

**UNIVERSITY OF EDUCATION, WINNEBA**

**CUSTOMERS' PERCEPTION AND PURCHASE INTENTION OF COCO**

**WOOD FURNITURE**

**BY**

**MARK ADU LARBI**

**AUGUST, 2018**

**UNIVERSITY OF EDUCATION, WINNEBA**

**CUSTOMERS' PERCEPTION AND PURCHASE INTENTION OF COCO  
WOOD FURNITURE**



**BY**

**MARK ADU LARBI**

**7161230002**

**A project in the Department of Construction and Wood Technology, Faculty of  
Technical Education, submitted to the School of Graduate Studies, University of  
Education, Winneba in partial fulfillment of the requirements for award of the  
Master of Technology (wood) degree.**

**AUGUST, 2018**

## DECLARATION

### STUDENT'S DECLARATION

I, Mark Adu Larbi declare that this project, with the exception of quotations and reference contained in published works which have all been identified and duly acknowledge, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE-----

DATE-----

### SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of project as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: PROF MARTIN AMOAH

SIGNATURE-----

DATE-----

## ABSTRACT

The purpose of this study was to assess customers' perception and purchase intention of coco wood furniture. The study was guided by the following objectives; to evaluate customer's perception of coco wood furniture with respect to functionality and aesthetics. To identify the environmentally friendliness of coco wood chair and their satisfaction with customers. To evaluate customers purchase intention of coco wood furniture. The study was done by research and analysis for designer's consideration factors such as durability, function, aesthetics, environmentally friendliness, and purchase intention. A descriptive quantitative research method was used. Primary data was collected using a five scale Likert questionnaire. The questionnaire was distributed to the 2018 Sandwich and Distance students of the University of Education, Winneba-Kumasi Campus. Data submitted through questionnaire was entered into Statistical Package for Social Sciences (SPSS v 21) statistical software and analyzed for descriptive statistics. Sampling technique was used to select a population sample from the entire University student's population. Descriptive statistics was used to analyze data. Tables were used in rating the data to establish the relationship between variables. The research found out that the durability, function, aesthetics, environmentally friendliness, and purchase intention of the coco wood chair have positively influenced on the respondents comment. The study therefore further recommends that the Ministry of Tourism, Culture and Creative Arts and other stakeholders should encourage the nation's TVET institution and wood workers in the coastal towns to harvest, process and use the over-aged coconut trees for furniture and other related use in other to contribute to the conservation of the forest.

## ACKNOWLEDGEMENT

First, I would like to thank the Almighty God for continuously blessing me with the presence of mind, health, and faith to complete my Master's Degree. May all the Praise, Glory and Honor be unto Him?

I would like to thank my parents; Mr. Samuel Asamoah Larbi and Mrs. Regina Korantenma, who have always encouraged my siblings' and me to reach for our dreams. They have made enormous sacrifices in their lives to ensure we get the best education. Their love and support has inspired me to accomplish things I never imagined. I thank them for being great parents and excellent role models. I love you, and no matter how high I go in life, I will always look up to you.

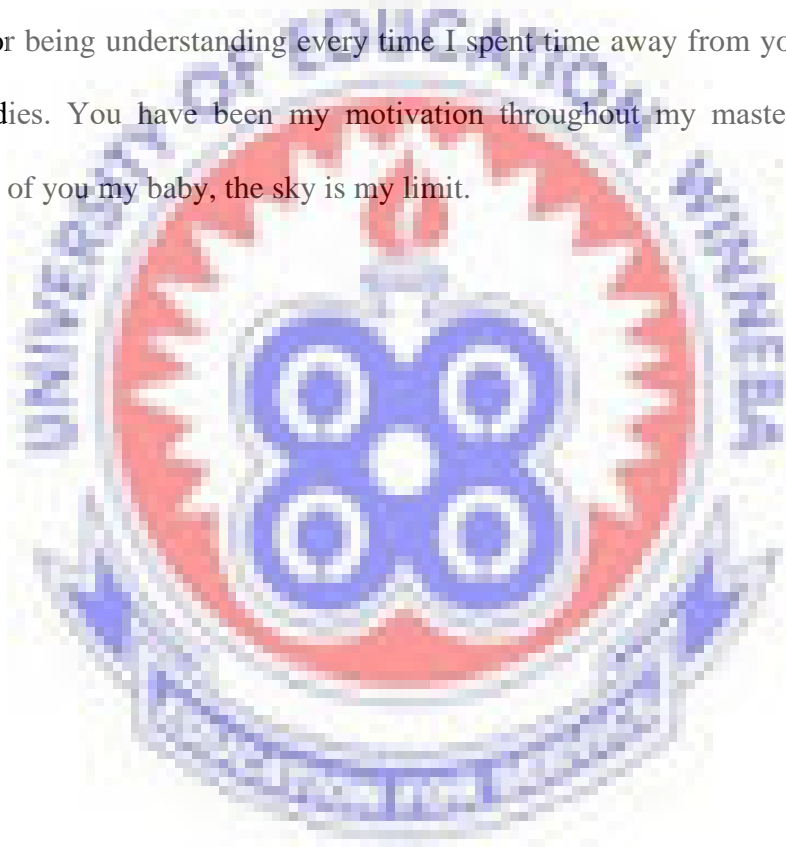
I would like to thank my wife' Mrs. Regina Adu Larbi for her generous support and encouraging words throughout the program. Your support indeed went a long way in pushing for this achievement. May God bless you abundantly?

I would also especially like to thank my Supervisor, Professor Martin Amoah for his continued friendship, guidance and mentoring through the project process. This would indeed not have been achieved without his comments and contributions.

Lastly to the principal and staff of Asuansi Technical Institute most especially to Mr. Anthony Awuah of Furniture Department, Mr. Francis Fynn of Wood Technology Department, Mr. Emmanuel Fynn of Fashion Department, Mr. Robert Sam of Creative Art Department and all the students in the Furniture Department for their enormous support during the project construction and administering of the questionnaire. May God bless you All.

## DEDICATION

I would like to dedicate this project to my Wife Regina Asante and our child (Ama Korantenma Adu Larbi) for being my cheerleaders throughout this process. I am truly grateful to you my wife for your assistance, support, encouragement and understanding. It is amazing what a simple statement like “you are doing a good job” does for one’s morale as a master’s student especially when you are a father, husband, employee and student all at the same time. A big thank you to my little angel; Ama Korantenma Adu Larbi for being understanding every time I spent time away from you as I undertook my studies. You have been my motivation throughout my master’s program and because of you my baby, the sky is my limit.



## TABLE OF CONTENTS

DECLARATION .....	ii
ABSTRACT.....	iii
ACKNOWLEDGEMENT .....	iv
DEDICATION .....	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES .....	xi
LIST OF FIGURES .....	xii

### **CHAPTER ONE .....**

<b>1.0 INTRODUCTION .....</b>	<b>1</b>
1.1 Background of study .....	1
1.2 Statement of Problem.....	4
1.3 Purpose of the Study .....	5
1.4 Objectives of the Study.....	5
1.5 Research Questions.....	6
1.6 Significance of the Study .....	6
1.7 Scope of the Study .....	7
1.8 Limitations of the Study.....	8
1.9 Organization of the Study.....	8
1.10 Definition Of Terms.....	8
1.11 Chapter Summary .....	10

### **CHAPTER TWO .....**

<b>2.0 LITERATURE REVIEW .....</b>	<b>11</b>
2.1 Introduction.....	11
2.2 Design .....	11
2.2.1 Process Design .....	12
2.2.2 Design Evaluation.....	13
2.3 Durability .....	14
2.4 Functionality .....	15
2.5 Aesthetic .....	15
2.6 Purchase Intention.....	16

2.7 The Coconut Palm.....	17
2.7.1 Origins, Natural Distribution, and Global Dispersal.....	18
2.7.2 Botanical Description.....	19
2.7.3 Fronds .....	20
2.7.4 Flowers.....	21
2.7.5 Fruit.....	21
2.7.6 Stem .....	22
2.7.7 Roots .....	22
2.7.8 Genetic of Coco Wood.....	22
2.7.9 Properties of Coconut Palm .....	23
2.7.10 Structure of the Coconut Palm .....	23
2.7.11 Physical and Strength Properties of Cocos nucifera .....	23
2.7.12 Mechanical Properties.....	25
2.7.13 Chemical Properties .....	25
2.7.14: The Anatomy of Coconut Palm .....	26
2.7.14 Processing Coconut Wood.....	27
2.7.15 Harvesting, sorting and handling logs.....	27
2.7.16 Harvesting .....	28
2.7.17 Sorting Logs.....	28
2.7.18 Cutting Pattern .....	28
2.7.19 Grading of Coco Lumber .....	29
2.7.20 Cross-section showing grades of timber from a milled log .....	30
2.7.21 Sort green, off-saw .....	30
2.7.22 Dip to protect sawn boards against stain and moulds .....	31
2.7.23 Stack.....	31
2.7.24 Machining .....	32
2.7.25 Finishing .....	32
2.7.26 Coconut Craft.....	34
2.8 Joint.....	35
2.8.1 Widening Joint .....	35
2.8.2 Angle Joint .....	35
2.8.3 Framing Joint .....	35
2.8.4 Halving Joint.....	36
2.8.6 Mortise and Tonon Joint .....	36
2.8.7 Dowel Joint .....	37



2.9 Chapter Summary ..... 38

**CHAPTER THREE..... 39**

3.0 METHODOLOGY ..... 39

3.1 Introduction..... 39

3.2 Profile of the Study Areas..... 39

3.3 Research Design..... 40

3.4 Population and Sampling Design..... 41

3.4.1 Sampling Design ..... 41

3.4.2 Sampling Strategy ..... 42

3.4.3 Sampling Frame ..... 42

3.4.4 Sampling Technique ..... 42

3.4.5 Sample Size..... 43

3.5 Data..... 43

3.5.1 Primary Data ..... 43

3.5.2 Secondary Data Collection ..... 44

3.5.3 Data Collection Instruments..... 44

3.5.4 Validation of Instruments ..... 44

3.5.5 Data Collection Procedure ..... 44

3.6 Methods of Data Analysis..... 45

3.7 Tools and materials used for the constuction of the chair..... 45

3.8 General work procedures and processes ..... 51

3.8.1 Isometric View of Convertible Chair..... 52

3.8.2 Orthographic View..... 53

3.8.3 Sectional Drawing..... 54

3.8.4 Exploded View of Chair ..... 55

3.8.5 Parts List Of Convertible Chair ..... 56

3.8.6 Details Of Construction of Joints..... 57

3.8.7 Cutting List ..... 59

3.8.8 Material Costing..... 60

3.8.9 Procedure for the Construction of the Convertible Chair ..... 61

3.8.9.1 A Coconut Plantation ..... 61

3.8.9.2 Felling of Coconut Tree ..... 61

3.8.9.3 Round Logs of Coco Wood ..... 62

3.8.9.4 Conversion of Coco Wood in to Board..... 63

3.8.9.5 Stacking of Coco Wood Boards.....	64
3.8.9.6 Planing of Coco Wood Board.....	65
3.8.9.7 Ripping and cross cutting.....	66
3.8.9.8 Making out and construction of various joint.....	66
3.8.9.9 Pre-Assemble of Joints.....	67
3.8.9.10 Sanding of various parts with rough sand paper (60°-120°).....	68
3.8.9.11 Final Clamping of Joints and Lamination of Boards.....	69
3.8.9.12 Application of Sanding Sealer.....	71
3.8.9.13 Final Sanding (220°- 600°).....	72
3.8.9.14 Application of Final Coating Material (Lacquer).....	72
3.8.9.15 Fixing of Fittings (Hinges).....	73
3.8.9.16 Final Products.....	74
3.12 Chapter Summary.....	74
<b>CHAPTER FOUR.....</b>	<b>75</b>
4.0 RESULTS AND FINDINGS.....	75
4.1 Introduction.....	75
4.2. General Information.....	75
4.2.1 Response Rate.....	75
4.1.2 Gender of the Respondents.....	75
4.2.3 Age of Respondents.....	76
4.3 Durability.....	78
4.4. Functionality.....	78
4.5. Aesthetics.....	79
4.6. Environmentally Friendliness.....	81
4.7. Purchase Intention.....	82
4.8. Overall.....	83
4.10. Chapter Summary.....	83
<b>CHAPTER FIVE.....</b>	<b>84</b>
5.0 DISCUSSION OF RESULTS.....	84
5.1 Introduction.....	84
5.2 Customer's perception of coco wood furniture with respect to functionality, Aesthetics and Strength.....	84
5.2.1 Durability.....	84

5.2.3 Functionality .....	84
5. 2.4 Aesthetics .....	85
5.3 Environmentally Friendliness .....	85
5.4. Purchase Intention.....	86
5.5. Overall .....	86
5.6. Chapter Summary .....	87
<b>CHAPTER SIX .....</b>	<b>88</b>
6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATION.....	88
6.1 Summary .....	88
6.2 Key Findings of the Study .....	90
6.2.1 Customers perception of coco wood furniture with respect to functionality and Aesthetics.....	90
6.2.2 Durability .....	90
6.2.3 Functionality .....	90
6.2.4 Aesthetics.....	90
6.3 Environmentally Friendliness.....	90
6.4 Purchase Intention.....	91
6.5 Recommendation .....	91
6.6 Suggestions for Further Research .....	92
<b>REFERENCE.....</b>	<b>93</b>
APPENDIX A.....	99
APPENDIX B .....	100
APPENDIX C .....	101
APPENDIX D.....	103

## LIST OF TABLES

Table 1: Physical and Strength Properties of Cocos nucifera.....	25
Table 4.2: Background characteristics of respondents.....	79
Table 4.3.1: Durability rating.....	80
Table 4.4.1: Functionality rating.....	81
Table 4.5.1: Aesthetic rating.....	82
Table 4.7.1: Environmentally friendliness rating.....	83
Table 4.8.1: purchase intention rating.....	84
Table 4.9.1 Overall rating .....	85



## LIST OF FIGURES

Figure 1: Distribution and spread pattern by trade routes of coconut.....	19
Figure 2: Cross Section of Coconut Trunk.....	23
Figure 3: The three density areas of coco wood.....	24
Figure 4: Cutting pattern.....	29
Figure 5: Cross-section showing grades of timber from a milled log.....	30
Figure 6: Making up fungicide solutions.....	31
Figure 7: A coconut plantation.....	62
Figure 8: Felling of coconut tree.....	63
Figure 9: Round logs of coco wood.....	64
Figure 10: Conversion of coco wood in to board.....	65
Figure 11: Stacking of coco wood boards.....	66
Figure 12: Planing of coco wood board.....	66
Figure 13: Ripping and cross cutting.....	67
Figure 14: Making out and construction of various joint.....	68
Figure 15: Pre-assemble of joints.....	69
Figure 16: Sanding of various parts with rough sand paper.....	70
Figure 17: Final clamping of joints and lamination of boards.....	71
Figure 18: Application of sanding sealer.....	72
Figure 19: Final sanding.....	73
Figure 20: Application of final coating material.....	73
Figure 21: Fixing of fittings.....	74
Figure 22: Final products.....	75

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background of Study

The third International Conference on Coco wood Utilization, organized principally by the Forest Products Research and Development Institute (FPRDI) in coordination with the International Tropical Timber Organization (ITTO) and the Common Fund for Commodities International Tropical Timber Organization (CFITTO), was successfully conducted on 26-29 October, 1997 at Holiday Inn, Manila, Philippines. At that time, coco wood was considered as a good model of non-timber forest product (NTFP). The coconut palm (*Cocos nucifera* L.) is the most well-known member of the palm family (Last, 2001). It is the only species recognized in the genus *Cocos* (Chan and Elevitch, 2006). It is in the family *Arecaceae* (palm family), sub family *Cocoideae*, Genus *Cocos*, and species *nucifera* (Chan and Elevitch, 2006). In many cultures around the world the local name for the coconut palm translates to “tree of life”, “tree of heaven”, "Milk Bottle at the Doorstep of Mankind", the "Heaven's Gift to Mankind", or other such names because of the numerous uses and products derived from the coconut palm (Chan and Elevitch, 2006; Last, 2001; Ghana Ministry of Food and Agriculture (A), 2011; Frater 2004). *Cocos nucifera* is found throughout the tropics, with different varieties in different locations (Chan and Elevitch, 2006; Ghana Ministry of Food and Agriculture (B), 2011; Gunn et al. 2011; Noel et al. 2007; Quaicoe et al. 2009). However over the last decade, coco wood furniture sales in the world have experienced an increase and it is predicted that the growth will continue in the coming years. A majority of sales of coco wood furniture are produced in In Asia, with Indonesia as the largest area devoted to coconut (3,712,000 ha), followed by the Philippines (3,080,000 ha), India (1,669,000

ha), Sri Lanka (419,000 ha), Thailand (412,000 ha) and Malaysia (290,000 ha). Coco wood furniture became an important economic crop in Indonesia at the end of the 1960s with the growing motorization of river transportation and an increase in the number of traders and exporters (Asian-Pacific Network on Integrated Plant Nutrient Management, 2004). In terms of export value, coco wood furniture became by far Indonesia's most important NTFP. Although Africa is among the key producers of coco wood furniture, its market remains small. According to Mangi (2000), during the colonial period, there existed a significant trade in coco wood products in Africa. In particular, Cameroon and Gabon supplied France and its colonies and Ghana (formerly the Gold Coast) supplied a significant proportion of the large UK market during the inter-war period are among the countries in the world that export coco wood furniture. However in Ghana, coconut palms of the 'West African Tall' variety are common as is also a key source of household livelihood in coast region Quaicoe et al. (2009). The wood from these senile trees are potential renewable resource for timber and a good substitute for traditional hard woods as each part of the coconut tree can be used to produce items of value for the community. Coconut products provide food, shelter, and energy to farm households, and can be made into various commercial and industrial products. In a highly liberalized global trade environment, innovation and creativity in the coconut wood furniture industry are needed for survival (Boceta, 1997). In order for the Ghanaians to be globally competitive in coco wood furniture industries in the world the country must exert all efforts to design for durability and aesthetic. The term design aesthetic is employ in two ways: it may refer to the objective features of a stimulus (e.g. colour of a product) or to the subjective reaction to the specific product features. To make a distinction between the two meanings, in the present study aesthetic refers to the individual's reaction to these products, including form, tone, colour, and

texture (postrel, 2003). Conversely, attractiveness refers to the individual's reaction to these product features and represents the degree to which a person believes that the product is aesthetically pleasing to the eye (Van der Heijden, 2003). The response to aesthetic design is not only influenced by specific design factors (such as form or surface attributes) but may also be modified by characteristics of the individual, such as age, personality, cultural background or gender Crilly et al. (2004). Aesthetic value is considered to be the effect (or style) of objects as to what degree they can teach us to perceive or understand the appeal of beauty (Eco, 2004). Nevertheless a designed object, such as a piece of furniture, can be evaluated regarding whether beauty is involved in it, or not. Aesthetic value means the complexity of the properties of objects, devices or equipment, which provide appeal, pleasure and good experience when it comes to sensation, action or indirectly, to the general human state of health related to a given object (Antal, 2007). The durability of an artifact also depend on it joints. Joints According to coco wood furniture industry, the designer should extremely try to understand the nature of coco wood furniture joints to be able to provide a design which is easy to produce and cost saving. Coco wood joints can be divided into four types including literal jointing to expand the width, jointing to expand the thickness, jointing to extend the length, and cornering. In addition, the factors that affected the strength of coco wood joints are grain pattern, wood moisture, shrinkage and warping direction, wood joints pattern as well as joint material and method. Cornering is common in multi pattern furniture including upper, middle, and lower cornering as well as corner supporting using coco wood as an enhancement and warping prevention at upper, middle, and lower part. Therefore, this cornering will be done by full piece cornering which can be fixed with nail, pivot, tenon joint, dovetail, dowel, halving, and finger joint. "Not surprisingly, as the international business world increasingly focuses on



Ghana as a potential market place for coco wood furniture, there is a growing body of literature attesting to durability and aesthetic of coco wood furniture both across Africa and within Ghana. Ghana is viewed as attractive market place for coco wood furniture because of the availability of raw material. Therefore, the researcher would like to assess customers' perception and purchase intention of coco wood furniture.

## **1.2 Statement of Problem**

The coco wood furniture market is getting more complex in the world than it was before. In order to measure consumer's needs, preferences and habits, it is important to improve contemporary values of coco wood furniture. In recent years, it is evident that the habits of buying and using coco wood furniture have been changed (Domljan et al, 2006; Horvat et al, 2008). The construction of individual pieces of coco wood furniture is increasingly coming to the forefront. A personal contact is being established between the customer and the furniture, which is a relationship of one (product) to one (customer). In order to satisfy the individual demands, higher strength as well as higher quality appeared as a necessity. In the competition that occurs on the market, when choosing coco wood furniture, preference is given to individuality and emotions (Domljan and Grbac, 2014). Of course, there are various factors that also influence customer decisions when buying furniture: price, quality, reliability, etc. (Raport DTI, 2005). Therefore, functionality and aesthetic functions, determinative forms and fashionable style play a very important role in coco wood furniture design and production. Those parameters, usually connected with visual parameters of the design, are measurable, as well as other designer's parameters appearing in the product, by using special designer's methods such as Function analysis, sensation, action or indirectly, to the general human state of health related to a given object (Antal, 2007). In industrial design, objects are created with the intention to satisfy not only aesthetic

criteria but also criteria of utility and practical function (Papanek, 2005). These features are inseparable. In the products such as coco wood furniture they can only appear jointly. “Being useful also means being beautiful. There is no separate usefulness and beauty, but what is useful is considered beautiful as well” (Lissák, 1997). There has to be a suitable combination of usefulness and beauty. In contemporary world, people generally buy coco wood furniture in order to use it as well as to take pleasure in it. It is essential, however, to determine the proportion of functionality and aesthetic functions in coco wood furniture? This proportion has to be determined to satisfy consumer demands. To establish this proportion, both functionality and aesthetic functions have to be measured. It is important to notice that there is still no exact method that could determine precisely the proportion of these functions. A number of experiments have been carried out, but the exact definition of aesthetic and functions has been based on modelling consumers’ value judgements (Antal, 2007). The quality and function of two similar products can be measured on the level of function satisfaction. The satisfaction measure determines which product is better, more beautiful and stronger and more attractive (Lissák, 1997). This study is therefore to fill the knowledge gap by investigating on Customers’ perception and purchase intention of coco wood furniture.

### **1.3 Purpose of the Study**

The main purpose of the study was to assess customers’ perception and purchase intention of coco wood furniture.

### **1.4 Objectives of the Study**

The general objective of this study was to evaluate customers’ perception and purchase intention of coco wood furniture.

The specific objectives were:

1. To evaluate customers perception of coco wood furniture with respect to functionality and aesthetics.
2. To identify the environmentally friendliness of coco wood chair and their satisfaction with customers.
3. To evaluate customers purchase intention of coco wood furniture.

### **1.5 Research Questions**

In an attempt to get questions best suited to the study, the following questions will be in focus:

1. What perception does customers have on coco wood furniture with respect to functionality and aesthetics?
2. To what extent will the environmentally friendliness of coco wood chair influence customers satisfaction?
3. How does the coco wood furniture influence customer's purchase intention?

### **1.6 Significance of the Study**

In the recent years the habits of buying coco wood furniture have changed. The construction of individual pieces of coco wood furniture is increasingly coming to the forefront. A personal contact is being established between the customer and the furniture, which is a relationship of one (product) to one (customer). In order to satisfy the individual demands, higher quality as well as higher prices appeared as a necessity. The competition is beginning on the market, where emotion becomes a significant factor in decision-making process. Therefore, functionality and aesthetic functions, determinative forms and fashionable style play a very important role in coco wood furniture design and production.

It is my firm conviction that the study will provide very useful and adequate information that will help the government and manufactures of coco wood furniture make informed decisions as to exactly what to do to augment utilization of the coco wood furniture product. The study is as follows:

- Promote value addition as well as increased use of coco wood product.
- Provide market intelligence to inform both Government and industry on pricing, trade and product trends.
- It will assist the manufactures of coco wood furniture assess the strength of various joints.
- It will help the government to formulate policies that will hasten the local coco wood furniture manufacturing industry.
- It will help consumers to appreciate coco wood product.
- It will help coco wood furniture manufactures improved upon their skills.
- It will help improve coconut wood finishing technique in Ghana.
- The study will also serves as a reference material for all who want to carry any further research on the situation to further improve it.

### **1.7 Scope of the Study**

The study is to evaluated customers' perception and purchase intention of coco wood furniture, using the University of Education, Winneba- Kumasi Campus as a case study. Therefore, the study was geographically limited to the University of Education, Winneba- Kumasi Campus. Moreover, the study was conceptually limited to the customers' perception and their purchase intention of coco wood furniture

### **1.8 Limitations of the Study**

In spite of effort to ensure that accuracy and good work is accomplished, there were also potentials setbacks which may influence the final results some of these setbacks are as follows:

Participants were scatted in various parts of the University Campus such as Technology block, Autonomy Hall, Opoku ware Hall, Woodwork shop, and the School library as they also feel reluctant to disclose certain information because they fear they could be identified. The researcher assured them that the study was for academic purpose only and that anonymity is assured.

On the other hand, participant in certain parts of the University campus also feared that the outcome of the study will tarnish their image. Therefore, they were also unwilling to participate in the study. However, the researcher clarifies these thoughts and they were willing to correspond. Some participate may be unwilling to cooperate due to their heavy schedules. Therefore the number to be interviewed may be smaller than anticipated.

### **1.9 Organization of the Study**

The study was organized into six chapters. Chapter one explained the rationale and motivation for the study and also presents the objectives, research questions, significance and the limitations. Chapter two was on review of related and relevant literature. The methodology used to carry out the study was presented in chapter three with chapter four dealing with the presentation and interpretation of the results. The chapter five discussed the results of the findings. The final chapter, chapter six talks also about the summary, conclusions and recommendations.

### **1.10 DEFINITION OF TERMS**

FPRDI: Forest Products Research and Development Institute

**Aesthetic:** The objective features of a stimulus (e.g. colour of a product) or to the subjective reaction to the specific product features.

**FAO:** Food and Agriculture Organization

**ITTO:** International Tropical Timber Organization

**NTFP:** Non Timber Forest Product

**Participant:** Sampled population whose through questionnaire and interview.

**Coco wood:** A collective term commonly used in the genus *Cocos* belonging to Family *Arecaceae* (palm family), and sub family *Cocoideae*, Genus *Cocos*, and species *nucifera*.

**Joint:** Two ends meeting at a point to form an angle.

**Furniture:** A house holds item use for ornamental purpose

**SD:** Standard Deviation

**SPSS:** Statistical Package for Social Science.

### **1.11 Chapter Summary**

This chapter has presented a background of the research, the problem statement and objectives of the research, significance of the study and its scope as well as definition of terms used in the research. Chapter two presents a review of the literature with regards to the study objectives. Chapter three describes the methodology used in the research while chapter four dealing with the presentation and interpretation of the results. The chapter five discussed the results of the findings. The final chapter, chapter six also talks about the summary, conclusions and recommendations.



## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Introduction

Academics are mainly concerned with the issue of the effectiveness of coco wood furniture industries in Ghana. Although coco wood furniture is widely used in various countries, there is a clear lack of studies on customers' perception and purchase intention of coco wood furniture. Hence there is call for more in-depth research to be carried out on customers' perception and purchase intention of coco wood furniture. Hence this chapter present various literatures which is relevant to the research questions stated in chapter one.

The chapter has been broken down into the following units:

2.2 Design

2.3 Durability

2.4 function

2.5 Aesthetic

2.6 Purchase intention

2.7 Material (coconut palm)

2.8 Joint

#### 2.2 Design

Design is the international planning or inventing and making of an article for a particular use. The term design refers to the article itself as well as the planning of its construction, operation and appearance. It may be made by hand or machine and is influenced by materials, shape, structure and appearance. Therefore in designing for furniture, the designer must try to understand the nature of raw material, dimension of the user, safety and user feeling. Designing is therefore the organization or arrangement



of an element such as dot, line, shape and texture. However, the study in furniture designing has various objectives such as to develop new product, to improve manufacturing process, to improve present product and process, to find extra benefit on present or rejected product, to find technical data for main division in the organization, to analyze the competitor's product, and to find and extend the knowledge which is the main reason of furniture research as well as this study. The study processes are as follow:

- collecting information about product design
- Collecting information about manufacturing and usage of furniture to analyze the design
- Collecting specific information about coco wood for furniture manufacturing
- Analyze the design process of coco wood furniture
- Effectively analyze the risk factor affecting furniture design
- Design follows results
- Conclusion.

In designing an artefact, it must begin with a process.

The following are the design process:

### 2.2.1 Process Design

**Planning for Design;** is the initial process of wooden furniture design. The designer must identify customer group which leads to customer needs then plans for expected product to answers the demand of the marker. Thus, the designer may plan for the product that already has its demand in the market then finalize the decision and conclude the expected design as well as plan the guideline (list) for the task.

**Product Specifications;** begins with specific feasibility study of related wooden

furniture in target customer group. The designer must obviously state about production technology level, and basic information preparation.

**Concept Design;** is concept presentation of the wooden furniture which comprised of concept generation based on basic information, experience, and skill of the designer then will be concept selection and concept testing.

**Product Architecture;** is involving with various parts including design development, costing, prototype construction and prototype testing.

**Industrial Design;** in real wooden furniture industrial design, designer must start with a process in design revision. The designer and manufacturer must verify the design then the designer will begin production drawing and tendering for manufacturing and drawing again specially for manufacturing (Hall, 1965).

**Production;** for production process, the designer should cooperate with manufacturer as well as examine the product in every process with engineer. Website:

<http://www.edexcel.com/quals/btec/Pages/default.aspx>

### 2.2.2 Design Evaluation

A good furniture design must answer to the main objective of effective creative design in various ways such as ease in use, ease in manufacturing and ease in distributing using these following evaluation criterions.

Good function and aesthetics, Durability, Economy, Appropriated material, Appropriated structure, Personality/Identity, Beauty (Wattanakun, 200).

Design analysis and evaluation is not necessary to perform only in the last process. In the other hand, the designer involved people and should evaluate such design in other processes to made effective and accurate decision in each process (Rujikiatkamjorn, 2010).

### 2.3 Durability

Furniture quality is determined by its form, aesthetics, functionality, ergonomic, rigidity, strength and durability (Smardzewski, 2008). Moreover, different furniture items, similarly to other daily necessities, should be designed in such a way so as to guarantee safety of their utilization. Furniture intended for storing should in particular be characterized by high rigidity, durability as well as reliability. One of the key issues in coco wood construction is durability. Traditionally, durability design of coco wood components and structures is based on a mixture of experience and adherence to good building practice, sometimes formalized in terms of implicit prescriptive rules. Therefore, the expected performance cannot be specified in quantitative terms. The design cannot be optimized and any change of design will be associated with uncertain risks. A modern definition of durability is the capacity of the structure to give a required performance during an intended service period under the influence of degradation mechanisms. Conventional durability design methods for coco wood do not correspond to this definition. The development of performance-based design methods for durability requires that models are available to evaluate performance in a quantitative and probabilistic format. This means that the relationship between product performance during testing and in service need to be quantified in statistical terms and the models should be calibrated to ensure that they provide a realistic measure of service life, with reasonable degree of certainty. Tested, untreated coco wood had limited natural durability, suggesting it cannot be used in weather-exposed conditions (Keating and Bolza, 1982). However, above-ground durability greater than 10 years has been observed for higher density boards. Standard tests are needed to confirm this. High density, dry coco wood is not susceptible to powder-post beetle (*Lyctus* species) and is suitable for use in fully protected. Untreated coco wood is not resistant to termite attack.

## 2.4 Functionality

Function can be expressed as the properties related to the use of a product. These properties include the relation between a product and a consumer (Antal, 2007). On the basis of purchasing motivation, the system of functions can be divided into: - functionality (e.g. utility and practical function) and - aesthetic functions (e.g. visual sensation, emotions). Function analysis is a method for analyzing and developing a function structure. A function structure is an abstract model of the new product, without material features such as shape, dimensions and materials used. It describes the functions of the product and its parts and indicates the mutual relations. In function analysis, the product is considered as a technical-physical system. The product functions consist of a number of parts and components, which fulfil sub-functions and the overall function. By choosing the appropriate form and materials, a designer can influence the sub-functions and the overall function. The principle of function analysis is to specify what the product should do and then to infer what the parts - which are yet to be developed - should do as well (Boeijen et al, 2013).

## 2.5 Aesthetic

'Aesthetics' comes from the Greek word *aesthesis*, referring to sensory perception and understanding or sensuous knowledge. In the eighteenth century, the philosopher Baumgartner picked up the term and changed its meaning into gratification of the senses or sensuous delight (Goldman, 2001). Since works of art are (mostly) produced for this reason, i.e. to gratify our senses, the concept has since been applied to any aspect of the experience of art, such as aesthetic judgment, aesthetic attitude, aesthetic understanding, aesthetic emotion, and aesthetic value. Aesthetic value is considered to be the effect (or style) of objects as to what degree they can teach us to Perceive or understand the appeal of beauty (Eco, 2004). Nevertheless a designed object, such as a piece of furniture, can be evaluated regarding whether beauty is involved in it, or not.

Aesthetic value means the complexity of the properties of objects, devices or equipment, which provide appeal, pleasure and good experience when it comes to sensation, action or indirectly, to the general human state of health related to a given object (Antal, 2007). In industrial design, objects are created with the intention to satisfy not only aesthetic criteria but also criteria of utility and practical function (Papanek, 2005). These features are inseparable. In the products such as furniture they can only appear jointly. “Being useful also means being beautiful. There is no separate usefulness and beauty, but what is useful is considered beautiful as well” (Lissák, 1997). There has to be a suitable combination of usefulness and beauty. In contemporary world, people generally buy furniture in order to use it as well as to take pleasure in it. It is essential, however, to determine the proportion of functionality and aesthetic functions in case of furniture? This proportion has to be determined to satisfy consumer demands.

## **2.6 Purchase Intention**

Previous purchase experiences with satisfaction play a significant role in shaping purchase behaviors in the future especially as a minimization strategy effort (Jones and Suh, 2000; Russell-Bennett et al., 2007). Besides that, purchase satisfactions are also an important key driver of loyalty (Russell-Bennett et al., 2007) and repurchase intentions (Cronin and Taylor, 1992; De Run and Jee, 2009). In this phenomenon is thought to possess both affective and cognitive components (Bitner, 1990; Oliver, 1980). This can be explained through the construct of pre-purchase and post-purchase satisfaction. Studies done on examining the relationship between pre-purchase and post-purchase satisfaction showed that post-purchase satisfaction was to be the outcome of the pre purchase decision making process and consequently explaining the overall purchase satisfaction phenomenon (Chae et al., 2006). Hence, the easiest way to explain overall purchase satisfaction would be to explain and show it through post-purchase

evaluation (Dube and Menon, 2000; McCollough and Gremler, 2004). This is because when customers or consumers make a purchase decision that is based on what they need or how these purchases may be convenient to them, these customers or consumers would expect post-purchase services to be provided by the company or provider and hence it would lead to satisfaction and repeat-purchase intentions (Shim et al., 2002). Besides that, previous studies have also shown that anticipated satisfaction and pre-purchase satisfaction were both discernible constructs where pre-purchase were identified as the predictor of purchase behaviour, particularly for first time buyers (Simintiras et al., 1997). Other similar studies done on guarantee evaluation have also shown a significant relationship between evaluations and pre-purchase choice where guarantee would likely influence consumer satisfaction even if the guarantee was highly reliable (McCollough and Gremler, 2004). Such a phenomenon would anticipate post-purchase satisfaction that was to be likely identified as the predictor for overall purchase satisfaction and following a consumption experience pattern (Chae et al., 2006). Post-purchase satisfaction here is critical for increasing repeat purchase behaviors apart from maintaining the existing customers (Jaramillo and Marshall, 2004; Johnston and Marshall, 2003).

## **2.7 The Coconut Palm**

The coconut palm (*Cocos nucifera L*) is found throughout the tropics, where it is interwoven into the lives of the local people. It is particularly important in the low islands of the pacific where, in the absence of land- based natural resource, it provides almost all the necessities of life. In many cultures around the world the local name for the coconut palm translates to “tree of life”, “tree of heaven”, or other such names because of the numerous uses and products derived from the coconut palm (Chan and Elevitch 2006, Last, 2001; Ghana Ministry of Food and Agriculture (A), 2011; Frater, 2004). Today it remains an important economic and subsistence crop in many small

pacific island states.

### **2.7.1 Origins, Natural Distribution, and Global Dispersal**

The origins of the coconut palm, is based on genetic analysis and origination of ‘Dwarf’ cultivars, are in Southeast Asia and the islands around the seas surrounding Indonesia and Malaysia (Chan and Elevitch, 2006; Gunn et al. 2011; Last, 2001; Perera et al, 2003). From its origin, it naturally spread west to the east coast of Africa among the tropical islands of the Pacific (Last, 2001). The coconut would not have reached the west coast of Africa without human aid because of its inability to survive the duration of travel and southern climactic conditions that fall outside the coconut temperature tolerance. In addition, the coconut would not be able to compete in a trans-continental spread. Humans aided the spread of the coconut from West Africa to the Caribbean (Gunn et al. 2011; Last, 2001). Initial introduction of the coconut to Panama was most likely accomplished by pre-Columbian Austronesian seafarers. Europeans introduced different varieties later Gunn et al. (2011). The eastward expansion was aided by humans bringing other varieties from the west coast of the New World to the Caribbean side of the continent (Gunn et al. 2011; Last, 2001). Thus, completing the coconut’s pan tropic expansion, Human aid in the distribution of the coconut may or may not have been an intentional act (Last, 2001). Early Polynesians would have used the coconut as a source of fresh water or food (Chan and Elevitch, 200; Gunn et al. 2011; Last, 2001). An immature coconut can contain as much as two liters of water and keep fresh for a few days. The mature nuts may contain as much as 700 ml of water and has an edible kernel inside. If the mature nut sprouted into a seedling, the kernel inside would still be edible, or if it was a surplus at the end of the journey, it could be planted at the destination (Last, 2001). European followed in suit years later, approximately 500 years ago (Last, 2001). It was European trade vessels carrying coconuts for supplies that completed the coconut’s spread around the world. First, Europeans introduced coconuts

to West Africa, then from West Africa to the Caribbean and the rest of the Atlantic American tropics. Figure 1 displays a map from Last (2001), delineating the area of origin and natural distribution and global range. This map is super-imposed on a map from Gunn et al. (2011) showing the coconut varieties in different locations and the different trade routes that influenced the spread.

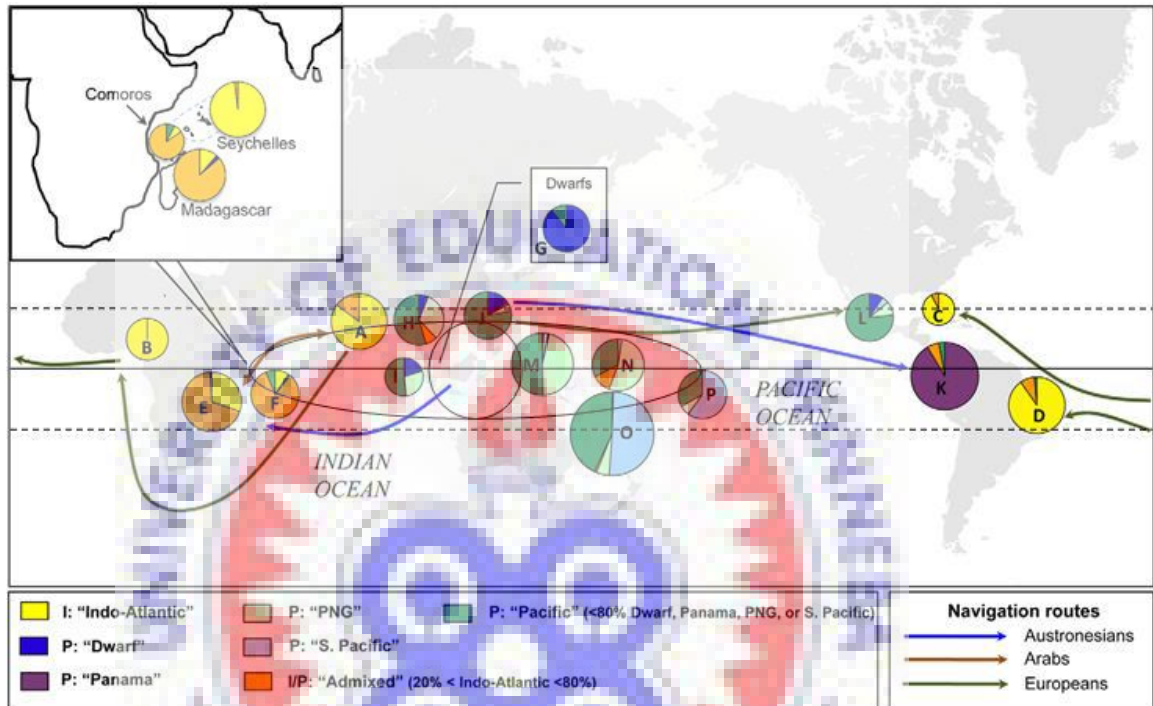


Figure 1: Distribution and spread pattern by trade routes of coconut.

The circle represents the origin, location of domestication, of coconut palms. The ellipse is the natural distribution, and the current distribution is delineated by the parallel lines approximating the Tropic of Cancer, in the north, and Tropic of Capricorn, in the south (Last, 2001). The pie charts represent the varieties present at the locations with the arrows showing how trade routes influenced coconut spread Gunn et al. (2011).

### 2.7.2 Botanical Description

The following description applies to the Tall variety of coconuts, which is the dominant type grown the world over.



The coconut palm (*Cocos nucifera* L.) is the most well-known member of the palm family (Last, 2001). It is the only species recognized in the genus *Cocos* (Chan and Elevitch, 2006). It is in the family *Arecaceae* (palm family), sub family *Cocoideae*, Genus *Cocos*, and species *nucifera*, non – preferred scientific names is *Palma coco*'s

Miller, **common name:**

Coconut palm (English),

ha'ari (Society Islands),

Iru (palu),

Lu (Yap, Kosrare),

ni ( Pohnpei, Marshall Islands),

niu (Polynesia, Papua New Guinea, Fiji)

niyog ( Guam),

nizok ( N.Mariana Islands),

nu ( Chuuk, Cook Islands),

te ni ( Kirbati). The local names for coconut (niu in Polynesia and Melanesia, niyog in the Philippines and Guam) are derived from the Malay word nyiur or nyior.

**Other regions:** *Coco da Babia, coco da Indian, coqueiro de Babia* ( Portuguese)

*Coco, coco de agua, cocotero, palma de coco, palmera de coco* ( Spanish)

*Coco, cocos, cocospalm, klapperboom* ( Dutch)

*Coco, cocotier, cocoyer, coq au lait noir de coco* ( French)

*Kokospalme* ( German)

*Kalapa, nyior* ( Malaysia/Indonesia)

*Niyog* (Philippines, Tagalog). (Chan and Elevitch 2006).

### 2.7.3 Fronds

The crown of the coconut palm consists of its fronds, flowers, and fruits, and is usually between 8-9 m (26-30ft) in diameter with fronds evenly distributed around the stem.

Fronds of the coconut palm are pinnate, with a primary rachis. The rachis has 200-250 lanceolate leaflets on each of the two horizontal planes (Chan and Elevitch, 2006).

#### **2.7.4 Flowers**

A coconut palm takes 3-7 years to flower (Chan and Elevitch, 2006; Last, 2001; Melendez-Ramirez et al. 2004; Okorley and Haizel, 2004), but some varieties, usually 'Dwarfs', fruit as fast as 3 years (Chan and Elevitch, 2006; Melendez-Ramirez et al. 2004; Okorley and Haizel, 2004). In ideal conditions, a healthy palm produces a new inflorescence, or spadix, with each new frond (Chan and Elevitch, 2006).

#### **2.7.5 Fruit**

The coconut palm name was derived from the description of its fruit by early Spanish explorers. The three indentations, or "eyes", of the hairy coconut resembled a "monkey face", coco, and nucifera referred to the "nut-bearing" property of the palm (Ghana Ministry of Food and Agriculture (A) 2011). The coconut consists of a thin hard skin (exocarp) covering a thick fibrous layer known as the husk (mesocarp) attached to the outside of a hard shell (endocarp). Inside the shell is a white kernel (endosperm when immature, copra when mature). The kernel surrounds a vacuole that is filled with water when immature, but the water is replaced by an empty space as the fruit ages (Chan and Elevitch, 2006; Last, 2001; Okorley and Haizel, 2004; Rachel et al. 2010). This empty space is crucial to the coconut's ability to be dispersed by the ocean; the empty vacuole helps the nut to float (Last, 2001). The coconut water is nutrient rich, almost perfectly isotonic, and aseptic enough to be used as an IV fluid (Frater 2004, Ghana Ministry of Food and Agriculture (A), 2011). The kernel of the coconut, known for its high-oil content, is rich in saturated fatty acids (Frater, 2004; Last, 2001; Ghana Ministry of Food and Agriculture (A), 2011).

### **2.7.6 Stem**

Capable of obtaining heights of 40 meters (130 ft.), the stem's primary purpose is to keep the palm in the light (Chan and Elevitch, 2006; Last, 2001). The coconut palm is a monocotyledonous plant; it does not have thickening circumferential rings or secondary thickening. Instead, the coconut palm reaches maximum diameter early in life and maintains an almost uniform size stem with efficient vascular bundles scattered evenly throughout the stem, giving it a homogeneous cross section. This makes the stem strong yet flexible and capable of sustaining massive amounts of damage while maintaining its function and sustaining the palm (Last, 2001).

### **2.7.7 Roots**

There is no tap root for the coconut palm, but rather a fibrous network of adventitious roots (Chan and Elevitch, 2006; Last, 200; Meerow and Broschat, 1993). The individual roots are approximately 1 cm (0.39in) in diameter, spreading mostly horizontally from the stem base. The majority of the roots is in the top 1.5 m (5ft) of the soil but can reach depths of 5 m (16 ft). The roots grow laterally about 6 m (20 ft) from the stem, but can reach as far as 30 m (100 ft) in ideal conditions (Chan and Elevitch, 2006).

### **2.7.8 Genetic of Coco Wood**

In Ghana there are two main varieties of coconut they are the 'Tall' and the 'Dwarf'. 'Tall' varieties, the more common to the two, are named mostly for their geographical location and sometimes the morphology of the fruit. The fruit of the coconut is spherical to oblong in shape, at least 850 g (1.9 lbs.), and occur in bunches on the palm. 'Dwarf' varieties are also named for their location and the color of the immature fruit. The 'Dwarf' variety, generally, are shorter in stature, have a thinner stem, fruit earlier, and have smaller fruits than the 'tall' varieties (Chan and Elevitch, 2006).

### 2.7.9 Properties of Coconut Palm

Unlike conventional trees, coconut palm is a monocotyledon with no tap root and has no outer cambium layer. Because the palm lacks cambium, when the stem is injured it cannot repair the wound by new growth (Oduor and Giothiomi, 2006; Ohler, 1999). Ohler (1999) and Oduor and Giothiomi (2006) agree that because of the lack of cambium, once the coconut stem is formed it does not increase in diameter with age. "The diameter varies from 200 to 300 mm, with a gradual reduction towards the top" (Ohler 1999).

### 2.7.10 Structure of the Coconut Palm

The cross section of the stem has three distinct zones: dermal, sub-dermal and the central zone. The dermal is most peripheral portion just below the bark; the sub-dermal is a zone between the dermal and the central zone or core (Arancon, 1997; Ohler, 1999; Oduor & Giothiomi 2006).

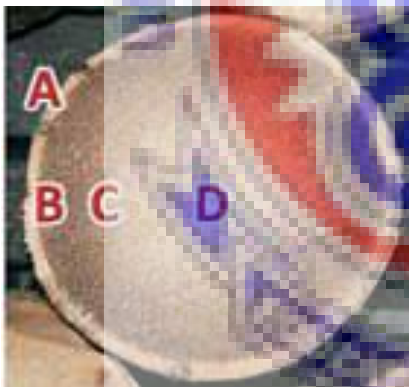


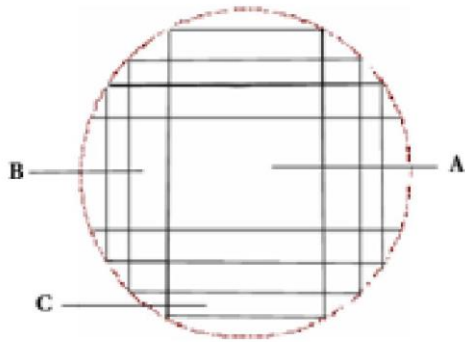
Figure 2: Cross Section of Coconut Trunk.

Source: Bailleres et al. (2010). A- Bark B – Dermal C - Sub-dermal D – Central zone or core.

### 2.7.11 Physical and Strength Properties of *Cocos nucifera*

The results are shown in Table 1. The wood is classified as ranging between light and heavy (Wimbush, 1957) due to its varying heterogeneity (density) over its cross section and along the stem height.

Figure 3: The three density areas of coco wood



A: Center (very light/faint grains), low density.

B: Towards the outer ring (light grains), medium density

C: Outer ring (deep grains), high density or hard wood

Under mechanical properties, two properties are considered - Modulus of Rapture (MOR) for the bending strength and compression strength for Crushing Strength. This too there was a range from very weak to very strong. Other physical and mechanical properties are listed below in Table 1.

Table 1: Physical and Strength Properties of Cocos nucifera

Density (g/cm <sup>3</sup> )-[air dry]	0.248 – 0.852	Light – Heavy
Bending strength (MOR) [N/mm <sup>2</sup> ]	16.34- 109.21	Very weak- very strong
Bending stiffness (MOE) [KN/mm <sup>2</sup> ]	1.982 – 12.705	Very weak – very strong
Crushing strength [N/mm <sup>2</sup> ]	9.84 – 77.56	Very weak – very strong
Shear strength (parallel to grain) [N/mm <sup>2</sup> ]	2.1 – 17.37	Soft – hard
Hardness (KN)	0.66 – 14.905	Soft – very hard
Machining	Moderately easy	
Drying rate	Slow rate	

### 2.7.12 Mechanical Properties

The mechanical properties of coconut which define the use are closely related to the basic density (Arancon, 1997; Killmann and Fink, 1996). Coco wood contains three degrees of density that dictate its uses:

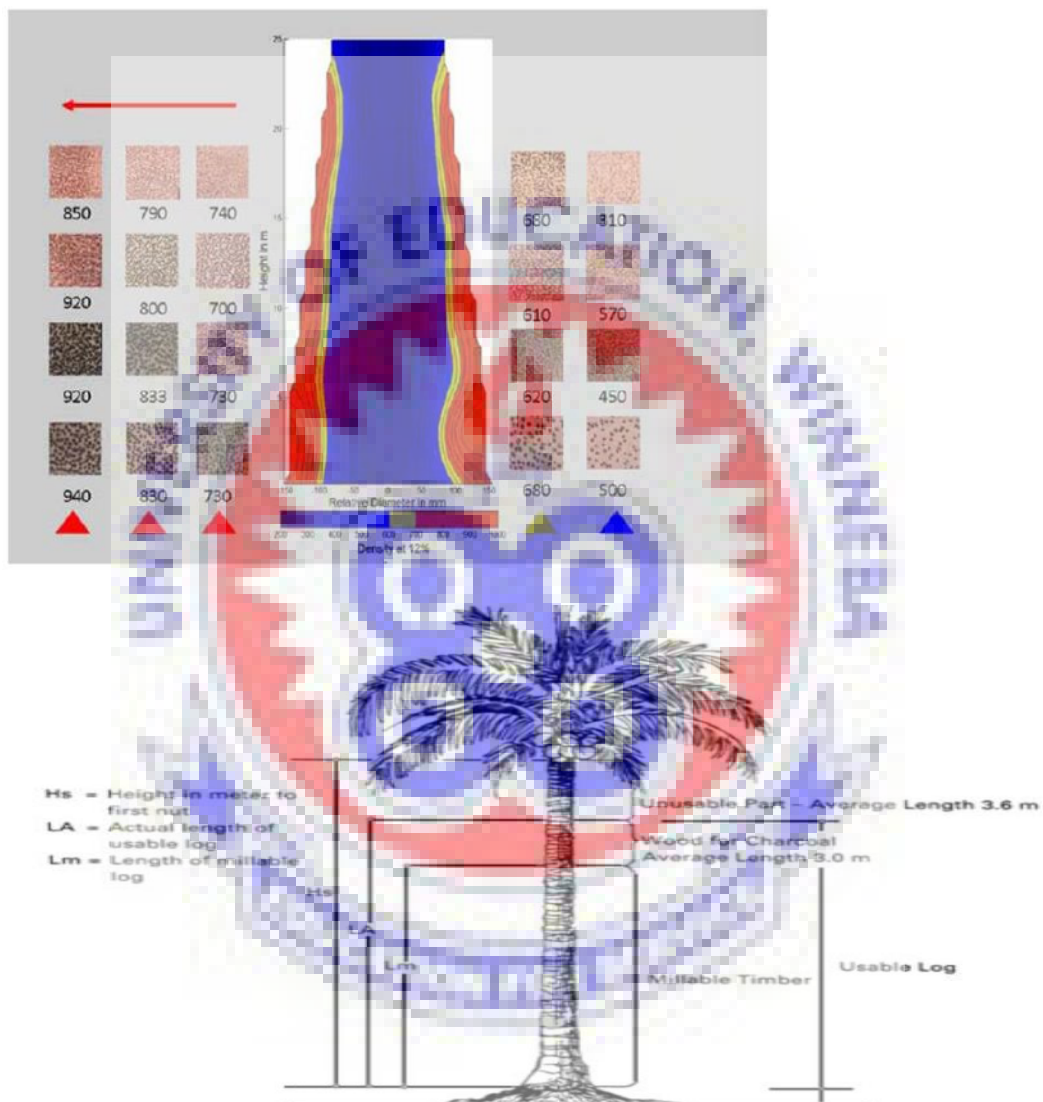
- High-density wood (dermal or at the periphery of the trunk) – hard: basic density of 600-900 kg/m<sup>3</sup>
- Medium-density wood (sub-dermal or next to the high-density portion) – medium/hard: basic density of 400-600 kg/m<sup>3</sup>
- Low-density wood (found at the core of the trunk) – soft/medium: basic density of 2000-400 kg/m<sup>3</sup> (Arancon, 2009).

### 2.7.13 Chemical Properties

"Chemical properties of coconut wood can be compared to conventional hardwoods and softwoods, as the holocellulose, lignin and pentosane contents are similar. However, the ash content of coconut wood is much higher" (Ohler, 1999). Arancon (1997) confirms by stating that: Coconut wood is comparable to Philippine

hardwood/softwood and bamboo as far as holocellulose, lignin and pentosane content are concerned. However, it contains higher ash than Philippine woods. The proximate chemical compositions of coconut wood are the following: holocellulose (66.7%); lignin (25.1%) and pentosanes (22.9%) (Chemical properties, para. 1)

#### 2.7.14: The Anatomy of Coconut Palm



Source of the photos: Bailleres H, Hopewell G, House S, Redman A, Francis L, and Ferhrmann, J (2010). Coco wood processing manual. From coconut wood to quality flooring. Department of Employment, Economic Development. Macroscopic and Microscopic features of *Cocos nucifera*.

#### 2.7.14 Processing Coconut Wood

Arancon (2009) writes that "coconut utilization involves primary and secondary processing. Primary processing includes logging, sawmilling, anti-sap stain treatment, lumber grading, drying and preservation. Secondary processing includes machining, assembly and finishing of products (furniture, handicraft, etc.)"

#### 2.7.15 Harvesting, sorting and handling logs

##### Selecting suitable stems

The variation in palm 'wood' quality means that it is important to identify the stems that are most likely to contain a high proportion of high density 'wood' (or hard fibre), as far as possible. Sometimes old coconut plantations contain some younger palms that were planted more recently after wind or storm damage. These stems will have a smaller proportion of hard material. The criteria used for selecting stems are:

- **Stem age** - tall variety stems older than 60 years have a higher proportion of hard fibre.
- **Stems no longer bearing** economically viable coconut crops— these are usually older trees.
- **Absence of scars on the stem:** —scars left by fallen leaves are worn smooth in older trees and hardly visible.
- **Height**—older palms are taller and the tall variety palms generally hold more hard fibre.



### **2.7.16 Harvesting**

Felling and removing the coconut palm is similar to operations for plantation timber trees. Standard chainsaw equipment and tree-felling techniques used for forest trees are also used for coconut palms. Tractors used for snigging the palm logs to the loading site are the same as those used in timber harvesting operations.

Personal protective equipment is strongly recommended: earmuffs or earplugs, helmet or hard hat, eye protection, gloves, chaps, safety boots.

### **2.7.17 Sorting Logs**

On a cut stem, the high density wood is visible as a dark band inside the bark. Stems with more high density wood can be identified at this stage. Logs are also selected for straightness because straighter stems recover longer boards. Suitable logs are usually cut from 0.5 to 12–13 meters in the stem; rarely extending to 15 meters.

### **2.7.18 Cutting Pattern**

Remove the cortex ('bark') layer carefully to avoid wasting the narrow band of high density wood underneath. Unlike the bark tissue in normal timbers, the cortex of coconut palms is inter-grown with the outer, peripheral fibre, and it is relatively difficult to separate with hand tools. This means that it should be sawn off. Set the saw to cut parallel to the external surface of the log to ensure that the board has a consistent density profile from one end to the other. If necessary, raise the small diameter end of the log so the cut remains parallel along its whole length.

If a board has high density fibre at one end, gradually changing along its length to low density at the other end, the board will be at high risk of distorting during drying and service.

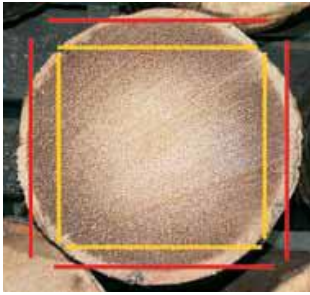


Figure 4: Cutting pattern

**A typical cutting pattern for maximum recovery:**

- Cut 1 – de-bark
- Cut 2 – cut parallel to cut 1, taking the high Density wood, board 1.
- Turn log one quarter turn.
- Cut 3 – de-bark
- Cut 4 – cut parallel to cut 3, taking the high density wood, board 2.
- Turn log one quarter turn.
- Cut 5 – de-bark
- Cut 6 – cut parallel to cut 3, taking the high density wood, board 3.
- Turn log one quarter turn.
- Cut 7 – de-bark
- Cut 8 – cut parallel to cut 3, taking the high density wood, board 4.

**2.7.19 Grading of Coco Lumber**

Not all the trunk of a coconut tree is suitable for construction timber. The top, say one third, is not milled at all, it being the growing tip and hence quite soft. Furthermore, young trees (which normally means less than 40 years) are considered to have produced little timber of commercial value. A mature tree will normally produce 3 logs of, say, 10 to 12 feet (3 to 3.6 m) long, starting from the bottom of the trunk. These are referred to as the butt, middle and top log. Of these, the outside cuts of the bottom two logs

could be considered grade 1, suitable for construction and, if seasoned, joinery and furniture. The remainder of the centre of the log is divided into second and third grade timber as per the diagram below. Grades 1 and 2 are considered to be off sufficient structural strength for single story frame housing, with grade 1 preferred for major structural components

The grade of the lumber is also a direct relationship to its density and weight. Hence grade 1 timber is distinguished from grade 3 by being heavier, darker in colour and having a higher density of vascular bundles.

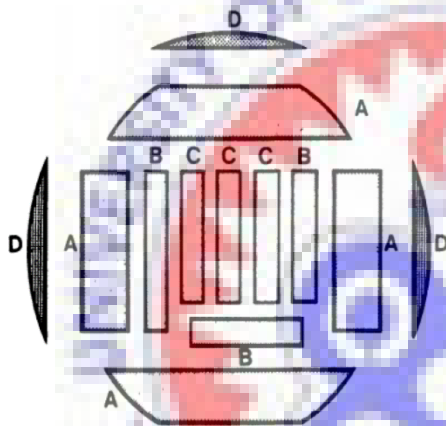


Figure 5: Cross-section showing grades of timber from a milled log.

#### 2.7.20 Cross-section showing grades of timber from a milled log

A= Grade 1: the hardest, strongest and darkest timber.

B= Grade 2: suitable for construction purposes, but not as durable as A.

C= Grade 3: suitable for interior linings, crates, pallets etc.

D= Bark offcuts.

#### 2.7.21 Sort green, off-saw

Green, off-saw sorting is done by a visual assessment of the colour and bundle density of the board. Separate the high density boards, which are suitable for flooring, from the medium and low density material.

### 2.7.22 Dip to protect sawn boards against stain and moulds

Stain control treatment Boards should be dipped immediately after sawing for ten seconds in an appropriate treatment solution.

**Note:** Boards should never be in contact with the ground or in direct sunlight, either before or after dipping.

Figure 6: Making up fungicide solutions



Water (litres) 2% anti-stain (litres)

1 - 0.02 (20 mL)

4.9- 0.1 (100 mL)

9.8 - 0.2 (200 mL)

14.7- 0.3 (300 mL)

19.6- 0.4 (400 mL)

### 2.7.23 Stack

Stack immediately as described fully in Section

Sticker-stacking—a quick reference:

- Stacks should be 400 mm clear off the ground on bearers.
- Full length boards are positioned on outside rows, and bottom and top layers.
- Board ends are supported.
- Dried rack sticks 20 mm (thick) x 30 mm (wide) must be vertically aligned and spaced 450 mm apart.

- Weights should be placed on top of the pack to minimize distortion during drying.
- Accelerated drying in a kiln is recommended to minimize the chance of staining and moulds growing in the wood.

#### **2.7.24 Machining**

Arancon (2009) defines machining as the process of cutting and milling the cocowood into various shapes, patterns and sizes using simple machine tools or more complex woodworking machines such as moulders, routers, lathes, and sanders. Arancon (2009) continues by adding that "The machining quality of coconut wood is influenced by the moisture content, density of specific gravity, and cellular structure of the wood itself or by the factors attributed to the machine used, such as knife angle, feed rate, depth of cut, number of knives, sharpness of knives, and others" Killmann and Fink (1996) and Ohler (1999) also agree that secondary processing involves producing various shapes and sizes using all woodworking machining methods such as sawing, planing, sanding, boring and mortising, lathing, gluing techniques, surface finishing and assembly. Ohler (1999) states that similar to conventional hardwoods, high density coconut wood is not easy to work on, tools and equipment become dull and blunt. Killmann and Fink (1996) suggest that "The tool-blunting properties of coconut palm wood are probably caused by the large density difference between the vascular bundles and the ground tissue together with the fine dust that is formed during machining".

#### **2.7.25 Finishing**

Finishing is one of the last manufacturing processes in all furniture and wooden products. Its main function is to protect the wood surface against environmental effects, enhance the appearance and service life through preservative action and for decorative finishing (Killmann & Fink, 1996; Ohler, 1999). Arancon (1997; 2009) writes that just like other furniture timber, cocowood needs the application of finishes to preserve and

show "the grain, color, or figure and to enhance its natural beauty. Finishes also impart good protection against abrasive wear, warping, raising of the grain, cracking, and shrinkage." Sanding and filling are also part of surface preparation, sanding levels the wood surfaces and removes the tool and machine marks to produce a smooth surface. Mechanical sanders instead of manual sanding ease finishing the surface of the wood. Also Killmann and Fink (1996) assert that: With regard to pre-conditions and results, there are considerable differences between the sanding directions along, across and perpendicular to the fibre (perpendicular to the end-grain). A rougher surface is obtained when sanding across the grain and a considerably higher amount of material is removed per unit of time (up to 100 %) than when sanding along the grain, under identical sanding conditions.... It may be beneficial to use the following work sequence, among others, when sanding wide faces of solid wood:

1. Sanding across the grain.
2. Sanding along the grain.

This combination is often used to achieve high-quality surfaces, since the first sanding pass (across the grain) shears off the fibres at the pore side edge and thus enables a better sanding quality. In addition, more material volume can be removed per unit time when sanding across the grain, as already mentioned. As a rule, the only additional thing that happens during the subsequent sanding along the grain is that the surface is freed from the transverse grooves left by the sanding grit of the cross-grain sanding, and is smoothed. (para. 8.6.7)

Coating involves the sequence application of stain, filler, sealer and top coating materials such as lacquer, polyurethane, polyester, shellac, wax and oil finish to enhance the natural beauty of the grain, colour and figure of cocowood products. Normally two or more coats of finishes are applied to cocowood to improve the

appearance and quality of the wood products. Since these are transparent, dyes or stains can be used if the wood needs to look darker (Arancon, 1997; Ohler, 1999).

Killmann and Fink (1996) write that: Stains are materials for changing the colour shade of the wood. Their purpose is to equalize the colour, to emphasize the grain structure and to modify the colour shade. Stains consist of soluble dyes, pigments, chemical reactants, solvents and additives. The main types that are used are water stains and solvent stains (organic solvents). Quick-drying solvent stains are especially suitable for use in continuous processes. In contrast to the environmentally friendly water stains, they do not roughen the wood (do not raise the grain). Also Killmann and Fink (1996) continue to caution that: *Cocos n. [nucifera]* can also be treated successfully with synthetic or natural oils and waxes. In a combined treatment, dissimilar materials must be matched to the sub-strate, i.e. to the density of the specific palm wood and to each other. The parenchyma is particularly absorbent when using oil or glaze. When using wax it may in some situations be necessary to refrain from using oil previously.

Greying of the surface may occur if the above instructions are not obeyed.

#### **2.7.26 Coconut Craft**

"Furniture, handicraft and novelty items can be made from coconut wood as it has an unusual but attractive grain, hence its name 'porcupine' timber" (Ohler, 1999 ).

According to Arancon (2009), Coconut wood has properties that make it ideal for furniture and handicrafts:

1. Density – the wood's high density is ideal for products like furniture, but chairs and tables which are quite heavy.
2. Durability – coconut has adequate resistance to insect borers. High density wood appears to withstand the test of time in interior application.
3. Good working properties – the wood has fair to good machining properties.

4. Finishing – the wood can be finished fairly well with transparent finishes.

## **2.8 Joint**

Joint in woodwork are devices for holding parts of wooden artefacts or structures together. There are variety of them and those used for cabinet construction may be categorised into three:widening joints, angle or box joints and framing joints. (Sackey, 1999).

### **2.8.1 Widening Joint**

Joints that are classified as widening joints are those used for holding together a number of narrow boards edge to edge to provide a wide board. Among these are butt joint, tongued joints, tongued and groove joints, rebated joint, dowelled joints and slot- screw joints.(Sackey, 1999).

### **2.8.2 Angle Joint**

Angle joints sometimes referred to as corner joints and are generally used for joining board when their faces meet at right angles with flush edges. They are mostly used in box- like constructions,such as drawers, boxes and solid cabinets. They are the simple butt jpoint, rebated butt joint, plain mitre joint, rebated and mitred angle joint, housed and shouldered joint, comb joint, dovetail joints. (Sackey, 1999).

### **2.8.3 Framing Joint**

Framing joint are those that are commonly used in forming fram-likeconstructions where the pieces meet end to end, with their edges at right angles. Those chiefly used are: dowelled joints, mitred joints,halving joints,bridled joints,and mortise and tenon joint. (Sackey, 1999).

In this project three joint where considered they are : the halving joint, mortise and tenon joint and dowelled joint.



#### 2.8.4 Halving Joint

The halved joint is frequently known as half-lapping, and sometimes as checking and half-checking. In the majority of cases it is made by halving the two pieces, i.e., by cutting half the depth of the wood away. There are, however, exceptions to this rule, as in the case of "three-piece halving" (or, as it is sometimes called, "third lapping") and in the halving of timber with rebated or moulded edges. Halving is one of the simplest methods of connecting two pieces of timber, especially where it is desired to make frames and bracket supports for either inside or outside use. Types of halving joints: Corner halving joint, mitred corner halving joint, Tee halving joint, dovetail Tee halving joint, cross halving joint.

**Corner halving joint:** This is where two pieces form a right angle and is used for frames of cheap flush doors, and other light frames (Fairham, 2007).

**mitred corner halving joint:** Mitred Halving," a somewhat weak joint, but necessary in mirror frames for where good appearance is required on the face side (Fairham, 2007 ).

**Cross halving joint:** Two cross rails and an upright halved together. This type of joint is used where three pieces meet and cross each other with their faces flush (Fairham, 2007 ).

**Dovetail halving joint:** This used for connecting cross rails of frames to resist outside strain (Fairham, 2007).

#### 2.8.6 Mortise and Tenon Joint

mortise and tenon joint is the method of joining timber by working a solid rectangular projection in the one piece and cutting a corresponding cavity to receive it in the adjoining piece. The projection is called the tenon, and the cavity the mortise. Joints of

this type are secured in various ways. Small wedges, wooden dowels, metal dowel pins, glue and paint are frequently used (Fairham, 2007 ).

**Types of mortise and tenon joint:** Barefaced Tenon Joint, Stub Tenon, Haunched Tenon.

### **Barefaced Tenon Joint**

This is called a barefaced tenon, and it will be noticed that the portion which carries the mortise is thicker than the rail on which the tenon is cut. The joint is therefore level (or flush as it is called) on one side only, and it should never be used at the corner of a frame. It is a useful for interior joint such framing that has to be covered on the back side with match boarding, and allows the work to finish level at the back when the boarding has been applied.

**Stub or Stump Tenon:** this is also occasionally called a joggle tenon. The tenon is not allowed to run through the stile. This type of tenon is often used at the corner of a frame (Fairham, 2007).

### **Haunched Tenon**

A Haunched Tenon is used at the end of a door frame. In this case it will be seen that the width of the tenon is reduced, so that sufficient timber will be left at the end of the stile to resist the pressure of the tenon when the joint is driven together. The short portion (A) which is left on the tenon is called the haunch, and the cavity it engages is termed the haunching. The haunch and haunching prevent the two pieces of timber lipping, or becoming uneven on the face side, as would be the result if it were cut away entirely up to the shoulder (Fairham, 2007 ).

### **2.8.7 Dowel Joint**

Dowelling is the term generally given to the method of jointing timber and other materials by wooden or metal pegs, which are called dowels. For cabinet-making and

similar work straight-grained beechwood dowels are mostly used; these may be bought by the gross, in lengths of about 36 ins and of any desired diameter. (Fairham, 2007 ).

## **2.9 Chapter Summary.**

This chapter presents a review of literature based on research objectives. Chapter three looks into the research methodology used in the research.



## CHAPTER THREE

### 3.0 METHODOLOGY

#### 3.1 Introduction

This chapter outlines the general procedure used to ensure the successful execution of the research. The chapter discusses the profile of the study area, research design, population for the study, sampling design, primary and secondary data, data collection instruments, Validation of instruments data collection procedure, data Analysis plan, Tools, equipment's and materials used for the construction of the coco wood chair as well as the General work procedures and processes of the coco wood convertible chair.

#### 3.2 Profile of the Study Areas

Asuansi Technical Institute started as a rural basic school in 1917, under the headship of late chief of Asuansi by name Nana Amo. The school train pupils up to standard three, where pupils were taught how to read, write and recall. In 1947 the school was then handed over to the Educational Division now Ministry of Education to train students in Carpentry, Masonry, Black Smiting, Block Lying and Agricultural Mechanization. In 1949 the school was handed over to the military to train it frontier men for the British campaigned. Later, they stated training students to write the City and Guild Certificate Examination of London in Building Construction, Carpentry and joinery, Electrical Electronic, Moto Vehicle Engineering, and Mechanical Engineering. In 1967 the name of the School was change to Asuansi Rural Trade School and later change to Asuansi Technical Institute. The school is considered to be the first Technical School in Ghana and West Africa. Currently, Asuansi Technical Institute runs programmes in Mechanical Engineering Technology, Electrical Engineering Technology, Agricultural Mechanization Technology, Motor Vehicle Engineering, Welding and Fabrication, Technology, Building construction Technology, plumbing and Gas fitting Technology, Architectural Draughting Technology Creative Art

Technology, Fashion Design Technology, Furniture Design and Construction, Wood Construction Technology, Business Accounting, Secretaryship and Information Technology. The population in 2018, with Mr. Ishmael Arthur as the principal, comprises 1800 students, 150 teachers and 55 non-teaching staff. The school is located in the Abura Asebu Kwamankese District in the Central Region of Ghana. The district has a total population of 117,185 with 55,275 as males and 6,910 as females. The total land area of the district is 380 square kilometers; the major occupation of the people is farming with coconut and citrus which are the major crops grown. In recent time most of the coconut trees were infected with Cape Saint Paul Wilt Disease (CSPWD) which were no longer bearing fruits, it is out of this that I decided to use those infected tree stems to construct chairs and evaluate people's perceptions on its function, aesthetic, environmental friendliness and their purchase intention. The chairs were designed and constructed by the students in the Furniture Design and Construction Department of Asuansi Technical Institute under supervision. The Department has a student population of hundred and twenty. The subjects taught in the Department are Design and Drawing, Material Technology, Production Technology, Practical's and Entrepreneur and Skill Training.

### **3.3 Research Design**

The researcher employed qualitative and quantitative approaches of research to carry out the study. Action, descriptive and quasi-experimental research methods were used. Qualitative research is concerned with collecting and analyzing information in as many forms, chiefly non-numeric, as possible. It tends to focus on exploring, in as much detail as possible, smaller numbers of instances or examples which are seen as being interesting or illuminating, and aims to achieve depth rather than "breadth" (Baxter, Hughes and Tight, 2006). Leede and Ormrod (2006) also assert that, qualitative research encompasses several approaches to research that are, in some respects, quite

different from one another. Yet all qualitative approaches have two things in common. Firstly, they focus on phenomena that occur in nature settings that are “in the real world” and second they study those phenomena in all their complexity.

### **3.4 Population and Sampling Design**

Amoh (2009) defines population as a group of people or objects with common characteristics that are of interest to a researcher. Scientific methods of population identification and sampling strategies were applied. Purposive and convenience sampling techniques were employed. The participants identified were based on proximity of their locations. The sampled population was also based on a careful selection. The population for the study was all year two and three furniture design and construction students of Asuansi Technical Institute respectively were selected as the accessible population.

#### **3.4.1 Sampling Design**

Sampling design is a method used in selecting some elements of a group to represent the entire group of the population of interest Cooper and Schindler (2006). According to Mugenda and Mugenda (2003), the process of selecting a number of individuals for a study in such a way that the individuals selected represents the large population is referred to as sampling. Sampling reduces on the length of time needed to complete the study. It cuts on costs and becomes manageable as it almost mirrors the populations (Gallardo, Lachlan and Davis, 2012). Sampling enables a higher overall accuracy than a census. In addition collecting data from fewer cases means that you can collect information that is more detailed (Sharp and Howard, 2006). This study made use of probability sampling to obtain the desired sample. As Cooper and Schindler (2006) put it, this is a controlled, randomized procedure that assures that each population element is given a known nonzero chance of selection.

### **3.4.2 Sampling Strategy**

Sampling is the process of shedding a selected subset of a research population (Raune, 2005). It is also the set of actual data sources that are drawn from a larger population of potential data source (Sage encyclopedia, 2010). In order to validate the research instruments a pilot study was conducted to a small sample of 5 respondents who were not included in the final study at the University of Education, Winneba – Kumasi. The pilot study was used to identify items on questionnaire that were ambiguous hence improve the final questionnaire.

### **3.4.3 Sampling Frame**

The sampling frame, according to Gill and Johnson (2000) is a list of members of the research population from which a random sample may be drawn. It is a set defining which individuals, households, or institutions qualify for a sample, and then the sample is drawn from those elements. Gallardo, Lachlan and Davis (2012) define sampling frame as the listing of the accessible population from which you'll draw your sample. In some instances sampling frame can be the whole or part of a population (Garson, 2012). For this study, our sampling frame was the year two and three furniture design and construction students of Asuansi Technical Institute.

### **3.4.4 Sampling Technique**

Sampling technique is the process used in drawing a sample from a population (Cooper and Schindler, 2006). Stratified random sampling was used for this study. With stratified sampling the population is divided into groups based on some characteristics. Then within each group a probability sample (often a simple random sample) is selected. In stratified sampling the groups are called strata (Cooper and Schilndler, 2006). A random sample from each stratum is then identified using proportional allocation procedures. In this study, the students were categorized in terms of gender,

age and level of education each consisting of a stratum. A representative sample was picked at random. Every potential respondent had an equal chance of being picked since the sampling was done at random. Stratification ensured fair representation of all business functions and fairness in the sample selected.

### **3.4.5 Sample Size**

He also defines “the sample size as the number of data source that are actually selected from the total population” The researcher used the purposive sampling techniques to draw the sample size for this study. Purposive sampling is a technique of handpicking supposedly typical or instructing cases (Blaxter, Hugther & Tight 2006). Ten students were drawn purposively from the year two and three Furniture Design and Construction students of Asuansi Technical Institute based on their ability and previous performance in practical work. Each student was assign to perform a specific task under the supervision of the researcher.

### **3.5 Data**

Clarke and Dawson (1999) have classified the research data into primary data and secondary data. The primary data are collected to satisfy the specific purpose of the study. Secondary data on the other hand are published findings from earlier research studies and may not pertain specifically to the current study. Secondary data are often collected at the beginning of research to provide back ground and basic information about the topic being researched (Anderson and Nylander, 1999).

#### **3.5.1 Primary Data**

Primary data is the data which is collected by the researcher directly from his own observations and experiences. Primary data for this study were collected using questionnaires.



### **3.5.2 Secondary Data Collection**

The secondary data were assembled through library visits to consult the relevant literary materials from books, journals, magazines, newspapers and the internet.

### **3.5.3 Data Collection Instruments**

Data collection is the process of gathering and measuring information on targeted variables in an established systematic fashion, which then enables one to answer relevant questions and evaluate outcomes (Cooper and Schilndler, 2006). For this study the collection of primary data was done using a five point Likert scale type of questionnaire for data collection. Questionnaire used was close ended. The choice of a questionnaire for this study was considered to be ideal given that questionnaires are stable consistent and uniform offering a considered and objective view of issues. The questionnaires that were used in this study contained only closed ended questions. (see appendix for quetionniar guide).

### **3.5.4 Validation of Instruments**

To ascertain that all primary information sourced through questionnaire guides were accurate, they were examined by the researcher, peers and finally by the supervisor before they were administered. Secondary source of information from libraries were as well examined by both researcher and peers and then it was finally examined by the supervisor before the information was considered valid.

### **3.5.5 Data Collection Procedure**

The researcher chose a day each during the semester examination period of the university. The reason was that during examination period it was difficult for students to be absent and that either absenteeism is nonexistent or reduced to barest minimum. This enabled the researcher to have all respondents he was interested in. The questionnaires were given to the students and they were made aware of the study and

its importance. The approximate time for the completion of the questionnaires was 80 minutes. The researcher had a 100 per cent rate of response.


### 3.6 Methods of Data Analysis



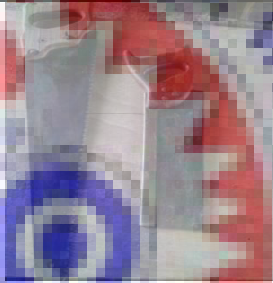
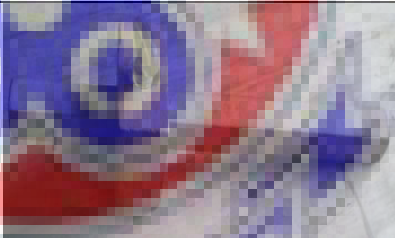


Data Analysis is the process of systematically applying statistical and/or logical techniques, to describe, illustrate and evaluate data (Cooper and Schilndler, 2006). Descriptive statistics was used to analyze data. Therefore, means, standard deviations, frequency distributions, percentages and regression analysis were used to analyze quantitative data that was generated from the research. The data was coded and analyzed with the aid of Statistical Package for Social Sciences (SPSS v 21) and MS Word. The data was then summarized and presented in tables and figures.




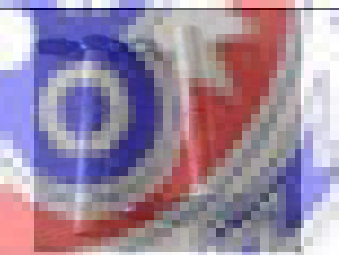

### 3.7 Tools and materials used for the constuction of the chair


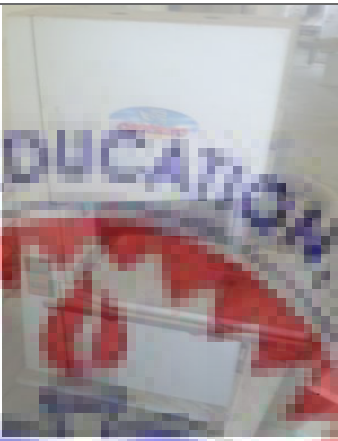
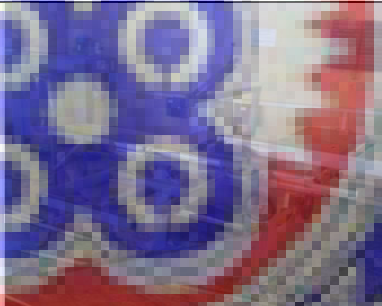

The materials and tools that were used in the construction and finishing of the chair have been described in this section of the project. The tools, equipment's and materials included, tape measure, pencil, making gauge, mallet, plane, try square, flat chisels, saw, spoke shave, brush, clamps, planing machine, jointer, circular saw, band saw, mortising machine, sanding machine, sandpaper, sanding sealer, white glue, lacquer and varnish. Other materials used were coco wood, hinges, nails and screws.






The uses of the tools, equipment's and materials provided are as follows:

Item no	Name of tools and materials	Illustration of tools and materials	Uses
1	Sharpening stone		This was used to keep chisels sharp.

2	Mallet		This was used for driving chisel.
3	Flat chisel		This was used for removing waste from the coco wood lumber.
4	Saw		This was used for cutting the coco wood lumber.
5	Spoke shave		This was used for shaping the back legs of the chair.
6	Clamp		This was used for holding pieces of coco wood together.
7	Plane		This was used for flating the surface of the coco wood material.

8	Tape measure		This was used for taking measurement.
9	Try square		This was used for marking out lines and checking the squareness of the work.
10	Marking guage		This was used for making out lines.
11	Hammer		This was used for striking nails into the coco wood.
12	Chain saw machine		This was used for felling the coconut tree and cross cutting.

<p>13</p>	<p>Planing machine</p>		<p>This was used for planing the coco wood boards</p>
<p>14</p>	<p>Band saw machine</p>		<p>This was used for cutting the back legs of the chair.</p>
<p>15</p>	<p>Circular saw machine</p>		<p>This was used for ripping and cross cutting of the coco wood board.</p>
<p>16</p>	<p>Mortising machine</p>		<p>This was used for mortising the joints.</p>

17	Portable sander machine		This was used for sanding the surface of the chair and table.
18	Spraying gun		This was used for spraying the chair and table.
19	Abrasive Sandpaper		This was used for smoothing the surface of the coco wood.
20	Sanding sealer		This was used to seal the pores of open grain coco wood.
21	White glue		This was used for bonding coco wood pieces together

22	Lacquer		This was used to enhance the natural beauty of the coco wood.
23	Brush		This was used in applying sanding sealer.
24	Coco wood		This was the material that was used for the construction of the furniture.
25	Hinges		This was used to secure the lid of the chair to allow it to be converted into ladder.
26	Nails and screw		This was used for fastening hinges and joint together.

### 3.8 General Work Procedures and Processes

The project started with the designing and working drawing of the unit. A working drawing is the detail drawings, showing all the exploded views, orthographic views, isometric, overall dimensions, cutting list and the detail of joints that was used for the construction of the unit. The researcher did all his drawings using professional AutoCAD inventor 2008, which makes his drawing looks nice and easy to interpret.

The drawing is as follows:

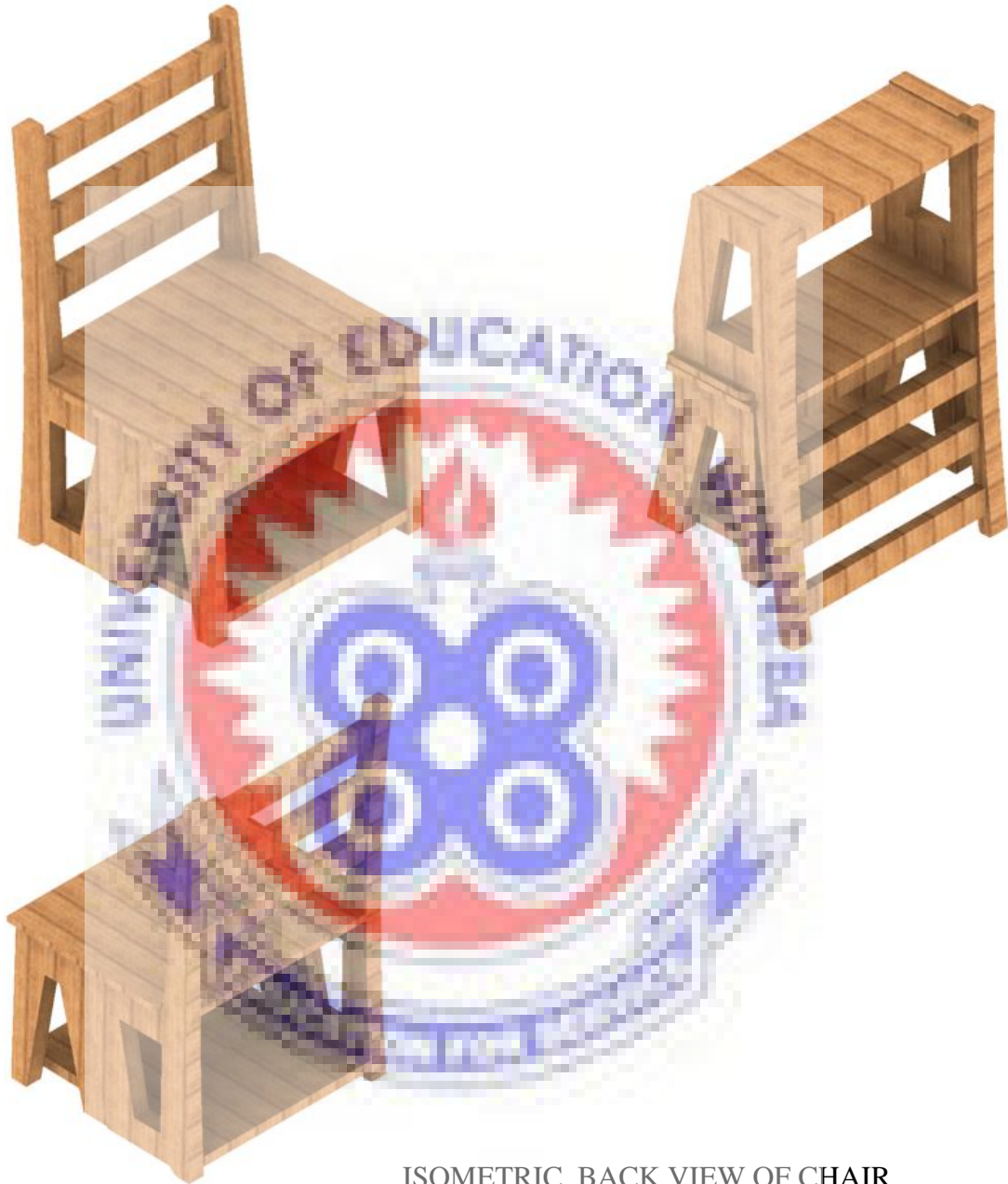




### 3.8.1 ISOMETRIC VIEW OF CONVERTIBLE CHAIR

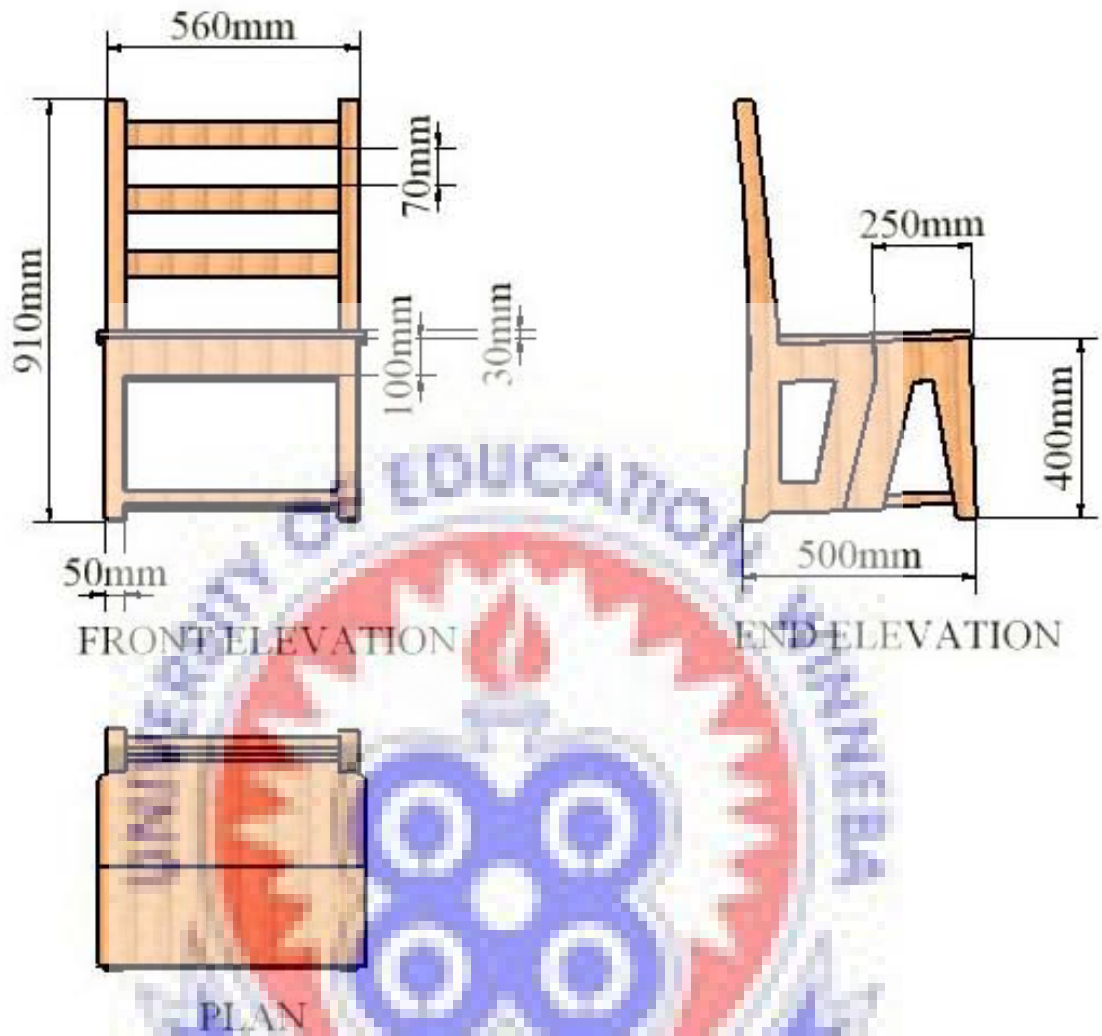
FRONT VIEW OF CHAIR

LADDER BACK CHAIR

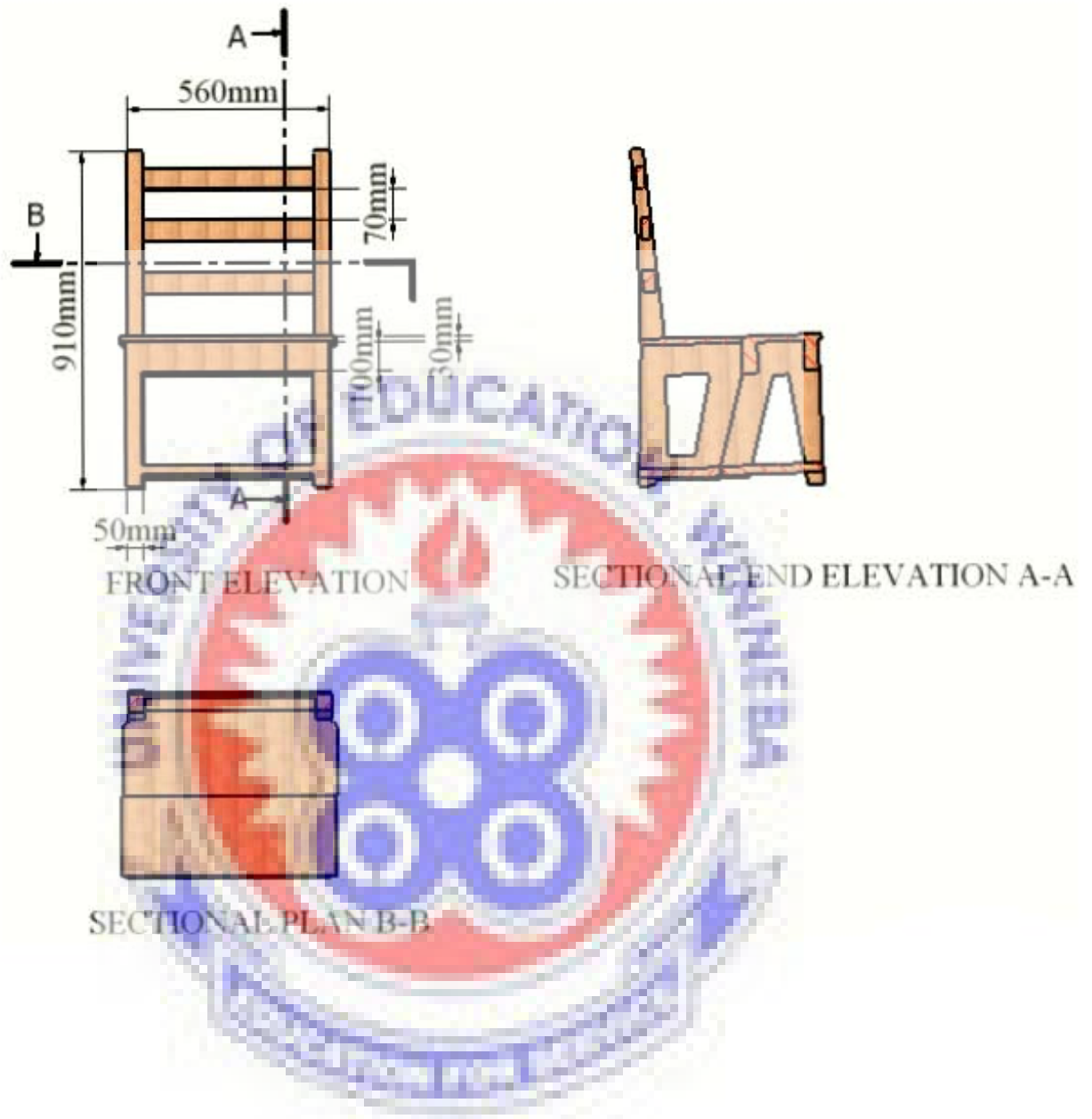


ISOMETRIC BACK VIEW OF CHAIR

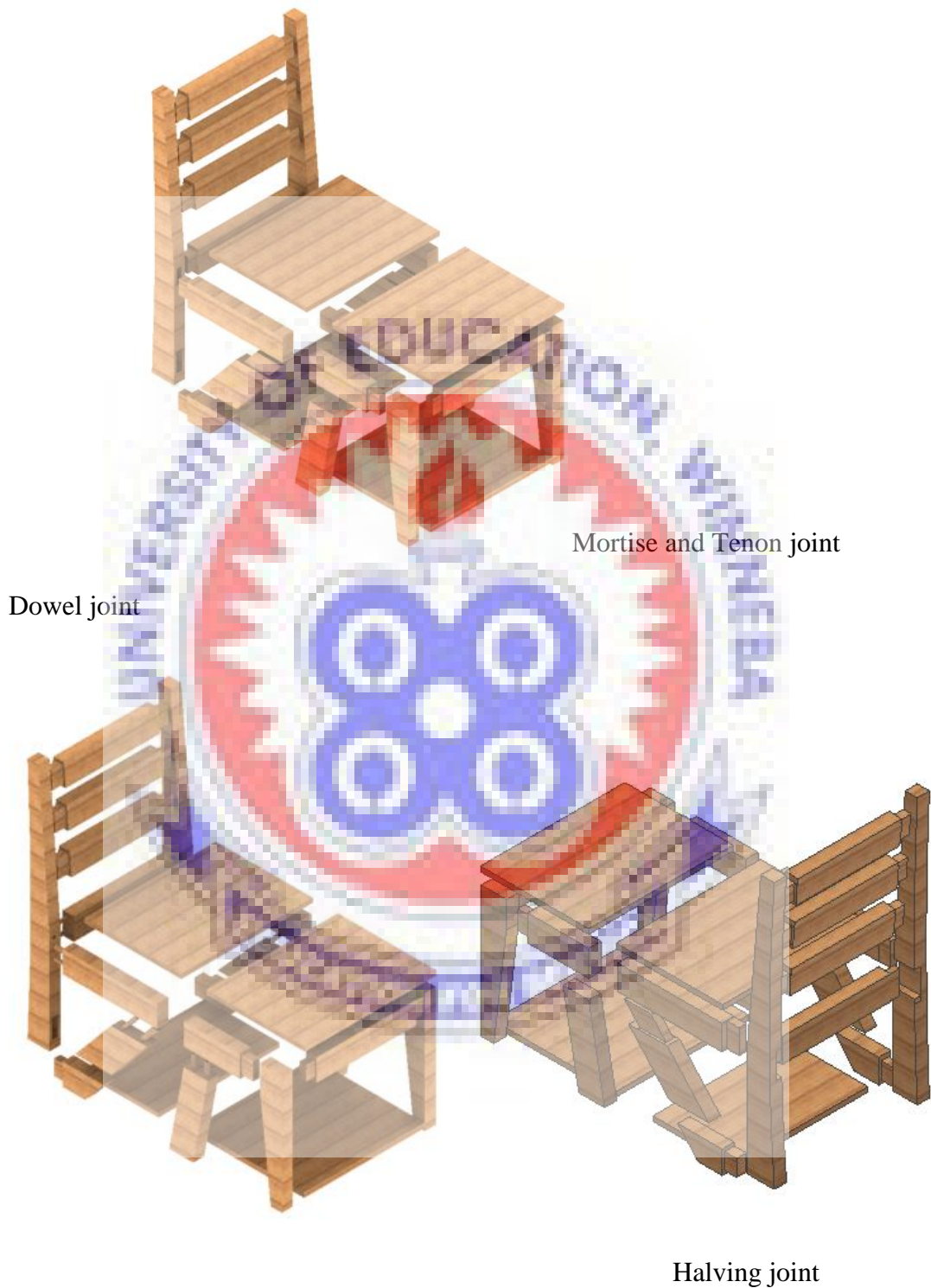
### 3.8.2 ORTHOGRAPHIC VIEW



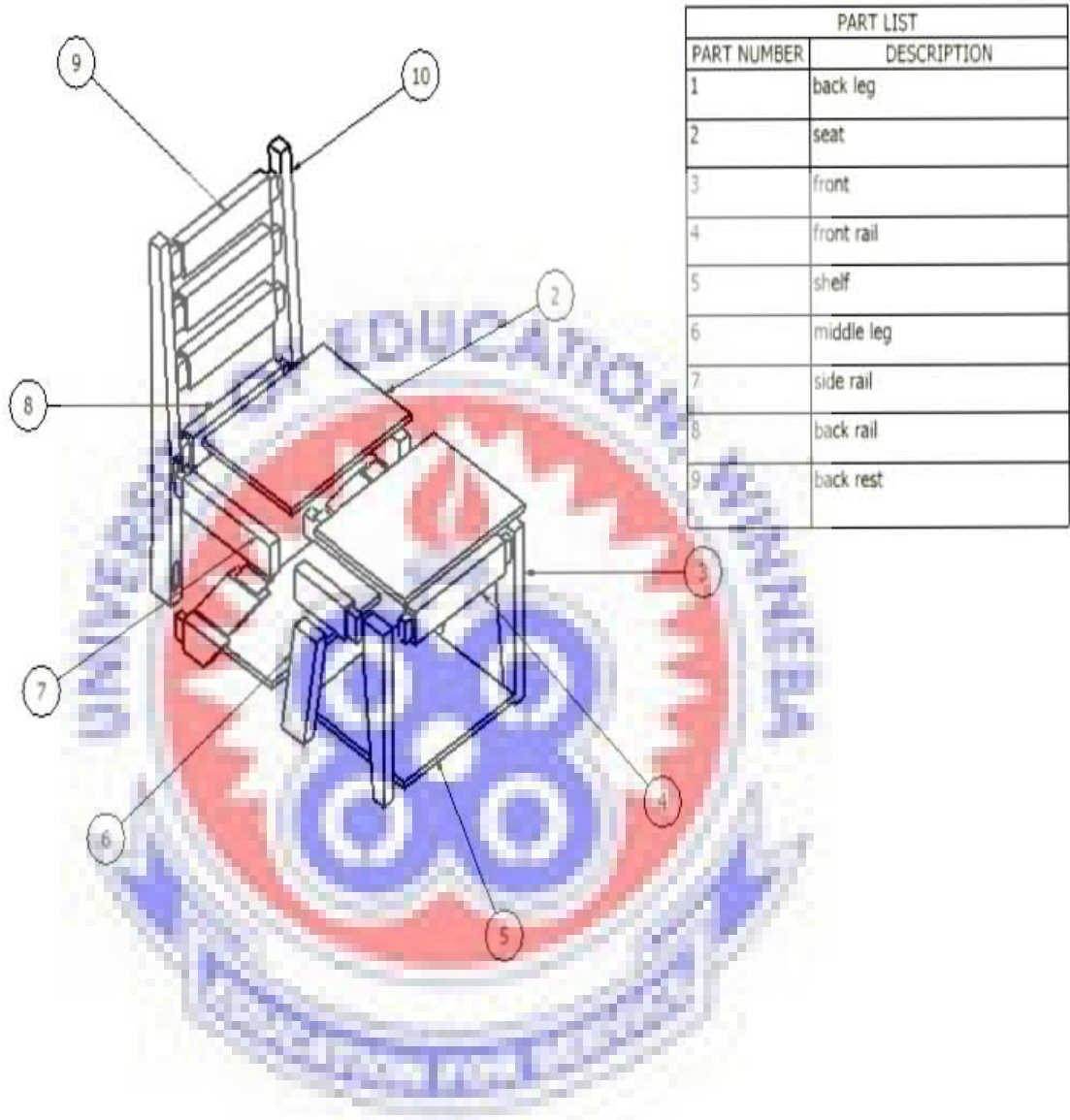
### 3.8.3 SECTIONAL DRAWING



### 3.8.4 EXPLODED VIEW OF CHAIR

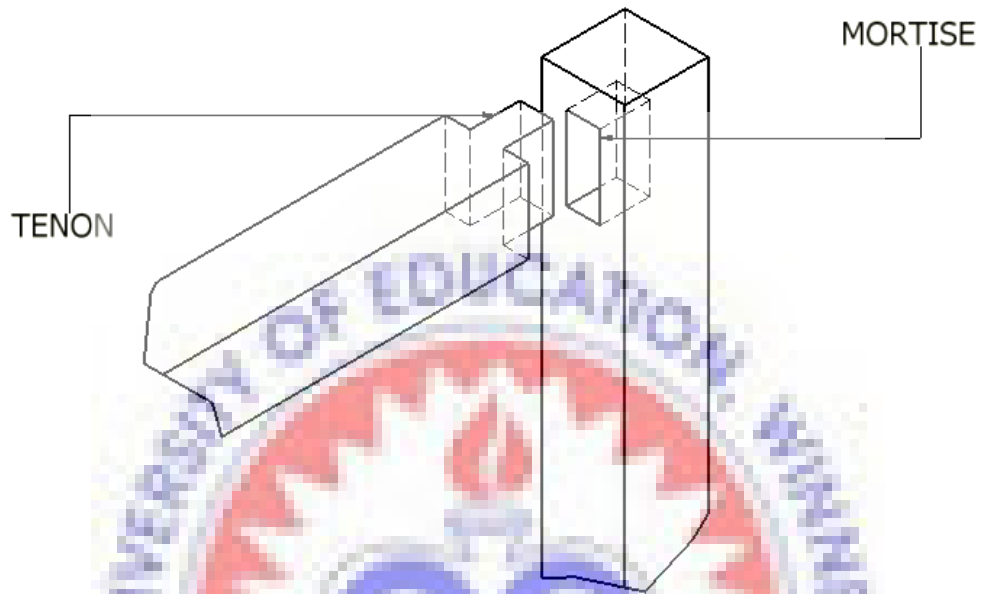


### 3.8.5 PARTS LIST OF CONVERTIBLE CHAIR

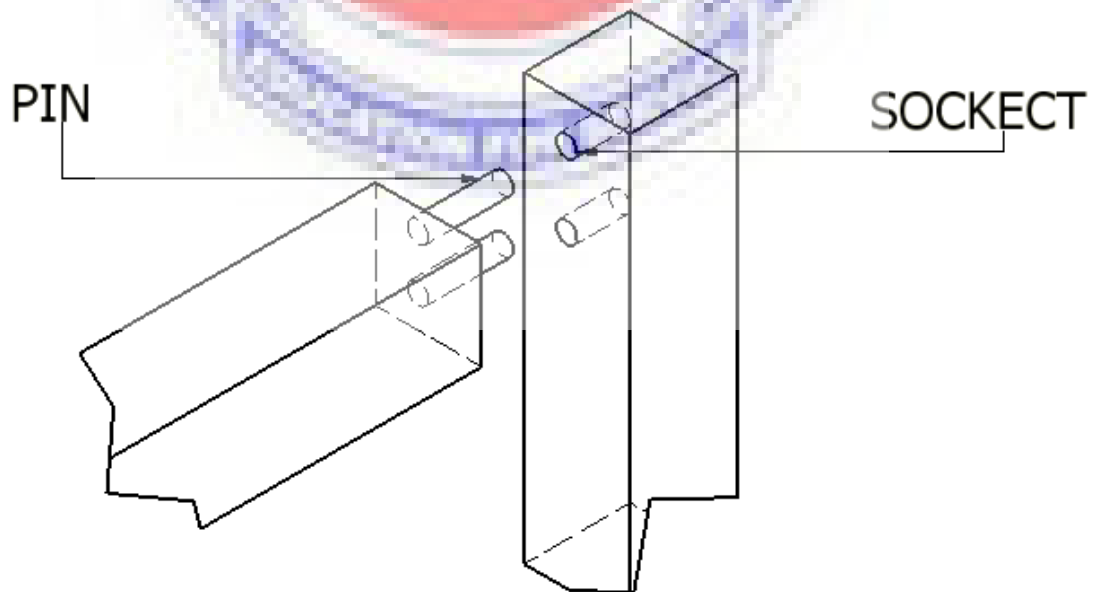


### 3.8.6 DETAILS OF CONSTRUCTION OF JOINTS

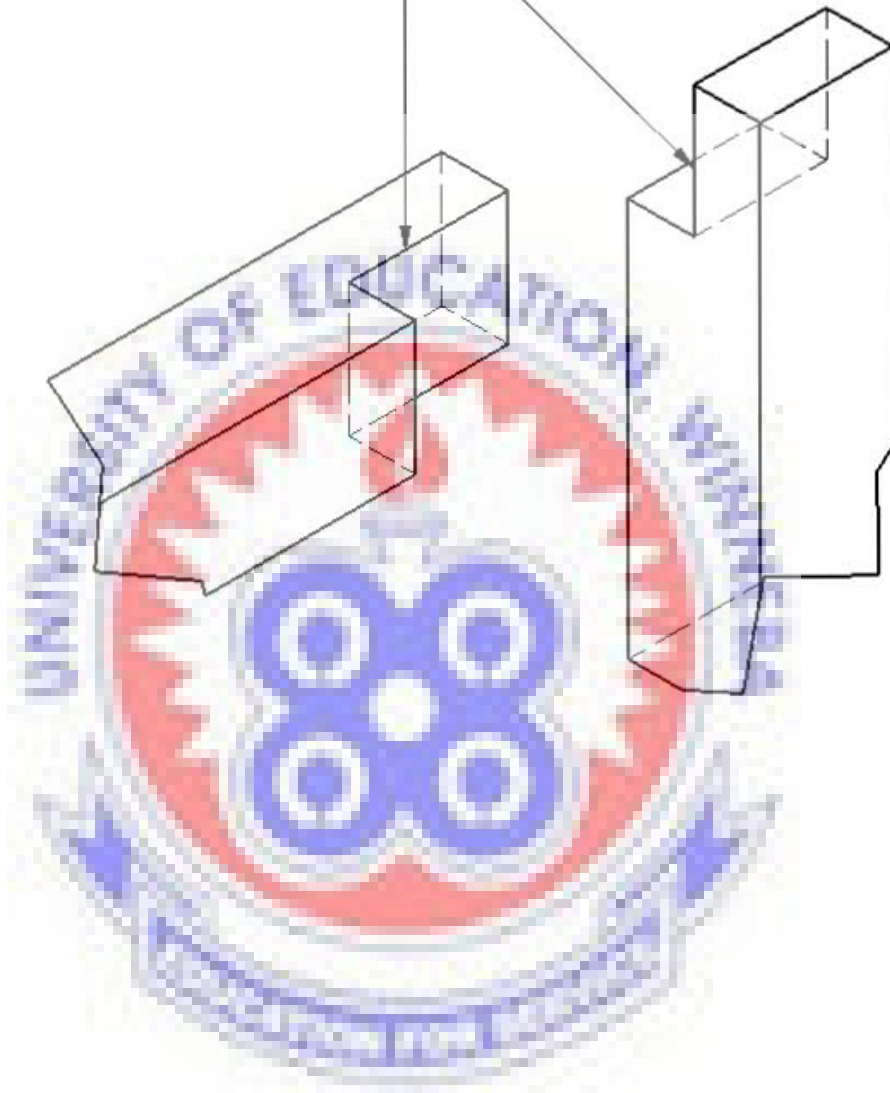
#### Mortise and Tenon joint



#### Dowel joint



## HALVING JOINT



### 3.8.7 CUTTING LIST

CUTTING LIST						
ITEM	DESCRIPTION	QTY	DIMENSION	MATERIAL	FINISH	REMARK
1	front legs	2	450*50*50	coco wood	lacquer	
2	back legs	2	910*50*50	coco wood	lacquer	
3	seat	1	560*500*30	coco wood	lacquer	
4	side rail	2	500*100*30	coco wood	lacquer	
5	front rail	1	500*100*30	coco wood	lacquer	
6	back rail	1	500*100*30	coco wood	lacquer	
7	shelf	1	530*500*30	coco wood	lacquer	
8	back rest	3	500*70*30	coco wood	lacquer	
9	side bottom rail	2	500*50*30	coco wood	lacquer	
10	middle legs	4	600*30*30	coco wood	lacquer	



### 3.8.8 MATERIAL COSTING

ITEM NO	DISCRIPTION	QUANTITY	UNIT COST GHC	TOTAL COST GHC
1	Coco wood (solid wood)	4(2*6*14)	40.00	160.00
2	Adhesive ( white glue)	½ gallon	35.00	35.00
3	Nails (1'',1 <sup>1/2</sup> '',2'')	2pounds each	4.00	16.00
4	Abrasive (60°,80°,120°)	4 yards each	3.00	36.00
5	Abrasive (400°,600°)	5 sheet each	3.00	30.00
6	Sanding sealer	½ gallon	45.00	45.00
7	Lacquer	½ gallon	45.00	45.00
8	Thinner	1½ gallons	80.00	80.00
9	Lind seed putty	1tin	10.00	10.00
				<b>GHC457.00</b>
10	<b>Machine cost</b>			35.00
11	<b>Labour cost</b>			120.00
			<b>TOTAL</b>	<b>GHC612.00</b>

### 3.8.9 PROCEDURE FOR THE CONSTRUCTION OF THE CONVERTIBLE CHAIR

#### 3.8.9.1 A Coconut Plantation

The researcher obtained his raw materials needed for the project at Asuansi a village in the Abura Asebu Kwamakese district in central region of Ghana.



Figure 7: A cocount plantation at Asuansi; Source of photo : Researcher

#### 3.8.9.2 Felling of Coconut Tree

Standard chainsaw equipment and tree-felling techniques used for forest trees are also used for coconut palms. The variation in palm ‘wood’ quality means that it is important for the researcher to identify the stems that are most likely to contain a high proportion of high density ‘wood’ (or hard fibre), as far as possible. The criteria the researcher used for the selecting of stems are as follows: *stem age*, *stems no longer bearing*, *absence of scars*, *height*. After a careful selection of the stem, the researcher then observes the conversion of the stem by a chain saw operator by name Sabah. During

conversion safety equipment such as earmuffs or earplugs, helmet or hard hat, eye protection, gloves, chaps, safety boots were put on by the operator.



Figure 8: Felling of coconut tree by Mr. Sabah. Source of photo : Researcher

### **3.8.9.3 Round Logs of Coco Wood**

Acquiring coco wood was easy because most of the trees were over age which cannot bear fruit any longer. For this study, the researcher has graded the coco wood into high, medium and low density. Coconut wood can be compared to conventional hardwoods and softwoods, as the holocellulose, lignin and pentosane contents are similar (Arancon, 2009).



Figure 9: Round logs of coco wood. Source of photo : Researcher

#### **3.8.9.4 Conversion of Coco Wood in to Board**

After felling the stem, the trunk was then cut into manageable sections or logs. The researcher then brought the logs to the wood work machine shop of Asuansi Technical Institute and sawn by heavy circular band saw into commercial sizes.

E.g board.



Figure 10: Conversion of coco wood in to board. Source of photo : Researcher

#### **3.8.9.5 Stacking of Coco Wood Boards**

Green, off-saw sorting was done by a visual assessment of the colour and bundle density of the boards. The researcher then separated the high density boards, which are suitable for furniture, from the medium and low density material after which the boards were stacked at the timber shed to allow ventilation to pass through. The researcher then sprayed the boards with Sunpyriforce to prevent it from insect attack. Sacking was done using stickers in order to prevent artificial defects such as twisting, cupping etc.



Figure 11: Stacking of coco wood boards at Asuansi Technical institute timber shed.

Source of photo : Researcher

#### **3.8.9.6 Planing of Coco Wood Board.**

The coco wood after three days of stacking was then convey back to the Asuansi Technical Institute wood work machine shop for planing. The reseacher then plane the coco wood boards to the require thickness using the thickneser machine.



Figure 12: Planing of coco wood board at Asuansi Technical Institute Woodwork Machine

shop. Source of photo: Researcher

### 3.8.9.7 Ripping and cross cutting

Ripping is the process of cutting of board along the grain of the wood while cross cutting is across the grain of the wood. The researcher at the machine shop then cut the boards into the required sizes and shapes using the circular saw, band saw, and the jointer machine.



Figure 13: Ripping and cross cutting of coco wood board at Asuansi Technical Institute Woodwork Machine shop. Source of photo: Researcher

### 3.8.9.8 Making out and construction of various joint

The joints that were used for the construction were mortise and tenon joint, halving joint, and dowel joint. These were then marked out to determine the face and edge of the pieces at the bench shop of the furniture department of Asuansi Technical Institute. The researcher and his students after marking out then recessed the joints using chisel and mallet.



Figure 14: Making out and construction of various joint at the bench shop of the furniture department of Asuansi Technical Institute. Source of photo: Researcher

### 3.8.9.9 Pre-Assemble of Joints

Assemble is the process of bringing all the various joints together to fine out if it can fit well. The researcher and hisn students then pre-assemble all the joints to fine out if day can fit well when final assembling is done.





Figure 15: Pre-assemble of joints by the students of the furniture department of Asuansi Technical Institute. Source of photo: Researcher

### **3.8.9.10 Sanding of various parts with rough sand paper (60°-120°)**

Sanding is the process of smothing the surface of a job to obtaine a uniform appearance.

Intitial sanding was done using 60° and 120° sand paper. This degree of sand paper is classified as rough.



Figure 16: Sanding of various parts with rough sand paper by Peter Tawiah a student in the furniture department of Asuansi Technical Institute. Source of photo: Researcher.

### **3.8.9.11 Final Clamping of Joints and Lamination of Boards**

Clamping is the process of holding joints together using cramps as lamination is the process of widening of boards. The reseacher and his students finally clamp and laminated the joints and boards together using urea formaldehyde ( white glue) as it is consider to be non staining, fairly heat resistance and resistace to fungi.



Figure 17: Final clamping of joints and lamination of boards by the student in the furniture department of Asuansi Technical Institute. Source of photo: Researcher.

### 3.8.9.12 Application of Sanding Sealer

Sanding sealer was used for the following reasons: to bring out the colour of the coco wood, to seal the pores of open grain coco wood, to give it a smooth appearance and to prevents the finishes material sinking into the coco wood grain. The researcher and his students apply sanding sealer mix with thinner using painting brush.



Figure 18: Application of sanding sealer by Abubakari a form three students in the furniture department of Asuansi Technical Institute. Source of photo: Researcher.

### 3.8.9.13 Final Sanding (220°- 600°)

Sanding is done in grades. The final sanding was done using 220° and 600° which is consider to be the smoothest among the sand paper family.



Figure 19: Final sanding of chair by students in the furniture department of Asuansi Technical Institute. Source of photo: Researcher.

### 3.8.9.14 Application of Final Coating Material (Lacquer)

Finishing is the application of any surface coating material to achieve the final desire appearance. The researcher, then sprayed the furniture using lacquer. Lacquer is a synthetic transparent or opaque gum finishing material and is compose of nitrocelluse as it provide a hard, cellulose- like finish that dries very quickly and durable, moisture and alcohol resistant.



Figure 20: Application of final coating material. Source of photo: Researcher

### 3.8.9.15 Fixing of Fittings (Hinges)

Fittings are devices that are used for holding objects together as they also serve as ornaments to the unit. Because the furniture was made for multi-purpose use, fittings such as butt hinge and screws were used for the parts that can be converted.



Figure 21: Fixing of fittings. Source of photo: Researcher.

### 3.8.9.16 Final Products

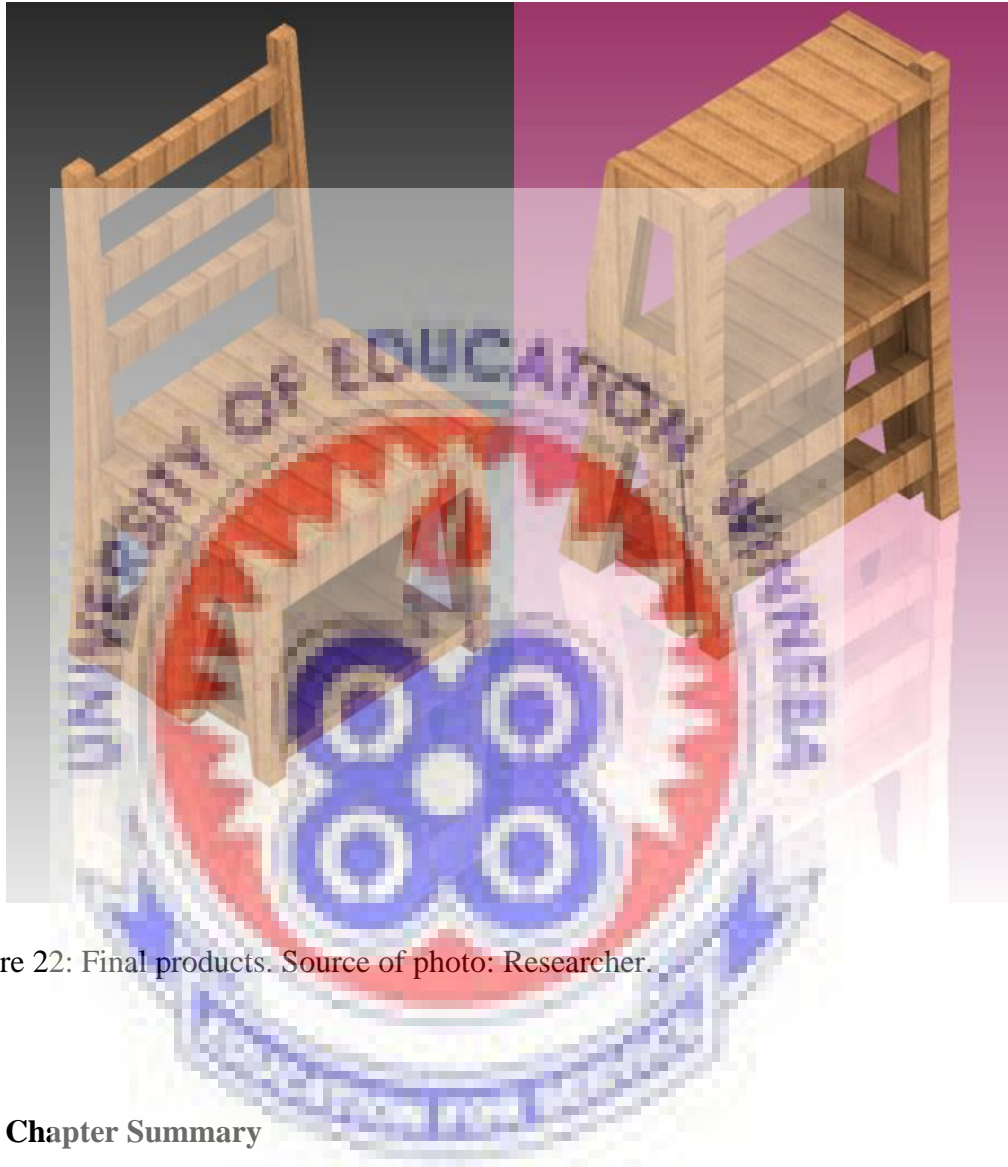


Figure 22: Final products. Source of photo: Researcher.

### 3.12 Chapter Summary

This chapter outlines how research design was applied, data types and data collection methods that were available and the way in which information collected was analyzed. Additionally the population sampling technique, sample frame and sample size that was used have also been explored. The data analysis tools, SPSS Program and MS Word have been mentioned; Tools, equipment's and materials used for the project as well as the General work procedures and processes of the coco wood chair

## CHAPTER FOUR

### 4.0 RESULTS AND FINDINGS

#### 4.1 Introduction

This chapter presents the results of the study on customers' perception and purchase intention of coco wood furniture. This chapter is categorized into eight sections, which are in line with the research questions. The first component talks about the general information on the population under study. The second component presents findings on durability. The third component examines findings on functionality. The fourth component talks about aesthetic of the chair. The fifth component represent findings on the environmentally friendliness of the chair. The sixth component present findings on the purchase intention of chair. Finally, the last component presents findings on the overall rating of the chair.

#### 4.2. General Information

This section provides vital information of the respondents based on gender, age, and level of education.

##### 4.2.1 Response Rate

This study had a sample size of 100 respondents from the Sandwich and Distance students of the University of Education Winneba, Kumasi campus. 55 of the respondents that gave a response were males and 45 females. This represents a response rate of 100%.

##### 4.1.2 Gender of the Respondents

From the findings the variable gender had a mean of 1.45 and a standard deviation of 0.500. The respondents with the highest proportion were male with 55% while female had a proportion of 45% as shown in figure 4.2 below. This showed that University of



Education, Winneba – Kumasi campus offer male dominating course than female course.

#### **4.2.3 Age of Respondents**

From the findings, 45% were those between the age ranges 31-40 years and 37% were those between the age ranges 24-30 as 18% were also between 41-48 years.

#### **4.2.4 Level of Education**

From the findings the variable Level of Education had a mean of 33.85 and a standard deviation of 6.338 and the respondents with the highest proportion were bachelor degree at 32% followed by Higher Nation Diploma at 25% and Masters Holders at 20%. Technician Part I,II,III, holders were at 11% while others Certificate holders were at 9% and PHD holders being the least proportion at 3%. This indicated that most of the respondents are Bachelor Degree holders who are probably doing their Master's Degree at the University of Education Winneba, Kumasi Campus. With this Majority of the respondents are academically qualified to understand the designing for strength and aesthetic: effect on the strength of joint on coco wood furniture.

Table 4.2: Background Characteristics of Respondents

Attribute	frequency	Percentage
<b>Gender</b>		
Male	55	55%
Female	45	45%
<b>Age group</b>		
24-30 years	37	37%
31-40 years	45	45%
41-48 years	18	18%
<b>Educational Level</b>		
Technician Part I, II, III	11	11%
Bachelor	32	32%
Masters	20	20%
PHD	3	3%
Others please specify	9	9%

### 4.3 Durability

In this section, the study sought to determine the durability rating of the coco wood furniture.

Table 4.3.1 Durability Ratings

Attribute	N	SA	A	N	D	SD	Mean	SD
This chair is structurally sound	100	49	41	7	2	1	4.35	.783
This chair can withstand pressure	100	30	56	12	2		4.14	.697
This chair can last longer	100	43	38	15	4		4.20	.841
This chair is solid in construction	100	49	44	7			4.42	.622
This chair will withstand all Weather condition	100	45	30	19	6		4.14	.932
This chair is dimensionally stable	100	23	62	15			4.08	.614
This chair has fewer defect	100	41	42	12	4	1	4.18	.869

Scale =1to5; Strongly Agree, Agree, neither Agree nor Disagree, Strongly Disagree

The respondents were asked to respond to the durability of the coco wood chair. Using a five (5) point liker scale the findings revealed that most of the respondents agreed with the variables and the variables with the highest mean was on this chair is solid in construction (4.42). The respondents, when asked if this chair is dimensionally stable had the lowest mean (4.08). This chair is dimensionally stable again had the least Standard Deviation (0.614) indicating that the respondents had minimal variations in their responses to this question while this chair will withstand all weather condition had (0.932) indicating that the respondents had the highest variations in their responses in this question. The results are shown in table 4.1.2 above.

### 4.4. Functionality

The section sought to determine the functionality of the coco wood chair.

Table 4.4.1 Functionality Ratings

Attribute	N	SA	A	N	D	SD	Mean	SD
This chair can be used in school	100	43	41	11	5		4.22	.836
I will feel impressed by using this chair	100	45	47	6	2		4.35	.687
This chair is a sophisticated brand	100	25	55	12	5	3	3.94	.919
This chair would make me feel good	100	38	48	12		2	4.20	.804
This chair will Make me comfortable	100	40	40	18	2		4.18	.796
This chair is fit for purpose for which it was made	100	45	49	4	2		4.37	.667
This chair can serve dual purpose	100	51	46	2	1		4.47	.595
This chair easy to handle	100	26	38	18	15	3	3.69	1.107

Scale =1to5; strongly Agree, Agree, neither Agree nor Disagree, Strongly Disagree

A descriptive statistic of the various variables of functionality was done and according to the findings, only the variables: used in school, feel impressed, feel good, make me comfortable, fit for purpose and serve dual purpose had a mean above 4.0. Easy to handle had the lowest mean of (3.69). This chair can serve dual purpose had the highest mean (4.47). Also this chair can serve dual purpose had the least Standard Deviation (0.595) indicating that the respondents had minimal variations in their responses to this question while this chair is easy to handle had the highest Standard Deviation (1.107) indicating that the respondents had the highest variations in their responses in this question.

#### 4.5. Aesthetics

The section sought to determine the aesthetic of the coco wood chair.

Table 4.5.1 Aesthetic ratings

Attribute	N	SA	A	N	D	SD	Mean	SD
I like the colour of this chair	100	44	44	11	1		4.31	.706
I like the grain of this chair	100	38	53	7	2		4.27	.687
I like the size of this chair	100	32	52	15	1		4.15	.702
I like the shape of this chair	100	39	45	15	1		4.22	.733
This chair is attractive	100	52	42	6			4.46	.610
I like the texture of this chair	100	40	48	11	1		4.27	.694

Scale =1to5; strongly Agree, Agree, neither Agree nor Disagree, Strongly Disagree

A descriptive statistic of the various variables of functionality was done and according to the findings, only the variables: I like the colour of this chair; I like the grain of this chair; I like the size of this chair; I like the shape of this chair; I like the texture of this chair and this chair is attractive had a mean above 4.0. I like the size of this chair had the lowest mean of (4.15). This chair is attractive had the highest mean (4.46) This chair is attractive had the least Standard Deviation (0.610) indicating that the respondents had minimal variations in their responses to this question while I like the shape of this chair had the highest Standard Deviation (0.733) indicating that the respondents had the highest variations in their responses in this question. These results are shown in Table 4.5.1.

#### 4.6. Environmentally Friendliness

The section sought to determine the environmentally friendliness of the coco wood chair.

Table 4.6.1 Environmentally Friendliness Ratings

Attribute	N	SA	A	N	D	SD	Mean	SD
This chair is environmentally safe	100	42	46	11	1		4.29	.071
This chair is environmentally friendly	100	34	51	8	7		4.12	.832
By patronizing this chair I will contribute to the conservation of the forest	100	50	43	3	4		4.39	.737
This chair is new in the environment	100	34	49	13	4		4.13	.787
This chair can contribute to reducing forest depletion	100	41	50	9			4.32	.634

Scale =1to5; strongly Agree, Agree, neither Agree nor Disagree, Strongly Disagree

A descriptive statistic of the various variables of strength was done and according to the findings, all the variables had a mean above 4.0. This chair is environmentally friendliness had the lowest mean of (4.12). By patronizing this chair I will contribute to the conservation of the forest had the highest mean (4.39). This chair is environmentally safe had the least Standard Deviation (0.071) indicating that the respondents had minimal variations in their responses to this question while this chair is environmentally friendly had the highest Standard Deviation (0.832) indicating that the respondents had the highest variations in their responses in this question. These results are shown in Table 4.7.1.

#### 4.7. Purchase Intention

The section sought to determine the purchase intention of the coco wood chair.

Table 4.7.1 Purchase Intention Ratings

Attribute	N	SA	A	N	D	SD	Mean	SD
I will Purchase this chair	100	39	51	1			4.29	.640
I am willing to buy this chair	100	30	49	17	4		4.05	.796
I will recommend this chair to my school	100	35	45	14	5	1	4.08	.884
This chair is my first choice	100	40	43	15	1	1	4.20	.804

Scale =1to5; strongly Agree, Agree, neither Agree nor Disagree, Strongly Disagree

A descriptive statistic of the various variables of purchase intention was done and according to the findings, all the variables had a mean above 4.0. I am willing to buy this chair had the lowest mean of (4.05). I will purchase this chair had the highest mean (4.29). I will purchase this chair had the least Standard Deviation (0.640) indicating that the respondents had minimal variations in their responses to this question. While I will recommend this chair to my school had the highest Standard Deviation (0.884) indicating that the respondents had the highest variations in their responses in this question. These results are shown in Table 4.8.1

#### 4.8. Overall

The section sought to determine the purchase intention of the coco wood chair.

Table 4.8.1 Overall Ratings

Attribute	N	E	VG	G	F	P	Mean	SD
Durability	100	53	32	12	3		4.35	.809
Functionality	100	42	40	18			4.24	.740
Aesthetic	100	42	41	13	4		4.21	.820
Environmentally friendliness	100	39	43	16	2		4.19	.775
Purchase intention	100	37	33	23	7		4.00	.943

Scale =1to5; strongly Agree, Agree, neither Agree nor Disagree, Strongly Disagree

A descriptive statistic of the various variables of overall was done and according to the findings, all the variables had a mean above 4.0. Purchase intention had the lowest mean of (4.00). Durability had the highest mean (4.35). Functionality had the least Standard Deviation (0.740) indicating that the respondents had minimal variations in their responses to this question while purchase intention had the highest Standard Deviation (0.943) indicating that the respondents had the highest variations in their responses in this question. These results are shown in Table 4.9.1

#### 4.10. Chapter Summary

This chapter provided an analysis of the data collected from the respondents. The first part provided an analysis of the demographic information on the respondents. The second part analyzed the findings on durability; functionality; aesthetics; environmentally friendliness and purchase intention. The third section provided findings on overall assessment of the chair in terms of durability; functionality, aesthetic; environmentally friendliness; and purchase intention. The next chapter puts forward the discussions of results.



## CHAPTER FIVE

### 5.0 DISCUSSION OF RESULTS

#### 5.1 Introduction

This chapter discussed the results of the study according to the research objectives of the study. The literature review of the study was used to discuss the specific findings in this chapter.

#### 5.2 Customer's perception of coco wood furniture with respect to functionality, Aesthetics and Strength.

##### 5.2.1 Durability

The development of performance-based design methods for durability requires that models are available to evaluate performance in a quantitative and probabilistic format. This means that the relationship between product performance during testing and in service need to be quantified in statistical terms and the models should be calibrated to ensure that they provide a realistic measure of service life, with reasonable degree of certainty. On analyzing the research objective it was revealed that the durability of the chair increase constantly from the variable this chair is structurally sound having the highest mean value of 4.35 and this chair is dimensionally stable having the lowest mean value of 4.08. The results of durability was similar to the studies by Smardzewski (2008) as he mentions that Furniture intended for storing should, in particular be characterized by high rigidity, durability as well as reliability.

##### 5.2.3 Functionality

Function can be expressed as the properties related to the use of a product. These properties include the relation between a product and consumer unction. Analysis is a method for analyzing and developing a function structure. A function structure is an

abstract model of the new product, without material features such as shape, dimensions and materials used. It describes the functions of the product and its parts and indicates the mutual relations. In function analysis, the product is considered as a technical-physical system. The product functions consist of a number of parts and components, which fulfil sub-functions and the overall function. According to the findings on the functionality of the chair, the variable, this chair can serve dual purpose had a mean value of 4.47 with the variable this chair is easy to handle having a mean value of 3.69. The findings indeed affirm Antal (2007) was right to state that the proportion of functionality and aesthetic functions is optimal if it meets the demands of consumers.

#### **5.2.4 Aesthetics**

The finding shows that the responds on all the variable are in the range of 4.00 with this chair is attractive having the highest mean value. In short the mean values of aesthetics valuables were from 4.46 to 4.15. The results of this study were similar to the study conducted on aesthetic value by Eco (2004) this is considered to be the effect (or style) of objects as to what degree they can teach us to Perceive or understand the appeal of beauty. Again these findings correspond to Hekkert et al.'s (2003) conclusion which state that both perceived typicality and perceived novelty affect aesthetic appraisal. Accordingly, perceived novelty is included as a covariate in the analyses concerning aesthetic appraisal.

#### **5.3 Environmentally Friendliness**

The finding shows on the environmentally friendliness variables also had a mean above 4.00 with the variable by patronizing this chair I will contribute to the conservation of the forest increased constantly from the responds. In short the mean values of environmentally friendliness variable were from 4.39 to 4.12. This is similar to the findings by Shmusudin and Selamat (2005) which shows that consumers prefer

products which are friendly to the environment that they live. However, they also like to shop in modern retail stores as they feel that such places are more likely to provide them with environmentally friendly products.

#### **5.4. Purchase Intention**

According to the findings on purchase intention, majority of the respondents strongly agree to purchase this chair with the variables ranging from a mean value of 4.29 to 4.05. This indicated that the consumer purchase intention is rather influenced by attitude, perceived behavioral control, subjective norm and past purchase experience. The consumer values of being health conscious and environmentally conscious have a significant influence on attitude. With regard to the environmental measures, respondents did not care about the environment which is aligned with the finding from Lea and Worsley (2005, p. 864). The results of this study revealed that the attitude of consumers towards purchasing of products is positively affected by their environmental consciousness.

#### **5.5. Overall**

According to the study, all variables increase consistently with a mean value above 4.0. In overall, durability had the highest mean value of 4.35. The findings agree with Smardzewski (2008) who argued that, Furniture quality intended for storing should, in particular, be characterized by high rigidity, durability as well as reliability. Moreover, different furniture items, similarly to other daily necessities, should be designed in such a way so as to guarantee safety of their utilization. The findings also reveal that the Overall functionality mean value was 4.24. This is because the strength and durability; Structural Concept shapes the wood product depend on its expected overall function. Normally, wooden furniture structure will comprise of 4 types therefore, structural forming by column and beam or frame structure, structural forming by hand board on

plains, structural forming by frame and panels, and structural forming by curved board. Moreover, according to Boonsanong and Pasit (2010) a designer must first consider the functionality of the product as well as the consumer. The studies also reveal that the overall aesthetic had a mean value of 4.2. This is similar to Domljan et al. (2006) who recommends in his research that customers' needs should be the first step in defining a number of requirements of a product. It means that it is necessary to establish designers' factor such as aesthetics for the development of a product. Again Hekkert (2006) in his paper argue that only part of a full product should be considered aesthetic. Environmentally friendliness also obtains an overall mean value of 4.19. According to principles of design, a designer must design furniture to suit its surrounding environment providing on its main expected function. Therefore, according to Fuller (2000) if consumers understood the real eco-cost of products, the majority of environmental problems would be solved by themselves. However, this could only with difficulty be realized without the massive intervention of governments, while experience tells us the short-term view of producers would probably prevent this intervention. This result implies that there are individuals who are willing to pay more for environmentally friendly products. Lastly, purchase intention overall mean value was 4.00. This is also in line with previous studies by Shim et al. (2002) they argue that when customers or consumers make a purchase decision that is based on what they need or how these purchases may be convenient to them, these customers or consumers would expect post-purchase services to be provided by the company or provider and hence it would lead to satisfaction and repeat-purchase intentions.

## **5.6. Chapter Summary**

This chapter provides a discussion of the result on durability; functionality; aesthetics; environmentally friendliness and purchase intention. The second section provides a

discussion on the overall assessment of the chair in terms of durability; functionality, aesthetic; environmentally friendliness; and purchase intention. The next chapter puts forward the summary, conclusions on the findings and recommendations for improvement and further advancement in future research.



## **CHAPTER SIX**

### **6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATION**

#### **6.1 Summary**

In the recent years the habits of buying furniture have changed. The fabrication of individual pieces of furniture is increasingly coming to the forefront. A personal contact

is being established between the customer and the furniture, which is a relationship of one (product) to one (customer). In order to satisfy the individual demands, higher quality as well as higher prices appeared as a necessity. The competition is beginning on the market, where emotion becomes a significant factor in decision-making process. Therefore, functionality and aesthetic functions, determinative forms and fashionable style play a very important role in furniture design and production. The purpose of this study was to assess customers' perception and purchase intention of coco wood furniture.

The research was guided by the following objectives:

1. To evaluate customers perception of coco wood furniture with respect to functionality and aesthetics
2. To identify the environmentally friendliness of coco wood chair and their satisfaction with customers.
3. To evaluate customers purchase intention of coco wood furniture.

This study employed descriptive method to gather the relevant data obtained from the research area. The study used quantitative research approach for the study. The population for the study was 100. The population was made up of sandwich and distance students of the University of Education Winneba, Kumasi. Purposive sampling technique was used to select 100 participants for the study. Primary and secondary data was used for the study. Primary data for this study were collected using questionnaires. The instruments were administered by the researcher in person. The data obtained from the respondents was analyzed using the Statistical Package for Social Sciences version (SPSS v 16). This was chosen for easy analysis and a better understanding of the study by interested parties.

## **6.2 Key Findings of the Study**

### **6.2.1 Customers perception of coco wood furniture with respect to functionality and Aesthetics**

#### **6.2.2 Durability**

On analyzing the research objective it was evident that the durability of the coco wood chair was strongly agree and agree by respondents with only one percent strongly disagree that this chair is structurally sound and this chair has fewer defect. However, the durability of the coco wood chair is belief to a have positively influenced on the respondents comment.

#### **6.2.3 Functionality**

The study established that functionality of the coco wood chair influence positively on the comment of the respondents. Forty-two of the respondents agree that the functionality of the chair is excellent with only forty of the respondents agreeing that is very good, and eighteen saying is good. This chair would make me feel good was the only variable that had two of the respondents strongly disagreeing.

#### **6.2.4 Aesthetics**

From the findings, all the aesthetics variables had a positive influence on the coco wood chair with only few of the respondents disagree to some of the variables. The findings revealed that I like the colour, size, shape and texture of this chair had only one percent each from the respondent's comment disagreeing.

## **6.3 Environmentally Friendliness**

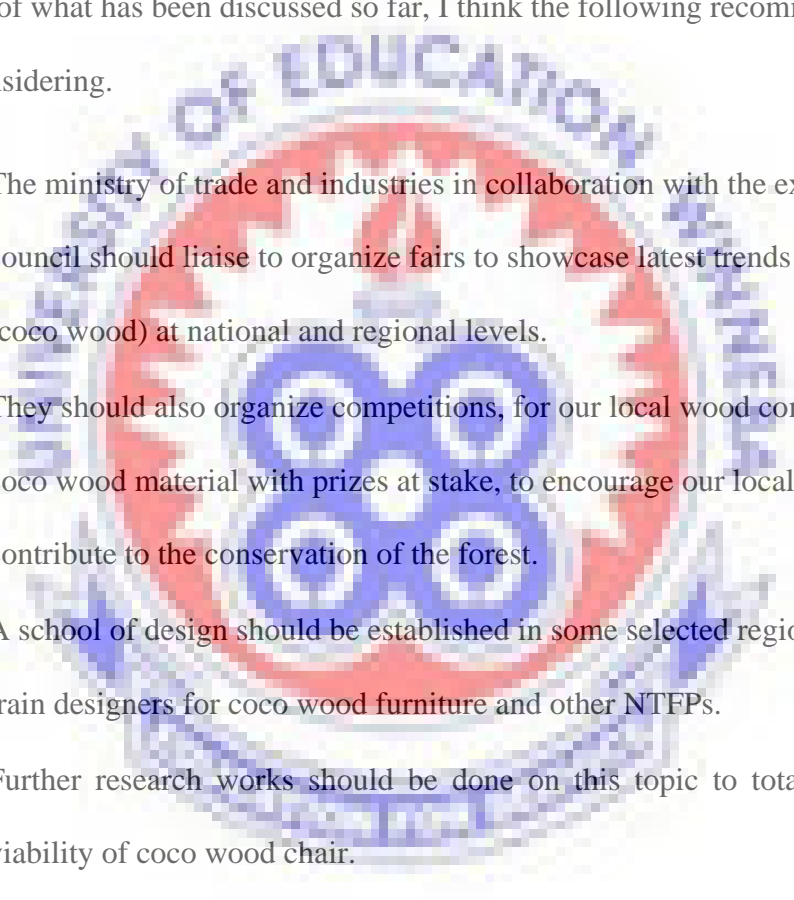
The findings of the all the variables on the environmentally friendliness of the coco wood chair also had positive influence on the respondents comment with only one of the respondent strongly disagree that this chair is environmentally safe.

#### 6.4 Purchase Intention

The result of the study confirms on purchase intention is that all the variables were strongly agree with only I will recommend this chair to my school and this chair is my first choice had one of the respondent strongly disagree to it. However, purchase intention also have positively influenced on the respondents comment.

#### 6.5 Recommendation

In view of what has been discussed so far, I think the following recommendations are with considering.

- 
- The ministry of trade and industries in collaboration with the export promotion council should liaise to organize fairs to showcase latest trends in coconut tree (coco wood) at national and regional levels.
  - They should also organize competitions, for our local wood companies using coco wood material with prizes at stake, to encourage our local wood workers contribute to the conservation of the forest.
  - A school of design should be established in some selected regional capitals, to train designers for coco wood furniture and other NTFPs.
  - Further research works should be done on this topic to totally exhaust the viability of coco wood chair.
  - The Ghana Education Service and other stakeholders of the woodwork fraternity should encourage students to undertake viable and environmentally sustainable projects.
  - Government should increase the development of non-timber forest products such as the senile coconut trees as a means of complementing and sustaining future raw material to the domestic and international markets.



- The Ghana Education Service (GES) should adopt this project and make copies available to libraries to serve as an educational resource material for educational institutions offering wood work as a subject of study.
- The Ghana Education Service (GES) should encourage schools in the coastal towns of Ghana to harvest, process and use the senile coconut trees for their practical training.
- The Ministry of Tourism, Culture and Creative Arts and other stakeholders should encourage the nation's wood workers in the coastal towns to harvest, process and use the over-aged coconut trees for furniture and other related use.

#### **6.6 Suggestions for Further Research**

Based on the recommendations of the study, the study suggested that a similar research should be undertaken to assess designing for Strength and Aesthetic: Effect of fittings type on the coco wood furniture.



## REFERENCE

- Amoh, E. (2009). Ahwiaa wood carving industry: New trends and their implication For art education, Master's thesis, Kwame Nkrumah University of Science and Technology, Ghana.
- Antal, M. R. (2007). Analysis of determinative forms of furniture of excellent quality From the point of view of developing the optimal proportion of function and aesthetics, PhD dissertation in Hungarian: University of West Hungary, Faculty of Wood Industry, and Sopron, Hungary.
- Asian and Pacific Coconut Community (1995). Coconut Statistical Yearbook. Jakarta, Indonesia.
- Bitner, M.J. (1990), "Evaluating service encounters: the effects of physical surroundings and employee responses", *Journal of Marketing*, Vol. 54, April, pp. 69-82.
- Boceta, N. (1997). The Sun Is Still Rising on the Tree of Life. In: The Food and Agriculture Centennial Book. University of Asia and the Pacific.
- Boeijen, A. Daalhuizen, J. Zijlstra, & P. Schoor, R. (2013). Delft Design Guide: Course Home (Function Analysis). Webster: <http://ocw.tudelft.nl/courses/product-design/delft-design-guide/course-home/> (Accessed Sept. 09, 2015).
- Boonsanong, R. and Pasit, I (2010). Research of design. Nation Science and Technology Development Agency Ministry of Science and Technology.

- Chan, E. Craig, R. & Elevitch, (2006). *Cocos nucifera* (coconut), Arecaceae (palm Family). Permanent Agriculture Resources (PAR). Traditional Tree Initiative – Species Profiles for Pacific Island Agroforestry: 1-27
- Cronin, J.J. and Taylor, S.A. (1992), “Measuring service quality: an examination and extension”, *Journal of Marketing*, Vol. 56, July, pp. 55-68.
- Daniel, D. Egya, N. Y. Fabian, P. & Michel, D. (2009). Resistance screening trial on coconut varieties to Cape Saint Paul Wilt Disease in Ghana. *Agronomie-Environnement*, pp.132-136.
- De Run, E.C. and Jee, T.W. (2009), “The influence of personal values on sales promotion techniques for convenience product”, *SEGi Review*, Vol. 3 No. 2, pp. 16-24.
- Domljan, D. Grbac, I. (2014) IMM Cologne 2014, Sajem noviteta i dizajna, Prirodnoga i funkcionalnoga. *Drvna industrija*, pp. 65 (1): 75-82. Raport DTI, 2005: Raport DTI: Creativity, Design and Business Performance. DTI Economics Paper No.15 November.
- Domljan, D. Grbac, I. Smardzewski, J. (2006). Contemporary values of products Design in the new environment. Proceedings of International scientific conference European Union – Challenges and perspectives for the wood processing industry, October 13th 2005, Innovawood, Faculty of Forestry Zagreb, UFI-Paris, pp. 31-44.
- Eckelman, C. A. (1968). *Furniture Frame Analysis and Design*. Ph.D. Thesis, Purdue University, West Lafayette, IN, pp. 231.

Eco, U. (2004). History of beauty (in Croatian). Hena Com, Zagreb, Croatia.

Erdil, Y.Z. Kasal, A. and Eckelman, C.A. (2005). Bendir moment capacity of rectangular mortise and tenon furniture joints. *Forest Prod. J.*, 55: 209-213.

Frater, A. (2004). The Tree of Life. *Geographical*, pp. 11: 59-64.

Ghana Ministry of Food and Agriculture (A) (2011). Coconut – The Cynosure of Ghana’s 2011 World Food Day Celebrations.

Webster: <http://mofa.gov.gh/site/?p=6430#>.

Fuller, D. A. (2000): *Sustainable Marketing: Managerial-Ecological Issues*, Sage, Thousand Oaks, California

Ghana Ministry of Food and Agriculture (B) (2011). Coconut farmers to have their Livelihood restored. Webster: <http://mofa.gov.gh/site/?p=6578>.

Goldman, A. (2001). The Aesthetic. In B. Gaut and D. McIver Lopes (Eds.). *The Routledge Companion to aesthetics*. pp. 181-192. London: Routledge.

Gribbons, B & Herman, J. (1997). True and quasi-experimental designs. *Practical Assessment, Research & Evaluation*, 5(14). Retrieved January 23, 2012.

Gunn, B. F. Luc, B. & Kenneth, M. O. (2011). Independent Origins of Cultivated Coconut (*Cocos nucifera* L.) in the Old World Tropics. *PLoS ONE*, pp. 1-8.

Hart, D. (1965). Some structural aspects of furniture design. *The Furniture Industry Research Association* 3(10): 14–17. FIRA, Steven age, Great Britain.

- Horvat, S. Domljan, D. & Grbac, I. (2008) Solid wood furniture in Croatian households – Users’ real needs demands and expectations. Proceedings of International scientific conference Wood is good – properties, technology, valorization, application, October 17th 2008, Innovawood, Faculty of Forestry Zagreb, UFI-Paris, Zagreb fair, pp. 59-64.
- Hekkert, P., Snelders, D., & Van Wieringen, P. C. W. (2003). ‘Most advanced, yet acceptable’: Typicality and novelty as joint predictors of aesthetic preference in industrial design. *British Journal of Psychology*, 94, 111-124.
- Jariya, w. (2000). Furniture History. The paper for teaching, King Mongkut's University of Technology North Bangkok.
- Jones, M.A. and Suh, J. (2000), “Transaction-specific satisfaction and overall satisfaction: an empirical analysis”, *Journal of Services Marketing*, Vol. 14 No. 2, pp. 147-59.
- Keating, W. & Bolza, E. (1982). Characteristics, properties and uses of timbers. South-east Asia, Northern Australia and the Pacific. Inkata Press.
- Killmand, W. & Fink, D. (1996). ProTrade, German Federal Ministry for Economic Cooperation and Development Coconut Palm Stem Processing: Technical Handbook.
- Kotas, T. (1957). The theoretical and experimental analysis of cabinet structures. Furniture Development Council Res. Rep. No. 6. London, UK.
- Last, f.t. (2001). Ecosystems of the world: tree-crop ecosystems. Amsterdam: Elsevier science.

- Lea, E. & Worsley, T. (2005). Australians' organic food beliefs, demographics and Values, *British food journal*, 107(11), pp. 855-869.
- Lissák, G.y. (1997). *A formáról*. Láng Kiadó. Budapest.
- Mangi, W. (2000). Helping the Coconut farmer into the 21st Century-Country Paper on Kenya. Proceedings of the 2nd International Coconut Workshop for Africa, Mombasa, Kenya
- McCollough, M.A. and Gremler, D.D. (2004), "A conceptual model and empirical examination of the effect of service guarantees on post-purchase consumption evaluations", *Managing Service Quality*, Vol. 14 No. 1, pp. 58-74.
- Mayende, K. (2006). Experiences with Coco Wood Utilization in Kenya. Paper Presented at Palm Wood Seminar held on 8th May 2006 at Lenana House Conference Centre, ABD/Danida –Danish.
- Noel, K. K. Jean, K. K. Edmond, K. J. Louis, L. Patricia, D. S.K. Sangare, A.( 2007). Microsatellite gene diversity in coconut (*Cocos nucifera* L.) accessions resistant's to lethal yellowing disease. *African Journal of Biotechnology*, pp.341-34.
- Oliver, R.L. (1980), "A cognitive model of the antecedents and consequences of satisfaction decisions", *Journal of Marketing Research*, Vol. 17, November, pp. 460-8.
- Olson, D. W. (1965). *Design in Woods and Woodworking for Industrial Art*. Englewood Cliffs, N.J.: Prentice-Hall.

Papanek, V. J. (2005). Design for the Real World. Academy Chicago Publishers,

Chicago, U.S.A

Quaicoe, R. N. Sylvester, K. D. Rene, P. Luc, B. Joseph, O. N. Joe N.P. Ransford, A.

Russell-Bennett, R., McColl-Kennedy, J.R. and Coote, L.V. (2007), “Involvement, satisfaction, and brand loyalty in a small business services setting”, Journal of Business Research, Vol. 60 No. 12, pp. 1253-60.

Sackey, J.K.N (1999). S.S.S Wood Work. MacMillan Education Ltd, London.

Shim, S. & Chen, Y. Q. (1996). Acculturation characteristics and apparel shopping orientations: Chinese students and spouses from the People’s Republic of China residing in the Southwest. Clothing and Textiles Research Journal, 14(3), 204-215.

Shim, J.P., Shin, Y.B. and Nottingham, L. (2002), “Retailer web site influence on customer shopping: an exploratory study on key factors of customer satisfaction”, Journal of the Association for Information Systems, Vol. 3, pp. 53-76.

Smardzewski, J. Projektowanie mebli. Poznan: PWRiL (2008).

The Bossiness and Technician Education Council, BTEC; Webster:  
<http://www.edexcel.com/quals/btec/Pages/default.aspx>

Simintiras, A., Diamantopoulus, A. and Ferriday, J. (1997), “Pre-purchase satisfaction and first-time buyer behavior: some preliminary evidence”, European Journal of Marketing, Vol. 31 Nos 11/12, pp. 857-72.

**APPENDIX A**

**UNIVERSITY OF EDUCATION WINNEBA**

**COLLEGE OF TECHNOLOGY EDUCATION, KUMASI**

**DEPARTMENT OF CONSTRUCTION AND WOOD TECHNOLOGY**

**QUESTIONNAIRE**

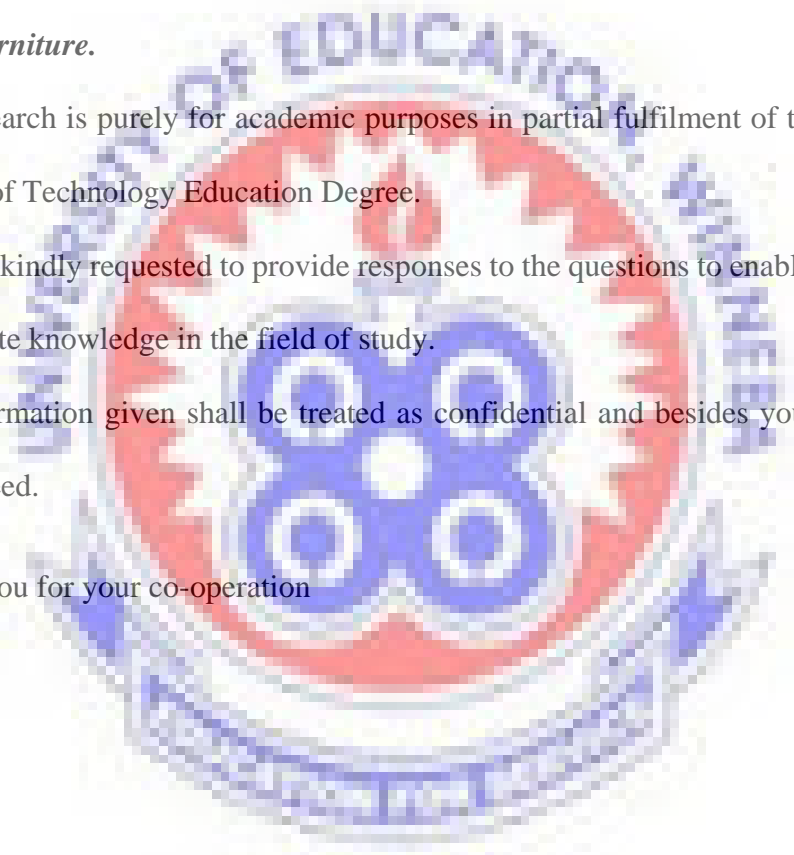
This questionnaire seeks to solicit views from students of the University of Education Winneba, Kumasi on the topic: *Customers' perception and purchase intention of coco wood furniture.*

The research is purely for academic purposes in partial fulfilment of the award of the Master of Technology Education Degree.

You are kindly requested to provide responses to the questions to enable the researcher contribute knowledge in the field of study.

All information given shall be treated as confidential and besides your anonymity is guaranteed.

Thank you for your co-operation





**APPENDIX B**  
**SECTION ONE**

*Please respond by ticking the appropriate responses below.*

**Gender:**      1. male [ ]      2. Female [ ]

**Your Age please -----years**

**Your highest educational Level**

Technician Part I, II, III [ ]

HND [ ]

Bachelor [ ]

Masters [ ]

PHD [ ]

Others please specify-----



**APPENDIX C**  
**SECTION TWO**

This chair was made from coco-wood (coconut palm tree). The quality of this chair is being evaluated in respect of its durability, aesthetics, functionality, environmentally friendliness and purchase intention. Please indicate the extent to which you agree or disagree with the following statements. The ratings are ‘strongly agree’, ‘agree’, ‘neither agree nor disagree’, ‘disagree’ and ‘strongly disagree’.

**Please select an option by ticking (✓) in the right column box.**

No	DURABILITY	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
1	This chair is structurally sound					
2	This chair can withstand pressure					
3	This chair will last longer					
4	This chair is solid in construction					
5	The chair will withstand all weather conditions					
6	This chair is dimensionally stable					
7	This chair has fewer defects					
No	FUNCTIONALITY					
8	This chair can be used in the school					
9	I will feel impressed by using this chair					
10	This chair is a sophisticated brand					
11	This chair would make me feel good					
12	This chair will make me comfortable					
13	This chair is fit for the purpose for which it was made					

		<b>Strongly Agree</b>	<b>Agree</b>	<b>Neither Agree nor Disagree</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
14	This chair can serve dual purpose					
15	This chair is easy to handle					
	<b>AESTHETICS</b>					
16	I like the colour of this chair					
17	I like the grains of this chair					
18	I like the size of this chair					
19	I like the shape of this chair					
20	This chair is attractive					
21	I like the texture of this chair					
	<b>ENVIRONMENTALLY FRIENDLINESS</b>					
22	This chair is environmentally safe					
23	This chair is environmentally friendly					
24	By patronizing this chair I will contribute to the conservation of the forest.					
25	This chair is new in the environment.					
26	This chair can contribute to reducing forest depletion.					
	<b>PURCHASE INTENTION</b>					
27	I will purchase this chair.					
28	I am willing to buy this chair.					
29	I will recommend this chair to my school.					
30	This chair is my first choice.					

**APPENDIX D**  
**SECTION THREE**

**Overall how do you assess this chair**

		<b>Excellent</b>	<b>Very good</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>
i.	Durability					
ii.	Functionality					
iii.	Aesthetic					
iv.	Environmentally friendliness					
v.	Purchase intention					

