Last age groups are 20 and above who are just above 10 %.

Table 2: Participants Sample Profile.

S/N		Frequency	%	Mean	Std. Dev.
1	**Gender**			**1.6471**	**.55664**
	Male	39	38.2		
	Female	61	59.8		
2	**Age**			**1.7451**	**.74043**
	21 – 30	43	42.2		
	31 – 40	43	42.2		
	41- 50	15	14.7		
	51- 60	43	42.2		
	60 and Above	1	1		
	Education Level			**2.7059**	**.98089**
	Certificate	11	10.8		
	Diploma	33	32.4		
	Bachelor	35	34.3		
	Postgraduate	21	20.6		
	PhD	2	2.0		
3	**Experience**			**2.8824**	**1.19648**
	0-5	14	13.7		
	6-10	26	25.5		
	11-15	31	30.4		
	16-20	20	19.6		
	20 and Above	11	10.8		

Source: Authors, (2023).

IV.2 DESCRIPTIVE STATISTICS RESULTS

Four distinct variables for the mean, the standard deviation, the lowest and max; accuracy in target setting; objectivity of the targets; and feedback, descriptive statistics were generated. Employee performance was the dependent variable.

IV.2.1 Effect of Accuracy

Descriptive statistics (mean, standard deviation, minimum, and maximum scores) were computed for the effect of setting accuracy targets on employee's performance scale (Table 3). The results show that Performance targets are linked to the Municipal goals scored highest (M = 4.70, S.D. = .462) followed by Performance targets have no ambiguity (M = 4.48, SD = .867). The least way through which effect of accuracy in target setting on employee's performance was explained is Performance targets are clear and specific (M = 3.82, SD = 1.218) followed by Performance targets have no Biases (M = 4.07, SD = .988).

Table 3: Accuracy opras target.

	Min	Max	M	Std. D
Performance targets have no ambiguity	1	5	4.48	.867
Performance targets are linked to the Municipal goals	1	5	4.70	.462
Performance targets are clear and specific	1	5	3.82	1.218
Performance targets have no Biases	1	5	4.07	.988
Performance targets are linked to the employees goals	1	5	4.11	.774

Source: Authors, (2023).

IV.2.2 Effect of Objectivity

Descriptive statistics (mean, standard deviation, minimum, and maximum scores) were computed for the effect of effect of Objectivity of targets on employee's performance scale (Table 4). The results show that Performance targets are lined with employees ability, knowledge and skills scored highest (M 4.38, S.D. = .701) followed by Performance targets are time bound in one year (M = 4.30, SD = .488). The least way through which effect of Objectivity in target setting on employee's performance was explained is Performance Targets are measurable (M = 4.21, SD = .708) followed by Performance targets are realistic (M = 4.27, SD = .789).

Table 4: Objectivity of OPRAS Target Setting.

	Min	Max	M	Std. D
Performance Targets are measurable	2	5	4.21	.708
Performance targets are realistic	2	5	4.27	.789
Performance targets are lined with employees ability, knowledge and skills	2	5	4.38	.701
Performance targets are always attainable	3	5	4.28	.488
Performance targets are time bound in one year	3	5	4.30	.660

Source: Authors, (2023).

IV.2.3 Effects of Feedback

Descriptive statistics (mean, standard deviation, minimum, and maximum scores) were computed for the effects of feedback on employee's performance scale (Table:5). The results show that Supervisors always give performance feedback accurately without biases scored highest (M = 4.39, S.D. = .665) followed by I always receive positively the feedback from supervisors because I trust him (M = 4.38, SD = .858). The least way through which effect of effect of feedback on employee's performance was explained is Always supervisors give performance feedback on time (M = 4.31, SD = .690) followed by Supervisors knows the standard set prior discussing the targets with employees (M = 4.34, SD = .612).

Table 5: OPRAS Results Feedback.

	Min	Max	M	Std. D
Always supervisors give performance feedback on time	3	5	4.31	.690
Supervisors knows the standard set prior discussing the targets with employees	3	5	4.34	.612
Supervisors always give performance feedback accurately without biases	2	5	4.39	.665
Performance feedback is very important in open appraisal review system	1	5	4.37	.778
I always receive positively the feedback from supervisors because I trust him	2	5	4.38	.858

Source: Authors, (2023).

IV.2.4 Employee's performance

Descriptive statistics (mean, standard deviation, minimum, and maximum scores) were computed for the dependent variable employee's performance scale (Table 4.2). The results show that Promotions are rewards of exceptional performance scored highest (M = 4.37, S.D. = .824) followed by Employees are fairly compensated for their performance (M = 4.22, SD = .583). The least way through which employee's performance was explained is There is a low staff turnover at Mtwara District Council (M = 3.92, SD = 1.098) followed by Employees career growth is determined by performance system (M = 3.94, SD = 1.12).

Table 6: Employees Performance.

	Min	Max	M	Std. D
Promotions are rewards of exceptional performance	2	5	4.37	.824
Employees career growth is determined by performance system	1	5	3.94	1.12
There is a link between my current performance and my goals in the organization	1.00	5.00	4.12	1.01
Training needs are identified through performance measurement	1.00	5.00	4.15	.951
Salary increment is linked to performance measurement systems	2.00	5.00	4.00	.928
There is a low staff turnover at Mtwara District Council	1.00	5.00	3.92	1.098
Employees are fairly compensated for their performance	1.00	5.00	4.22	.583
Organization leadership and management act as a source of encouragement to employees performance	1.00	5.00	4.10	1.072

Source: Authors, (2023).

IV.2.5 Multiple Regression Analysis

Multiple regression analysis was used as the dependent variable to determine the impact of OPRAS (independent factors) on employee performance. The results are presented in Table 7. The model is summarized with a focus on the revised R2 statistics (.189). This indicates that OPRAS is responsible for 18.9% of the variation in employee performance.

Table 7: Model Summary Results.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.189[a]	.036	.008	.38233
a. Predictors: (Constant), FB, OB, AC				
b. Dependent Variable: EP				

Source: Authors, (2023).

IV.2.6 Anova

The results of an analysis of variance (ANOVA), also known as model fit outcomes, are displayed in Table 8 below. In this table, the F-statistics and their associated sig. value are of particular interest. The results show that the F-statistics is 1.281 percent ($p< 0.001$). The results confirm the model's assertion that "the approach" possesses power to predict job performance using OPRAS scores." On the basis of OPRAS scores, it seems that the model may be able to forecast employee performance with accuracy.

Table 8: Anova Results.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.562	3	.187	1.281	.000[b]
	Residual	15.202	104	.146		
	Total	15.764	107			
a. Dependent Variable: EP						
b. Predictors: (Constant), FB, OB, AC						

Source: Authors, (2023).

IV.2.7 Coefficients

The regression model's coefficients are shown in (Table 8). The coefficients show, with a normalized B =.092 (p< 0.001) value, that the precision setting of OPRAS objectives positively predicts employee performance. These results showed that the performance of workers whose direct supervisor showed accuracy in defining goals increased by 89.9%. The findings also suggest that objectivity of the targets B .093, (p < 0.001) significantly and positively predicts employee performance. Feedback likewise significantly and positively predicts employee performance B = 138 (p < 0.001).

Table 9: Regression Coefficients Results.

Model		Unstandard. Coeff.		Std Coeff.	t	Sig.	Collinearity Statistics	
		B	Std. Er.	Beta			Tol.	VIF
1	(Const)	5.489	.746		7.355	.000		
	AC	.092	.101	.093	.914	.000	.901	1.110
	OB	.093	.112	.081	.826	.000	.954	1.048
	FB	.138	.113	.124	1.218	.000	.890	1.123
a. Dependent Variable: EP								

Source: Authors, (2023).

IV.2.8 Discussion of the Finding

The purpose of the study was to evaluate how OPRAS affected Mtwara Municipal Council employees' productivity in Tanzania. Three independent variables made up the effect of OPRAS: accurately set targets, objectively established targets, and feedback as goals. The performance of the employee was hypothesized to be predicted by these three variables. All theories were confirmed. Employee performance was found to be favorably and considerably impacted by setting accurate targets.

It was discovered that setting objective targets has a favorable and significant impact on employees' performance. This result lends credence to the earlier theory. [29] claim that goal-setting involvement has an impact on employees' pro-active behavior in support of this finding. When the objectives are clear, unambiguous, simple to understand, and impalement employees are easy to implement them.

Accurately setting OPRAS targets was proven to be beneficial and significantly related to employee performance. The conceptual model includes a relationship between target flexibility and firm performance as an intermediary of the impact of target difficulty, although this relationship has only been studied once before and has to be confirmed through replication. A study [2]. looks at how flexible targets affect a firm's success. They define "Target Flexibility" in their paper as "The extent whereby firms potentially modify targets over over the course of a period" when they first propose it. The [30] study is the only one to look at how intra-year adjustments to targets affect performance. [30] make the claim and provide evidence in support of it in their study that the relationship among target difficulty and business performance is moderated by the degree of target flexibility. Target setting needed objectivity for validation the particular goal.

Feedback from managers to employees was discovered to have a favorable and significant relationship influence on employee performance following the final assessment and scoring of OPRAS. The claim is that both positive and negative comments have a favorable impact on an employee's performance. Employees can actively offer job ideas and input in order to overcome challenges and improve their performance, according to research that previously showed a favorable impact of proactive behavior on the business [31] Feedback from managers to employees was discovered to have a favorable and significant relationship influence on employee performance following the final assessment and scoring of OPRAS. The claim is that both positive and negative comments have a favorable impact on an employee's performance. Employees can actively offer job ideas and input in order to overcome challenges and improve their performance, according to research that previously showed a favorable impact of proactive behavior on the business [31].

V. CONCLUSIONS

From the findings it may be concluded that OPRAS at Mtwara Municipal council is acceptable. Accuracy, Objectivity and feedback of OPRAS seem to be very important in order to make OPRAS work. These can be achieved only if supervisors and managers have quality nd skills in OPRAS management.

VI. CONTRIBUTION

This study has contributed in OPRAS management in local government authorities and also the public service working organizations. Theoretically, the study has brought in new perception of how well to management OPRAS so that it can be functionable by adding on the essence of new perception that

OPRAS is not for promotion and discipline action oriented but improving performance of employees and the entire organization. Practically the study has contributed on how well OPRAS targets should be treated based on accuracy, objectivity and also importantly sending feedback to employees whether positive and negative.

VII. RECOMMENDATIONS

From the findings, this study recommends that supervisors and managers when setting OPRAS targets as cascaded from organizational objectives, they should make sure and improve on accurately setting targets, objectively setting targets without ambiguity and attainable and time frame shortly known as (SMART)

Moreover, it is recommended that further studies to be undertaken focusing on OPRAS. This study used cross-sectional and quantitative approach. However a longitudinal study in qualitative approach may be used so as to trace if there is real behaviourial change for increasing performance after properly managed OPRAS target setting.

VIII. AUTHOR'S CONTRIBUTION

Conceptualization: Theresia Steven Mbukwini and Chacha Alfred Matoka.
Methodology: Theresia Steven Mbukwini and Chacha Alfred Matoka.
Investigation Theresia Steven Mbukwini and Chacha Alfred Matoka.
Discussion of results: Theresia Steven Mbukwini and Chacha Alfred Matoka.
Writing – Original Draft: Theresia Steven Mbukwini and Chacha Alfred Matoka.
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Resources: Theresia Steven Mbukwini and Chacha Alfred Matoka.
Supervision: Theresia Steven Mbukwini and Chacha Alfred Matoka.
Approval of the final text: Theresia Steven Mbukwini and Chacha Alfred Matoka.

IX. ACKNOWLEDGMENTS

Authors would like to acknowledge the effort, help and resourceful from Mtwara municipal council managers and all employees for their courtesy.

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Journal of Engineering and Technology for Industrial Applications

ITEGAM-JETIA

Manaus, v.9 n.41, p. 41-45. May/June, 2023

DOI: https://doi.org/10.5935/jetia.v9i41.863

ISSN ONLINE: 2447-0228

RESEARCH ARTICLE OPEN ACCESS

EFFECTIVENESS OF WHITE GUAVA LEAVES (*PSIDIUM GUAJAVA VAR. PYRIFERA L.*) IN REPAIR PROXIMAL TUBULE DAMAGE AND GLOMERULUS DIAMETER IN HYPERGLYCEMIC MICE

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ARTICLE INFO

Article History
Received: May 14th, 2023
Accepted: June 27th, 2023
Published: June 30th, 2023

Keywords:
Diabetes Mellitus,
White Guava Leaves,
Hyperglycemic Mice.

ABSTRACT

Diabetes Mellitus (DM) is a global health problem with a high prevalence rate in Indonesia, ranking 5th out of 10 countries with the highest number of diabetes cases. In 2019, Indonesia had the highest prevalence rate of diabetes mellitus at 9.3% (463 million) and an estimated increase to 12.2% (783 million) by 2045. The kidney, the primary organ affected by high glucose levels, is the primary organ affected by a compound. Guava leaves, which contain alkaloids, flavonoids, saponins, polyphenols, tannins, and calcium, have been found to have anti-diabetic properties. This research aimed to investigate the effect of variations in the number of white guava leaves used in making waters tew on kidney histopathology in alloxan-induced mice (Mus musculus). The mice were divided into five groups, with initial blood glucose levels measured after being induced by alloxan and after treatment with white guava seeds. After treatment, kidney histopathological preparations were made using Hematoxylin Eosin (HE) staining. The results showed that the average size of the proximal tubule proximal and glomerular diameter was larger than the positive (+) control group. The average glomerular diameter at K0, P1, P2, and P3 was smaller than the positive (+) control. The results of the study suggest that boiled water from white guava leaves may have potential therapeutic benefits for diabetics.

I. INTRODUCTION

Diabetes mellitus (DM) is a non-communicable disease (PTM) that is a global health problem. Patients with diabetes mellitus, from year to year, continue to experience enhancement. According to the International Diabetes Federation (IDF) 2021, Indonesia ranks 5th out of 10 countries with the highest number of diabetes cases, namely by the number of cases at around 19.5 million. The global prevalence rate of people with diabetes mellitus in 2019 was a big 9.3% (463 million) increase over 2021, becoming 10.5% (537 million). It is estimated that it will increase to 12.2% (783 million) by 2045 [1].

Results Research Health Base (Riskesdas) year 2018 shows the prevalence of diabetes mellitus in Indonesia based on doctor's diagnosis population aged 15 years by 2%. This figure shows an increase compared to the prevalence of diabetes mellitus in 2013, which was 1.5% [2]. Based on health profile, Central Java In 2019, people with diabetes mellitus took second place in PTM cases, with a total of 652,822 people with diabetes [3].

Diabetes Mellitus (DM) is a metabolic disease characterized by hyperglycemia (high blood sugar levels) that occurs when the pancreas fails to produce enough insulin or when the body fails to use the insulin that is produced effectively. Insulin is a hormone that regulates blood glucose levels. There are three types of diabetes, namely type 1 diabetes, type 2 diabetes, and gestational diabetes [4,5]

The kidney is the primary organ that is often disturbed by the effects of a compound. Kidneys have their own genre volume of blood, which tall filters toxic substances in the glomerular filtrate and carries them through the cellstubules [6]. High levels of glucose in the blood result from diabetes and make the kidneys filter too much blood. Glucose and high blood pressure can

damage the blood vessels in the kidneys [4]. Rate High glucose is the main cause of structural changes in the kidney. Mesangial cells produce TGF-β1 under hyperglycemia conditions, leading to an increase in consumption and transport, resulting in an excess of GLUT-1 mRNA and protein. These conditions cause metabolic abnormalities in mesangial cells. Impaired kidney function in diabetics is indicated by increasing serum creatinine, acid tendon, and nitrogen blood urea [7].

Use waters Tea leaf guava seed (*Psidium guajava*) can be used as a therapy herb to lower blood sugar in diabetics. According to Rosalina's research (2013), guava leaves can lower blood glucose levels in conditions of hyperglycemia [8]. Leaf guava white seeds (*Psidium guajava var. Pyrifera L.*) proved It has antidiabetic activity and is high in antioxidants. Several active compounds are contained in leaf guava seed white (*Psidium guajava var. Pyrifera L.*) that have anti-diabetic activity, including alkaloids, flavonoids, saponins, polyphenols, tannins, and calcium [8, 9]. The content of these compounds can be found in young leaves of guava seed, which are located on orders of 1–4 from shoots.

Based on research conducted by Darmawan (2021), giving water decoction of guava leaves has the effect of reducing glucose levels in the blood of mice with diabetes. Decline rate of glucose because there is a content compound active in leaf guava seed [10], whereas according to Jaya Chandra Netal's research on the observation of kidney histology in diabetic rats, leaf extract guava seed can reduce necrosis and swelling tubules [8].

Based on the description, researchers want to know how variations in the number of white guava leaves (*Psidium guajava var. Pyrifera L.*), which are used in making water tea, affect the kidney histopathology of alloxan-induced mice (Mus musculus). Research This study uses animal mice (Musmuscle) because their structure, anatomy, physiology, and genetics are similar to humans [11]. Circumstances diabetes in experimental animals is done by inducing alloxan. Alloxan is a material chemistry that is used to induce diabetes. Use alloxan on the test. This is because fasting causes permanent hyperglycemia within 2–3 days [12]. This research is expected to add new information about the effectiveness of giving boiled water from white guava leaves (*Psidium guajava var. Pyrifera L.*) to histopathology kidneys.

II. MATERIALS AND METHODS

This research was carried out experimentally at the Experimental Animal Laboratory, Faculty of Medicine, Diponegoro University (UNDIP) in March 2023 and has passed ethical eligibility from the Semarang Ministry of Health Polytechnic with number 0566/EA/KEPK/2023.

This study used 25 samples of mice (Mus musculus) aged 8–12 weeks and weighing 20–40 grams. The mice used had been adapted and conditioned to hyperglycemia using alloxan (blood sugar level> 120 mg/dL). 25 mice were divided into 5 groups (K0: control group without treatment, K+: control group induced by alloxan). P1: treatment group induced by alloxan and given boiled water of white guava leaves with a 35-gram content; P2: treatment group induced by alloxan and given boiled leaves of white guava with a 45-gram content; and P3: the treatment group was induced by alloxan and given boiled water of white guava leaves with a 55-gram content. Initial blood glucose levels were measured after being induced by alloxan and after treatment with white guava seeds. After the treatment, kidney histopathological preparations were made using hematoxylin and eosin (HE) staining. Observations were made in the area of the proximal tubule and glomerulus with a magnification of 400x.

The data obtained were processed using SPSS version 25.0 to be tested for normality and homogeneity. After that, the One-Way Anova test was carried out with a significance value of 95%, while the data on histopathological changes in the kidneys were presented descriptively.

III. RESULTS AND DISCUSSIONS

This research was conducted using experimental mice (Mus musculus) with a total of 25 mice divided into five groups, namely K0: control group without treatment, K+: alloxan-induced control group. P1: an alloxan-induced treatment group was given boiled white guava leaf water with a concentration of 35 grams; P2: the treatment group was induced by alloxan and given boiled water of white guava leaves with a concentration of 45 grams, and P3: the treatment group was induced by alloxan and given boiled water of white guava leaves with a concentration of 55 grams. Preparations of mice's kidney organs (Mus musculus), which were treated with boiled water from white guava leaves, were then observed for the size of the narrowing tubule proximal and diameter glomerulus obtained results as follows:

Table 1: Mean Results of Proximal Tubule Size and Glomelurus Diameter.

Variable	**Group**					***p-values* (ANOVA)**
	K0 n=5 mean±SD	**K+ n=5 mean±SD**	**P1 n=5 mean±SD**	**P2 n=5 mean±SD**	**P3 n=5 mean±SD**	
Proximal Tubule	16.85±0.54	16.02±0.18	16.24±0.42	16.53±0.77	16.89±0.79	0.120
Shapiro wilk	0.236	0.273	0.866	0.273	0.853	
Levene test	0.134					
Glomelurus diameter	51.15±2.98	55.03±2.60	53.53±3.37	53.28±2.84	52.20±3.55	0.193
Shapiro wilk	0.858	0.337	0.570	0.157	0.163	
Levene test	0.145					

Source: Authors, (2023).

Based on Table 1, it can be seen that the average size of the tubules proximal to the group K0, P1, P2, and P3 was larger compared to the positive (+) control, while the average glomerular diameter at K0, P1, P2, and P3 was smaller than the positive (+) control.

From the results of reading the size of the proximal tubule and glomerulus, we carried out statistical tests using SPSS. Results of the normality test obtained mark significance >0.05 in the proximal tubule and glomerulus, which means the data distribution is normal. Then, using Levene's test, the homogeneity test results obtained on tubular size and glomerular diameter significance >0.05 can be interpreted as homogeneous. Furthermore, a hypothesis test was carried out on the tubules proximal and glomerulus using the analysis of variances (ANOVA). Mark significance obtained in the size of the proximal tubule was 0.120 more than 0.05 (>0.05) and on the glomerular diameter was 0.193 more than 0.05 (>0.05). It can be concluded that there is a difference but not significant in the administration of tew leaf guava seed white (*Psidium guajava var. Pyriferous L.*) to histopathology tubule proximal and glomerulus. Data histologically is also viewed descriptively (Figure 1).

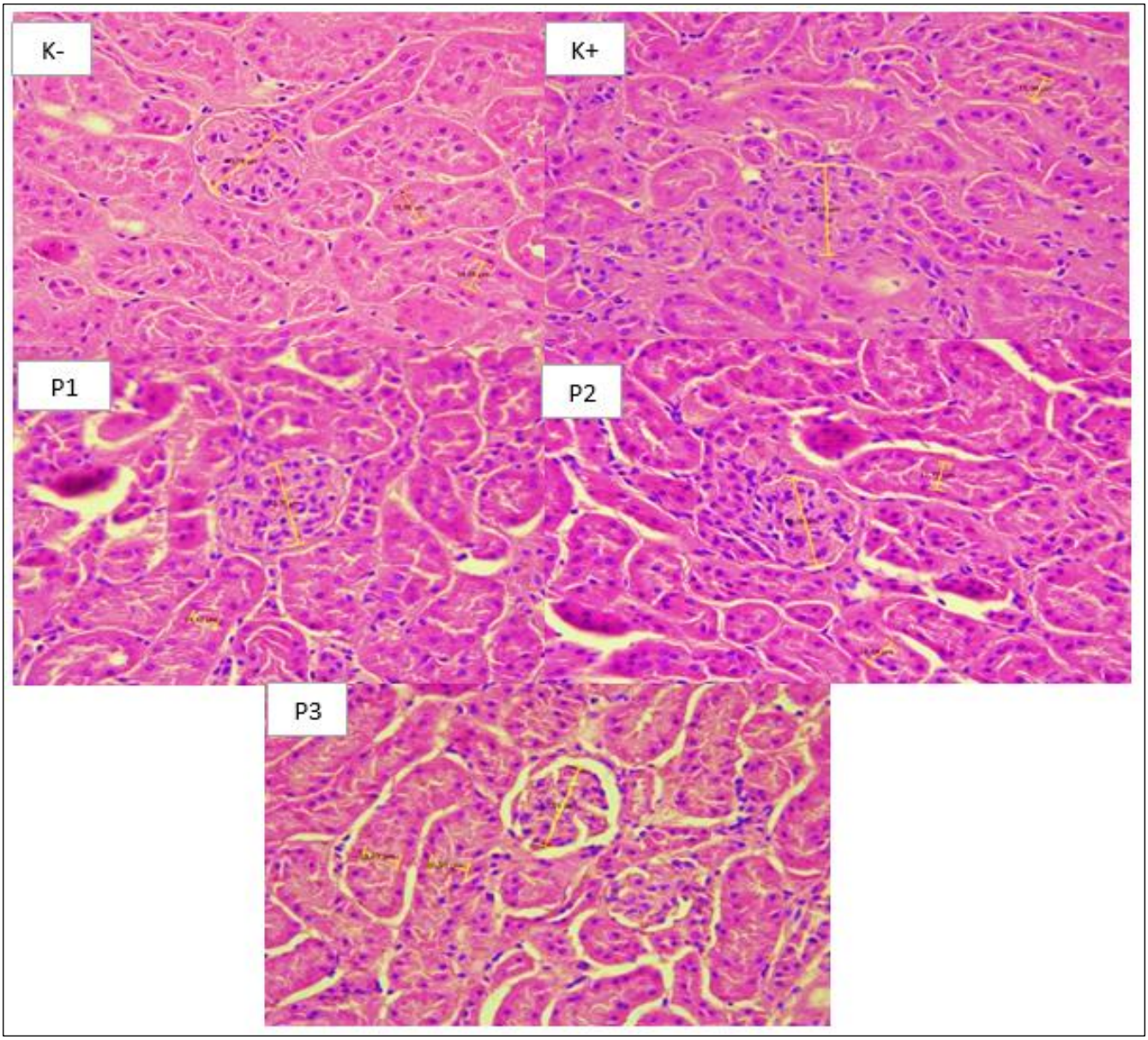

Figure 1: Histopathology glomerulus And tubule proximal mice magnification 400x.
Source : Authors, (2023).

In Figure 1, it can be seen that the proximal tubules in the Control + group (alloxan-induced) appeared to shrink and began to experience improvement or enlargement, best when given 55 grams of white guava treatment. In the control group, the glomerular border was damaged due to alloxan induction, so that the cells inside experienced irregular enlargement. The P3 group, when compared to the K0, P1, and P2 groups, experienced improvement with a reduction in glomerular diameter, and the glomerular borders had begun to be clearly visible.

III.1 DISCUSSION

Study This is an experimental study that aims to know the effect of fluence waters of tew leaf guava seed white (*Psidium guajava var. Pyrifera L*) on kidney histopathology in mice (Mus musculus) alloxan-induced. Alloxan is a fast way to produce a diabetic experimental (hyperglycemic) condition in animals. Diabetes is caused by the alloxan effect on damage to the cells

that make up the kidney tissue, such as degeneration and necrosis in tubules and glomeruli [13].

Leaf guava seed white has content that is good for lowering blood glucose rate with drinking water from the stew [10]. The content of active compounds found in guava leaves and seeds, such as flavonoids, tannins, and calcium, has antidiabetic activity. Tannins function as inhibitor enzymes of glucosidase, slowing down the release of glucose in the blood. Calcium is capable of raising cell production in the pancreas to produce insulin [7]. Flavonoid-sown antioxidants, which can ward off free radicals, Antioxidants are substances that can kill other substances, which makes cells brittle and unable to repair damaged cells [13].

The results showed that giving guava leaf, boiled water, and white seeds for 7 days had an effect on reducing glucose levels in the blood of mice (Musmuscle). This is in line with a study carried out by Darmawan, which found that water from boiling guava leaves can reduce blood glucose levels in diabetic mice [10]. Based on the results of observation in a microscopic manner on tubule proximal and glomerular diameter, measurement results in the form of data ratios were obtained. And tested statistics using Analysis of Variance (ANOVA) yielded proximal tubule size results of sig 0.162 and glomeruli sig 0.331 (P >0.05). Matter This means that, based on analysis statistics, giving white guava leaves boiled water has no significant effect on the size of tubules or the diameter of glomeruli.

Observation on tubule proximal done with measure constriction of the tubules, in the negative control group (K-) has an average size of 16.85 µm while the positive control (K+) or induced mice alloxan has the smallest average tubular constriction, namely 16.02 µm. This is in accordance with the study by Jaya Chandran et al. (2018), which stated that diabetic rats will experience swelling of the tubules [8]. Swelling on tubules is called albuminous or parenchymatous degeneration. Proximal tubular swelling causes lumen tubules to experience narrowing until they close [14]. While in the treatment group, the average in the P1 group was 16.2 ± 4 µm, in the P2 group 16.53 µm and the 16.89 µm P3 group. The third treatment group (P3) was given boiled water 25 sheets of guava leaves have an average tubule size that is close to that of the control negative (K-) ormice.

Observations on the diameter of the glomerulus obtained results showing that the negative control group (K-) has an average size of 51.15 µm positive control group (K+) or mice alloxan-induced have an average size of 55.03 m, and the largest glomerular diameter is 55.03 µm. Group positive control (K+) alloxan induced had the largest diameter; this is in line with research by Fanhriyansyah (2021), which stated that alloxan induced in mice will result in hyperglycemia, which furthermore will result in hypertrophy of the glomerulus because there is pressure on the glomerular cells [15]. Research done by Handani showed that mice induced with alloxan would have a widening glomerulus This results in adhesions between the glomerulus and Bowman's capsule [16]. Meanwhile, in the treatment group, the average flat on group P1 was 53,53 µm, group P2 was 53,28 m, and group P35 was 2.20 µm. Group treatment three (P3), given 25 sheets of guava leaves, has an average tubule size that is close to that of the control negative (K-) or healthy mice.

Based on the results of this study, it was shown that the water boiled leaves of 25 guava sheets had an effect on the histopathology of the mice's kidneys after alloxan-induced tubule size and glomerular diameter were close to those of the negative control group (K-). However, the influence exerted is not very significant.

IV. CONCLUSIONS

Based on the results of observation, the study concluded that a 25-sheet water decoction of white guava leaves (*Psidium guajava var. Pyrifer L.*) would better fix the damage to histopathology in kidney mice (Mus musculus). Compared to 15 sheets and 20 sheets of white guava leaves, Should study furthermore use extract leaf guava seed to take active substances like flavonoids, tannins, and similar substances that are expected to have an effect on histopathology of the kidney.

V. AUTHOR'S CONTRIBUTION

Conceptualization: Eko Naning Sofyanita and Anisa Rizky Yunianti.
Methodology: Eko Naning Sofyanita.
Investigation: Anisa Rizky Yunianti.
Discussion of results: Eko Naning Sofyanita and Anisa Rizky Yunianti.
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Journal of Engineering and Technology for Industrial Applications

ISSN ONLINE: 2447-0228

ITEGAM-JETIA

Manaus, v.9 n.41, p. 46-50. May/June, 2023

DOI: https://doi.org/10.5935/jetia.v9i41.864

RESEARCH ARTICLE OPEN ACCESS

SOLAR ENERGY, AN ALTERNATIVE FOR COST REDUCTION IN SHOPS AND INDUSTRY IN BRAZIL

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ARTICLE INFO

Article History
Received: June 07th, 2023
Accepted: June 27th, 2023
Published: June 30th, 2023

Keywords:
Solar energy,
Photovoltaic plates,
Sustainability,
Energy matrix.

ABSTRACT

Solar energy is an increasingly popular option in cities and in the countryside, as it is a clean, renewable source of energy that can generate significant savings on the electricity bill. Installing solar energy in businesses and small industries is a relatively simple process and can be carried out by specialized professionals. By opting for solar energy, businesses not only save money, but also contribute to a more sustainable world, reducing greenhouse gas emissions and preserving natural resources. It is important to remember that it is necessary to choose a suitable company to make a correct assessment of the location and energy consumption to ensure efficiency. The feasibility of installing solar energy in a small bakery was studied in order to deepen the analysis of technical feasibility, feasibility of physical space, financial feasibility, payback time, during the development of the work visits were made to the structure of the BAKERY As part of the study, a survey was carried out of the equipment installed in the bakery and the current energy consumption and the cost of this energy were also verified, thus evaluating the location where the photovoltaic panels will be installed.

I. INTRODUCTION

Solar energy is the generation of electrical energy from the capture of solar radiation through solar panels installed on site for the generation of thermal and electrical energy [1]. This energy is then sent to the grid and can be used to power electrical appliances. The photovoltaic energy scenario in Brazil has shown significant growth in recent years [2-4]. According to the Ministry of Mines and Energy (2020), the country registered a significant increase in installed solar energy capacity, reaching around 10 gigawatts (GW) in 2020. This expansion is a result of both the abundant solar potential and government policies favorable.

According to [5], Brazil has enormous potential for solar energy due to its privileged geographic location. The country receives high average solar irradiation, approximately 2200 kWh/m² per year, making it one of the best places for solar power generation in the world. In addition, the predominantly tropical climate favors the maximum use of solar radiation.

Government policies have played a key role in the development of photovoltaics in Brazil. The Distributed Electricity Generation Development Program (ProGD), launched in 2015, has encouraged the adoption of renewable sources, including solar. This initiative has contributed to the diversification of the Brazilian energy matrix and to the reduction of dependence on non-renewable sources [6].

The reduction in the costs of photovoltaic technology has also driven the sector's growth. The drop in prices of solar panels, combined with the increase in the efficiency of photovoltaic systems, has made solar energy an increasingly competitive option compared to conventional energy sources [5]. This factor has aroused the interest of investors and entrepreneurs, resulting in a significant increase in the number of solar projects across the country.

Despite promising growth, photovoltaic energy in Brazil still faces significant challenges. One of the main obstacles is the lack of transmission infrastructure for the flow of energy generated in isolated regions [7]. The expansion of the transmission network

is essential to enable the efficient integration of solar systems into the national electricity matrix.

To overcome these challenges, it is essential to continue investing in research, development and implementation of solar projects in the country. Promoting tax incentives and improving transmission infrastructure are necessary measures to further boost the growth of photovoltaic energy in Brazil [7-10].

II. THEORETICAL REFERENCE

The increase in the energy source through photovoltaic panels shows a very high and perceptive growth trend over the years. In 2018, in an unprecedented way, 100 GW were installed globally in the same year, which is something great and which shows the potential of solar energy in the world as a whole, not just in one region, the growth took place from of 1.2 GW in the year 2000. According to [11] in 2007 there were 9.2 GW of solar photovoltaic plants, in 2018 this capacity had already been increased to 505 GW, or that is, a surprising exponential growth, which exceeded 42,000%.

From an environmental point of view, photovoltaic energy generation offers several benefits, which, together with savings in energy bills, become one of the main renewable sources to be used in the coming years. In addition, it is an inexhaustible and free source, which is available for the vast majority of habitable places on the planet, with Brazil being one of the main optimal countries for the installation of solar panels [12].

Exploiting the sun's rays does not imply scarcity of resources, does not produce liquid or solid waste or significant environmental damage over time. During the operation of the photovoltaic systems, there are no GHG emissions or any polluting substances that may harm the environment or human beings. These characteristics mean that the generation of energy through solar panels can be installed not only in large plants, but also in small businesses or even in homes, since it does not offer harm to health or well-being; on the contrary, it can benefit it, since it is replacing another source of energy that harms the environment and may even pollute. Therefore, the decrease in pollution can reduce the incidence or worsening of several chronic diseases, such as those of the respiratory system and the heart, etc. [13-14].

Figure 1 presents an overview of the energy matrix in Brazil in the years 2020 and 2021, in this overview it is possible to verify that the source of solar energy was the one that grew the most in proportion, having reached more than 55.9% of growth, while wind had an increase of more than 26.7%, natural gas a little more than 46.2% and coal more than 47.2%. This panorama was largely due to the rainfall in 2021, which directly affected the production of energy through hydroelectric plants in Brazil, thus other renewable sources had their growth accelerated in this period [15].

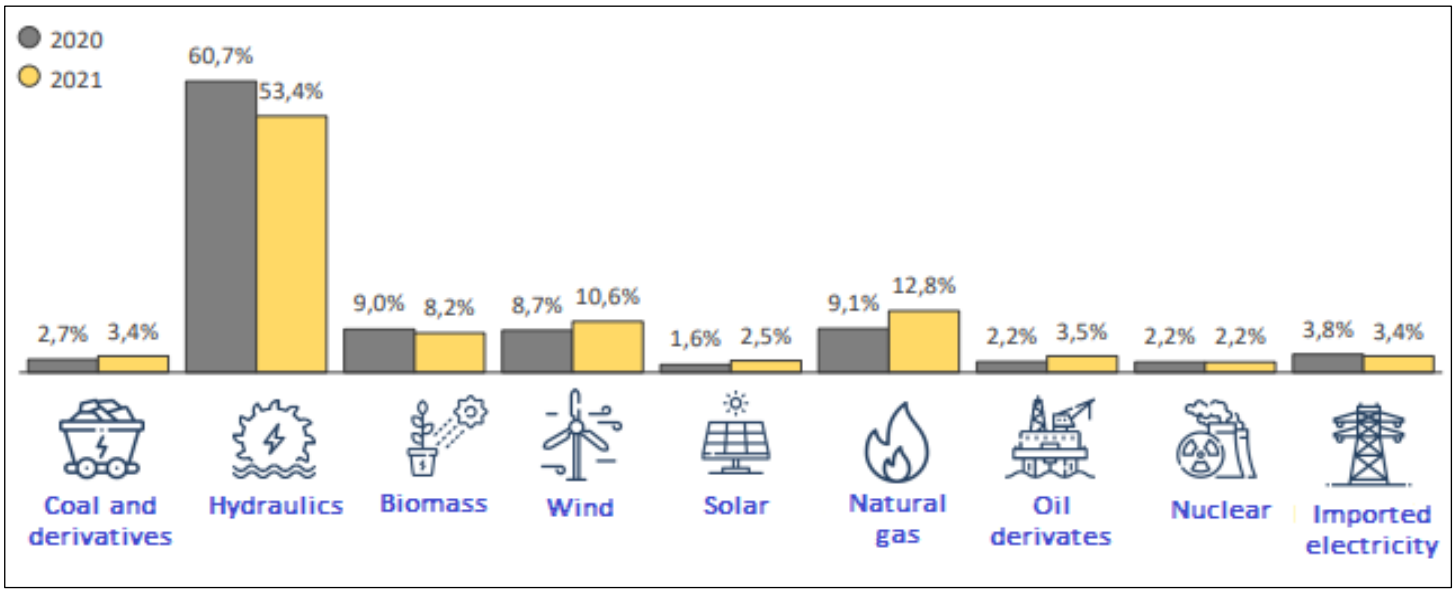

Figure 1: Energy matrix in the years 2020 and 2021.
Source: [15].

II.1 ADVANTAGES AND BENEFITS OF SOLAR ENERGY

According to [10], solar energy for bakery has many advantages and benefits, such as:

- Be a clean and renewable source of energy;
- Generates significant savings on the electricity bill;
- It is a positive reinforcement of the brand that cares about the environment;
- Allows greater energy independence;

According to [16] solar energy also contributes to the reduction of the carbon footprint, having a high potential for replacing hydroelectric and thermoelectric plants.

II.2 BAKERY SOLAR ENERGY INSTALLATION

Installing solar energy in a bakery is a relatively simple process that can be carried out by specialized professionals. The responsible company must have trained professionals, good quality panels and inverters and have its own teams for each stage of the project, such as planning, engineering and installation. In addition, the solar energy company must carry out an analysis of the installation site, to verify inclinations, a [17] orientation in relation to the sun, possible shading and if the bakery has enough space to install the panels. It is also necessary to make an assessment of the current energy consumption and the intended consumption after installation, in order to correctly dimension the project.

II.3 HOW SOLAR ENERGY CONTRIBUTES TO A MORE SUSTAINABLE WORLD

Solar energy contributes to a more sustainable world in many ways, including:

Reduction in the emission of greenhouse gases: generating electricity from solar energy does not emit greenhouse gases, which helps reduce carbon emissions and contributes to the fight against climate change; According to [18], the generation process, which is performed by a semiconductor device, does not produce waste, does not release residual heat and does not alter the balance of the environment, being considered sustainable.

Preservation of natural resources: solar energy is a renewable energy source, which means that it does not deplete natural resources like fossil fuels; Energy independence: the generation of electricity from renewable sources, such as solar energy, helps businesses to become independent from traditional energy sources [16].

Photovoltaic energy in Brazil shows the solar potential it has due to the country's ability to deploy and invest in clean, renewable energy and not in scarce energy, thus being able to reach the level of countries that are a reference when it comes to solar energy such as Germany, Italy, United States, Japan and China [19].

Within this context, on photovoltaic solar energy, the objective is to analyze the economic viability of the implementation, efficiency in replacing conventional electrical energy, in addition to addressing technical issues and an overview of this technology installed in a small bakery in the Manaus region.

III. MATERIALS AND METHODS

Table 1 shows the materials used in the installation of solar panels, the main ones being the photovoltaic module (solar plates), inverters, male and female connectors, solar cable and protection frame, this is a kit that was necessary for the implantation of the plates. solar.

Table 1: Materials used to implement the system with photovoltaic panels.

Photovoltaic Module		**Inverter 9.1 Kw,3MPPTSC/ WIFI**	
Manufacturer:	**Leapton**	Manufacturer:	solplanet
Power:	**665 Wp**	Power:	9100 w
Warranty (defects)	**10 years**	Warranty (defects)	10 years
Guarantee (efficiency):	**25 years**	monitoring	wifi
Amount:	**40**	Amount:	1
Inverter 7.3 Kw,3MPPTS, C/ WIFI		**Additional Equipment**	
Manufacturer:	solplasnet	Protection frame set	
Power:	7300w	AO CC (1E/1S + 2X 2E/2S)	
Warranty (defects)	10 years	Manufacturer:	So Energy
monitoring	wifi	Amount:	1
Amount:	1		
Additional Equipment		**Additional Equipment**	
Pair of MC4 1500V connectors (Male+Female)		Black Solar Cable 6mm	
Manufacturer:	SOU ENERGY	Manufacturer:	So Energy
Amount:	24	Amount:	120 m
Additional Equipment		**Additional Equipment**	
Red Solar Cable 6mm		Slab/soil KIT for 14 modules	
Manufacturer:	So Energy	Leapton 665 in Portrait-Solar Group	
Amount:	120 m	Amount:	2
Additional Equipment		**Additional Equipment**	
Mini rail 27.5 cm for fiber cement roof		AC Component KIT for three-phase	
(for thirds of wood with spacing)		220V (S11-B63-220v)	
between 1.3 m and 1.8 m)		Amount:	1
Amount:	12		
Manufacturer:	So Energy		

Source: Authors, (2023).

IV. RESULTS

IV.1 COST OF INSTALLATION

In this topic, the estimated financial aspects of the project and installation will be described, such as: Savings generated, prices, payment methods and analysis of financial viability.

Table 2 shows the cost with and without the system, without the system the monthly expenditure on energy is R$ 2,525.00, while with the photovoltaic panel system, the value drops dramatically to R$ 201.86 per month, generating savings of R$ 2323.14 per month, showing that the value of savings is very high and that the investment in a solar system is worth it.

Continuing the comparison in Table 2, another data that proves to be relevant is the estimated savings for the year, which is close to R$ 27,877.69, this value in the long, medium and long term is quite satisfactory for small businesses such as the bakery studied.

Table 2: Application costs.

Item description	Amounts in reais (R$)
Account cost without system	2.525 R$/month
System account cost	201.86 R$/month
Estimated cost of first year without system	30,300.00 R$/Year
Estimated cost of the first year with the system	2,422.31 R$/year
Estimated average monthly savings in the first year	2,323.14 R$/month
Estimated total savings in the first year	27,877.69 R$/month

Source: Authors, (2023).

IV.1.1 Feasibility Indicators

Table 3 shows the advantages of applying solar panels in homes and small businesses, it also shows percentages and values of the project carried out. It is worth noting that the study was based on a small bakery, but the feasibility of installing solar panels is also valid for other bakeries and local businesses that, with the high amount of energy consumed, become a point to be explored by small entrepreneurs in the city of Manaus, which have medium and long-term returns.

Table 3: Advantages of the application.

Application advantages	Values and deadlines
System value without financing	BRL 89,954.12
Annual energy readjustment	10% average
Payback (turnaround time)	2 years and 10 months
Roi (return on investment)	28.72 times
Tir (Internal Rate of Return Investment)	40.93%
Value kwh System	0.14R$/kwh (0.84 savings per hour)
Economy in 25 years	BRL 2,583,452.78

Source: Authors, (2023).

Table 3 shows that the value of the cost for the implementation of photovoltaic panels in the bakery has a relatively high cost, but it has a skillful and satisfactory payback time, considering that photovoltaic panels last on average about 25 years if well cared for , having a payback of 2 and a half years, means that the bakery owner would have about 22 years of low energy costs, the biggest expense being with maintenance and cleaning of the plates, which is a considerably low cost, thus being feasible have solar panels.

And the most striking data is the savings that would be achieved in 25 years, which would be approximately R$ 2,583,452.78, which is a high amount, this economy is due to the fact that Brazil is an excellent country to have a of photovoltaic panels, since the climatic conditions are propitious for this purpose.

This article seeks to show in a simple way that the use of photovoltaic panels for the consumption of renewable energy is valid in Brazil and that the financial return in savings with the energy bill is quite satisfactory, despite some difficulties such as the capital for the implementation of the system and the lack of some laws that encourage the implementation of this system, the use of photovoltaic panels is still quite valid.

V. CONCLUSIONS

Solar energy in Brazil has experienced significant growth, driven by factors such as abundant solar potential, favorable government policies and lower technology costs. Although there are challenges to be overcome, such as energy transmission and storage infrastructure, the future of solar energy in Brazil looks promising. With continuous investments in research, development and implementation of solar projects, the country can take full advantage of its solar potential, contributing to the diversification of the energy matrix and environmental sustainability.

V. AUTHOR'S CONTRIBUTION

Conceptualization: Antônio Rodrigues de Oliveira.
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