# A SURVEY OF THE FACTORS THAT DETERMINE ARCHITECTS' PREFERENCES FOR ROOFING MATERIALS IN NAIROBI

BY
MURIUKI JUDITH WANJUGU

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## DECLARATION

This project is my original work and has not been submitted for a degree in any other University.

Signed .....

Judith Wanjugu Muriuki

Date 12/10/03

This project has been submitted for examination with my approval as University Supervisor.

Signed .....

Dr Martin Ogutu
Department of Business Administration
University of Nairobi.

Date 30/10/2003

## DEDICATION

This project is dedicated to my mother, the late Scholastica Nyambura Muhoro, for her love of education.

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There are many other people that I may not have mentioned but they contributed. I am very grateful for all their contributions.

Lastly, despite the contributions from other people, I bear full responsibility for any mistakes in this project.

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## ABSTRACT

This study was conducted with the objective of finding out the factors that determine preference for roofing materials among architects in Nairobi, and also find out the most important attributes of roofing materials.

In order to achieve the above objectives, a sample of 60 respondents was taken from the list of all registered architects. A questionnaire was administered to each respondent. The questionnaire had unstructured and semi-structured questions.

The data collected was analyzed using mainly the percentages, means and standard deviation. Factor analysis was also used in order to reduce the high number of factors under consideration.

Analysis of the data indicated that there are some factors that architects consider important in their preference of roofing materials. These included quality, strength, beauty, durability and availability of the material. The intended use of the building as well as capability of the client also came out as major considerations.

Recommendations were made based on the results of the analysis. The marketers of roofing materials need to understand their customers as well as the attributes they look for in roofing materials.

Further studies could also be done especially on specific roofing material attributes. Such studies would be expected to afford deeper insights about such attributes.

# CHAPTER ONE

## INTRODUCTION

### 1.1. BACKGROUND AND OVERVIEW OF THE STUDY

In all purchase situations, consumers are faced with the need to make decisions on brand choice. Although the purchase may differ depending on the category of the product being bought, in almost all situations, the brand or product bought is just one among many other competing brands or products. The purchase process has several stages that the consumer passes through.

To start with, a need must be recognized. The need or problem can be triggered by internal or external stimuli. The second stage is information search. Once a person has recognized some need, one is aroused and inclined to search for more information. This may involve looking for reading material, enquiring from friends, and visiting dealers to learn about the product. Through the gathering of information, the consumer learns about competing brands and their features. The third stage in the purchase process is evaluation of alternatives. This is where the consumer processes competitive brand information to make a final value judgement. In this stage the consumer compares the various alternatives based on the already gained information. This is done through the consideration of product attributes of

interest in relation to the consumer needs. The consumer pays most attention to the attribute(s) that deliver the sought benefits. (Kotler, 2003)

Kotler (2003) further says that the consumer then develops a set of brand beliefs that end up making a brand image. The image held leads the consumer to arrive at attitudes toward the various brands. Depending on the attitudes towards each of the brand, the consumer forms preferences. This may then lead to making a brand, vendor, quantity, timing, and payment method decisions. It is at this point that the consumer actually buys the product. After purchase, the consumer will experience some level of satisfaction or dissatisfaction.

The roofing materials market does not exhibit a different consumer decision making process. Once a need has been identified, alternatives are evaluated based on their attributes and the specific need of the consumer. Preferences are formed and purchase executed. This means that there are factors that drive the consumer to prefer one material to the others.

Roofing is the very essence of shelter. Despite achieving great heights in technological advancement, it is a challenge to provide adequate shelter for mankind. Roofing cost will be as high as 70% of the total cost of a shelter

(Manandhar & Roger 1987). As a rule, roof construction constitutes at least half the cost of even a low cost house in the tropics.

In developing countries traditional roofing materials like thatch and timber are in short supply, while modern ones like concrete and sheet metal are not affordable to consumers. Housing is an emotional and political issue. Government's role should not be to provide the shelter. It should be to provide an arrangement that will give people appropriate incentives. It should first provide security of tenure of the land and thereby assure that of the shelter.

Two thirds of the global population live in developing countries but generate only a quarter of the world's National Product, and only a quarter of the world's construction activity. In drafting development plans and allocation of external development aid, no weight is given to the construction sector. Nor are relationships between Construction and other sectors pointed out. Yet the construction sector acts as an important indicator of development. Construction output is not covered by statistics. Contribution of construction to GNP is approximately 5%. Asian countries have just over 3%, Africa just under 5% and Latin America with 5.5%. Industrialized countries stand at

8%. Building by-laws and specification make shelter expensive. Authorities do not punish contractors for flouting the rules.

In 1985 ITDG commissioned Jorgensen, a Nairobi based Housing Economist, to investigate the potential market for FCR tiles. He predicted that 135,000 new houses were needed each year to cope with the population growth and rural to urban migration. The middle and low-income groups needed 97% of these. If one third of the population were in rural areas, half in secondary towns and the rest in major towns, there would be need for 600 tile making plants to be able to meet demand in the rural areas alone. (Jorgensen, 1985). It later became apparent that the penetration of FCR tiles into the GCI sheets market stood at 5% per year, a sixth of the size predicted by Jorgensen. This means that FCR tiles were not as widely accepted as GCI sheets. But demand for housing persisted due to rural to urban migration and population growth.

## 1.2. STATEMENT OF THE PROBLEM

Roofing materials in Kenya are available from natural and processed sources. Traditionally, Africans used grass thatch or Makuti. Then came the processed types such as Galvanized sheets, clay tiles and wood shingles. The choice is wide and consumers choose depending on different attributes that they look

for. It is in the interest of manufacturers of roofing materials to know their exact market segments and the preferences of their target buyers.

Demand for roofing materials arises from construction activity in the economy. When the economy is healthy, construction activity is higher. Nairobi is growing into a conurbation with Thika, Kiambu and Athi River.

The Kenyan population is growing at a healthy 3% per annum. This ensures an ever-increasing demand for new construction. In addition, after many years in use, roofing materials need replacement.

Roofing material manufacturers continue to be monopolies in their own type of roofing, no doubt resulting from the fact that Kenya's Industrial sector is still developing. Since 1992 when the Kenyan economy became liberalized, competition was created. Many new manufacturers found it easier to invest in processing including manufacturing of roofing materials. Further some businessmen started trading concerns and were appointed sole Stockists/ Distributors of imported roofing materials. With this in mind, it is increasingly creating pressure to establish market segments in this market.

In the face of liberalization, Companies are finding it a challenge to meet their bottom lines. In 2001 to 2002, several multi-national corporations went to the extent of selling off brands to their competitors. This must be the result of not measuring customer needs, monitoring and knowing their market segments well. Roofing materials are also not strictly subjected to adherence to Kenya Bureau of Standards Specifications for the manufacture of materials like the First Moving Consumer Goods.

As a result of the increased demand, coupled with the lack of strict standards specification adherence, there has been declining quality of roofing materials in Kenya. In most cases, the producers of these materials have not been driven by the market. Rather, they have attempted to drive the market. There has therefore not been so much concern about what customers look for in roofing materials. As manufacturers face increased competition especially due to liberalization, the consumers have on the other hand become more enlightened and are looking for what best meets their needs.

As such, most consumers' decisions are rationally made from a point of knowledge. This market situation of a more demanding consumer versus increased competition requires that the roofing material manufacturer strives

to know the factors underlying consumer preferences. Such factors may be social, marketing or even situational (Churchill, 1998).

A thorough knowledge of the preference factors can aid the producers in segmenting the market in order to position their offers. The researcher is not aware of any study done in Kenya on the preference of roofing materials. Kitaka (1991) studied the future of thatch as a roofing material in rural Kenya. Bullard (1987) did a study on tiles as an alternative roofing technology in Kenya. The research question that this study sought to answer was "what determines architects preferences for roofing materials?"

## 1.3. OBJECTIVES OF THE STUDY

This study was conducted to address two major objectives. The first objective sought to identify the factors that determine roofing materials preference by customers. The second objective aimed at finding out the most important attributes of roofing materials to consumers.

## 1.4. IMPORTANCE OF THE STUDY

1. Manufacturers of roofing materials may be able to know the various product attributes of interest.

2. Marketers may be able to know how to segment the market and position the roofing materials.

3. Academicians who may be interested in pursuing further research related to roofing materials customer preferences.

## 1.5. OVERVIEW OF THE REPORT

This report is organized as follows. Chapter One contains the introduction. Chapter Two and Three covers the literature review and methodology respectively. The results, conclusions, and recommendations are dealt with in chapters four and five.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 INTRODUCTION

This chapter gives a review of the literature that is relevant to the study. It is specifically concerned with the existing types of roofing materials. The chapter also describes how consumers make decisions to purchase products and also the factors that drive them in making preferences.

## 2.2. COMPONENTS OF A ROOF

A roof may be broken down into the following components:-

1. Roof covering

This is the external material laid or fixed on a roof to protect the building from the vagaries of weather from the top. (Kimeu, 1991). This is the main subject of this study. Common roof coverings in Kenya include Galvanized corrugated iron (GCI) sheets, Thatch, Aluminium sheets, tiles, Shingles and Asbestos Cement sheets.

2. Trusses

This is made up of inclined joists whose distance from one another depends upon the roof covering to be used. They are framed together and support purlins in the absence of cross-walls. (Kimeu, 1991).

3. Ridge Piece

This is the member fixed at the head to receive the head of the rafter. (Kimeu, 1991)

4. Wall Plate

This is the member laid on top of a wall running round the perimeter of the building to receive the feet of the trusses. (Kimeu, 1991). Their size depends on the size of the building and type of roof covering.

## 2.3. FUNCTIONAL REQUIREMENTS OF A ROOF

According to Kimeu (1991), the functional requirements of a roof are that the structural frame must have adequate stability and strength to support its own weight and the wind load. It must have wind braces to stiffen the frame against the racking effect of wind without taking into account the effect of the roof and wall covering in stiffening the frames.

Secondly it must be able to adequately provide good thermal insulation. The best materials that do this are fibrous, cellular or porous. This is best achieved by using a layer of material to specially provide thermal insulation. This increases the range of temperature differences inside the building with the seasonal ones on the outside. Thirdly, it must be able to last long. Fourthly, it

should have acceptable appearance, have good sound insulation, and good fire resistance. It must not only be strong to endure fire, but also resist the rapid spread of fire. Fire propagation is the degree to which a material contributes to a fire by its ignitability. Resistance of a material to an external fire in adjacent buildings is also important

## 2.4. TYPES OF ROOFS

Kimeu (1991) and Ganijee (1977) identify 3 broad types of roofs as follows. Firstly, flat roofs. These are very heavy ranging from 300 kg/ $m^2$ to 500 kg/ $m^2$. They are not suitable for earthquake prone areas and tend to be sensitive when it comes to water drainage. There must be adequate water proofing with watertight materials, in an appropriate design and constant maintenance. These roofs are best in hot dry climates. Lime washing of these roofs increases solar reflection to 90%. Waterproofing is done using bituminous felt, plastic sheeting etc. These are susceptible to damage by UV rays and require constant maintenance. Secondly pitched/ sloped roofs. Lastly there are domed/ curved roofs.

## 2.5. TYPES OF ROOFING MATERIALS

### 2.5.1. SIMBARITE

This is a sheet made from asbestos fibre and sulphate resistant cement. Sometimes cellulose pulp is added to increased flexibility to the product. The asbestos used in manufacture was imported from Swaziland. It comes in Brick Red, Roofing Green, Saddle Brown, and Natural Grey colours. The colour is added in the mixing process and is therefore an integral part of the sheet and not a surface coating . Unfortunately there was sensitization to the effect that Asbestos was thought to be unsafe for humans in the mid- 1970's. (The Simbarite product catalogue 1987).

Asbestos cement fibre is locked within the cement and industry parties have argued that Asbestos is safe for humans and that the variety commonly used in Kenya is not the harmful one.

Exposure to asbestos has been known to cause the following:

1) Asbestosis, which is difficulty in breathing because of scaring of the lungs or pleura. One must be exposed over a long time, in high concentrations of Asbestos fibre to a variety not in use in Kenya.
2) Bronchopulmonary Cancer or lung cancer found commonly among cigarette smokers. It is a painful nearly always fatal disease.
3) Mesothelioma, which is a rare cancer of the lining of the pleura or peritoneum (stomach), caused by exposure to several materials like crocidolite asbestos fibre which is not used in Kenya (The Asbestos

Users Group Kenya 1985 and British Society for Social Responsibility in Science 1979).

Asbestos does not cause skin cancer and none of the above are contagious. The Kenya Government Chemist (1979) confirmed that water collected from an Asbestos Cement roof is suitable for human consumption after testing a water sample from an asbestos roof in Maragua (Asbestos Users Group Kenya January 1985 & July 1986).

Colours darken after many years and they last a minimum of 40 years.

They come in the following types: Romana whose length is 750mm, Super Seven which is 6mm thick, Kijabe which is 4.5mm thick both come in 1500mm – 3000mm length, Standard Three 4.5mm thick and Elgon 3mm thick both available in 1500mm to 2500mm length, Canaleta 8mm thick available in 4000mm to 7500mm with a width of 4.5mm, Curved sheets that are self-supporting and close fitting ridges and ridge ventilators (The Simbarite Product catalogue 1987).

They are fixed with roofing screws, j-bolts, roofing bolts, L-bolts or crook bolts, all of which should be capped by a washer (Simbarite Product catalogue 1987).

**ADVANTAGES OF SIMBARITE**

They are incombustible, resistant to corrosion, attack by vermin, resistant to most chemicals and solvents or decay, have good thermal and acoustic

insulation, are durable, reduce external noise from being heard inside the building, safe water can be collected for human consumption, are produced using labour intensive production generating more employment and is strong (The Simbarite product catalogue 1987).

**DISADVANTAGES OF SIMBARITE**

They are dull, their thickness makes it impossible to make a close joint at overlap for low pitched roofs, are brittle when handling, fixing or using and they are heavy to transport (The Simbarite product catalogue 1987).

Bullard (1987) found in a study sponsored by Intermediate Technology Development Group (ITDG) that Galvanized Corrugated Iron (GCI) sheets with 97% sales dominate Kenya's roofing. Yet total roofing costs between GCI and Fibre Concrete Roofing (FCR) tiles are similar.

The alternative to asbestos cement sheets is Sisal cement sheets. Simbarite's manufacture is no longer undertaken in Kenya, though it was a popular roofing material. Most asbestos cement sheets are currently imported.

### 2.5.2 TIMBER SHINGLES

These are small wooden tiles usually used in forest areas. They are laid like shells, lapped twice and nailed with galvanized nails to battens. Any edges are sealed with galvanized iron ridge caps or bituminous felt strips.

## ADVANTAGES OF TIMBER SHINGLES

- Are decorative and very long lasting
- Are lightweight and do not need good timber trusses or skilled labour to

Timber also requires less processing energy per unit weight of Steel, Aluminium or concrete, provides good thermal insulation than most materials, insulates against noise, higher ratio of strength and stiffness to weight than other materials, easy to work and join, requiring only simple tools not sophisticated equipment and in some cases has higher durability than other materials (Keenan and Tejeda 1984). Timber is renewable and if harvested from well managed reafforestation plans, does not require sophisticated equipment and can be recycled/ reused (Stulz and Mukerji 1988).

## TIMBER WEAKNESSES ARE:

Timber is flammable, shrinks when drying, is vulnerable to insect attack and expensive (Keenan and Tejeda 1984).

Other arguments against timber include that it is expensive as forest resources in the world shrink. It is high in cost, thermal and moisture movement make it distorted, shrink or split, suffers insect attack, fungal decay and fire risk, joints of timber fail due to shrinkage or corrosion of metal connectors and it discolours and becomes brittle due to sunlight (Stulz and Mukerji 1988).

Timber is said to have knots, rots, susceptible to fungal decay, resin pockets or Bark Pockets (where the Bark or Gum Resins are partly or wholly enclosed in wood), dead borer holes (which form holes or tunnels), gets Blue stain which causes a bluish discolouration, and bows (which develops in the direction of the wood's length (Campbell 1969).

### 2.5.3. CONCRETE TILES

These are made with a wider variety in colour compared to clay tiles. Mareba tiles come in Red, Yellow, Green, chocolate Brown and Slate Grey. They have Ridge, Verge and Valley tiles.

**ADVANTAGES OF CONCRETE TILES**

Concrete tiles have good thermal capacity, can achieve high strengths, remain unaffected by water and doesn't swell or shrink, are resistant to fire and other biological hazards, are considered prestigious and can take any shape (Stulz and Mukerji 1988).

**DISADVANTAGES**

Cement, one of its raw materials, is expensive, cracks occur in hot dry climate, exposure to Sulphates and salts can cause deterioration, quality

control is an issue, and is fire resistant only up to $500^{0}$c. If exposed to higher temperatures, the tiles have to be replaced (Stulz and Mukerji 1988).

### 2.5.4. FIBRE CONCRETE ROOFING (FCR) TILES

According to N'gang'a, Agevi and Mjaria (1997), these are a thin screed of sand, cement and water in the ratio 1:3 by weight, on which is added a small percentage of natural fibre. This mixture is poured into a vibrator/ mould and vibrated for 40-60 seconds, to produce a thin compacted screed of 6-10 mm. The standard tile measures 500mm x 250mm, and weighs 1.9 – 2.4 kilograms, depending on thickness.

John Parry introduced FCR technology in Kenya in 1983 after he developed it while working as a consultant for ITDG – UK in 1977 in Britain. Funding for this project came from the British Overseas Development Administration. The Architectural Association of Kenya (AAK) collaborated with ITDG and HABRI (formerly HRDU) and monitored and evaluated the tiles for 3 years. Once satisfied, they started promoting the technology in Kenya.

Other agencies played a role in disseminating this technology such as GTZ which supported HABRI between 1984-1994, Undugu Society which was one of the equipment manufacturers, ApproTEC which continued to perfect the

design of locally manufactured equipment for tile manufacture, NCCK, Shelter Afrique, African Housing Fund (AHF), the CITC's of Kapsabet and Thika, St. Joseph the Worker Church Kangemi, Kenya Bureau of Standards (KEBS), Germany's Institute for Tropical Building (IFT), NACHU, Ewaso Nyiro North Development Authority, KENGO and USAID.

ITDG became involved in promotion of FCR tiles in 1986. The aim changed to that of creating employment for the rural poor. Initially the aim had been to create a do-it-yourself roofing material, in order to move away from thatch, which was becoming rare and GCI sheets, which were expensive. By 1990, all the necessary manufacturing equipment was locally manufactured at a fraction of the cost of the imported one.

FCR Tiles took time to penetrate the rural market because of low farmiliarity of tiles with professionals, contractors, artisans and the public, adverse economic conditions of high inflation and lack of aggressive marketing by producers, high inflation forces of small scale producers to keep their prices low in order to remain in business, well established entrepreneurs had a better chance of succeeding in this business, no stocks of tiles can be held in Hardware shops. Further no credit is available to producers for working

capital, nor to clients through hire purchase, and FCR tiles require a higher degree of skills to manufacture (N'gan'ga, Agevi and Mjaria 1997).

**TABLE 2.1**

**COST COMPARISON PER SQUARE METRE OF FCR TILED AND GCI GAUGE 30 SHEETS**

| Year | Price/m2 (KES) | Price/m2 GCI sheet 30G (KES) |
|---|---|---|
| 1984[a] | 129.95 | 118.65 |
| 1986* | 133.86 | 129.91 |
| 1988[b] | 141.70 | 146.43 |
| 1990* | 167.80 | 168.90 |
| 1992[c] | 220.00 | 213.84 |
| 1993[d] | 480.00 | 675.00 |
| 1994[d] | 612.00 | 585.00 |
| 1995d | 628.00 | 610.00 |

[a] = Peter Coughlin, Steel versus Tiles What Appropriate for Kenya?

[b] = Jill Wells. Accelerated Dissemination of FCR Tiles in Kenya

[c] = Solomon Mwangi

[d] = ApproTEC

* = Estimated

*Source: Pg 28. N'gang'a, Agevi and Mjaria 1997.*

By March 1996 over 1000 vibrators had been sold, 582 being locally manufactured. Some producers were not active for reasons such as lack of market, capital, or raw materials being too expensive. FCR have not captured

the 5% predicted market share from GCI sheets. Producers need to boost production to 51000m$^2$ that is 2500 producers in full time production. They have also not captured significant share of the tile market either. The market is dominated by 3 Clay and 5 Concrete tile manufacturing companies. 6 are in Nairobi with a combined output of 5200m$^2$ of tiles per day.

In 1993 the price for cement rose by over 18%. The price for GCI sheets fell by 37% (N'gan'ga, Agevi and Mjaria 1997).

**TABLE 2.2**

**MR. COSMAS MWADIME MAKELELE CASE STUDY**
**A FCR TILE PRODUCER IN WUNDANYI**
**PRODUCTION COSTS.**

(Note: For calculating depreciation it is assumed that the workshop and equipment will be replaced after 10 years).

(a) Variable Cost (Cost of materials- 3600 tiles per month)

| | **Cost/tile** | **Monthly costs (KES)** |
|---|---|---|
| Sand/ tile | 0.75 | 2700.00 |
| Cement/ tile | 4.00 | 14400.00 |
| Fibre/ tile | 0.10 | 360.00 |
| Labour/ tile | 3.00 | 10800.00 |
| 5% sundries | 0.39 | 1413.00 |
| | Sub Total | 29673.00 |

(b) Fixed Costs

| | |
|---|---|
| Capital Investment (Workshop equipment tools etc. = 200000) | |
| Foreman | 1000.00 |
| Depreciation | 1666.70 |

| | |
|---|---|
| Overheads | 3234.00 |
| Total | 35573.70 |
| Contribution per tile | 6.76 |

*Source: Pg 34 N'gang'a, Agevi and Mjaria 1997.*

**ADVANTAGES OF FCR TILES**

The supply of FCR tiles is inexpensive and it is a material suitable for use in low cost housing, raw materials for manufacture are locally available, thermal and acoustical performance is superior, free from fungi or bacteria because of alkalinity, it does not matter what scale of production is in question since it adapts to small-scale production, which is also labour intensive, creation of small-scale enterprises creates employment as it improves the supply of roofing materials, the more compacted the mixture, the better the tile. This increases the strength of the product, because it is concrete based it has a longer lifespan and FCR tiles cost almost 40% cheaper than any other tiles

**DISADVANTAGES OF FCR TILES**

FCR tiles are breakable, demand is still not being met because of the actual scale of operations of the entrepreneurs, production method was manual, requiring accuracy and quality control, yet there was no guarantee of uniformity of the tiles. Definitely requires highly trained workers, the tiles are thinner and fragile requiring careful handling and breakages in transportation and a tiles roof substructure (the wooden trusses on which tiles

are mounted on) requires more timber than GCI and requires a skilled artisan (N'gang'a, Agevi and Mjaria 1997).

Research and Development of FCR technology aimed at finding an affordable solution to the manufacturing equipment. Imported equipment supplied by JPA was too expensive at Kshs. 130,000/= in 1986. JPA was not persuaded to make the unit locally under licence. The AAK and HABRI went ahead to develop local tile vibrators and moulds in 1987. Other NGOs, ITDG and NCCK joined them later. Two types of vibrators were further developed and are now locally manufactured by M/s Makiga Engineering Works and Hartz and Bell. Finally when all equipment for making FCR tiles was developed, the demonstrations were conducted using ASK shows countrywide. Brochures were distributed indicating availability of FCR manufacture equipment and training. As a result, the technology got buyers from the ASK shows to the tune of 7 out of every 10 visitors to their stand.

Building by-laws were outdated and did not recognize FCR tiles. FCR tiles were not manufactured to any specifications. For these two reasons, they did not become popular. Nairobi City Commission was reluctant to approve the use of the tiles in city housing. NGO's confined their activities to informal settlements. The ITDG, HABRI and AAK lobbied the KEBS for specifications

of FCR tiles. AAK was appointed to chair the technical committee that would draft the specifications. In November 1989, a new standard specification for FCR tiles was effected (KS 02 – 749).

Seminars and workshops were held to raise the awareness among professionals and decision-makers in the public sector about FCR tile. Seminars targeting producers were held between 1990 – 1993, with representation from KIE, KMAP, FKE, SEFCO and relevant Government Departments. As a result some financial institutions started approving loan applications for entrepreneurs of FCR tiles. 6 producers received loans from SEFCO and KIE between 1991 – 1994. Unfortunately due to various reasons, they started defaulting on these loans. Between 1984 and 1994, the price of FCR tiles compared very well with the lighter gauges of GCI sheets like 30 and 32 Gauge. Sometimes it was lower (N'gang'a, Agevi and Mjaria 1997).

### 2.5.5. CLAY TILES

Earth is sorted, crushed, sieved and mixed. It is wetted and thoroughly mixed with water. This mixture is thrown in a sanded mould and excess clay cut off level with the top of the mould with a rod. Nail holes are made with a hollow punch. These are dried then fired in kilns. Clay tile manufacture often incurs

defective tiles of between 7% to 19% of total production. One manufacturer of these is Clayworks Kenya Limited.

Varieties of clay tiles include Mangalore, Roman, Brosley, Pantiles, Roof ridges in Standard and Roman varieties and Ventilators in the Torino variety (Clayworks Kenya Limited price list of 24th August 1981).

**ADVANTAGES OF CLAY TILES**

Clay tiles have high compressive strength even when wet, so have good resistance to impact and abrasion, are long lasting and decorative, allows moisture movement without changes – can breathe, high thermal capacity, good fire resistance and do not rust, incur little wastage because broken clay tiles can be used as e.g. hardcore and are produced using labour intensive methods creating employment (Stulz and Mukerji 1988)

**DISADVANTAGES OF CLAY TILES**

Clay tiles are expensive, are heavy requiring a stronger heavier roof truss, and require skilled labour for laying.

They also incur high fuel consumption during firing, leading to the destruction of forests, quality and uniformity of tiles not assured, are susceptible to defects such as lime blowing and efflorescence (soluble salts in clay or water mixed with the clay)(Stulz and Mukerji 1997)

### 2.5.6. METAL ROOFING MATERIALS

These include all roofing material based on metal including those based on Aluminium and galvanized iron/ steel.

### ADVANTAGES – METAL ROOFING SHEETS

Metal is strong, flexible, durable and impermeable, enable prefabricated framed construction of steel or aluminium is done quickly and easy to transport and install. Need lighter support structures (Stulz and Mukerji 1988).

### DISADVANTAGES - METAL ROOFING SHEETS

Metals are high in costs, lack of tolerable thermal insulation, have poor fire resistance and corrode (Stulz and Mukerji 1988). They are noisy when it rains.

#### 2.5.6.1. GCI SHEETS

Galvanized Corrugated Iron Sheets consist of a steel sheet that is usually cold-rolled or hot-rolled into a certain thickness, usually between gauge 22 to 32. This thread of steel sheet is dipped into molten Zinc or Aluminium-Zinc alloy, to form a coat that makes the steel sheet more resistant to rust and corrosion. Finally this galvanized sheet is profile and sheared.

**DISADVANTAGES OF GCI SHEET**

Galvanized corrugated iron sheets rely on imports, have poor durability, poor insulation and relies on capital intensive production (Bullard 1987)

**2.5.6.2. ALUMINIUM SHEETS**

These sheets are lightweight and malleable. When exposed aluminium corrodes to form a thin oxide coating, which adheres strongly. It is insoluble and protects the metal from within from further corrosion. They have a bright reflective colour when new.

**ADVANTAGES OF ALUMINIUM SHEETS**

They need no paint for protection, are light and easy to handle, do not burn or rust and are extremely long lasting.

**DISADVANTAGES OF ALUMINIUM SHEETS**

They are expensive, are a poor insulator and the sheets are noisy when it's raining.

**2.5.7. ONDULINE**

This is a corrugated asphalted plastic sheeting homogeneous complex of oil and paraffin enriched asphalts, combined with mineral and vegetable fibre vacuum, saturated at high temperature. It has medium rating flame spread. It comes in colour it does not fade.

## 2.5.8. MUD BRICK DOME AND VAULT CONSTRUCTION

According to Ramesh Manandhar and Allan Roger (1986), earth is available everywhere and the industrialized roofing material alternatives are beyond the reach of consumers. Further fuel and energy conservation is becoming expensive and scarce and that's the alternative used when being manufactured. Mud bricks also known as adobe do not need skills to make, cost nothing to the builder, are warm in winter, cool in summer and can be rendered smooth or painted.

They use water and earth and are stabilized using straw, sand, lime, cement, saw dust, fly, bitumen, asphalt cutbacks, resins, whey, molasses or a mixture of these. Buildings have been known to stand for more than 1000 years using this, for example in Egypt from the times of Rameses II around 2000 BC, Iran, the Middle East, Nepal and Yemen. This is also common in Victoria Australia.

These buildings have been maintained by a periodic coating of mud clay mixed with cow dung. The mud bricks for roofs have a larger proportion of straw increasing its water repellant properties (Manandhar and Roger 1987).

### ADVANTAGES OF EARTH ROOFING MATERIALS

Earth as a roofing material is available easily in most regions, is easily workable without special equipment, fire resistant, good thermal insulation and is environmentally appropriate (Stulz and Mukerji 1988).

### DISADVANTAGES OF EARTH ROOFING MATERIALS

Earth exceedingly absorbs water causing cracks and deterioration, has low resistance to abrasion and impact, is susceptible to attack by rodents and insects, makes structures susceptible to earthquake destruction because of low tensile strength and is not considered prestigious by users (Stulz and Mukerji 1988)

### 2.5.9. THATCH/ GRASS/ MAKUTI

These are generally very different materials from different sources. But since they are not in common use in the city of Nairobi, I will treat them as the same. Makuti (Palm Leaves) are mainly used in the coastal region. The number of leaves per tree is lower in Mombasa (20-24leaves) while that in Lamu may go up to 40. A new leaf is produced every six weeks, 9-10 per year. Makuti mats are traditional roofing materials. They are palm leaf blades tied to a rib. Weather proofing is done by multiple overlapping from eaves (bottom of roof, top of wall) to top. These are laid on rafters and stems tied

with sisal or dried fibre, Makuti mats are at least 600mm x 600mm. The roof slope is at least 45 degrees. Production of the mats is done in the dry season.

**ADVANTAGES OF THATCH/ GRASS/ MAKUTI**

These purify air indoors, offer good thermal insulation and control indoor comfort by evaporation and soundproofing (United Nations Centre for Human Settlements Habitat 1986).

## 2.6. ACCESSORIES FOR ROOFS

These include rainwater collection accessories such as Gutters, Ridges, down pipes, angles, and support brackets. In this market they are available in painted or unpainted Galvanized Iron or plastic.

**WHY IS OUTPUT FOR CONSTRUCTION MATERIALS LOWER THAN DEMAND?**

According to Riedel and Shultz (1978) there is under utilization of production capacity, supply bottlenecks on the inputs side, low factor productivity, difficulty in mastering more complicated production processes and administrative and planning obstacles.

## 2.7. LOCAL MANUFACTURERS AND AGENTS OF ROOFING MATERIALS

| | |
|---|---|
| Cabroworks | Bituminous roofing felts |
| Corrugated Sheets Limited | GCI and colored GCI (Nyumba) |
| Kenya Asbestos Cement Co. Ltd | Fibre cement Simbarite |
| Kenya General Industries | GCI (Tembo) |
| Mabati Ltd | GCI & Coloured GCI |
| Mareba Enterprises | Coloured concrete roofing tiles |

These weaknesses have to be eliminated.

## 2.8. ESTIMATION OF DEMAND FOR BUILDING MATERIALS

The period from 1990 to date has been dubbed the era of liberalization and declining donor inflows (National Development Plan 2002 - 2008). Economic performance has had a declining trend.

"In urban areas, 76% of the poor and 80% of non-poor rent their dwellings. In the rural areas 95% of the poor and 83.5% of non-poor own their dwellings. Over 47% of Kenyan urban dwellers seek shelter in informal settlements, which are poorly constructed and are in areas of unemployment, high crime rates and increasing cases of HIV/ AIDS. These informal

settlements are characterized by degradation of the environment and in most cases develop outside the formal urban plan" (National Development Plan 2002 – 2008 pp 71).

"During the Plan's period, the following will be undertaken:

- Finalize the draft National Housing Policy;
- Collaborate research efforts with other organizations with an aim of increasing efficiency and effectiveness in the provision of housing;
- Facilitate acquisition of land for housing the low income group;
- Identify and develop appropriate innovative approaches for financing shelter and human settlements;
- Intensify efforts for improving sustainable environmental planning and management practices in shelter development;
- Implement the revised building by-laws and planning regulations;
- Implement recommendations of Presidential Commission of building by-laws by establishing the Building By-laws Review Board in the Ministry of Local Government;
- Promote participation of communities and Private Developers in provision of shelter and infrastructure through a well designed enabling institutional framework." (National Development Plan 2002 – 2008 pp 71)

TABLE 2.3.

**REPORTED COMPLETIONS OF NEW PRIVATE AND PUBLIC BUILDINGS IN MAIN TOWNS 1995-2000**

| Year | Number | | | Estimated Cost (Kshs. Million) | | |
|---|---|---|---|---|---|---|
| | Private | Public | TOT | Private | Public | TOT |
| 1995 | 1343 | 142 | 1485 | 1139 | 60 | 1199 |
| 1996 | 1492 | 109 | 1601 | 1324 | 45 | 1370 |
| 1997 | 1482 | 99 | 1581 | 1464 | 44 | 1508 |
| 1998 | 1472 | 73 | 1545 | 1610 | 31 | 1641 |
| 1999 | 1135 | 53 | 1188 | 1275 | 26 | 1301 |
| 2000 | 1024 | 21 | 1045 | 995 | 16 | 1011 |
| **TOTAL** | **7948** | **497** | **8445** | **7808** | **223** | **8030** |

Government houses vacated by civil servants will be rehabilitated and leased at market rates. The Government is to allow market forces determine optimal number of houses and buildings in the economy.

Strategies to be adopted to address housing shortages.

- 'Protect lower income groups by allocating more resources to small urban areas and low income urban settlements;

- Implement the revised building by-laws and planning regulations;
- Ensure the environmental considerations are incorporated in housing developments;
- Cease financing of activities of National Housing Corporation (NHC) during the Plan period." (National Development Plan 2002 – 2008 pp 92)

The Government will issue title documents in support of slum upgrading and security of tenure. Rural housing improvement will be promoted to stem rural to urban migration. The Government will continue to assist in the efforts of parents, communities, private sector, NGOs, voluntary organizations and the donor community in construction and development of health, education and public institution facilities through cost sharing.

Building and construction standards will be improved by reviewing current building code for appropriate building standards, promoting the use of affordable housing materials through private sector investors rehabilitating historical and monumental sites and facilities (National Development Plan 2002 – 2008)

**2.8.1. HOW CAN CONSTRUCTION DEMAND BE MANAGED?**

Construction demand can be managed through continous planning, supporting private housing by facilitating cheaper loans and credit

guarantees, mobilizing of savings by safeguarding against inflation, creating and developing special institutions to provide mortgage finance for lower income groups, supporting self help housing for lower income groups by opening supply centers for building materials, developing rural infrastructure to connect agricultural areas to their markets, conducting educational work and subsidies for maintaining existing buildings and developing of economic integrations (Riedel and Shultz 1978).

### 2.8.2. STRENGTHENING CONSTRUCTION MATERIALS SUPPLY

This can be done by seeing that known mineral deposits for roofing raw materials are exploited, prospecting for new deposits, using traditional raw materials, researching on building materials, enabling building contractors obtain easier credit terms and enabling hire purchase or lease hire of technical equipment (Riedel and Shultz 1978).

## 2.9 CONSUMER BEHAVIOR

The term consumer behavior refers to how consumers search for, purchase, use, evaluate and dispose of products and services that they expect will satisfy their needs. It is therefore concerned with how individuals make their decisions to spend their available resources like time, money and effort on

consumption-related items. It includes the study of what they buy, why they buy it, when they buy it, where they buy it and how often they buy it. (Schiffman, 1996).

Marketers should recognize why and how individuals make their consumption decisions. This allows them (marketers) to make better strategic marketing decisions. They are able to predict how consumers are likely to react to various informational and environmental cues. This gives the marketer a competitive advantage in the market place. (Schiffman, 1996).

It is critical that the marketer understands the motivations, needs and preferences of his/her customers. This provides cues for developing new products, product features, prices, channels, messages, and other marketing mix elements. (Kotler, 2003).

### 2.9.1. INFLUENCES TO CONSUMER BEHAVIOR.

A consumer's buying behavior is influenced by many factors. These may include cultural, social, personal, and psychological ones.

Culture is the fundamental determinant of a person's wants and behavior. A child, in the process of growing up, acquires a set of values, perceptions, preferences, and behavior through the family and other key institutions. Each culture consists of smaller subcultures that provide more specific identification and socialization for their members. Further, all human societies exhibit social stratification. This takes the form of social classes – relatively homogeneous and enduring divisions in a society – which are hierarchically ordered and whose members share similar values, interests and behavior. Social classes show distinct product and brand preferences in many areas such as clothing, home furnishings, automobiles and even roofing materials. (Kotler, 2003).

Social factors such as reference groups, family and social roles and status also influence consumer behavior. Each of these exerts some influence and the consumer ends up making a decision that conforms to the other members of the reference group, family or status.

The decisions of buyers are also influenced by personal characteristics such as the buyers' age and stage in the life cycle, occupation, economic circumstances, lifestyle and personality, and self-concept. At the same time, a

person's buying choices are influenced by psychological factors such as motivation, perception, learning, and beliefs and attitudes. (Kotler, 2003).

In the decision to purchase roofing material, the consumer is certainly influenced by the factors such as the above but in different levels.

### 2.9.2 STAGES IN BUYING DECISION PROCESS.

The buying decision stages model shows that the consumer passes through five stages. These include problem recognition, information search, evaluation of alternatives, purchase decision and post purchase behavior. However, consumers may skip or reverse some stages depending on the specific product being bought. This usually happens only when the purchase is not a highly involving new purchase.

The buying process starts when the buyer recognizes a problem or a need. This can be triggered by internal or external stimulus. The consumer will then search for information from the various sources available like personal, commercial, public or experiential ones. Each of these sources performs a different function in influencing the buying decision. For example commercial information normally performs an informing function, and

personal sources perform a legitimizing or evaluating function. Through the gathering of information, the consumer learns about competing brands, and their features. (Kotler, 2003).

Evaluation of alternatives is the third stage in the buying decision process. This involves the processing of competitive brand information to make a final value judgement. Here the consumer looks at the product's attributes, which allow it to deliver the benefit(s) required to meet the need at hand. Consumers vary as to which product attributes they see as most relevant and the importance they attach to each attribute. They will pay most attention to attributes that deliver the sought benefits. After the consumer has formed preferences among the brands or even has formed an intention to buy the most preferred brand, then a purchase decision is made. Purchase is then executed. Once the consumer is using the product, he/she may experience a postpurchase satisfaction or dissatisfaction.

**2.9.3. CONSUMERS PREFERENCE FORMATION.**

The stage of evaluating alternatives is where the consumer processes information to arrive at brand choices. The consumer arrives at attributes towards different brands through the evaluation procedure. The way this is done depends on the individual consumer and the specific buying situation.

For example, the beliefs already formed about different alternatives will be differing and these guide the process of evaluation (Kotler, 2001).

The process of choosing between alternative brands involves different stages. Some of the stages are under the control of consumers while others are under the control of suppliers. The first important consideration is whether the consumer is even aware of the product or brand. Awareness is mostly under the control of the supplier, and its level reflects the intensity and success of the communication strategy. Another important aspect is access to the product by the consumer. This is under control of the producer and distribution chains.

The consumer chooses products on the basis of benefits they offer. First, the consumer decides which benefits he/she is seeking, and which attributes of the product are necessary to obtain the benefits. An image of each brand is built in terms of such attributes. Consumers then match attributes of competing brands. Marketers must understand the process of evaluating and comparing benefits and attributes. (Czinkota, 2002).

The process of consumer decision making, in which preference formation is part, may take different forms depending on the product being purchased. It

may be a routine, limited or an extensive one. The process is routine when the purchase is not expensive and of little involvement to the consumer. When the purchase requires some effort in terms of involvement, the process is said to be limited. In the case of roofing materials, the decision making process can be said to be extensive. This is normally the case when the product is expensive or complex, or when it is unfamiliar or significant to the consumer. This type of decision making involves comparing many alternatives and evaluating them in terms of many different characteristics. The consumer in this case also consults a variety of information sources. It is a less common type of decision making.

As mentioned in the introduction, regardless of the form of decision making, several factors influence the process and even the decision. These factors can be divided into categories based on where they emanate from. Culture, subculture, social class, reference groups and family can be seen as social influences. Another category can be seen as marketing influences and may include the product itself, pricing, placement (channels of distribution), and promotion (marketing communications). The situational influences are the third category and they include physical surroundings, social surroundings, time, task, and monetary conditions (Churchill, 1998).

When a customer obtains information about different brands or products, one has evaluation criteria. These are the specifications used by the consumer to compare and evaluate the alternative products and brands. The evaluation criteria can either be objective or subjective. Objectivity means that emphasis will be laid on specific physical features such as price, colour, material, durability and other related attributes. The criteria is subjective when it is mainly based on symbolic values or benefits such as perceived age, prestige, class or other such considerations of the product. In other situations, many criteria may be used. For example, when one is buying a pen, availability may be the only consideration. However, in buying a car, many criteria such as price, style, economy, dependability, colour, spares availability, status and other may be considered. (Kibera, 1998).

The decision to purchase roofing materials may therefore be done with consideration of many criteria. As a result of the nature of the product, it is possible that both subjective and objective considerations are done. It is expected that such factors as color, variety, durability, strength, quality, weight, ease or difficulty in fixing, possibility of recovery and re-use, price, availability and other such factors play a key role in guiding consumer decision process and especially preference formation.

### 2.9.4 VALUE OF PREFERENCE FORMATION TO THE MARKETER

Marketing strategies rely on a better knowledge of the consumer. This is the philosophy known as marketing concept, and it states that marketers must first define the benefits that consumers seek, and then gear marketing strategies accordingly. The modern consumer is more selective in his purchase and consumption habits. The marketer must research the market to identify consumer needs and develop products to fit those needs. This has in turn resulted in expanded sets of product offerings. It has also caused advertising strategy to change from being brand awareness oriented to more creative, diverse campaigns designed to communicate product benefits (Assael, 1998).

Many companies have had to shift to a consumer orientation. This shift has changed the nature of marketing operations by showing the need for consumer behavior research, and also creating a more customer – oriented framework for marketing strategies. Today's customers are unique and their needs are diverse. They have different tastes and preferences. In order to successfully market a product, the marketer must measure the factors that influence consumers' preference and purchase, emphasize market segmentation through preferences and emphasize product positioning in

order to meet consumer needs. Greater selectivity must be created through all possible communication and distribution outlets. (Assael, 1998).

# CHAPTER 3

# METHODOLOGY

This chapter discusses the research design, population of the study, sampling and data collection method. Data analysis is also discussed.

## 3.1. RESEARCH DESIGN

This chapter highlights the methodology that was adopted in order to meet the objectives of the study. The research was a cross sectional descriptive study. It was seeking to unearth the various consumer preferences for roofing material by users.

## 3.2. POPULATION OF STUDY

The population of interest consisted of all registered architects operating within Nairobi. This is because they are the ones who come up with the various designs for consumption by their clients. They also advice their clients

on what they think is appropriate roofing materials for them (clients). In most cases, the clients do not go against the professional advice and simply end up buying what has been prescribed. It was taken that architects have a thorough knowledge about roofing materials and therefore were seen as an appropriate population for this study.

### 3.3. SAMPLING

The study aimed at sample size of 60 respondents. A list of all registered architects had been acquired from the Architectural Association of Kenya. According to the list, there were 130 registered architects operating within Nairobi. The choice of Nairobi had been done in consideration of financial resources and time available. A random sample of the 60 respondents was drawn from the list. This sample size was taken using the rule of thumb that a sample of 30 and above is considered large enough for the normal distribution expected in random samples. Further, Makawiti (1985) used a sample of 34 respondents and yielded good results.

### 3.4. DATA COLLECTION METHOD

Primary data was used in the study. The data was collected by the use of a semi-structured questionnaire, which were administered to the respondents. In order to ensure a high proportion of usable responses, the questions were dropped and picked later by the researcher or the assistants.

## 3.5. DATA ANALYSIS

Tabulations and cross tabulations were generated in order to establish basic patterns of relationships between variables. Other descriptive statistics like charts and percentages were also used to represent the response rate and information on variables of interest. Frequency tables were used to summarize important factors that were brought by the respondents as important in choice of roofing materials.

Factor analysis was also used for analysis due to the large numbers of variables being considered. This was because the researcher intended to look at the interrelationships among all the possible variables that may impact on preference together.

# CHAPTER FOUR

# DATA ANALYSIS AND FINDINGS

This chapter contains the data analysis and the findings of the study.

## 4.1. RESPONSE RATE

After the questionnaires were filled in and returned, they were edited and coded. All the questionnaires returned were usable for data analysis. The response rate was 34 respondents out of the targeted 60. This represents a 57% response rate. The researcher deemed this as adequate and sufficient for data analysis purposes. This compares with other studies such as Karemu (1993) with 55% and Lagat (1995) with 62%. The response rate also conforms to the widely held rule of thumb that a response rate of 30 respondents is sufficient for the normal distribution expected in a random sample.

## 4.2. DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

### 4.2.1. PERIOD OF PRACTICE

**TABLE 4.1.**

**PERIOD IN PRACTICE**

| Years in practice | Frequency | Percentage |
|---|---|---|
| 1 – 5 years | 10 | 29% |
| 6 – 10 years | 14 | 41% |
| 11 – 15 years | 4 | 12% |
| 15 – 20 years | 5 | 15% |
| Over 20 years | 1 | 3% |
| **Total** | **34** | **100%** |

*Source: Research Data*

From the above table, it can be seen that a total of 24 (74%) of the respondents are architects with minimum six years experience in the building industry. As a result, one can conclude that the respondents are people who hold reasonable experience that puts them in a good position in commenting on and responding to questions on building materials.

### 4.2.2. AGE

**TABLE 4.2: AGE OF RESPONDENTS**

| Age | Frequency | Percentage |
|---|---|---|
| 20 – 30 | 12 | 35% |
| 31 – 40 | 15 | 44% |
| 41 – 50 | 4 | 12% |
| Above 50 | 3 | 9% |
| **Total** | **34** | **100%** |

*Source: Research Data*

Table 4.3. above shows that 22 (65%) of the respondents are above 30 years of age. This situation further confirms that, coupled with professionalism, the respondents' age allows them to give rational responses and views regarding the important attributes of roofing materials.

### 4.2.3. GENDER

**TABLE 4.3: GENDER**

| Gender | Frequency | Percentage |
|---|---|---|
| Male | 30 | 88% |
| Female | 4 | 12% |
| **Total** | **34** | **100%** |

*Source: Research Data.*

From the table above, 30 (88%) of the respondents are male. This shows that the profession of architects is a male-dominated one. At the same time, the responses are therefore based on a deep focus of a goal-oriented environment. This is because men have been known to focus on that part of the environment that helps them achieve a goal, and they tend to be more self-expressive and goal-directed. On the other hand, women tend to be more communal-minded and take in more of the data in their immediate environment (Kotler, 2003). One may also possibly argue that the architectural profession is more masculine and thus the domination by males.

### 4.2.4. EDUCATION

**TABLE 4.4.**

**EDUCATION LEVEL**

| **Education Level** | **Frequency** | **Percentage** |
|---|---|---|
| Undergraduate | 29 | 85% |
| Post Graduate | 5 | 15% |
| **Total** | **34** | **100%** |

*Source: Research Data.*

From the responses received, all the 34 (100%) respondents are at least University graduates. Table 4.5 above shows that 5 (15%) of those

respondents even have postgraduate qualifications. It is also important to note that the researcher did not come across any respondent who is working as an architect and who does not hold a University degree. A situation such as the above shows further that the decisions made by architects concerning roofing materials are mainly based on rationality. People with reasonable levels of education are known to act with rationality in most decision making.

### 4.2.5. ARCHITECTS' OPERATIONS

From the data collected, all the 34 respondents other than one, either own or work for locally indigenous architectural firms. This means that for most of these firms, Kenya is their main target market. It can therefore be expected that a lot of attention is paid by these architects to this market in terms of trying to understand the market requirements. The architects can thus be expected to give views that represent the true situation on important attributes of roofing materials.

## 4.3. KNOWLEDGE OF ROOFING MATERIALS

**TABLE 4.5.**

**KNOWLEDGE OF ROOFING MATERIALS.**

| Roofing material | Frequency | Percentage |
|---|---|---|
| Clay Tiles | 34 | 100% |
| Concrete Tiles | 34 | 100% |
| Galvanized Corrugated Sheets | 34 | 100% |
| Colour Coated Galvanized Sheets | 34 | 100% |
| Wooden Shingles | 34 | 100% |
| Thatch/makuti | 34 | 100% |
| Asbestos | 34 | 100% |
| Glass | 34 | 100% |
| Bitumen | 34 | 100% |

Source: Research Data

As shown on the table above, when the respondents were asked to list down the roofing materials that they know, most of the commonly used alternatives were listed. Most of the architects indicated knowledge of such materials as concrete tiles, Galvanized Corrugated iron sheets, Clay tiles, thatch/makuti, Colour coated galvanized iron sheets, Asbestos sheets, Wooden shingles, glass, Bitumen, Concrete roof, Plastic and Canvas. One can go further and therefore assume that the listed materials are the ones most used in the

## TABLE 4.6: RELATIVE IMPORTANCE OF ATTRIBUTES (N=34)

| Factor | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| 1. Strength | 4.00 | 5.00 | 4.7353 | .4478 |
| 2. Beauty | 1.00 | 5.00 | 4.3235 | .8428 |
| 3. Durability | 4.00 | 5.00 | 4.8235 | .3870 |
| 4. Quality | 4.00 | 5.00 | 4.7647 | .4306 |
| 5. Less noisy when raining/sound proofing | 1.00 | 5.00 | 4.1765 | .9035 |
| 6. Weight of the material | 1.00 | 5.00 | 3.7059 | 1.0009 |
| 7. Material is less fragile | 1.00 | 5.00 | 3.8529 | 1.1582 |
| 8. Capacity to maintain low temperatures during | 1.00 | 5.00 | 3.9412 | 1.0714 |
| 9. The material can be recovered and used elsewhere. | 1.00 | 5.00 | 3.0588 | 1.3013 |
| 10. Easy of difficult to fix | 1.00 | 5.00 | 3.6176 | 1.1810 |
| 11. The material requires use of more timber | 1.00 | 5.00 | 2.6765 | 1.2240 |
| 12. Ready availability of material | 1.00 | 5.00 | 4.3235 | .8428 |
| 13. Intended use of the building being constructed. | 2.00 | 5.00 | 4.0588 | .7361 |
| 14. Capability | 2.00 | 5.00 | 3.9412 | .8507 |
| 15. Reputable manufacturer | 1.00 | 5.00 | 3.7941 | .9138 |
| 16. Conformity with neighborhood | 1.00 | 5.00 | 2.9706 | 1.2182 |
| 17. Constant communication from the manufacturer. E.g. Advertising and promotions | 1.00 | 4.00 | 2.7353 | .9942 |
| 18. Cost of the roof compared to the rest of the building. | 1.00 | 5.00 | 3.8824 | .9460 |
| 19. Rainwater collected from roof is fit for drinking. | 1.00 | 5.00 | 2.9118 | 1.3788 |
| **Valid N (listwise)** | | | | |

Mean score ranked on a 5-point scale with **1** = not at all important and **5** = Very important

*Source: Research data.*

As shown on the above table, the importance of the various attributes is considered to varying degrees by different respondents. There was only one attribute, which did not have even one respondent who considered it as very important. This was constant communication from the manufacturer.

Further, three of the attributes had minimum scores of 4 each. This means that to the minimum, these factors were considered important by the respondents. The attributes with that score included Strength, Durability and Quality. There were only two other attributes, which did not have a minimum score of one. These were intended use of the building being constructed, and capability of the client.

From the results, 7 out of the 19 factors scored a mean of above 4. This means that they were considered to be highly important. The most important attribute was durability, which had a mean score of 4.8235. This was followed by quality, strength, beauty and ready availability of material which had mean scores of 4.7647, 4.7353, 4.3235 and 4.3235 respectively. Other factors with relatively high scores included the material being soundproof, and the intended use of the building being constructed. These had mean scores of 4.1765 and 4.0588 respectively.

The attributes that were reported as not being important were the material requiring use of more timber which scored a mean of 2.6765, constant

communication from the manufacturer like advertising and promotions with 2.7353 rainwater collected from roof being fit for drinking with 2.9118, and conformity with neighborhood which had a mean of 2.9706.

Looking at the results above, one can also note that there were no significant differences among the factors. It can thus be argued that the sample was properly taken and representative.

## 4.5. FACTOR ANALYSIS ON FACTORS DETERMINING PREFERENCE IN ROOFING MATERIALS

Factor analysis was used to determine the significant factors that architects may consider or considered in the formation of preference for roofing materials.

### 4.5.1. COMMONALTIES

Communalities represent the proportion of variance of each particular item that is due to common factors or that is shared with other items.

## TABLE 4.7: COMMUNALITIES

| Factor | Initial | Extraction |
|---|---|---|
| 1. Strength | 1.000 | .755 |
| 2. Beauty | 1.000 | .653 |
| 3. Durability | 1.000 | .630 |
| 4. Quality | 1.000 | .621 |
| 5. Less noisy when raining/sound proofing | 1.000 | .736 |
| 6. Weight of the material | 1.000 | .775 |
| 7. Material is less fragile | 1.000 | .848 |
| 8. Capacity to maintain low temperatures during | 1.000 | .804 |
| 9. The material can be recovered and used elsewhere | 1.000 | .872 |
| 10. Easy of difficult to fix | 1.000 | .851 |
| 11. The material requires use of more timber | 1.000 | .675 |
| 12. Ready availability of material | 1.000 | .858 |
| 13. Intended use of the building being constructed. | 1.000 | .734 |
| 14. Capability | 1.000 | .529 |
| 15. Reputable manufacturer | 1.000 | .648 |
| 16. Conformity with neighborhood | 1.000 | .933 |
| 17. Constant communication from the manufacturer. E.g. Advertising and promotions | 1.000 | .751 |
| 18. Cost of the roof compared to the rest of the building. | 1.000 | .831 |
| 19. Rainwater collected from roof is fit for drinking. | 1.000 | .688 |

Extraction Method: Principal Component Analysis

*Source: Research Data.*

The above table helps to estimate the communalities for each variance. This represents the proportion of variance that each item has in common with other factors. For example, conformity with neighborhood has 93.3% communality or **shared** relationship with the other factors. This variable has the greatest communality with the others. On the other hand, the variable, 'capability of the client has 52.9% shared relationship with other variables. This is the variable with the least communality with others.

## 4.5.2. TOTAL VARIANCE EXPLAINED

**TABLE 4.8.**

**TOTAL VARIANCE EXPLAINED**

| Component | Initial Eigenvalues | | | Extraction Sums of squared Loading | | | Rotation sums of squared loading | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 3.460 | 19.155 | 19.155 | 3.640 | 19.155 | 19.155 | 2.432 | 12.801 | 12.801 |
| 2 | 2.681 | 14.110 | 33.265 | 2.681 | 14.110 | 33.265 | 2.350 | 12.370 | 25.171 |
| 3 | 1.980 | 10.423 | 43.688 | 1.980 | 10.423 | 43.688 | 2.338 | 12.306 | 37.477 |
| 4 | 1.870 | 9.841 | 53.529 | 1.870 | 9.841 | 53.529 | 2.073 | 10.912 | 48.384 |
| 5 | 1.426 | 7.506 | 61.035 | 1.426 | 7.506 | 61.035 | 1.792 | 9.432 | 57.821 |
| 6 | 1.279 | 6.731 | 67.766 | 1.279 | 6.731 | 67.766 | 1.514 | 7.966 | 65.787 |
| 7 | 1.118 | 5.883 | 73.648 | 1.118 | 5.883 | 73.648 | 1.494 | 7.861 | 73.648 |
| 8 | .881 | 4.639 | 78.287 | | | | | | |
| 9 | .798 | 4.197 | 82.485 | | | | | | |
| 10 | .650 | 3.419 | 85.903 | | | | | | |
| 11 | .604 | 3.181 | 89.084 | | | | | | |
| 12 | .526 | 2.770 | 91.854 | | | | | | |
| 13 | .449 | 2.362 | 94.217 | | | | | | |
| 14 | .308 | 1.621 | 95.838 | | | | | | |
| 15 | .230 | 1.208 | 97.046 | | | | | | |
| 16 | .194 | 1.021 | 98.067 | | | | | | |
| 17 | .177 | .934 | 99.001 | | | | | | |
| 18 | .109 | .573 | 99.574 | | | | | | |
| 19 | 8.0931-02 | .426 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis

*Source: Research Data.*

The use of the Kaiser Normalization criterion allows for the extraction of components that have an eigen value greater than 1. The Principal Components was used and seven factors were extracted. As the table shows, these factors explain 73.651 of the total variation. Factor 1 contributed the highest variation of 12.80%. The contributions decrease as one moves from one factor to the other upto factor 7.

## 4.5.3. ROTATED COMPONENT MATRIX

**TABLE 4.9.**

**ROTATED COMPONENT MATRIX**

| Factor | Component | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Strength | .773 | .155 | .038 | .057 | .156 | -.285 | .018 |
| 2. Beauty | .069 | -.233 | .024 | .182 | -.013 | .732 | .090 |
| 3. Durability | .791 | -.092 | .076 | -.138 | -.076 | .083 | .021 |
| 4. Quality | .729 | -.114 | .047 | .140 | .015 | .086 | .070 |
| 5. Less noisy when raining/sound proofing | .187 | .311 | .369 | .295 | -.536 | -.295 | -.085 |
| 6. Weight of the material | -.155 | .341 | .200 | -.104 | .050 | .731 | -.182 |
| 7. Material is less fragile | -.041 | .258 | .852 | .094 | .171 | -.005 | .097 |
| 8. Capacity to maintain low temperatures during hot weather. | .138 | .371 | .683 | .174 | .303 | -.253 | -.023 |
| 9. Material can be recovered and used elsewhere. | -.190 | .479 | -.141 | .532 | .487 | .056 | .239 |
| 10. Easy or difficult to fix | -.056 | -.260 | .111 | .783 | -.176 | .048 | .345 |
| 11. The material requires use of more timber | -.660 | .087 | .158 | .317 | .278 | .108 | .131 |
| 12. Ready availability of material | .012 | .114 | -.022 | .135 | .760 | .039 | -.248 |
| 13. Intended use of the building being constructed | .078 | -.049 | .307 | .020 | .038 | -.132 | .797 |
| 14. Capability of customer | .054 | .652 | -.142 | .020 | -.033 | .095 | -.348 |
| 15. Reputable manufacturer | .034 | -.030 | .050 | -.110 | .776 | .127 | .303 |
| 16. Conformity with neighborhood | .062 | .108 | .110 | .012 | .151 | -.099 | .894 |
| 17. Constant communication from the manufacturer e.g. Advertising and promotions | -.211 | .221 | -.022 | .416 | .551 | .346 | .221 |
| 18. Cost of the roof compared to the rest of the building. | -.097 | .880 | .050 | -.167 | -.145 | .046 | .038 |
| 19. Rainwater collected from roof is fit for drinking | -.222 | .061 | -.303 | .269 | -.026 | .573 | .345 |

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 10 iterations.
Source: *Research findings*

The initial Component Matrix was rotated using Varimax (Variance Maximization) with Kaiser Normalization. The above results allowed the researcher to identify what variables fall under each of the 7 major extracted factors. Each of the 19 variables was looked at and placed to one of the seven factors depending on the percentage of variability it explained in the total

variability of each factor. A variable is said to belong to a factor to which it explains more variation than any other factor.

From table 4.9 above, the individual variables constituting the 7 factors extracted are summarized. These are identified below: -

**FACTOR 1**

Strength

Durability

Quality

This factor can be called quality of material

**FACTOR 2**

Cost of roof compared to the rest of the building

Capability of the client

This factor can be called the cost of the material

**FACTOR 3**

Less noisy when raining/sound proofing

Material is less fragile

Capacity to maintain low temperatures during hot seasons

This factor can be called heat and soundproofing.

**FACTOR 4**

Material can be recovered and used elsewhere.

Easy or difficult to fix.

Material requires use more timber.

This factor can be called material fixing process.

**FACTOR 5**

Constant communication from the manufacturer e.g. Advertising and

Promotion

Ready availability of material.

Reputable manufacturer.

This factor can be called manufacturer's marketing activities.

**FACTOR 6**

Beauty

Weight of the material

Rainwater collected from the roof is fit for drinking.

This factor can be called beauty and safety perception of on material.

**FACTOR 7**

Conformity with neighbourhood.

Intended use of the building being constructed

This factor can be called use of the building and conformity with neigbourhood.

## 4.6. ATTRIBUTES BASED RATING

**TABLE 4.10.**

**RATING ON ATTRIBUTES POSSESSED (N=34)**

| Variables | Min | Max | Mean | Std. Deviation |
|---|---|---|---|---|
| Clay Tiles | 1 | 5 | 3.8235 | 1.1407 |
| Concrete Tiles | 1 | 5 | 3.8529 | .9888 |
| GI Sheets | 1 | 5 | 3.2647 | 1.0534 |
| CCGI Sheets | 2 | 5 | 3.4412 | .9595 |
| Asbestos | 1 | 5 | 2.1765 | 1.2666 |
| Thatch/Makuti | 1 | 5 | 2.2353 | 1.2567 |
| Shingles | 1 | 5 | 2.9412 | 1.3244 |
| Valid N (likewise) | | | | |

Rating on a 5-point scale according to preferred attributes possession. **5** = very great extent and **1** = Not at all

*Source: Research Data*

As the above table shows, the respondents were asked to rate the various roofing materials based on the extent they (materials) possessed attributes of importance. The results indicated that concrete tiles were rated as leading in possessing attributes considered important. This had a mean score of 3.8529. Clay tiles came second with a mean score of 3.8235. Colour Coated Galvanized Iron Sheets was position three with 3.4412. On the other hand,

Asbestos possessed very little of the preferred attributes, and it had a mean score of 2.1765. This was followed by thatch/makuti with a mean score of 2.2353.

## 4.7. RANKING OF ROOFING MATERIALS

**TABLE 4.11.**

**ROOFING MATERIAL RANKING (N=34)**

| Variables | Min | Max | Mean | Std. Deviation |
|---|---|---|---|---|
| Clay Tiles | 1 | 6 | 2.1471 | 1.3288 |
| Concrete Tiles | 1 | 6 | 2.3529 | 1.3681 |
| GI Sheets | 1 | 7 | 3.8235 | 1.5070 |
| CCGI Sheets | 1 | 6 | 3.2941 | 1.3378 |
| Asbestos Sheets | 3 | 7 | 5.6765 | 1.3645 |
| Wooden Shingles | 1 | 7 | 4.8529 | 1.6539 |
| Makuti/Thatch | 1 | 7 | 5.8529 | 1.5789 |
| Valid N (listwise) | | | | |

Ranking done starting from 1 = Most preferred to 7 = Least preferred.

*Source: Research findings.*

As shown on the table above, when the respondents were asked to rank the various roofing materials in order of preference, each of the other roofing

materials, (other than Asbestos sheets) had at least one respondent who ranked them highest. However, asbestos sheets had 3 as its highest rank.

Overall, Clay tiles was ranked highest with a mean ranking of 2.1471. This was followed by Concrete tiles and Colour Coated Galvanized Iron Sheets, with a mean ranking of 2.3529 and 3.2941 respectively. Makuti/Thatch was ranked last with 5.8529 and it was followed by Asbestos sheets, which had 5.6765.

# CHAPTER FIVE

# SUMMARY, DISCUSSIONS, AND CONCLUSIONS

## 5.1. INTRODUCTION

This study intended to identify the factors that determine preference for roofing materials. The study also sought to find out the most important attributes of roofing materials.

In Chapter Two, preference formation was discussed and also some of the factors that may influence the process were highlighted. This study attempted to confirm whether such factors are important, and also find out any others which roofing materials customers may consider in their decisions.

## 5.2. DISCUSSIONS AND CONCLUSIONS

The findings of the study as highlighted in Chapter Four are discussed here below.

### 5.2.1. FACTORS CONSIDERED IMPORTANT IN PREFERENCE FORMATION

From the analysis, it was found out that most of the architects know the roofing materials that exist in the market. It can further be assumed that as far as the architects are concerned, knowledge of existing materials go

together with knowledge of the attributes that each material possesses. This is because architects are professionals in issues of construction.

The various factors had inputs of different levels to preference formation as one moves from one architect to the other. However, attributes such as strength, durability and quality of the material came out as most important. The other quite important factors were the intended use of the building being constructed and also the capability of the client.

The availability of the material is also an important consideration. Other factors that came out as important considerations included, flexibility of the material, colour variety, fire proof, waterproof and ability to cover intricate curvilinear forms.

When factors analysis was conducted, the seven factors that emerged were: - quality of the material, cost of the material, heat and soundproofing capability, process of fixing the material, manufacturer's marketing activities, customers perception of the material on beauty and safety, and the use of the building being constructed. The above factors therefore are the most important attributes of roofing materials as far as the respondents are concerned.

As earlier mentioned in Chapter Two, preference formation is important to the marketer because when customers prefer products, it means that the marketers' job becomes easier. As a result of this, the factors considered important in preference formation are also seen as the most important attributes of materials from the marketer's standpoint. Attributes like strength, durability, beauty, colour, heat and water proofing ability as well as availability of the material are critical issues that the roofing materials marketer should address.

## 5.3. RECOMMENDATIONS

From the findings, it is clear that the architects who are the secondary customers of roofing materials, are well educated people. They make decisions based on rationality. In their decision to prefer a particular roofing material over others, they are guided by some factors. The manufacturers and marketers of roofing materials need to understand their customers well in all relevant basis. This will help them tailor their offerings targeting to win the consumer preference. Consistent preference leads to customer loyalty and this has long term mutual profitable relationships between the customer and the seller.

It is further recommended that roofing material manufacturers should try to improve most of the factors that were bought out by the architects as

important in their decisions. It is paramount that quality of the roofing materials is taken care of. This should go together with the issue of durability. This is because the consumers want to use durable roofing materials. Beauty and also availability of varieties is another important aspect that the marketers need to address.

Lastly, it is recommended that roofing material manufacturers keep researching in order to keep themselves abreast with the dynamics of their products preference formation. It is important that the marketer of roofing material does all that is possible to ensure preference in favour of his/her product.

**5.4. LIMITATIONS OF THE STUDY**

The results of this study may have been affected by the following possible limitation.

1. The sample size was small (60). This could have limited the confidence in the results and it might limit generalizations to other situations.

2. The study was done in Nairobi. The situation in Nairobi may differ from that of rural areas in many aspects. As such, the results may not be generalized.

3. The respondent groups (architects) views may not represent the general views of primary consumers of roofing materials. This is because architects are

professionals.

4. Since the study was a survey, and pre-determined questions were used, respondents may have been forced to respond to even questions they did not understand.
5. Some respondents did not fill in the questionnaires. This reduced the response rate to 57%, which reduced the probability of reaching a more conclusive study. However, conclusions were still made based on this response rate.

## 5.5. SUGGESTIONS FOR FUTURE RESEARCH

The study was broad-based as it dealt with many factors of preference formation in roofing materials.

The researcher suggests that future studies could be done which deal only with one factor at a time. This may help the researcher bring out other detailed aspects and issues related to each of the factors. The extent to which each of the factors drives consumer preference may also be determined when the factor has been isolated and studied separately from the others.

Further, studies on roofing materials could be done based on other aspects and not necessarily on factors responsible for their preference formation.

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