FAMILIARIZING WOOD SUBSTITUTES FOR EFFECTIVE INTERIORS

By

S.NAGASUDHA

(10PIR11)

A Thesis submitted to the

AVINASHILINGAM DEEMED UNIVERSITY FOR WOMEN,

Coimbatore-641043

IN PARTIAL FULFILLMENT OF THE REQUIREMENT

FOR THE DEGREE OF

MASTER OF SCIENCE

In

INTERIOR DESIGN AND RESOURCE MANAGEMENT

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CERTIFIED AS BONAFIDE RESEARCH WORK

Signature of the
Head of the Department

Signature of the
Supervisor

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I.INTRODUCTION

"We shape our home and then our home shape us"-Winston Churchill

House is a building or structure that has the ability to be occupied for habitation by humans or other creatures. The term house includes many kinds of dwellings ranging from rudimentary huts of nomadic tribes to complex structures composed of many systems **(Holl, 2007).**

Many houses have several large rooms with specialized functions and several very small rooms for other various reasons. These may include a living/eating area, a sleeping area, and washing and lavatory areas Most conventional modern houses will at least contain a bedroom, bathroom, kitchen or cooking area, and a living room **(Neilson *et al.*,2002)**.

Interior design is a discipline that looks after designing all of the interiors of a space. This can include things like flooring, windows, doors, walls, lighting, furniture, and miscellaneous design pieces. The goal of interior design is generally to make a space that is both comfortable and aesthetically pleasing, often catered specifically to the needs of the inmates in home **(Gibbs, 2005)**.

Interior design is the process of shaping the experience of interior space, through the manipulation of spatial volume as well as surface treatment. Interior design draws on aspects of environmental psychology, architecture, product design and furniture design in addition to traditional decoration **(Chaudhari, 2003).**

Residential design is the design of the interior of private residences. As this type design is very specific for individual situations, the needs and wants of the individual are paramount in this area of Interior Design. The interior designer may

work on the project from the initial planning stage or may work on the remodeling of an existing structure **(Mitton and Nystuen, 2011)**.

Furniture plays a great role in any interior design. An empty room is a blank canvas for an interior designer. The very first thing to go into an empty room is furniture. Everything else cushions, mirrors, lamps and other – will follow. That's why the furniture in interior design has such a heavy weight, and will what other items will be to finish the painting**(Lovell *et al.*, 2007).**

Furniture defines the empty space into meaningful areas and rooms such as living room, bedroom, dining area, kitchen and foyer. Furniture expresses the mood of the room and the theme of the room. Furniture constitutes the major role in designing interiors **(Sarkar, 2009).**

Building material is any material which is used for a construction purpose. Many naturally occurring substances, such as clay, sand, wood and rocks, even twigs and leaves have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use, some more and some less synthetic **(Duggal, 2009).**

A material is that out of which anything is, or may be made. Or that which may be made use of for any purpose. By interior materials we mean the material employed in an interior for various purposes **(Miller *et al.*, 2009).**Materials used for interior design have played a great role in the development of this discipline of design as an interest, obsession and way of life for many people today and historically (**www.buildnew.com)**

A natural material for building dwellings for thousands of years, the main problems with wood structures are fire risk and durability. Wood is an aesthetically pleasing material that never goes out of trend completely, though the current popularity of plastic is taking its place in many construction sites **(Domone and Illston, 2010)**.

Wood is the oldest material used by humans for constructional purposes, after stone. Despite its complex chemical nature, wood has excellent properties which lend themselves to human use. It is readily and economically available; easily machinable; amenable to fabrication into an infinite variety of sizes and shapes using simple on-site building techniques; exceptionally strong relative to its weight; a good heat and electrical insulator; and of increasing importance it is a renewable and biodegradable resource. However, it also has some drawbacks of which the user must be aware **(Caleb, 1991).**

Wood is a versatile and widely used structural engineering material for indoor and outdoor applications. Wood has been used by mankind to increase his comfort and wellbeing. It has been and is being used in construction of buildings. It is so light in weight but strong enough to construct large structures on slender foundations and beams of great strength could be handled easily **(Allen and Iano, 2011).**

Almost any type of wood could be used to build furniture, but some woods have always been favored for their beauty, durability, and workability. Furniture woods are chosen and valued for the character of their grain and color. Hardwoods usually have a richer and finer-textured grain than softwoods, but there are rich grains of all colors and patterns **(www.newfurn.com).**

The advantages of wood for housing construction and note are the following: Low cost due to its light weight and low energy consumption required to produce, transport and processing. Rating load to bear and the weight of the structure, the wood is stronger than steel and concrete. It also has a great capacity to absorb energy and resist impact loads, which makes it ideal for building in earthquake zones **(Taylor, 2000)**.

Wood has been used by man from time immemorial for construction purpose. Forest was the main source of wood. As the population increased the

demand for wood also increased. With the industrial revolution the demand went further up. The indiscriminate deforestation is showing signs of global warming, melting of polar ice, and rising of sea water level, draught and consequent destruction **(Wood news, Feb 2011).**

Forests play a very significant role for the welfare of not only the present generation but also of the future generations. They are essential component of the environmental conservation efforts and degradation of forests has adverse impact on bio-diversity, water/soil resources, climate, as also on the subsistence living of people living in and around or in close proximity of forests **(Lindenmayer and franklin, 1991)**.

One of the major direct contributions of forest has traditionally been in meeting the need for shelter, one of the three basic human needs, the other two being food and clothing. Wood, bamboo and other natural fibers from forests have been in use in times immemorial in house construction and still wood continues to be the favored material for housing and construction and other sectors of use. There is a huge gap between supply and demand for wood, including the gap in respect of industrial wood raw material, which is of the order of 25-30 per cent of the demand **(www.Saveforest.com).**

The National Forestry Action Programme - India, a twenty year comprehensive plan for development of forests, has envisaged three main action areas, namely

(i) Protection of existing forests,
(ii) Improvement of forest productivity
(iii) Reduction of total demand

As we rush toward the end of the century, we are consuming the Earth's forests faster than nature's regeneration rates can match. The building industry is

facing a scarcity of good quality lumber. The paper industry continues to pollute our rivers and streams with dioxin and chlorine, while sucking up trees at a ferocious rate. Global warming, drought, top-soil depletion, stream degradation, loss of habitat, and the extinction of species are some of the effects of non-sustainable forestry practices **(http://envfor.nic.in/nfap/)**

The declining quality and quantity and increase cost of wood products has caused a movement toward a more efficient use of wood through the development of engineered wood products that no longer depend on the dwindling supplies of large dimensional timber, i.e. Old Growth. As Science and Technology developed, several alternate materials like metals, plastics and composites with improved strength and working properties were developed. But none of them had the feel of wood and it was concluded that there is no true substitute for wood. The continued search for wood led to the utilization of secondary species of wood like real substitute of wood, which is made through the husk and the panel boards. Depleting forests leading to rising prices has only made alternative material more competitive but has not taken the shine off wood **(Messler, 2006)**.

Wood produced in fast growing plantations has several characteristics compared to wood available from traditional forest grown tree species, viz. smaller diameters, lower dimensional stability and low natural durability, necessitating technological intervention for their proper utilization in meeting the societal needs in respect of wood and wood products **(Lund, 1994)**.

Now in this decade wood is essential for construction and interior works. The scarce of wood, the environmental concern, rules imposed by government for cutting trees made an alarming stage to find out the alternatives for wood, which is highly required for construction and interior design. Environmentally most problem occurs due to chopping down of trees, such as sudden climatic change

and disasters. Therefore the wood substitute is the boon to people which has similar properties of wood **(Rangwala, 1999)**.

People depend on wood substitutes for their furniture requirements as a secondary source as the primary source in the form of traditional wood is getting difficult to be purchased. Meanwhile, the easy availability of wood substitutes has led to the finding of an alternative to the conventional sources of wood. Currently, people rely on wood substitutes as it has the qualities that enable them to cut it easily, sew as per the woodworks and turn screws wherever required. It can withstand robust conditions and provides extreme quality even after several years of usage **(Simmons, 2011).**

Procurement of engineered and composite wood products is the alternative to reduce the wood usage. This new and growing industry uses wood fiber and shorter pieces of wood (formally destined to be scrapped or burned) to make structural lumber. However, there are a couple of potential drawbacks with this product **(Verma, 2003)**. Engineered wood products use low grade wood and or agriculture and paper waste to create all types of lumber replacements. I-joists, glue-laminated beams, oriented strand board (OSB), composition boards (plywood, particle and chipboards), and finger-jointed lumber and trim are all engineered wood product **(Ply Gazette, 2010)**.

The major wood substitutes used in interior work are Plywood, MDF, HDF, Particle board, finger joint board. Wooden boards are use maximum used in interior for paneling, partition, furniture making, door and window frames. The wood substitutes are adopted by people due to the scarcity of wood and the high rate of wood. **(www.civil.com)**

Wood substitute is easy to work. It can be cut down and worked in various shapes and sizes using simple tools and machines. It can be assembled and pasted

with suitable adhesives, joining with nails, screws, bolts and special connectors that produce clean joints, strength and durability. Being a hollow fiber composite material and aligned axially the length of the tree, these voids contain air that provides excellent sound-insulating properties and heat **(David, 2003)**.

Glued engineered wood products are manufactured by bonding together wood strands, veneers, lumber or other forms of wood fiber with glue to form a larger, more efficient composite structural unit. These products include glued laminated timber (glulam); wood structural panels (including plywood, oriented strand board and composite panels).The trends suggest that particle board and fiber board will overtake plywood **(Varghese, 2008).**

Unfortunately, most of the engineered wood manufactured today use plastic resins to bind, along with formaldehyde additives. But, fortunately it can also be manufactured using non-toxic glues, no formaldehyde, 100% recycled fibers and certified sustainably harvested wood **(Keeler and Burke, 2009).** Hence the study on "**Familiarizing wood substitutes for effective interiors**" is significant and undertaken with the following objectives to,

1. educate vital importance of decreasing the usage of log wood as forest is being depleted which in turn affects the environment.
2. impart the knowledge of new wood substitutes available in the market and making people aware of the Indian standard and eco-friendly wood substitutes.
3. familiarize natives with the new eco-friendly wood substitute honeycomb board and bamboo plywood.
4. impart the knowledge on using specific wood substitutes for unique furniture and interior as reducing the budget and
5. evaluate the impact of the wood substitute's workability.

II. REVIEW OF LITERATURE

The literature pertaining to the study on **"Familiarizing wood substitutes for effective interiors"** are reviewed under the following headings

A. House and interior design
B. Types of wood and their specific characteristics.
C. Role of wood in construction and interior design.
D. Reasons for adopting wood substitutes in interior design.
E. Various Wood substitutes their role and characteristics.
F. Comparison of wood substitutes by their unique characteristics.
G. Familiarizing the new available wood substitute.

A. House and Interior Design

House has several large rooms with specialized function and several very small rooms for other various reasons. These may include a living/eating area, a sleeping area, and washing and lavatory areas **(Riley and Howard, 2002)**

Ideally, architects of houses design rooms to meet the needs of the people who will live in the house. Such designing, known as "interior design", has become a popular subject in universities. Feng shui, originally a Chinese method of moving houses according to such factors as rain and micro-climates, has recently expanded its scope to address the design of interior spaces with a view to promoting harmonious effects on the people living inside the house **(Marshal and Worthing, 2006).**

"For a house to be successful, the objects in it must communicate with one another, respond and balance one another" - Andre Putman

In the developed world, energy-conservation has grown in importance in house-design. Housing produces a major proportion of carbon emissions (30% of the total in the India. Development of a number of low-energy building types and techniques continues. They include the zero-energy house, the passive solar house, the autonomous buildings, the super insulated houses (**cook, 2009**).

Houses may express the circumstances or opinions of their builders or their inhabitants. Thus a vast and elaborate house may serve as a sign of conspicuous wealth, whereas a low-profile house built of recycled materials may indicate support of energy conservation. Home ownership provides a common measure of prosperity in economics**(www.Wikipedia.com).**

B. Types of Wood and their Specific Characteristics

Wood is a hard, fibrous tissue found in many trees. It has been used for hundreds of thousands of years for both fuel and as a construction material. It is an organic material, a natural composite of cellulose fibers which are strong in tension embedded in a matrix of lignin which resists compression **(Rangwala, 2003)**. Wood may also refer to other plant materials with comparable properties, and to material engineered from wood, or wood chips or fiber.

Wood is a versatile and widely used structural engineering material for indoor and outdoor application **(Kasu, 2005).**The earth contains about one trillion tones of wood, which grows at a rate of 10 billion tons per year. As an abundant, carbon-neutral renewable resource, woody materials have been of intense interest as a source of renewable energy. In 2001, approximately 13.5 billion cubic meters of wood were harvested. Dominant uses were for furniture and building construction **(en.wikipedia.org)**

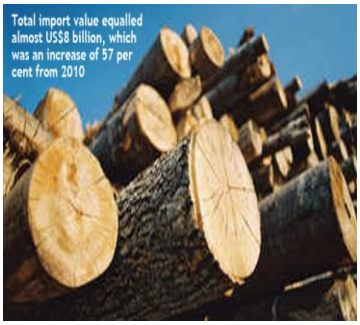
Types of wood

According to **Botannini, 2011** Wood is of two types' softwood and hardwood. The classification is based on the structure, hardness, density.

Hardwood

Hardwood is wood from angiosperm trees (more strictly speaking non-monocot angiosperm trees). Hardwood is a cellular construction. Hardwoods are not necessarily harder than softwoods. In both groups there is an enormous variation in actual wood hardness, with the range in density in hardwoods. Examples are Aspen, Birch, Cherry, Elm, Hazel, Mahogany, Maple, Oak, Teak **(Botannini,2011).**

Softwood



The term softwood is used to describe wood from trees that are known as gymnosperms. It may also be used to describe trees, which tend to be evergreen, notable exceptions being bald cypress and the larches. Softwood is the source of about 80% of the world's production of timber. The term is opposed to hardwood, which is the wood from angiosperm trees. Softwoods are not necessarily softer than hardwoods. In both groups there is an enormous variation in actual wood hardness, with the range in density in hardwoods completely including that of softwoods Conifers are an example **(Surhone, *et al.*, 2010)**

According to **www.woodtechnology.com,** The Encyclopedia of Wood features of hardwood and softwood are explained,

Table 1: Characteristics of Hardwood and Softwood

Characteristics	**Hardwood**	**Softwood**
Definition	Comes from deciduous trees that drop their leaves every year.	Trees that are conifer and have needles, and normally do not lose needles.
Properties	Broad leaves; enclosed nuts. Higher density not all hardwood is hard e.g. poplar and basswood.	Less dense; less durable; high calorific values; coniferous trees.
Examples	mahogany, teak, walnut, oak, ash, elm, aspen, poplar, birch, maple etc.	pine, spruce, cedar, fir, larch, douglas-fir etc.
Density	It has a higher density and is therefore harder	It has a lower density; therefore most softwood varieties are softer than hardwood.
Growth rate	Hardwood has a slower growth rate.	Softwood has a faster rate of growth.
Type	Mostly deciduous.	Evergreen.
Applications	Used for trimmings and furniture but less frequently than softwood.	Widely used as wood ware for building (homes/cabins) and furniture.
Cost	Hardwood is typically more expensive than softwood.	Softwood is typically less expensive compared to hardwood.

C. Role of Wood in Construction and Interior Design.

Wood has been an important construction material since humans began building shelters, houses .New domestic housing in many parts of the world today is commonly made from timber-framed construction. Engineered wood products are becoming a bigger part of the construction industry. They may be used in both residential and commercial buildings as structural and aesthetic materials. In buildings made of other materials, wood will still be found as a supporting material, especially in roof construction, in interior doors and their frames, and as exterior cladding **(Deplazes, 2006).**

Moreover, wood is not only it's a sustainable material but it's also very versatile and can add a rustic as well as a modern look to interiors. Wood is the dominating material and demonstrates its power of linking traditional, rustic feels, with modern design approaches. Wood has been used since the birth of man for building materials and we intend to continue with our interior design applications of wood under strictly renewable guidelines. Wood has been used for thousands of years throughout the planet by our ancestors for a wealth of building and interior related materials. Woodlands flourished across the planet and people quickly utilized this material for building shelters, homes, pens for animals when farming began, heat and security to name but a few applications **(Green, 2007)**.

Wood has inherent properties which make it ideal for an interior design related material. It can be incredibly strong. Some hardwoods will last centuries with little maintenance if kept indoors, this is a dream come true for furniture makers throughout the years. Its strength is matched by its ability to be manipulated. Wood can be bent, cut, sanded, joined and strengthened with pins. This versatility makes wood another choice material. Wood is unique. This small detail makes wood another choice material for interior design applications, as no two pieces of wood are the same, which appeals to designers and home owners

alike as they will have something personal to them. Wood can be treated with colours, it can be painted, and stained, polished, lacquered, and again lending itself to dream finishes **(Spielman, 2003).**

Wood is also commonly used as shuttering material to form the mould into which concrete is poured during reinforced concrete construction. Hardwoods are employed in a large range of applications including construction, furniture, flooring, cooking, utensils, etc. Solid hardwood joinery tends to be expensive compared to softwood **(Lewis and Vogt, 2000)**

In the past, tropical hardwoods were easily available but the supply of some species such as Burma teak, and mahoganies are now becoming scarce due to over-exploitation. Hardwoods can also be used in a variety of objects but mainly for furniture or musical instruments because of their density. This is due to the variety of characteristics apparent in different timbers including density, grain, pore size, growth pattern, wood fiber pattern, flexibility and ability to be steam bent. For example, the interlocked grain makes it suitable for the making of chair seats where the driving in of legs and other components can cause splitting in other woods. Wood has always been used extensively for furniture, such as chairs and beds **(Scaglia, 2011)**

Use of wood in building construction and decoration is still considered of higher aesthetic value than other competing materials. In general, softwood is easy to work with; it therefore forms the bulk of wood used by man. Softwood has a huge range of applications it is the primary material used for building components, and is also found in furniture and other products such as millwork (moldings, doors, windows). Softwood is also used in the production of paper, and for various types of board such as MDF (medium-density fiberboard). The finer softwoods have many special uses. Hardwood is also used for construction, flooring etc**. (Eassie, 2010)**

Wood never goes out of style - making it a smart way to invest in your home's interior design. One of the nicest things about decorating with solid wood is how well it blends with the rest of your interior design - draperies, area rugs, furniture and accessories. There are endless options in wood stain colors these days that you can absolutely match the wood items in your house to any color or design scheme **(Varghese, 2008).**

D. Reasons for Adopting Wood Substitutes in Interior Design

Depleting forests leading to rising prices has only made alternative material more competitive but has not taken the shine off wood the major reason for scarcity of wood, is due to the major use of wood for fuel, construction, furniture making. The forest depletion occurs and it leads to deforestation which affects the climatic change, and environmental disasters **(Brezina, 2009).**

The growth ring is also decreasing in natural wood so the wood cannot be used for furniture's or interior works. Now for the urge need of wood agriculturist grow trees in the hybrid plantation method such as teak are grown in this way and chopped after a certain time which doesn't have the proper growth **(wood and wood products magazine, 1990).**

Pest attack is high in hardwood which should be maintained and which will require additional money. When weather modifies, climate changes the compression and rarefaction takes place which will reduce the stability of the wood which leads to rupture of wood **(**http://www.sciencedirect.com**).**

In this age of declining forest resources, the search for aesthetic alternatives to wood for interior designing and making furniture has never been more desirable. More and more interior designers are now favouring substitutes to

wood, as consciousness about depletion of forest areas is driving people to options that ensure minimal use of timber As the world is waking up to the reality of shortage of timber and to the importance of using alternatives to wood products, various alternatives to wood has gained attention over the years **(Whipple, 1985)**.

However, the days of large wooden doors, stairs, partitions and shelves have long ceased to exist. And search has long been started for substitutes that can offer qualities such as easy workability, durability, dimensional stability and aesthetic appeal. Wood substitute offers an alternative to the non-traditional aesthetics of interior designing that has emerged over the last many decades **(Shaw and Wood, 2000).**

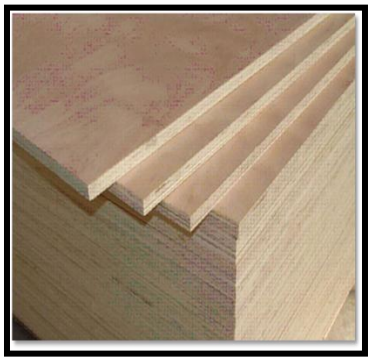
E. Various Wood Substitutes their Role and Characteristics.

Engineered wood products, glued building products "engineered" for application-specific performance requirements, are often used in construction and industrial applications. Glued engineered wood products are manufactured by bonding together wood strands, veneers, lumber or other forms of wood fiber with glue to form a larger, more efficient composite structural unit **(Duggal, 2009)**.

Engineered wood products display highly predictable and reliable performance characteristics and provide enhanced design flexibility on one hand, these products allow the use of smaller pieces, and on the other hand, they allow for bigger spans. Engineered wood products prove to be more environmentally friendly and, if used appropriately, are often less expensive than building materials such as steel or concrete. These products are extremely resource-efficient because they use more of the available resource with minimal waste. In most cases, engineered wood products are produced using faster growing and often underutilized wood species from managed forests and tree farms **(Peters, 2000)**.

Wood unsuitable for construction in its native form may be broken down mechanically (into fibers or chips) or chemically (into cellulose) and used as a raw material for other building materials, such as engineered wood, as well as chipboard, hardboard, and medium-density fiberboard (MDF). Such wood derivatives are widely used wood fibers are an important component of most paper, and cellulose is used as a component of some synthetic materials. Wood derivatives can also be used for kinds of flooring, for example laminate flooring **(Jeffris and Smith, 2009).**

a).PLYWOOD



Plywood is a wood product built up of layers of wood and glue binders. It is flexible, inexpensive, workable, re-usable, and can usually be locally manufactured. Plywood is used instead of plain wood because of its resistance to cracking, shrinkage, and twisting/warping, and its general high degree of strength. Nobel the founder realized that several thinner layers of wood bonded together would be stronger than one single thick layer of wood. Plywood is now a staple of the construction industry, used in floors and roofing **(Sellers, 1985)**.

Groundwork of Plywood

Plywood layers (called veneers) are glued together with adjacent plies having their grain at right angles to each other for greater strength. Plywood consists of 3 or more odd number thin panels of wood veneers glued to form one thick panel(Because of the way plywood is bonded (with grains running against one another and with an odd number of composite parts) it is very hard to bend it perpendicular to the grain direction. Plywood is created by stacking alternating

layers of thinly sliced wood and securing them with an adhesive. Because of the method used to construct plywood, it is stronger than most types of equally sized and shaped lumber. These compromises the integrity of both the wood and the adhesive used to hold the layers together **(Ply gazette, 2011)**.

It is quite usual for the outer layer on each face to be of a higher-grade timber, and sometimes thinner than the other layers, and perhaps more decorative. The principal reason for the central layers is to increase the separation of the outer layers, where the stresses are highest - in bending, the maximum stress is in the outer layers, one in tension, the other in compression, changing lineally with distance from the surface, i.e. zero bending stress in the middle, where only a very weak layer is needed. Shear stress is constant throughout the depth **(Jagadish, 2008)**.

Plywood size: 2440 x 1220mm and 1525 x 1525mm sheets**, Thicknesses** are 4, 6, 9 and 12 mm **(Ngo and Pfeiffer, 2003)**.

Plywood Applications in Interior Design

Roofing can use the thinner plywood. Subfloors thickness depends on the distance between floor joists. Plywood is used for flooring applications. Plywood is used in all application such as furniture, cabinets in kitchen, door frame, and window frame. Paneling is prepared using plywood. The room partition and commercial partition is done through plywood. It has a high planar shear strength and impact resistance, which make it especially suitable for heavy-duty floor and wall structures. Oriented plywood construction has a high wheel-carrying capacity **(Ngo and Pfeiffer, 2003)**.

Merits of Plywood

- Plywood has become an integral part of construction today.
- It started as a curiosity that has since become a stable product in all forms of construction.
- Plywood is constructed of layers of wood glued together at right angles, which is what gives it its strength.
- The layering makes the plants resistant to warping, cracking and twisting, making it ideal for use in construction.
- In addition to its strength, plywood is less expensive than similar boards made of full wood species, which makes it ideal as a construction planking material **(Hoadley, 2000)**

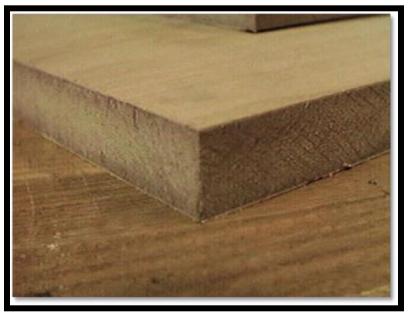
Demerits of Plywood

- Plywood is subject to a variety of problems, both from its unsuitability for certain purposes and from environmental hazards.
- Used incorrectly, plywood can rapidly fail.
- Plywood used in flooring also suffers from weathering, such as that caused by dampness under the house or flooding severe enough to soak the plywood **(Koones and Sanders, 2004).**

b). MEDIUM DENSITY FIBER BOARD (MDF)

MDF or Medium Density Fiberboard is a type of hardboard, which is made from wood fibers glued under heat and pressure... It is dense, flat and stiff and does not have knots. Thus it can easily be painted to produce a smooth quality surface but also cut, drilled, machined and filed without damaging the surface. MDF may be glued together, painted, varnished, veneered and laminated to achieve a different finish. MDF is used for many different building projects **(Strong, 2003)**.

Groundwork of MDF



Medium Density Fiber board (MDF) is third generation plywood -substitute formed by de-fiberizing bagasse wherein high quality bagasse fibres are bonded with resin under pressure. The MDF Board has a homogenous internal structure with a super smooth finish. The high-tech manufacturing process of the board eliminates the need for seasoning. It also ensures that there is no warping, cracking, splitting or knot formation while keeping the material termite and fungus resistant. Moreover, being homogenous in its nature and structure, the Board has machinability as its premium property. It can be sawed and routed easily. MDF can be easily cut, drilled and filled without damaging the board. It also works well with glue, paint, varnishes, veneers and laminates **(Bingelli, 2011).**

MDF Application in Interior Design

Being moisture and fire resistant MDF boards provide excellent stability, making them ideal for use in both residential and commercial environment. Medium Density Fiber Boards are used in Furniture, Interiors (Residential and Commercial), Carving, Partitions, Molded Furniture, and Modular Kitchens, where its smooth surfaces, tight edges and excellent machinability are well suited to the needs of these industries. Plain MDF can also be used for Toys, Shields, Doors, Clock frames, Photo -lamination, Carved Doors, Trophies, Hand Rail, Cable Drums and Gift items **(Dunn, 2003).**

MDF Thicknesses mm 6, 8, 10, 12, 16, 18, 19, 22, 25, 28, 30, **Size mm** 2620 x 2070, 2800 x 2070, 3660 x 3440 **(www.insidewoodworking.com)**

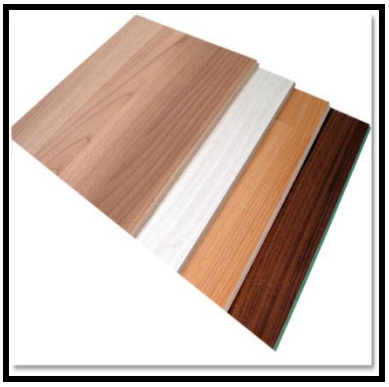
Merits of MDF

- Smooth surface, with uniform density and high internal bond, make it ideal for turning, milling, carving, grooving, painting and lacquering.
- Eco-friendly, since it uses lops and tops of fast growing species of plantation wood, thus preserving forest cover.
- Free from defects of waviness, telescope, air pockets or other bonding defects
- Provides superior strength combined with workability in all directions.
- High dimensional stability in variable atmospheric conditions.
- Highly economical.
- Does not warp, bend or change even when exposed to humid conditions **(Reid and Ralls, 2003).**

Demerits of MDF

- This board is made from fine particles and therefore the surface grain is almost invisible.
- Some people are worried about the health risks that come with using MDF, which can include irritation to the eyes, nose and throat.
- MDF contains a substance called urea formaldehyde, which may be released from the material through cutting and sanding.
- The dust produced when machining MDF is very dangerous. Masks and goggles should always be worn at all times.
- MDF can be fixed together with screws and nails but the material may split if care is not taken. If you are screwing, the screws should not be any further than 25mm in from the edge **(www.design-technology.org)**.

c). HIGH DENSITY FIBER BOARD (HDF)



HDF (High Density Fiber Board) will be an engineered wood substitute formed by refining of Bagasse into small and fine fiber and combining it with paraffin wax and resin by applying high temperature and pressure. The HDF board has a smooth, hard surface which makes it perfect for painting, staining, grain printing and lamination. HDF Board is a wood fiber board made from fine wood fibers. The board is homogeneous through and through, has a particular dense, smooth, surface which is harder than MDF board **(Gesimondo, Postell, 2011)**.

Groundwork of HDF

Due to its flatness and excellent treatment possibilities HDF board can be cut, drilled, painted or processed in other ways. Although HDF is similar to particleboard and medium-density fiberboard, it is much more dense and harder because it is made out of highly compressed exploded wood fibers. HDF is one of the closest substitutes for wood. It is composed of wood fibers heated and pressurized to bond as a hard component. It can have plain, smooth surface, or a glossy finish; it can also be made to be comparable to stone and tiles. Easy to cut and fix and can also be painted **(Bokalders and block, 2010).**

HDF Application in Interior Design

HDF board is mainly used to build furniture such as kitchen cupboard doors, tables etc. This material is also used in construction, carpentry and packaging. HDF finds applications in

Exterior Furniture, Door Frames, and TV Cabinet Covers. It is mainly used in construction and for building furniture but also in the automobile industry. This material can be used in walls, floors, ceilings, for building doors and furniture such as sofas and in other areas **(www.indiamart.com).**

HDF Thicknesses mm 3, 4, 6, **Size mm** 1525 x 1525, 2440 x 1220, 2500 x 1250, 1500 x 3000

Merits of HDF

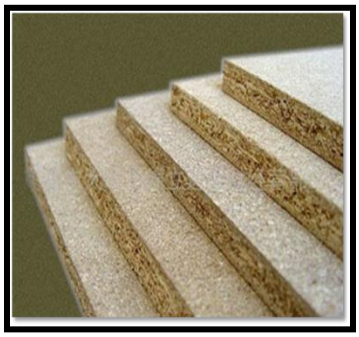
- It includes high strength and stability.
- It can be worked out to thin sheets, it is flexible.
- It is ease of machining
- Good weathering properties
- Low thickness and swelling.
- It is strong, but can also be formed into different shapes **(www.gharexpert.com).**

Demerits of HDF

- This board is made from fine particles and therefore the surface grain is almost invisible.
- Some people are worried about the health risks that come with using HDF, which can include irritation to the eyes, nose and throat.
- HDF can be fixed together with screws and nails but the material may split if care is not taken. If you are screwing, the screws should not be any further than 25mm in from the edge

- HDF contains a substance called urea formaldehyde, which may be released from the material through cutting and sanding (**http://www.teamrocs.com**)

d). PARTICLE BOARD



Particle board is a composite product. It is manufactured by mixing waste-wood products, such as sawdust, wood chips or sawmills shavings, with a synthetic resin or another type of binder. Particle board was first manufactured in Germany during World War II in response to a lumber shortage that limited the availability of plywood. At that time, manufacturers discovered that the more uniform the wood chips used in the manufacturing process, the more attractive and stronger the particle board **(EIRI magazine, 2011).**

Groundwork of Particle Board

Particle board made from small chips of spruce and pine wood bonded together under pressure. A multi-layered mat is built out of the chips and hot-pressed under high pressure. Selected chips, segregated, are of precise dimensions and are compressed under a controlled temperature and pressure to retain the balance of the board; resulting in superb dimensional stability and superior machinability. Fine chips are placed at the top and bottom of the mat ensuring a smooth surface suitable for painting. After cooling down the boards are cut to size and sanded. Particle board has high quality and excellent screw holding capability. Boards can be finished and coated differently **(Domone and Illston, 2010).**

Particle board Thicknesses mm 6, 8, 10, 12, 16, 18, 19, 22, 25, 28 **Size** mm 1830 x 2750, 2600 x x1200

Particle Board Application in Interior Design

Particle board comes in two grades. Standard grade is widely used in furniture manufacturing and general joinery, particularly where the boards will be covered by a veneer or laminate. Flooring grade is meant for interior use, is produced as a square-edged panel and is also available with a grooved profile. Particle board can be used to create furniture, cabinets and cupboards, shelves and toys. A cheaper alternative to solid wood furniture, particle board is more affordable but may be less durable. Particle board is also widely used in construction, packaging and carpentry **(Hughes, 2004).**

Merits of Particle Board

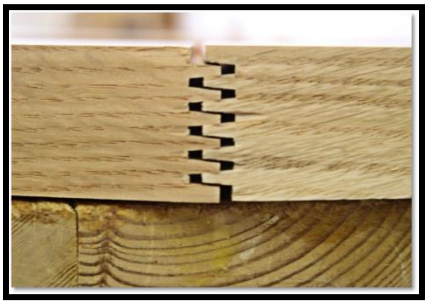
- Particle board is fairly inexpensive to manufacture, which translates into lower cost for the consumer.
- Particle board is readily available and can be easily decorated in different styles with laminated overlays.
- As it's manufactured from recycled wood products, Particle board is considered an eco-friendly material **(Clair,2011)**

Demerits of Particle Board

- Particle board is not appropriate for outdoor use due to the fact it can expand and become discolored when exposed to moisture.
- Particle board includes limited durability and a faux-wood appearance that lacks the texture and rich colors of solid wood.
- The big problem with particle board is its vulnerability to moisture.
- It is comparatively less strong than other boards.

- When particle board comes in contact with moisture, it can expand and darken in color **(Hedden and Horowitz, 1979).**

e). FINGER JOINT BOARD



Finger joint boards are made from Teak Wood, Mango Wood, Rubber Wood and other hard woods Kiln Dried and Chemically Treated out Of Solid Wood, with thicknesses ranging from 12mm to 60 mm. A finger joint board is a woodworking joint made by cutting a set of complementary rectangular cuts in two pieces of wood, which are then glued. To visualize a finger joint simply interlock the fingers of hands at a ninety degree angle; hence the name "finger joint board." It is stronger than a butt or lap joint, and often contributes to the aesthetics of the piece **(www.alibaba.com).**

Groundwork of Finger Joint Board

The strength of a finger joint comes from the long-grain to long-grain contact between the fingers, which provide a solid gluing surface. The number of contact points also allows for more gluing surface as opposed to a butt joint or a rabbet joint. . Finger Jointed Lamination Board is a Wood processing technique that enables the jointing of individual pieces of wood together to form longer lengths. The process involves the machining of inter-locking finger profiles into each end of small wood pieces. The ends are the coated with adhesives and meshed together, end-to-end, under pressure to form a longer piece of wood, which is known as lamellas. These lamellas are segregated end edge glued to form a board according to the colors and the quality. In general finger joints add strength to whatever projects they are used for. **(www.indiamart.com)**.

Fingerjointboard Applications in Interior Design

It is widely used in furniture house, wooden carvings, kitchen shutters, door frames and panels. The finger joint can also be invaluable when fixing tables and chairs and also can be used in such things as floor boards, timber roof and door construction. Finger joint boards are used in making floors for high traffic areas such as gymnasium, as well as the hardwood floors found in homes. It is widely used in furniture, wooden carvings, kitchen shutters, door frames and panels. Finger Joint Rubber Wood Boards find vast application in furniture industry **(www.beta.com)**

Finger joint board Thicknesses 12 to 25, **Size m** 2620 x 2070, 2800 x 2070,

Merits of Finger Joint Board

- Finger joint board provides high prolific performance.
- It has high Magnificent bending strength and Long lasting life
- It is Low Shrinkage in nature, less warping.
- Dimensional accuracy is high in finger joint boards.
- It is cheaper and easier to work with **(www.ikeafans.com).**

Demerits of Finger Joint Board

- Finger joints can be hard to make without the right tools.
- It requires efficient technicians to joint finger joint boards.
- Even under the most favorable conditions, strength of a finger joint will be lower than strength of clear wood.
- If good wood is not used the boards will not be guaranteed **(www.wedidwood.net).**

F. Comparisons of Wood Substitutes by their Unique Characteristics. (Jagadish, 2008, Bingelli, 2011, Bokalders and block, 2010, Domone and Illston, 2010)

Table 2: Preparation method, Availability, Strength of Wood Substitute

S.No	Material	Preparation method	Availability	Strength
1	**Plywood**	Plywood is manufactured from veneers that are peeled off mature timber hence logs of higher diameter are must resulting into high level of wastage.	With the natural timber resources becoming scarce plywood availability is under pressure.	It has more strength compared to particle board, MDF and HDF.
2	**MDF**	It is a type of mechanically manufactured wood product formed by breaking down wood residuals into wood fibers and by combining by glue and pressing it under heat and pressure.	MDF is an engineered solution & is available year round	MDF does not have good strength when compared to solid wood, other board.
3	**HDF**	It is made by compressing wood fibers mechanically.	HDF is an engineered solution & is available year round	HDF is the best board which has high strength.
4	**Particle Board**	It is made from a hot pressed composite of wood-based waste materials bound together with formaldehyde resin.	It is developed for the economical substitutions for timber, plywood.	It is stronger and dense but comparatively less.

Table 3: Bonding type, Texture and Finish, Lamination Process of Wood Substitute

(Sellers, 1985, Strong, 2003, Gesimondo, Postell, 2011, EIRI magazine, 2011)

S.No	Material	Bonding Type	Texture and finish	Lamination process
1	**Plywood**	Plywood has a uni-dimensional bonding - that is surface to surface. Such a bond is weak & the prime reason for Plywood feathering at the edges. It has lower Internal Bond.	Plywood has a rough wood textured surface despite the sanding. The surface needs to be made paint/polish ready or even for the matter of fixing MICA or Veneer.	In case of Plywood the Pre-lamination cannot be done at all. Hence the user has to finish the furniture/panels in the conventional method using Paint/Polish/MICA. However, one has to smoothen the surface
2	**MDF**	MDF has a multi-dimensional bonding amongst the fiber/chips with highest compared to particle board active bonding surfaces. This results in higher Internal Bond & the strength of the product.	MDF has an ultra-smooth paint / polish ready surface & this ensure the ease of application & as a matter of fact MDF has been used with a transparent lacquered surface which is not possible with plywood	With the Pre-laminated MDF the user has the option of multiple shades/decors in Pastel & Wood Grain best suited to the esthetics of the interior decoration.
3	**HDF**	Same as MDF	Same as MDF	Same as MDF
4	**Particle Board**	Same as MDF and HDF.	Same as MDF and HDF.	Same as MDF and HDF.

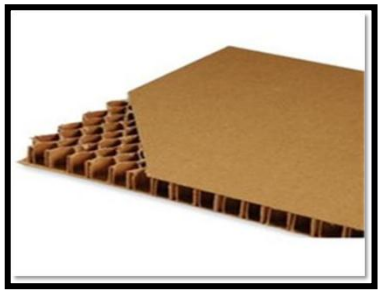
Table 4: Surface Decoration, Workability, Interior Application of Wood Substitute

(Ngo and Pfeiffer, 2003, Dunn, 2003, www.indiamart.com, Hughes, 2004)

S.No	Material	Surface decoration and workability	Application in Interior Design
1	**Plywood**	Plywood cannot be carved or routed or profiled. It shall always have a straight profile & zero workability	Plywood is used in both for home as well as for commercial purpose and it is less expensive and flexible. This can be used for home décor, paneling, roofing, lining, flooring, and furniture.
2	**MDF**	MDF can be profiled, carved, molded, and routed.	MDF are used in Furniture, Interiors, Carving, Partitions, Molded Furniture, and Modular Kitchen.
3	**HDF**	Same as MDF	HDF finds applications in Exterior Furniture, Door Frames, and TV Cabinet Covers. It is mainly used in construction and for building furniture.
4	**Particle Board**	Particle Board to certain extent can be edge molded & surface routed.	Particle board can be used to create furniture, cabinets and cupboards, shelves and toys.

G. FAMILIARIZING THE NEW AVAILABLE WOOD SUBSTITUTE.

A). HONEYCOMB STRUCTURE



Honeycomb Structure is a strong and lightweight structures based on a nature shape called hexagonal shape which can be found everywhere in

nature world including animal, insect, plant and human cells. It is the strongest structures known to human being **(Campbell, 2010).**

Half-way the last century, there was talk of unprecedented building activities. Because of the great need, solid filling materials, like wood, became scarce and thus expensive. Paper honeycomb appeared to be a very appropriate alternative. Nowadays honeycomb has very successfully in for instance panel doors and standard hardboard applications. Since the development of expanded, water-repellent honeycomb it is also applied in moist environments **(Bitzer, 1997)**.

HONEYCOMB BOARD

The honeycomb boards are light but have extraordinary strength. The honeycomb board prevents a damage of transported products.
It is a substitution of a wood board/pack. The honeycomb boards are light but have extraordinary strength. Honeycomb board is made in various dimensions, thickness and parameters according to Customer requirement, e.g. interleaving and covering honeycomb boards **(Eekhout, 2008)**.

Groundwork of Honeycomb Board

They are ideally suited for design and architectural applications as a result of their optimal ratio of weight to load-bearing capacity and bending strength. In addition this composite material, which generally consists of a honeycomb core and external facing, can be adapted to individual requirements with regard to strength and choice of materials. And not least, the aesthetic properties of these materials are being increasingly valued. From transparent to translucent, catching the eye and directing the gaze, this versatile material can be tailor-made for a variety of design purposes **(Arnold, 1994)**.

Honeycomb Board Application in Interior Design

Honeycomb in inner doors is perhaps the most spread and at least the 'oldest' application known of honeycomb. By using fire-retardant paper the honeycomb is more and more used in stands and exhibitions. Honeycomb Panels and Beams are the lightest and strongest. Among other applications the material is used in the construction of ships and skiing equipment. Depending on application a range of facing sheets are available. The flooring system comes in fixed cell

Clusters and can be installed in minutes - ideal for tradeshows, gyms and even residential areas **(Wicks, 2009).**

Merits of Honeycomb Board

- Honeycomb board has huge pressure resistance and shearing resistance.
- It is low weight which saves on handling, packing and transporting.
- It is made from recycled paper, recyclable therefore it is Environmental friendly.
- Easy processing and gives flexibility in shapes.
- It is available in all thicknesses and in lower cost price.
- After specific processing also suitable for use in moist environments

Demerits of Honeycomb Board

- For withstanding moisture it need special treatment.
- It cannot be used in main doors and other furniture's which requires much stability, safety **(www.eltete.com.)**.

b). BAMBOO PLYWOOD

Bamboo are giant, woody grasses which put out several length, full diameter, naturally pre-finished, ready to use each year. A single bamboo clump can produce up to 9 miles of usable pole (up to 12 inches in diameter) in its lifetime. Bamboo (in the grass family) is amongst the most diverse group of plants. It is distinguished by a woody, hollow stem, complex branching and infrequent flowering **(Meredith, 2001)**.

Bamboo plywood is made from 100 percent rapidly renewable bamboo, using adhesives that are both strong and emissions free. Bamboo plywood can be cut and sanded using conventional woodworking equipment. It can also be glued or mechanically fastened using the same materials and fasteners commonly used with wood. Bamboo is a low resin, open grained material that takes stains and finishes exceptionally well **(Wilson and piepkom, 2008).**

Groundwork of Bamboo Plywood

Four to five year old bamboo is a more stable raw material for the production of bamboo panels. After processing split bamboo with machine and glue, bamboo board can be produced for almost all purposes where timber is now used. Bamboo mats and slivers are hot-pressed to produce bamboo ply board. Bamboo ply board is very strong and it can be made water resistant. Vertical grain bamboo plywood and horizontal grain bamboo plywood are the most prolific

forms of this new construction material and it is produced as natural and carbonized in color. Natural bamboo plywood is light in color and is called blonde. Carbonized bamboo receives a steam treatment that gives it a warmer color and referred as amber **(chan, 2008).**

Bamboo plywood Application in Interior Design

Bamboo provides for many current and future needs for sustainable raw material and is valuable NTFP (Non- timber forest product). Bamboo is used extensively around the world for construction materials including Roof, walls, floors and concrete forms because of the remarkable strength. Bamboo panels or plywood are also attractive for construction of cabinets, furniture. Bamboo plywood has phenomenal strength, makes beautiful furniture and cabinets and is an ideal building material **(Villegas, 2003)**

Merits of Bamboo Plywood

- Bamboo is sustainable and environmental-friendly.
- It replaces many hardwoods as a building material of choice.
- It is harder and resistant to molds, termites and warping.
- Bamboo plywood has become green building.
- It is versatile and renewable.
- It is not a tree but grass- bamboo can grow to maturity in as little as one growing season, yielding many harvests over a typical 25-30 year tree life cycle

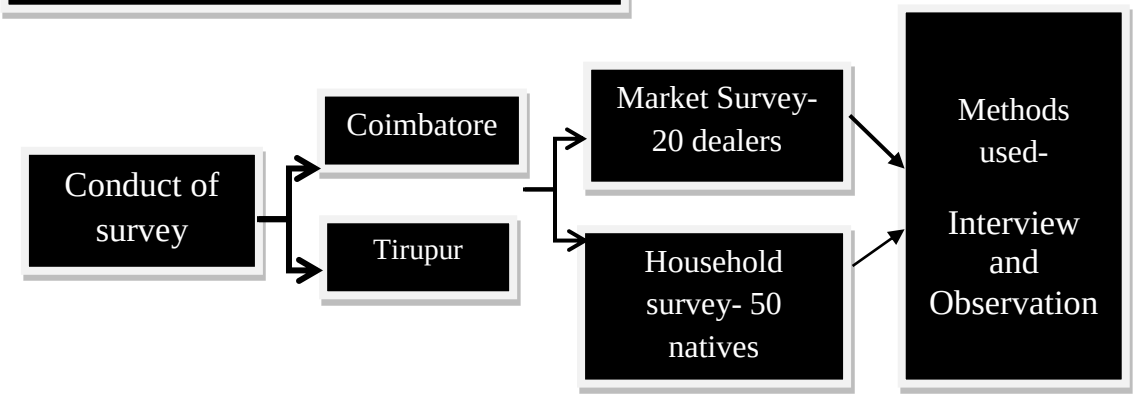
Demerits of Bamboo Plywood

- For withstanding moisture it need special treatment.
- It cannot be used in main doors and other furniture's which requires much stability **(Lyons, 2010)**.

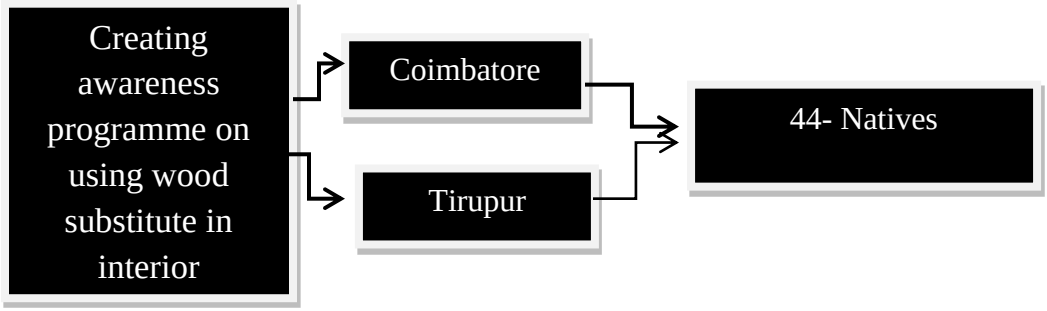
- Bamboo is indigenous materials which cannot be procured by all region people.
- Bamboo plywood is not available in all thickness so the require size cannot be made with ease.
- It requires special fitting fixtures which add to its demerits.

RESEARCH DESIGN

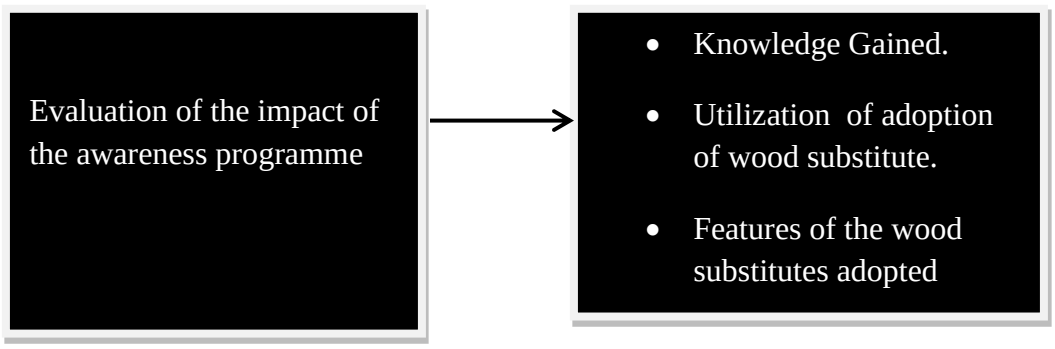
PHASE I – CONDUCTING OF SURVEY



PHASE II – CREATING AWARENESS



PHASE III – EVALTING THE IMPACT OF AWARENESS PROGRAMME



III. METHODOLOGY

The methodology pertaining to the study on "**Familiarizing wood substitutes for effective interiors**" consist of the following phases.

1. **Conducting of survey.**
2. **Creating awareness on using wood substitutes in interiors.**
3. **Evaluating the impact of the awareness programme conducted.**

1. Conducting of survey:

Conducting of survey consists of two aspects,

A. **Market and household survey**.

The Market and household survey include the following aspects,

a) Selection of the area.
b) Selection of sample.
c) Selection of Research tool.
d) Formulation of the research tool.
e) Collection of data.
f) Analysis and interpretation of the collected data.

a) Selection of the area:

Coimbatore city is one of the top 10 fastest growing cities of India. Coimbatore, also known as Kovai, is a major industrial city in India and the second largest city in the state of Tamilnadu. Coimbatore city is 23.5 square kilometers. The population of this city is 1,446,034.

"I have always believed that the more educated the clients are, the easier they are to work with. Clients with knowledge of decorating, and an ability to articulate what they want from the finished project, make the designer's job easier- Albert Hadley."

Coimbatore city has been both traditional and modern city. People here in Coimbatore relishes the stay as of the good climate, people prefer both individual house and apartment dwellings. Now in Coimbatore extreme renowned 5 star hotels are prevailing and leading property developers develop portion of vertical buildings.

Tirupur is the 7th largest city in Tamilnadu in terms of city population and area after Chennai, Coimbatore, Madurai, Trichi, Salem and Vellore. Total population as per 2011 census is 444,543.The cities fast development leads to growth to its status as district. Tirupur is the area where the plush houses and bungalow can be seen at the same time most people dwell in rented houses as people are temporary skilled labours.

Therefore the areas selected for the study were Coimbatore and Tirupur city in Tamilnadu state.

b) Selection of sample:

A sample is a group from which measurements will be sort. In many cases, the sample will be only a very small fraction of sampling frame and therefore, of sampling population **(Groves, 2011).**

The investigator identified the wood and wood substitute dealers with the help of family, friends, Just dial and yellow pages in Coimbatore and Tirupur.

For market survey, 20 premier dealers were selected 10 each from Coimbatore and Tirupur city that have abundant experience in wood substitute work field. For Household survey 50 upper, middle income group natives each 25 residing in Coimbatore and Tirupur city that have used wood substitute for interior and construction work were selected for the study. For this study, purposive sampling technique was used.

According to **Schutt 2006**, purposive sampling is a technique in which a desired number of sample unit is selected deliberately or enquiry. In purposive sampling each element is selected for the particular purpose, usually because of the unique position of the sample elements. Purposive sampling may involve study in the entire population of some limited group or a subset of population.it may be used to examine the effectiveness of some intervention with clients who have particular characteristics such as specific diagnosis **(Engel and Schutt 2009**).

c) Selection of research tool:

Survey is the process of collection of data and this is the first step for any statistical enquiry to collect the information **(Rao, 1995)**. According to **Drividi, 1994** survey research is the method of collecting data by asking a set of preformatted questions in a predetermined sequence using a structured questionnaire to sample of individuals drawn, so as to be representative of defined population.

An Interview involves a social interaction, between two people. During the interaction, the respondents' perception of the interviewer can directly affect the latter's ability to establish proper rapport. Interviewers who can establish effective relationships with respondents are able to collect more complete and accurate data (**Gupta, 1999)**.

According to **Malhotra, 2008** observation is the potential to provide valuable information when properly used. Observation means viewing or seeing **(Kothari 2008)**.Using observation as a method of collecting data-whether you also act as a participant in the clients you are observing or not, like interviewing, potentially very time consuming. The time absorbed occurs not just during the observation, but afterwards as well, when you come to interpret and analyze what you have recorded. **(Blaxter *et al.*, 2006).**

Hence, the investigator followed survey, interview, and observation as the research tool in order to get the relevant and full details required for the research study.

d) Formulation of research tools:

According to **Gupta, 1999** schedule is the name usually applied to a set of questions which are asked and filled in a face- to-face situation with another person. Schedule is generally filled out by researcher or the enumerator who can interpret the question when the investigator framed schedule for the client survey **(Reddy, 2004)**.

For Market survey, the investigator prepared the schedule to be obtained the data about the functioning of their firm, details of the Indian standard wood substitutes, various and new wood substitutes accessible which are Eco-friendly and stable. For household survey, the questions are designed to collect data's about the wood substitutes used in the house and, details regarding the house owners, the material used in interior works. The finalized schedule of market and household survey are presented in Appendix I and Appendix-II respectively.

e) Collection of data:

According to **Paneerselvam, 2004** data are the basic input in any decision making process.

For both market and household survey questions were asked informally and necessary information was gathered for the study. The investigator contacted the dealers and the household natives and explained about the purpose of the study. A good rapport was established between the interviewer and interviewee. The investigator went from firm to firm and house to house interviewed the individual personally and administered the question one by one, and filled up the schedule on

Plate 1: Investigator Interviewing the Dealer

the basis of the information supplied by the individual. Plate 1 and 2 represents the investigator interviewing the respondents and collecting required information.

f) Analysis and interpretation of collected data:

The analysis of data involves number of closely related operation that are performed with the purpose of summarizing the collected data and organizing them in such a manner that will yield answer to the research question **(Mohan, 2007)**.

According to **Krishnaswami, 1999** after the transcription of data is over; the data should be summarized and arranged in compact form for further analysis. This process is called tabulation. This phase involves coding tabulation and analysis of the information received. **(Stewart and Cart, 2008 and Devi, 1998)** stated that once all the interviews are computed, the final phase of the surface begins. It involves the orderly and systematic presentation of numerical data in form designed to elucidate the problem under consideration, the tabulation is the process of summarizing raw data and displaying them on compact tables for further analysis. Interpretation is not only necessary but unavoidable as research is concerned. In fact, it is an important step in so far as conclusions of research study **(Reddy, 2004)**. **Jain, 2009** views the purpose of the table is to simplify the presentation and to facilitate comparison.

Thus the data collected was consolidated, tabulated and presented in chapter IV.

2. Creating awareness on using wood substitutes in interiors.

Based on the data, the awareness creation to Natives was essential as maximum people have the ideology or belief that wood cannot be substituted by any other material for its strength, long life and the grains for the beauty. Few

Plate 2: Investigator Interviewing the Natives

people rely on interior designers for choosing material. As city people are busy enough and they are time conservative awareness programme was conducted by the investigator is crisp and informative.

For creating awareness the following steps are included,

a) **Selection of sample.**
b) **Formulation of the awareness programme.**
c) **Organization of the awareness programme.**

a). Selection of sample:

44 native 26 from Coimbatore and 18 from Tirupur city, who are interested to implement and attend the awareness programme, were selected as sample. Totally 44 natives attended the awareness programme.

b). Formulation of the awareness programme.

Based on the data collected, the awareness programme was formulated. The major areas dealt in the awareness program is given below,

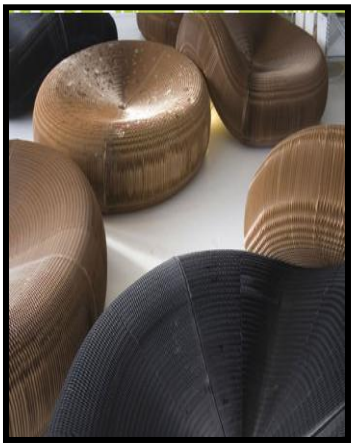
Table 5: Course Content of the Awareness Programme

Course Content	Method Used
Familiarizing the new and eco-friendly wood substitutes available in the market.	Descriptive method.
Imparting ideas on using the various wood substitutes for specific furniture and interior works for their benefit.	Lecture method
Elucidating the Indian standards for various wood substitute	Descriptive Method

1. **Familiarizing the new and eco-friendly wood substitutes available in the market**.

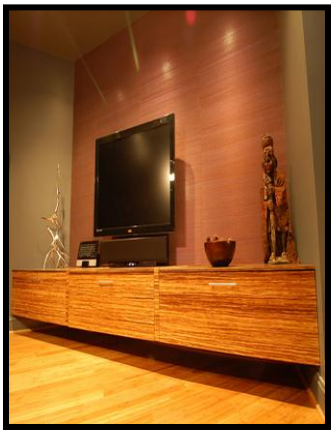
The new honey comb board and bamboo plywood which is 100 percent eco-friendly, economical and their benefits and applications were elucidated to the natives.

Honeycomb board



Honeycomb in inner doors is perhaps the most spread and at least the 'oldest' application known of honeycomb. By using fire-retardant paper the honeycomb is more and more used in stands and exhibitions. Honeycomb Panels and Beams are the lightest and strongest. Depending on application a range of facing sheets are available. The flooring system comes in fixed cell clusters and can be installed.

Bamboo plywood



Bamboo provides for many current and future needs for sustainable raw material and is valuable NTFP (Non-timber forest product). Bamboo is used extensively around the world for construction materials including Roof, walls, floors and concrete forms because of the remarkable strength. Bamboo panels or plywood are also attractive for construction of cabinets, furniture, furnishings and products. Bamboo plywood has phenomenal strength, makes beautiful furniture

2. Imparting ideas on using various wood substitutes for specific furniture and interior works.

The ideas imparted to the natives by investigator are specified in two phases construction phase and interior phase, construction phase include door and window frame and interior phase include work such as partition, paneling and flooring and different furniture.

Construction phase: (Main door and Window frame)

Door and window frame must be sturdy strong, safe in individual home and apartment. Teak wood is the main species used for main door and door frame, considering wood substitute hardwood finger joint board can be used at 6" thickness and teak finger joint boards can be used for main door. This reduces the total log wood usage. In apartments HDF thick frames can be used. In educational institutions & commercial spaces natives can prefer upvc windows for ease in construction and application.

Construction phase: (Inner door or middle door/ bathroom door)

Inner door are used for the segregation of space and for privacy. Wood substitutes are the major applications. Various wood substitutes such as 18mm plywood finished with veneer can be used, flush door with small pieces of hardwood can be finished with 4 or 6mm ply. Particle board with post forming veneer can be used and honey comb with post forming veneer can be used. Bathroom doors can be less sturdy due to the minimal usage so, fiber and upvc doors can be used.

Interior phase: Flooring

Wooden floors are intermittent in Indian houses, flooring concepts lay on mostly granite, marble, vitrified tiles. Air-conditioned rooms and gymnasiums, commercial space wooden floorings are used. Laminated HDF can be used which is economical durable and gives aesthetic look, bamboo flooring can be used.

Interior phase: False ceiling

Wooden false ceiling are used for high visual appeal and to reduce a/c usage and minimizes the consumption rate and usage. In Olden days teak wood/ hardwood 12mm wooden bars are used. Now day's plaster of Paris commonly known as pop boards and gypsum boards are used and wood substitute like plywood can be used for decorating pop woods.

Interior phase: Partition

For partition in commercial spaces people go for aluminum frame with particleboard as it is economical and durable and in residences and home, plywood can be used. The honeycomb board, bamboo plywood can be used

Interior phase: Paneling

Paneling in residence is highly recommended to do with waterproof plywood with veneer or lamination, Paneling can be also be finished by bamboo veneer. Bamboo plywood can be used.

Wood and wood substitute application in furniture

Furniture: Wardrobe

Considering the wardrobe, it should be strong, easy to work with, ease in fixture fitting and aesthetic. To satisfy all plywood with veneer polish or plywood with lamination, pre-laminated MDF can be used. Now the new trend of material finger joint board, bamboo plywood can be used with polish or lamination, Particle board can be used exclusive of the fixture or screwing problems.

Furniture: Dining Table

Considering dining table, the legs should be strong to hold load therefore wood is the maximum adoption, considering wood substitutes Plywood with high thickness; Fingerjointboard can be used for the legs and for the table top finger joint board, plywood, thick glass can be used.

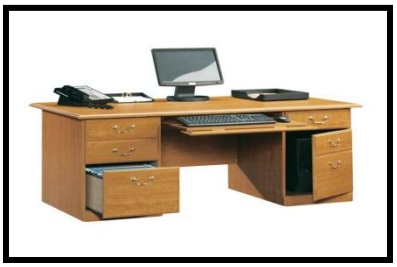
Furniture: Dressing table

Considering dressing table, the minimal strength is sufficient with good fixture fitting feature, MDF with pre-lamination, Plywood with veneer polish or lamination is recommended.

Furniture: Kitchen cupboard

Considering the kitchen, Particleboard is not recommended as it is not resistant to water; water proof plywood with pre-lamination or veneer polish, finger joint board can be used for the durability and for the good strength, MDF can also be used for the best.

Furniture: Computer table/ Study table



For computer table particleboard is maximum recommended as it is economical and purely it justifies the functional part.

Furniture: Cot

For cot wood is suggested, to substitute wood, plywood boxes reduce the cost and it is sturdy, now the new trend of available wood substitutes Fingerjointboard can be used with all surface decoration.

Furniture: Cupboard/ Display unit

Considering display unit, finger joint board, Plywood can be used, particle board is desirable, and the new wood substitute bamboo plywood can be used for the best functionality.

3. Elucidating the Indian standards of various wood substitute

It is vital that natives must have the awareness on Indian standards of wood substitute.

Table 6: Indian Standards of Wood Substitute

S.No	Wood substitute	Indian standard
1	Plywood	**IS:710:1976WPP, IS:303:1989**
2	MDF	**IS:12406 ,IS:14587**
3	HDF	**IS:12406 ,IS:14587**
4	Particle board	**IS:3087,IS:12823**
5	Bamboo plywood	**IS: 13658: 1984 IS: 2380. 13598**

c). Organization of the awareness program

The awareness programme was conducted in five days to the selected area natives by visiting door steps of the native's house. The awareness programme was carried out for one hour. During the programme specially prepared booklet and presentation in computers were provided to the natives for the perfect conveying of ideas. Plate 3 displays the investigator creating awareness to natives.

3. Evaluating the impact of the awareness programme conducted

The impact of the awareness programme conducted was evaluated based on the initial and final knowledge and attitude in initial and final stage of the natives, the acceptance and adaption of standard eco-friendly wood substitute. The steps involved were,

1. Formulation of evaluation schedule.
2. Conduct of evaluation.
3. Analysis and presentation of data.

Plate 3: Investigator Creating Awareness to Natives

1.Formulation of evaluation schedule.

a) Knowledge gained by the selected natives

The knowledge gained by the selected natives before and after the awareness programme has to be elicited from them. The extent of the knowledge gained by the natives is assessed using the knowledge check/ inventory compressing information relating to several aspects such as the various wood substitutes available in the market which are ecofriendly, durable and the Indian standards. Annexure III presents the schedule to find out the knowledge gained on the wood substitutes.

2. Conduct of evaluation

The impact of the awareness programme was assessed after a period of six months. In addition, evaluation was completed through direct observation of the knowledge put into practice by selected natives and by the utilization quality of the adopted wood substitutes based on the imparted ideas by ten natives. The evaluation conducted is presented under chapter IV.

a). Acceptance and adoption of eco-friendly wood substitute:

The Number of natives who have accepted and adopted wood substitute was assessed under two heads such as utilization and the features of adopted wood substitute and presented under chapter IV.

3. Analysis and presentation of data:

The data collected through observation and interview were analyzed, tabulated, presented and discussed under chapter IV.

IV. RESULTS AND DISCUSSION

The findings of the study on **"Familiarizing various wood substitutes for effective interiors"** are analyzed and presented under the following headings.

I. **Conducting of Survey.**
II. **Creating awareness on using wood substitutes in interiors.**
III. **Evaluating the impact of the awareness programme conducted.**

I). Conducting of survey

1. **Conducting of market Survey**
2. **Conducting of household Survey.**

1. Conducting of market Survey

Market survey was conducted in Coimbatore and Tirupur city selecting each 10 dealers from the premier shops.

The findings of the market survey are discussed under

A. **General information about the dealers.**
B. **Details of the wood trade in enterprise.**
C. **Details of the wood substitutes trade in enterprise.**
D. **Additional information on wood substitute.**

A). General information about the dealers.

General information of the dealers such as Gender, age, educational status and years of experience, are dealt in the following.

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1. **Gender, Age, Educational Status and experience of the dealers.**

The Age, gender their Educational Status, and the years of experience of the dealers, are discussed in the table 7.

Table 7: Age, Gender, Educational Status and Experience of the Selected Dealers

Details	Percentage (n=20)
Gender ▪ Male ▪ Female	98 2
Age ▪ 25-35 ▪ 35-45 ▪ Above 45	28 34 38
Educational status ▪ School graduation ▪ Under-graduation ▪ Post-graduation	58 36 6
Years of experience ▪ 1-5 ▪ 5-10 ▪ 10-15 ▪ Above 15	14 48 30 8

From the above table it was found that 98 per cent were male dealers. As dealers do it as family trade it includes all age group dealers, 38 per cent of the selected dealers were above 45 and 34 per cent in the age group of 35-45, The basic educational status of dealers was, School Graduation is 58 per cent, under

graduation is 36 per cent. The results revealed that 48 per cent had an experience of 5-10 years, followed by 30 per cent who had experience of 10-15 years.

2 Annual turnover of the enterprise:

The annual turnover of the enterprise is detailed in table 8

Table 8: Annual Turnover of Enterprise

S.No	Amount	Percentage (n=20)
1	50 lakhs - 1 crore	12
2	1 crore- 2 crore	24
3	2 crore- 3 crore	36
4	Above 3 crore	28

From the above table, it is revealed, 36 per cent of the enterprise have turnover of 2 crore – 3 crore, 28 per cent enterprise have turnover above 3 crore.

B. Details of the wood trade in enterprise

The sale in enterprise, different types of wood traded in the enterprise, features of wood such as quality, durability and customer preference of wood for interior and furniture is dealt below.

1. Sales in enterprise:

It is vital to know the sale in enterprise, the wood and wood substitutes traded in enterprise is given in table 9.

Table 9: Sale in enterprise

S.No	Sale in enterprise	Percentage (n=20)
1	Real wood	14
2	Wood substitute	78
3	Both	8

It is noted from the above table that 14 per cent of dealer's trade solely wood, 78 per cent trade wood substitute.

2. **Different types of wood traded in the enterprise for interior and furniture.**

It is revealed that 92 per cent of the dealers trade all wood type, whereas six per cent trade Country wood.

3. **Customer preference of wood for interior and furniture**

The customer preference of wood for interior divulges that 46 per cent of the customers prefer Padak, 28 per cent prefer teak wood, and preference for furniture is such a way that 60 per cent of customers prefer Teak wood.

4. **Features of different wood such as quality and durability**

The qualities such as water resistant, weather resistant, termites resistant and durability of various woods are depicted in figure 2.

Figure 2: Features of Wood

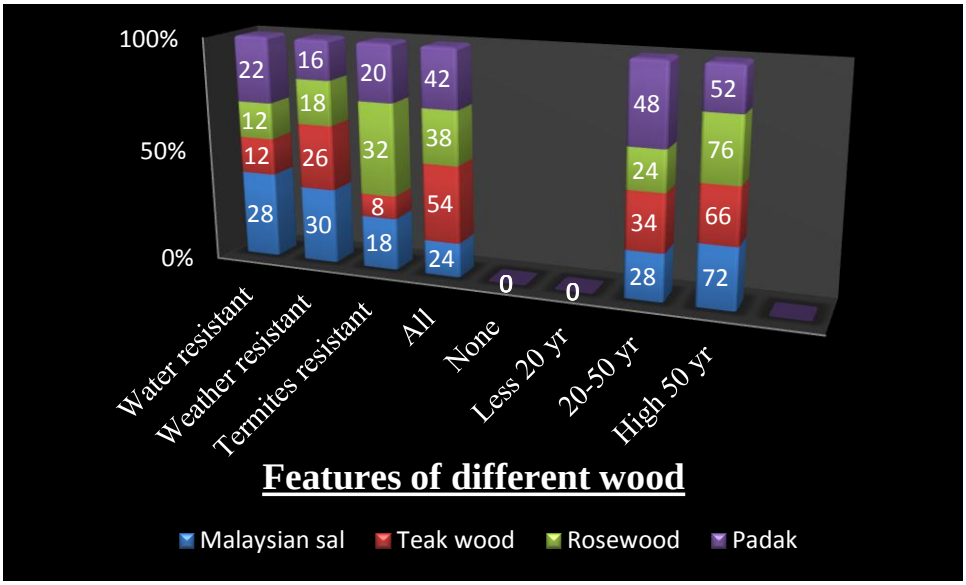


Figure 2 divulges the features of wood, considering Water resistant Malaysian Sal is admitted by 28 per cent, Padak by 22 per cent ,considering weather resistant Malaysian Sal by 30 per cent, Teak wood by 26 per cent ,considering termites resistant Rosewood by 32 per cent, Padak by 24 per cent, Considering all three resistant, Teak wood by 54 per cent and Venghai by 44 per cent, Considering Durability of high than fifty years, Rosewood by 76 per cent, Malaysian Sal is admitted by 72 per cent.

5. Various problems of Hardwood, Softwood and Country wood:

The varied problems associated with woods such as cracking, fixture fitting, Shrinkage, Strength, pliable, termite attack are dealt in Table 10.

Table 10: Frequent Problems of Wood

S.No	Wood	Percentage (n= 20)						
		Cracking	Shrinkage	Strength	Pliable	Termite attack	None	All
1	Hardwood	12	18	8	50	12		
2	Softwood	6	8			4	82	
3	Country	8	12	4	6	12		58

Table 10 give the details of the frequent problems of wood, Considering hardwood 50 per cent states they are pliable and secondly 18 per cent states it is endangered to shrinkage, whereas in softwood 82 per cent states that there is no problem, considering country wood, 58 per cent states that it has all type of problem and each 12 per cent states that it has problems such as shrinkage and termite attack.

C. Details of the wood substitutes traded in enterprise.

1. The various wood substitutes traded in the enterprise:

The various wood substitutes traded in the enterprise are dealt in figure 3.

Figure 3: Wood Substitutes Traded in Enterprise

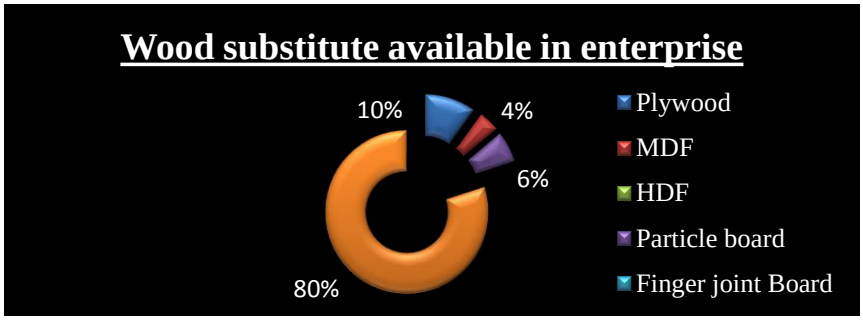


Figure 3 reveals the details of traded wood substitutes in the enterprise, 80 per cent dealers trade all wood substitutes, and ten per cent trade only plywood.

2. The thickness and sizes of plywood traded in the enterprise:

The details of the traded thickness and size of the plywood in the enterprise is hundred per cent of the dealers trade all thickness and sizes of the plywood.

3. Features of different Plywood such as quality and durability

The qualities such as water resistant, weather resistant, termites resistant and durability of standard IS: 710:1976, IS: 303:1989 and country wood plywood are depicted in figure 4

Figure 4: Features of Plywood

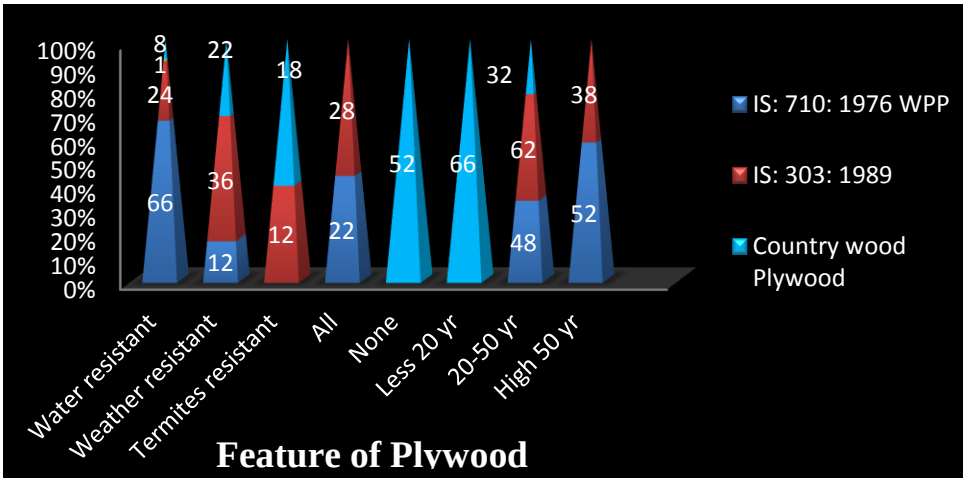


Figure 4 divulges the features of plywood, considering water resistant IS:710:1976 WPP is admitted by 66 per cent, considering weather resistant IS:303:1989 by 36 per cent, considering termites resistant, country wood plywood by 18 per cent, Considering all three resistant,IS:710:1976 is admitted by 22 per cent, IS:303:1989 by 28 per cent, considering no resistant, 52 per cent specified country plywood, considering the durability of high than 50 years, 52 per cent admitted IS:710:1976 WPP.

4. The thickness and sizes of MDF traded in the enterprise

Considering thickness, 68 per cent trade all thickness and 20 trade 18mm MDF, considering the size 86 per cent trade 8x4 while six per cent trade all size boards.

5. Features of different MDF such as quality and durability:

The qualities such as water resistant, weather resistant, termites resistant and durability of standard IS: 12406, IS: 14587 and MDF are depicted in table 11

Table 11: Features of Medium Density Fiber Board

Material	Qualities percentage (n=20)					Durability (n=20)	
	Water resistant	Weather resistant	Termites resistant	All	None	Less 20 yrs.	20-50 yrs.
IS:12406	46	12	18	24		12	88
Is:14587	24	38	32	6		18	82
MDF	22	30	32		16	36	64

The above table reveals the features of MDF, considering IS:12406 MDF 46 per cent states that it is water resistant and 24 states it is resistant to all three and considering durability 88 per cent admits it has durability of 20-50 years, considering IS:14587 MDF 38 states it is weather resistant and 32 states it is termites resistant and considering durability 82 per cent admits that it has durability of 20-50 years, considering MDF 30 states it is weather resistant and 32 states it is termites resistant and considering durability 64 per cent dealers admits it has durability of 20-50 years.

6. The thickness and sizes of HDF traded in the enterprise

Considering thickness of HDF, 66 per cent of the dealers trade all thickness and 22 and 12 per cent trade only 18mm and 12mm HDF, considering the size 92 per cent trade 8x4.

7. Features of different HDF such as quality and durability:

The qualities such as water resistant, weather resistant, termites resistant and durability of standard IS: 12406, IS: 14587 and HDF are depicted in figure 5

Figure 5: Features of High Density Fiberboard

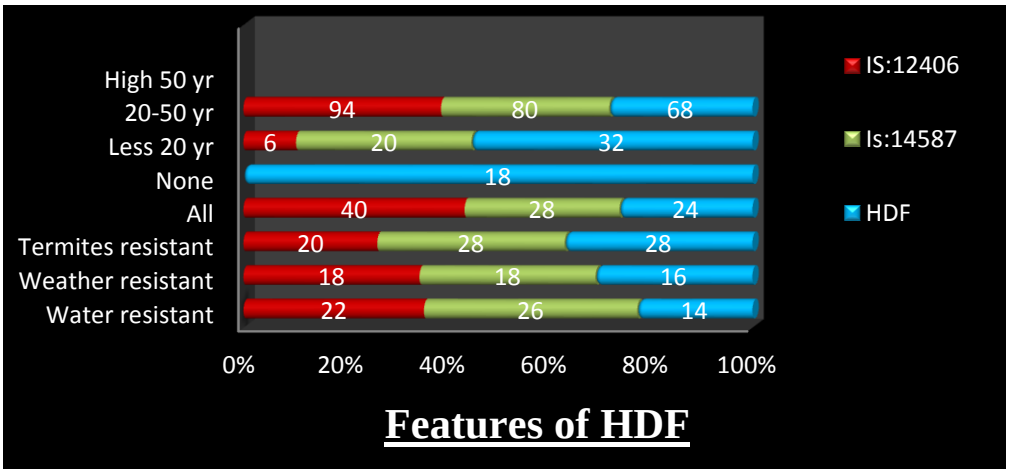


Figure 5 reveals the features of HDF, considering IS: 12406 HDF 40 states it is resistant to all and considering durability 94 per cent dealers admits that it has durability of 20-50 years, considering, IS: 14587 HDF 26 per cent states it is resistant to all and considering durability 80 per cent dealers admit it has durability of 20-50 years, considering HDF 24 states it is resistant to all, considering durability 68 per cent dealers admits it has durability of 20-50.

8. The thickness and size of Particleboard traded in the enterprise

Considering thickness of particle board, 82 per cent trade all thickness and 18 trades only 18mm HDF, considering the size 28 per cent trade 9x6, 22 per cent trade 6x4, board respectively.

9. Features of different particleboard such as quality and durability:

The qualities and durability of standard IS: 3087, IS: 12823 and Particleboard are depicted in figure 6

Figure 6: Features of Particle Board

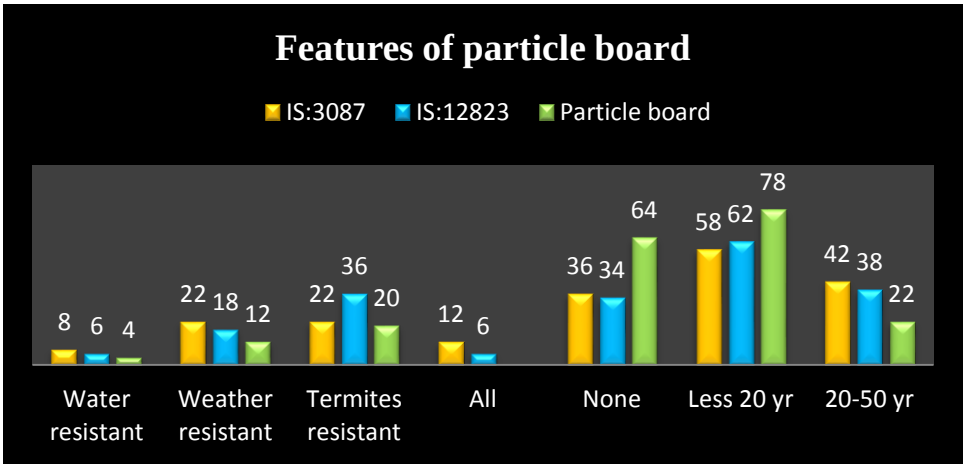


Figure 6 reveals the features of Particleboard, considering IS: 3087 36 per cent states it is not resistant to all three, and considering durability 58 per cent admits it has less than 20 years durability, considering IS: 12823 Particleboard 36 states it is termites resistant and 32 states that it is not resistant to all and considering durability 38 per cent admits it has durability of 20-50 years and 62 admits it has less than 20 years durability.

10. The thickness and sizes of Fingerjointboard traded in the enterprise

Considering thickness of finger joint board, 86 per cent trade 18mm thickness, considering the size, 96 per cent trade 8x4 boards.

11. Features of different Fingerjointboard such as quality and durability:

The qualities such as water resistant, weather resistant, termites resistant and durability of standard Fingerjointboard, 22 per cent states it is water resistant and 46 per cent states it is resistant to all and considering durability 88 per cent states it has durability of 20-50 years.

D. Additional information on wood substitute

1. Preference of customer:

Every customer has their own preferences of selecting or adopting the material, the preference may be for varied reasons such as taste, economic, durability are represented in table 12.

Table 12: Preference of Customer

Preference of the customer	Percentage (n=20)
Real wood	38
Wood substitute	62

Table 12 states that 62 per cent of the customers prefer wood substitute while 38 per cent of the customers prefer wood.

2. Reasons for customers adopting wood substitute

There may be varied and vital reason for customers adopting wood substitute as their material for interior and furniture which are detailed in table 13.

Table 13: Reasons for Adopting Material

S.No	Reasons for adopting Wood substitute	Percentage (n=20)
1	Economical	46
2	Durable	22
3	Aesthetic	2
4	Ease in maintenance	2
5	Eco-friendly	
6	traded in varied types	28

Table 13 states the reasons of customers adapting wood substitute, 46 per cent adapt as it is economical, whereas 28 per cent accept as it is traded in varied types.

3. New and eco-friendly wood substitutes traded in the enterprise

The traded new and eco-friendly wood substitutes in the enterprise are elucidated in table 14.

Table 14: **New and Eco-Friendly Wood Substitute Traded**

New traded wood substitute	Percentage (n=20)	New Eco-friendly product	Percentage (n=20)
Bamboo plywood	68	Bamboo plywood	68
Honeycomb board	32	Honeycomb board	32

Table 14 states the new and eco-friendly traded wood substitute in the enterprise, where 68 per cent of them stated bamboo plywood and 32 specified Honeycomb board.

4. Application of wood substitutes in interior:

Applications of wood and wood substitutes in interior are given in table 15

Table 15: Application of Wood Substitute in Interior

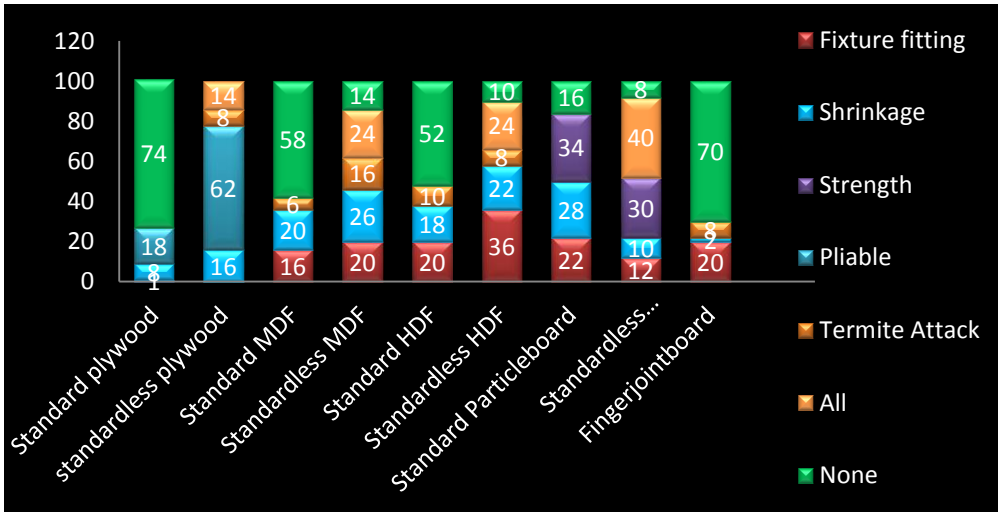
Application in interior	Wood	Plywood	MDF	HDF	Finger joint board	Particle board
	Percentage (n=20)					
Furniture	34	12	38	32		86
Paneling	2	8	2	12		6
Flooring		2	4	36		
Partition		8	8	8		8
Door frame	64				4	
All		70	48	12	96	

The application of the wood and wood substitutes in interior are elucidated considering Wood, 64 per cent states wood is used in door frame, considering plywood 70 per cent states it can be used in all application, secondly 12 states it is used in furniture, Considering application of MDF in interior, 48 per cent states that it can be used in all application, Considering HDF in interior, 32 states that it is used in furniture, 36 per cent is used for flooring, Considering Particleboard, 86 per cent states that it can be used in furniture, secondly eight states it is applied in partition and Considering Fingerjointboard, 96 states it can be used in all application.

5. Frequent problems of wood substitutes:

Wood substitutes have their own unique problems, the problems is analyzed as standard wood substitute and standard less wood substitute and are provided in figure 7.

Figure 7: Frequent Problems of Wood Substitutes



The above figure states that in standard plywood 74 per cent of the dealers states that there won't be any problems, in standard less plywood 62 per cent states that it is pliable, in standard MDF 52 per cent states that there won't be any problems, in the standard less MDF 27 per cent of the dealers states that it has shrinkage problem, in standard HDF 52 per cent of the dealers states that there won't be any problem, in the standard less HDF 36 per cent states that it has fixture fitting problem, 34 and 30 per cent of the dealers states that there is strength weakness in standard and standard less particleboard, Considering Fingerjointboard 70 per cent states there is no problem.

6. Cost of the wood and wood substitute per Sqft.

Wood substitutes have varied cost and they differ according to the qualities, the standard cost per Sqft of the wood substitute is given in figure 8.

Figure 8: Cost/Sqft of Wood and Wood Substitute

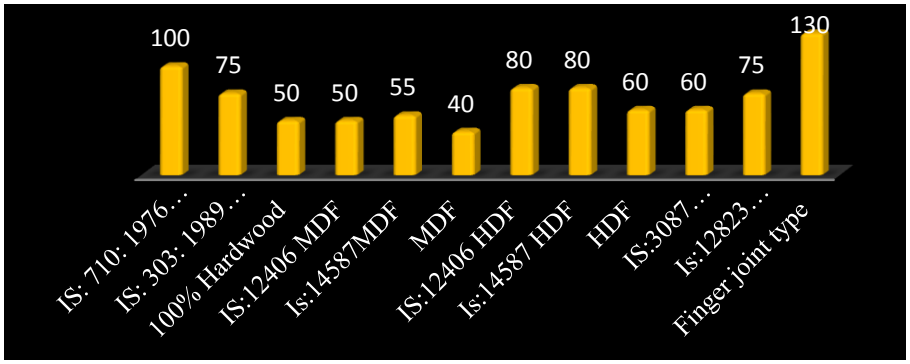


Figure 8 gives the Per Sqft cost of the premium wood substitute's traded in the enterprise, Considering Plywood, IS: 710: 1976 WPP is Rs 100 , IS: 303: 1989 is Rs 75, 100% Hardwood is Rs 50, Country wood Plywood is Rs 45, Considering MDF, IS: 12406 is Rs 50, IS: 14587 is Rs 55 and MDF is Rs 40, Considering HDF traded in the enterprise, IS: 12406 is Rs 80, IS: 14587 is Rs 80 and HDF is Rs 60, Considering particleboard IS: 3087 is Rs 60, IS: 12823 is Rs 75, cost per Sqft of the Fingerjointboard is Rs 130. Considering wood, Malaysian Sal is Rs1800, Teakwood is Rs 3000, Rosewood is Rs 4000, Padak is Rs 2000 and Venghai is traded at the cost of Rs 1100.

2. Household survey.

The findings of the household survey are discussed under

A. General information of the selected natives.

B. Details of the house.

C. Details of the wood substitutes used in rooms.

D. Specific information of the material used.

A. General information of the selected natives.

The use of wood substitutes and its preference is something that differs from person to person.

1. Age, Educational Status and Occupation of the natives

The Age, family size, gender, education, Occupation, family type of the natives is discussed in table below.

Table 16: Details of the Natives

S.no	Category	Classification	Percentage (n=50)
1	Age (in years)	Below 30 30-40 40-50 Above 50	22 34 42 2
2	Family size	Below 4 Above 4	76 24
3	Gender	Male Female	38 62
4	Education	Higher education Under-graduation Post-graduation	36 52 12
5	Occupation	Employee Business Home maker	38 14 48
7	Family type	Nuclear family Joint family	88 12

Table 16 gives the general information of the natives such as age, gender, educational status, Family size, education, occupation, family type, taking the age, natives 42 per cent are between the age group of 40-50, considering family

size, 76 per cent are 4 and below, taking the gender of natives, male constitute 38 per cent and female is 62 per cent, considering education under graduates are 52 per cent, making the note of occupation 52 per cent of them do business, noting the family type of natives 88 per cent of the natives belong to the nuclear family.

2. Monthly Income of the selected natives.

Tamil Nadu Housing Board (2005) classifies monthly income level of the family (http://tnhb.gov.in/citizen.aspx) as:

- Economically Weaker Section - up to Rs. 2100/- per month.
- Lower Income Group - Rs. 2101/- to Rs. 4500/- per month.
- Middle Income Group - Rs.4501/- to Rs. 7500/- per month.
- Higher Income Group - Rs. 7501 and above per month.

Table 17: Monthly Income of the Families

Monthly income (in Rs.)	Percentage (n=50)
20,000-30,000	16
30,000-40,000	22
40,000-50,000	32
50,000-60,000	18
Above 60,000	12

Though all the selected families belong to the High Income Group, it was seen that there was a lot of variation in their incomes. A majority of 32 per cent of the families earned an income between Rs. 40,000 and 50,000 monthly, 22 per cent of the family earned 30,000-40,000 12 per cent earned above 60,000 respectively.

B. Details of the House.

The details of the house such as the total Sqft of the house, construction year, house type, no of rooms, house storied, and style of the house are dealt in the table 18

Table 18: Details of the House

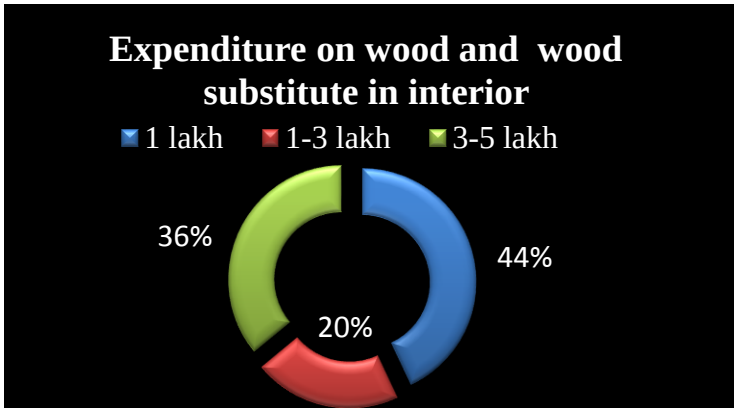
S.No	Category	Classification	Percentage (n=50)
1	Total Sqft of the house	2000-3000 3000-4000 4000-5000 Above 5000	48 20 12 20
2	Construction year	2000-2005 2005-2012	68 32
3	House type	Individual house Apartment	40 60
4	No of rooms	3 4	84 16
5	House storied	Single Double	68 32
6	Style of the house	Traditional Modern Contemporary	16 28 56

Table 18 gives the details of the house, considering Total Sqft of the house, 48 per cent of the natives house has Sqft of 2000-3000 Sqft, , Considering construction year, 68 per cent have houses built in the year of 2000-2005 and 32 per cent have houses built in the year 2005-2012, specifying the house type, 60 per cent are from apartment and 40 per cent are from individual house, considering the No of rooms in house, 84 per cent have 3rooms, specifying house story, 68 per cent are single storied, considering the style of the house 56 per cent stay in contemporary style, while 28 per cent have traditional as their style of the building.

2. Expenditure on wood and wood substitute:

The total expenses on wood and wood substitute for interior is quoted in figure 9

Figure 9: Expenditure on Wood and Wood Substitute in Interior



Based on the above figure, 44 per cent of the natives have spent one lakh for wood substitute whereas 36 per cent have spent between 1-3 lakh.

C. Details of wood substitutes used in the room

1. Furniture Details of the room- Living room:

The furniture details of the living room for instance TV unit, Sofa or seating unit, Centre table, Computer table is discussed in Table 19.

Table 19: Furniture Details of Living Room

Classification Percentage(n=50)								
S.No	**Category**	**Wood**	**Plywood**	**MDF**	**HDF**	**Particle board**	**Finger joint board**	**Other**
1	TV unit		32	18		46	4	

2	Sofa or seating unit	72	26				2	
3	Centre table	18	36	28		18		
4	Computer table		28	10		62		

Considering living room furniture TV, 46 per cent used particleboard, secondly 32 per cent used plywood , Considering seating Unit, 72 per cent used wood, considering Centre table 36 per cent used plywood, Considering the computer table 62 per cent used Particleboard.

2 Furniture Details of the Living room TV unit:

Various wood substitutes used for TV unit and their qualities and problems associated are dealt in table 20.

Table 20: Details of the TV Unit

Item	Quality percentage(n=50)			Problem percentage (n=50)				
	Water resistant	**Weather resistant**	**Both**	**Cost**	**Fixture problem**	**Surface work**	**Durable**	**No**
Plywood	4	8	20	26				6
MDF	6	4	8		10		6	2
Particle board	10	36			12	8	22	4
Finger joint board			4	2				2

Table 20 deals with the quality and the problems associated, considering quality, 20 percent states plywood is both resistant to water and weather, eight per cent states MDF is both resistant to water and weather, 36 per cent states particle board is weather resistant, four percent states finger joint board is resistant to both,

considering problem, 26 per cent states plywood is high in cost, 10 percent states MDF has fixture problems, 22 percent states particle board has durable problem and two percent states finger joint board has no problem.

3. Details of the Living room Sofa/ Seating unit:

The quality and the problems associated of seating unit, considering quality, 46 per cent states wood is weather resistant, 20 per cent states plywood is resistant to both, two per cent states finger joint board is resistant to both, considering problem, 66 per cent states wood is high in cost, 20 per cent states plywood cost is high whereas6 percent states there is no problem and two percent states finger joint board cost is high.

4. Details of the Living room Center table:

Various wood substitutes used for Centre table and their qualities and problems associated are dealt in figure 10.

Figure 10: Details of the Centre Table

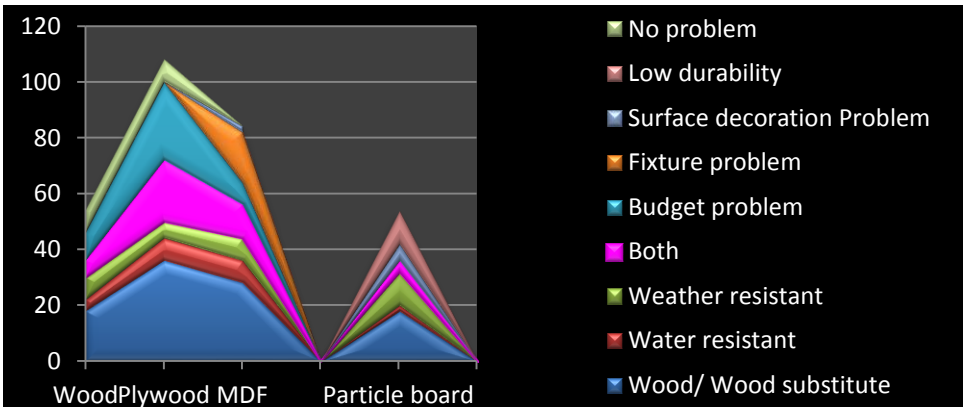


Figure 10 deals with the quality and the problems associated of Centre table, considering quality, eight per cent states wood is weather resistant, six per

cent states it is resistant to both, 12 per cent states MDF is resistant to both, 12 per cent states it is resistant to weather, considering the problem, 10 percent states wood is high in cost, 28 percent states plywood is high in cost, 18 per cent states MDF has fixture problem, 12 per cent states particle board has less durability and 6 per cent states it has fixture problem.

5. Details of the Living room Study/Computer table:

Various wood substitutes used for Computer table and their qualities and problems associated are dealt in table 21.

Table 21: Details of the Computer/ Study Table

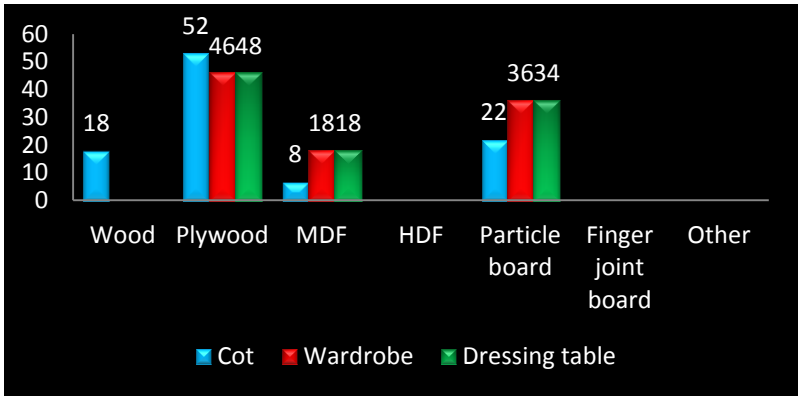
Item	Quality percentage (n=50)				Problem percentage (n=50)				
	Water resistant	Weather resistant	No	Both	Cost	Fixture problem	Surface work	Durable	No
Plywood	6	4		18	20				8
MDF	2	4		4		4		2	4
Particle board	12	48		2		12		48	2

The above table deals with the quality and the problems associated of study table, considering quality, 18 percent states plywood is resistant to both, each four per cent states MDF is resistant to both and weather respectively, 48 per cent states particleboard is weather resistant, considering problem, eight per cent states plywood has no problem, each four per cent states MDF has no problem and fixture problem respectively, 48 percent states Particle board has strength and durable problem.

6. Details of the room -Bedroom:

The furniture details of the Bed room for instance Cot, Wardrobe; Dressing table is discussed in Figure 11

Figure 11: Furniture Details of Bedroom



Considering Bed room furniture's, 18 per cent used wood, 52 per cent used plywood, eight used MDF and 22 per cent used particleboard for Cot, For wardrobe, 46 per cent used plywood while 18 per cent and 36 per cent used MDF and Particleboard., Considering dressing table, 48 per cent used plywood, 18 per cent and 34 used MDF and particle board.

7. Details of the Bedroom –Cot

Various wood substitutes used for Cot and their qualities and problems associated are dealt in table 22.

Table 22: Details of Cot

Item	Quality percentage (n=50)			Problem percentage (n=50)				
	Water resistant	Weather resistant	Both	Cost	Fixture problem	Surface work	Durable	No
Wood	8	4	6	12				6
Plywood	12	14	26	20				32
MDF	2	4	2		2	4		2
Particle Board	14	6	2		14		8	

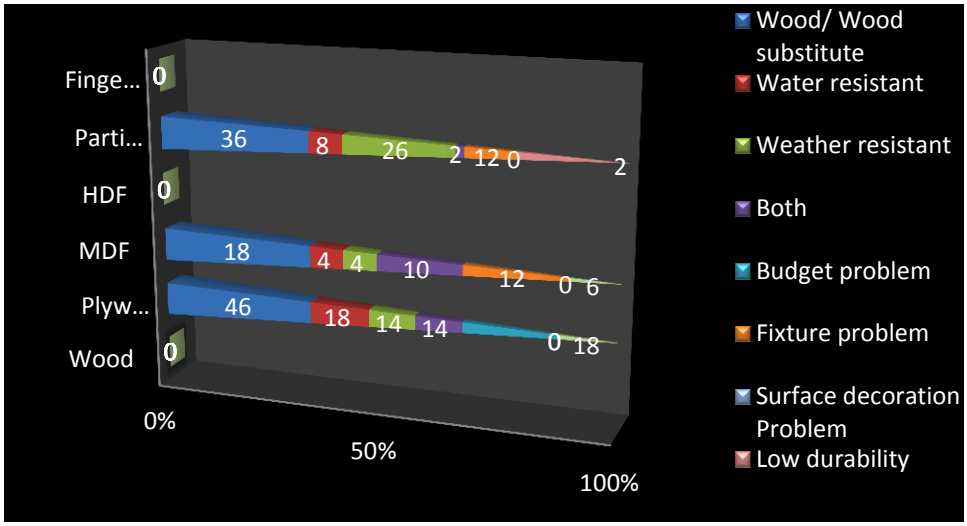
The above table deals with the quality and the problems associated of Cot, Considering quality, eight percent states wood is water resistant, 26 per cent states

plywood is resistant to both, four percent states MDF is weather resistant, fourteen states particle board is water resistant, considering problem, 12 per cent states wood is high in cost, 32 per cent states plywood has no problem, four per cent sates surface decoration has problem, 14 per cent states particle board has fixture problem.

8. Details of the Bedroom -Wardrobe:

Various wood substitutes used for wardrobe and their qualities and problems associated are dealt in figure 12.

Figure 12: Details of the Wardrobe



The above figure deals with the quality and the problems associated of wardrobe, considering quality, 18 per cent states plywood is water resistant, 10 per cent states MDF is resistant to both, 26 percent states particle board is weather resistant, considering problem, 28 percent states plywood cost is high, 18 percent states there is no problem, 12 per cent states MDF has fixture problem, 12 per cent states Particle board has fixture problem, and 22 per cent states it has less durability.

9. Details of the Bedroom - Dressing table

Various wood substitutes used for Dressing table and their qualities and problems associated are dealt in table 23.

Table 23: Details of Dressing Table

Item	Quality Percentage (n=50)			Problem Percentage (n=50)				
	Water resistant	Weather resistant	Both	Cost	Fixture Problem	Surface work	Durable	No
Plywood	16	8	24	22				26
MDF	2	8	8	4	6			8
Particle board	8	16	10			14	20	

The above table deals with the quality and the problems associated of Dressing table, Considering quality, 24 per cent sates plywood is both resistant, 16 per cent sates it is water resistant, each eight per cent states it is water and weather resistant respectively, 16 per cent states particle board is weather resistant, considering problem, 26 per cent states plywood has no problem, eight per cent MDF has no problem, 20 percent sates particle board has durable problem and 14 per cent states it has surface problem.

10. Details of the room –Kitchen

The furniture details of the kitchen for instance table, upper, lower cupboard, storage and display unit is discussed in Table 24

Table 24: Furniture Details of Kitchen

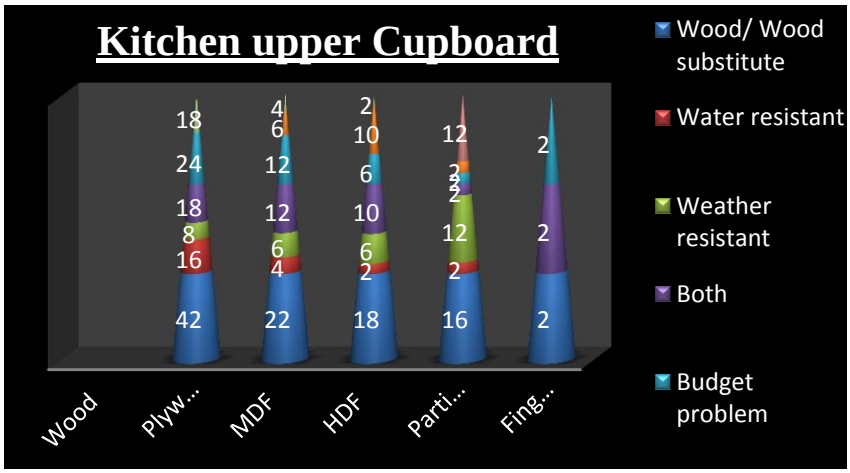
S.No	Category	Classification Percentage (n=50)						
		Wood	Plywood	MDF	HDF	Particle board	Finger joint board	Other
1	Upper cupboard		42	22	18	16	2	
2	Lower Cupboard		42	22	18	16	2	
3	Display unit		30	24	18	6		22

Considering Kitchen furniture's, For upper and lower cupboard, 42 per cent used plywood, 22 per cent used MDF, 18 per cent used HDF and 16 per cent used particleboard and 2 per cent used Fingerjointboard, For display or storage unit, 30 per cent used plywood while 24 per cent used MDF, 18 per cent used HDF and 6 per cent used particle board and 22 per cent used other material.

11. Details of the Kitchen – Upper& lower Cupboard:

Various wood substitutes used for kitchen cupboard, their qualities and problems associated are dealt in figure No 13.

Figure 13: Details of Kitchen Upper and Lower Cupboard



The above Figure deals with the quality and the problems associated of upper and lower cupboard, Considering quality, 16 per cent states plywood is water resistant, 18 per cent states it is resistant to both, 12 per cent states MDF is resistant to both, 10 percent states HDF it is resistant to both,12 percent states particle board is weather resistant, two per cent sates finger joint board is resistant to both, Considering problem, 18 per cent states plywood has no problem, 12 per cent states MDF is high in cost, six per cent states fixture is problematic, 10 per cent states HDF has fixture problem, 12 states particle board has low durability, two per cent states finger joint board is high in cost .

12. Details of the Kitchen- Display / Storage unit:

Various wood substitutes used for display unit, their qualities and problems associated are dealt in Table 25.

Table 25: Details of Storage Unit

Item	Quality percentage (n=50)			Problem percentage (n=50)				
	Water resistant	Weather resistant	Both	Cost	Fixture Problem	Surface work	Durable	No
Plywood	12	8	10	18				12
MDF	6	6	12	8	6			10
HDF	4	4	10		6	4		8
Particle board	2	4			2		4	

The above table deals with the quality and the problems display/ storage unit associated, Considering quality, 12 per cent states plywood is water resistant, 10 per cent states it is resistant to both, 12 percent of MDF is resistant to both, 10

percent states HDF is resistant to both, four percent states it is weather resistant, considering problem, 12 per cent states plywood has no problem, 10 per cent states MDF has no problem, eight and six percent of HDF has no problem and fixture problem respectively, four percent states particle board has durability and strength problem.

13. Details of the Dining area:

The furniture details of the dining area for instance Dining table, Dining chair, service table, display unit cum Cupboard is discussed in Table 26

Table 26: Details of Dining Area

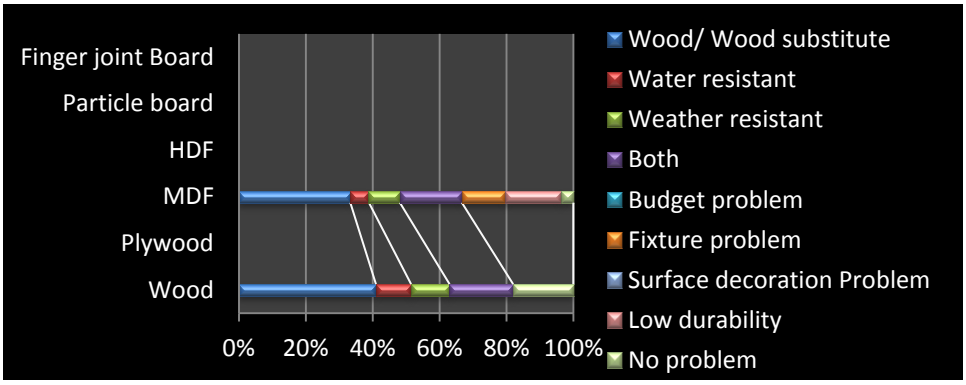
S.No	Category	Classification percentage (n=50)					
		Wood	**Plywood**	**MDF**	**HDF**	**Particle board**	**Finger joint board**
1	Dining table	82		18			
2	Dining chair	98					2
3	Display unit cum cupboard		58	24		16	2

Considering dining furniture's in the house, considering dining table 82 per cent used wood, 18 per cent used MDF, Considering dining Chair 98 per cent used wood, and 2 per cent used Fingerjointboard, considering display unit cum cupboard, 58 per cent used plywood and 24 per cent used MDF and 16 per cent and 2 per cent used particleboard and Fingerjointboard.

14. Details of the Dining area- Dining table:

Various wood substitutes used for dining table, their qualities and problems associated are dealt in figure 14.

Figure 14: Details of Dining Table



The above figure deals with the quality and the problems associated of dining table, Considering quality, 38 per cent states wood is resistant to both, 10 per cent states MDF is resistant to both, Considering problem, 46 per cent states wood cost is high, 36 per cent states wood has no problem, 10 per cent states MDF has low durability.

15. Details of the Dining area- Dining chair:

The quality and the problems associated of dining Chair, Considering quality, 54 per cent states wood is weather resistant, 14 per cent states it is resistant to both, 2 per cent states Fingerjointboard is resistant to both, Considering problem, 76 per cent states wood cost is high, 24 per cent states there is no problem, 2 states Fingerjointboard there is no problem.

16. Details of the Dining area - Cupboard cum Display unit:

Various wood substitutes used for display unit, their qualities and problems associated are dealt in table 27.

Table 27: Details of Cupboard or Display Unit

Item	Quality percentage (n=50)			Problem percentage (n=50)				
	Water resistant	Weather resistant	Both	Cost	Fixture Problem	Surface work	Durable	No
Plywood	22	14	22	34				24
MDF	8	6	10	4	8			12
Particle board	10	2	4		6		8	2
Fingejoint board			2	2				

The above table deals with the quality and problems associated of cupboard cum display unit, Considering 58 per cent of plywood, 22 per cent states it is resistant to both, Considering problem, 34 per cent states cost is high, Considering 24 per cent of MDF eight per cent states it is water resistant, Considering problem, 8 states there is fixture problem, Considering Fingerjointboard two per cent states it is both resistant Considering problem, two per cent state it is high in cost.

17. Details of Doors and Window frames:

The wood and wood substitutes that are used in the construction phase such as main door, middle door, Bathroom door, window frames.

Table 28: Details of Door, Window Frames

S.No	Category	Classification percentage (n=50)						
		Wood	Plywood	MDF	HDF	Particle board	Finger joint board	Other
1	Main door	86	14					
2	Middle door	38	28	16		18		
3	Bathroom door	4	64					32(pvc)
4	Window	76						24(upvc)

Considering Door and window frames, considering main door 86 per cent used wood, Considering Middle door 38 per cent used wood, 28 per cent used plywood, For bathroom door, four per cent used wood, 64 used plywood while 33 used other material, considering Window, 76 per cent used wood and 24 per cent used other material.

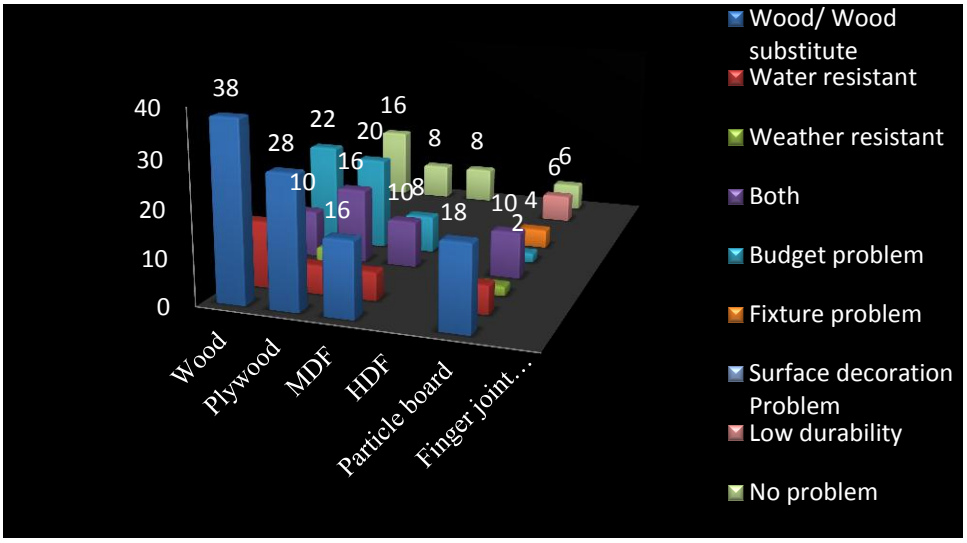
18. Detail of Door- Main door:

The quality and the problems associated of Main door, considering quality, 56 per cent states wood is water resistant, eight per cent states plywood is weather resistant, Considering problem, 64 per cent states wood cost is high, 22 Per cent states there is no problem, considering eight per cent states plywood is weather resistant, considering problem, 10 per cent states that cost is high, four per cent states there is no problem.

19. Details of Door -Middle door:

Various wood substitutes used for middle door, their qualities and problems associated are dealt in figure 15.

Figure 15: Details of Middle Door



The above figure deals with the quality and the problems associated of Middle door, Considering quality, 14 per cent states wood is water resistant, 16 per cent states plywood is resistant to both, six per cent states MDF is water resistant, 10 per cent states particle board is resistant to both Considering problem, 22 per cent of wood states cost is high, 16 per cent states plywood has no problem, 20 per cent states plywood cost is high, 8 per cent states MDF has no problem, six per cent states particle board has low durability.

20. Details of Door - Bathroom door:

The quality and the problems associated of bathroom door, Considering four per cent of wood, four per cent states wood is resistant to both, 34 per cent states plywood is weather resistant, eight per cent states it is resistant to both,

Considering problem, Four per cent states wood has no problem, 34 per cent states there is no problem.

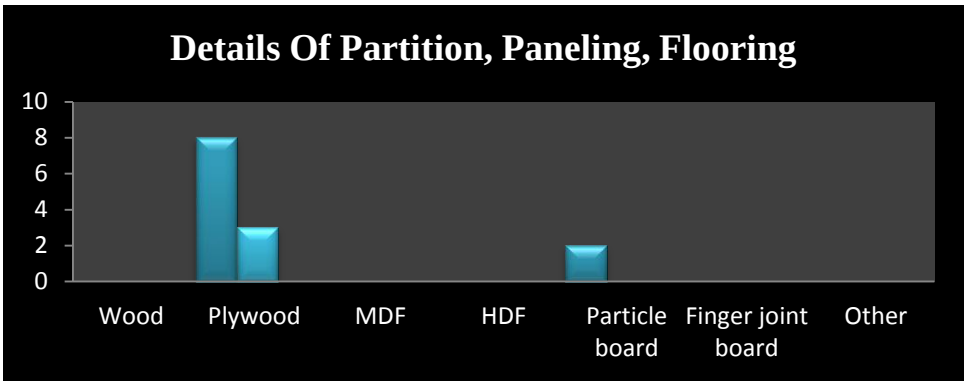
21. Details of Window:

Considering the quality and the problems associated of window, and 38 per cent states wood is resistant to both,22 per cent states wood is resistant to water, Considering problem, and 64 states there is no problem and 12 states wood cost is high.

22. Details of the Partition, Paneling and Flooring:

The details of wood and wood substitute used for partition, paneling, Flooring is represented in figure 16

Figure 16: Details of Partition, Paneling, Flooring



Considering partition, paneling and flooring in the house, considering partition, 8 per cent used plywood, 2 used particle board, considering paneling 4 per cent used plywood.

23. Details of Partition:

Considering various wood substitutes used for partition, their qualities and problems associated, Considering quality, four per cent of plywood is resistant to

both, two per cent states it is weather resistant, Considering problem, 6 states plywood has no problem, 2 states particle board has less durability.

24. Details of Paneling:

Considering the qualities and problems associated, four per cent plywood is resistant to both, considering problem, 4 per cent states plywood has no problem.

D. Specific information of the material used

1. Preference of wood/ wood substitute:

It is revealed that 56 per cent of the natives prefer wood substitute and 44 per cent prefer wood.

2. Reasons for using wood substitute:

The reason for using wood substitute divulges that 34 per cent states the reason as economical, 28 per cent as Durable, 30 as aesthetic, 8 per cent states because of ease in maintenance.

3. Aware of Indian standards

Considering the awareness toward standards, 88 per cent are not aware of the standards and 12 per cent are aware of standards.

4. Aware of Eco-friendly and interest in using the eco- friendly products

Considering the awareness 24 per cent are aware of the new products traded and 76per cent are not aware and considering the interest in using Eco-friendly products, 46 per cent are interested and 54 per cent are not interested.

ii). Creating awareness on using wood substitutes in interiors.

With the surveyed details, the five days awareness programme was conducted in the selected areas of Coimbatore and Tirupur City. The natives were created awareness on various standards of wood substitute. The new and eco-

friendly wood substitutes traded in the market and ideas of using specific wood substitute for construction and interior for the economical and eco-friendly support were made aware to the natives approaching the door steps of the native's house.

Table 29: Natives Attended Awareness Programme

S.No	Area	Number of participants
1	Coimbatore	26
2	Tiruppur	18

The above table implies natives have participated in the awareness programme from Coimbatore and Tirupur city.

iii). Evaluating the impact of the awareness programme conducted.

The impact of the awareness programme on familiarizing wood substitutes for effective interiors by the selected natives were assessed on the following ways,

a). Knowledge gained by the natives

b). Extent of adoption of suggested wood substitutes.

a. **Utilization of the adopted wood substitute**
b. **Features of the adopted wood substitute.**

c). Suggestion for better adoption of wood substitute.

a).Knowledge gained by the natives.

Table 30 exhibits knowledge gained by the selected natives through the awareness programme.

Table 30: Knowledge Gained by the Natives

S.No	Aspects	Percentage (n=40)	
		Before	**After**
1	Knowledge on Scarcity of wood	62	94
2	Indian Standards of wood substitute	8	86
3	Traded new wood substitute	32	72
4	Eco-friendly wood substitute	24	86
5	Interest in using eco-friendly wood substitute	16	68
7	Idea of selecting specific wood substitute for interiors and construction	22	78
8	Qualities of various wood substitute	36	92

From the above table it was found that, knowledge gained has increased comparatively among the natives after attending the awareness programme, the knowledge on wood scarcity, Indian standards, availability, interest in using Eco-friendly wood substitute and the ideas of selecting wood substitute and their specific qualities are highly increased after the awareness programme.

b). **Extent of adoption of suggested wood substitutes.**

After providing awareness programme, the natives were, encouraged to adopt the standard, eco-friendly, and suggested wood substitutes. While analyzing utilization, as purchasing furniture and doing interiors is comparatively costly and it is based on function and necessity 10 natives adopted wood substitute based on the imparted ideas and Indian standards.

a. Utilization of the adopted of wood substitute

Ten natives adopted wood substitute for furniture and interiors based on the imparted ideas and the awareness programme. The details regarding the adopted wood substitute is given below.

Native 1: A Native of thudiyalur, Coimbatore adopted TV unit based on the imparted idea. Native have used plywood rather preferring wood.

Native detailed that by selecting plywood as the material, it was cost beneficial, aesthetic appeal and it gives satisfaction. Plywood is certainly available in varied sizes and types and are labor saving raw material.

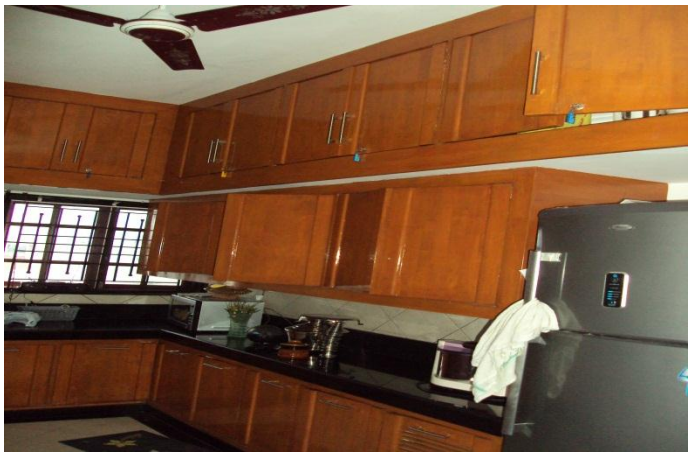
Native 2: A native of may flower apartment, Coimbatore have used plywood and finger joint board for the cot rather preferring wood. Native used finger joint board for the head rest and plywood for the boxes.

Native also included that the cot is aesthetic, visually appealing and serves the function in the best way and also it is strong and sturdy.

Native 3: Native of Tirupur, have used MDF as their wood substitute based on the imparted ideas.

Native added that MDF is stronger, the surface decoration is easier and it is cost beneficial and have visual appealing feature.

Native 4: Native of Lakshmi apartment peelamedu, Coimbatore has adopted plywood as wood substitute for the kitchen upper and lower cupboard based on the idea imparted**.**



Native stated that plywood is stronger, aesthetic and satisfies the function, the color finish attracts the attention.

b. The features of the adopted wood substitute:

The features regarding the adoption of wood substitutes are presented in table no: 31

Table 31: The Features of the Adopted Wood Substitute

S.No	Features	Percentage (n=10)				
		SF	F	N	UF	SUF
1	Workability	72	18	10		
2	Economic	62	14	24		
3	Aesthetic	42	30	28		
4	Ease in maintenance	32	26	42		
5	Durability	38	22	38		
6	Water and weather resistant	38	38	24		
7	Selected on the desired size	56	22	22		
8	More satisfaction	68	18	14		

SF- Strongly favorable, F- Favorable, N- neutral, UF- Unfavorable, SUF- strongly unfourable.

From the above table, the opinion of natives regarding the adoption of wood substitute states that considering workability, 72 per cent states it is strongly favorable, ten percent states workability is neutral, considering economic 62 per cent states it is strongly favorable, 14 per cent states it is favorable, considering aesthetic, 48 percent states it is strongly favorable and 28 per cent state it is

neutral, Considering ease in maintenance 32 per cent state it is strongly favorable, considering durability and water and weather resistant 38 per cent states it is strongly favorable, considering varied sizes,56 percent states it is strongly favorable, considering staisfaction,68 percent states it is strongly favorable.

c). Suggestion for better adoption of wood substitutes.

The suggestion of the natives towards the adoption of wood substitutes is detailed in table 32

Table 32: Suggestion for Better Adoption of Wood Substitutes

S.No	Suggestions	Percentage (n=10)
1	Educational campaigns providing more ideas	28
2	Durable wood substitute	34
3	A Wood substitute should satisfy all qualities such as strength, durable, stable.	58

From the above table it is revealed that, 28 per cent of the natives require educational campaigns, 34 per cent of the natives states wood substitute must be more durable and 58 per cent of the natives states the wood substitute must be developed with all qualities.

V. SUMMARY AND CONCLUSION

The thesis entitled **"Familiarizing wood Substitutes for effective interiors"** is made as one of the key objectives of "The National Forestry Action Programme" - India, a twenty year comprehensive plan for development of forests, has envisaged three main action areas, namely

(iv) Protection of existing forests,

(v) Improvement of forest productivity

(vi) Reduction of total demand

The thesis enhances the third objective as reduction of total demand for wood, by adopting eco- friendly wood substitutes. The study has the other following objectives, such as educate vital importance of decreasing the usage of log wood and impart the knowledge of new wood substitutes available and their Indian standards. Familiarize natives with the new eco-friendly honeycomb board and bamboo plywood. Impart knowledge on using specific wood substitutes for furniture and interior as reducing the budget.

To conduct the survey, Coimbatore and Tirupur city was selected. For market survey, 20 premier dealers were selected 10 each from Coimbatore and Tirupur city and for Household survey 50 upper middle income group natives each 25 residing in Coimbatore and Tirupur city were selected for the study. For this study, purposive sampling technique was used.

For Market survey, the investigator prepared the schedule to be obtained the data about the functioning of their firm, details of the Indian standard wood substitutes, various and new wood substitutes accessible which are Eco-friendly and stable.

"People love chopping wood, in this activity one immediately sees results."
-Albert Einstein

For household survey, the questions are designed to collect data's about the wood substitutes used in the house and, details regarding the house owners, the material used in interior works.

Based on the data, awareness programme was conducted in crisp and informative manner.20 native each from Coimbatore and Tirupur city, who are interested to implement and attend the awareness programme were selected as sample. The awareness programme was conducted in five days to the selected area natives. The programme included lectures, participatory discussions. The visual aids included specially prepared booklet and pamphlets.

The impact of the awareness programme conducted was evaluated based on the initial and final knowledge of the natives and the acceptance and adaption of standard eco-friendly wood substitute for their interiors based on the imparted ideas.

The major findings of the market survey are presented below,

A. General information of the dealers.

- Considering General information of the dealers, 98 per cent were male dealers, 38 per cent of the selected dealers were above the age of 45, educational status of dealers was, School Graduation 58 per cent, 48 per cent of dealers had an experience of 5-10 years.36 per cent of the enterprise have turnover of 2 crore – 3 crore.

B. Details of the wood trade in enterprise.

- The features of wood, considering all three water, weather, termite's resistant, Teak wood by 54 per cent, Considering Durability of high than fifty years, Rosewood by 76 per cent. As regard of problems 50 per cent states hardwood are pliable, 82 per cent states softwood there is no problem, 58 per cent states country wood has all type of problem.

C. Details of the wood trade in enterprise.

- The features of plywood, Considering all three water, weather, termites resistant, IS: 710:1976 is admitted by 22 per cent, considering the durability of high than 50 years, 52 per cent admitted IS:710:1976 WPP.
- The features of MDF, IS: 12406 MDF and 24 states it is resistant to all three water, weather, termites resistant, 88 per cent admits it has durability of 20-50 years.
- The features of MDF, IS: 12406 MDF and 24 states it is resistant to all three water, weather, termites resistant, 88 per cent admits it has durability of 20-50 years.
- The features of HDF, considering IS: 12406 HDF 40 states it is resistant to all and considering durability 94 per cent dealers admits that it has durability of 20-50 years.
- The features of Particle board, considering IS: 3087 36 per cent states it is not resistant to all three, and considering durability 58 per cent admits it has less than 20 years durability.
- The features of finger joint board, 22 per cent states it is water resistant and 46 per cent states it is resistant to all and considering durability 88 per cent states it has durability of 20-50 years.

D. Additional information on wood substitute.

- The preference of customer, 62 per cent of the customers prefer wood substitute while 38 per cent of the customers prefer wood.
- The reasons of customers adapting wood substitute, 46 per cent adapt as it is economical, whereas 28 per cent accept as it is traded in varied types.
- The new eco-friendly traded wood substitute in the enterprise, 68 per cent stated bamboo plywood and 32 per cent specified Honeycomb board.

- The application of wood and wood substitute in interior, 64 per cent states wood is used in door frame, 70 per cent states plywood and 48 per cent states MDF can be used in all application, 36 per cent states HDF is used for flooring, 86 per cent states that particleboard can be used in furniture, 96 states Fingerjointboard can be used in all application.
- The problems in wood substitutes, in standard plywood 74 per cent of the dealers states that there won't be any problems, in standard MDF 52 per cent states that there won't be any problems, in standard HDF 52 per cent of the dealers states that there won't be any problem, 34 per cent of the dealers states that there is strength weakness in standard particleboard, 70 per cent states there is no problem in finger joint board.

The major findings of the household survey are presented below

E. **General information of the selected natives**.

- Taking the age of the natives 42 per cent are between the age group of 40-50, female natives is 62 per cent, considering education under graduates are 52 per cent, 52 per cent of the natives do business, 88 per cent belong to the nuclear family. A majority of 32 per cent of the families earned an income between Rs. 40,000 and 50,000 monthly.

F. Details of the house

- 48 per cent of the natives house has Sqft of 2000-3000 Sqft, Considering construction year, 68 per cent have houses built in the year of 2000-2005, specifying the house type, 60 per cent are from apartment, considering the No of rooms in house, 84 per cent have 3rooms, specifying house story, 68 per cent are single storied, 56 per cent stay in contemporary style house.
- Considering expenditure, 44 per cent of the natives have spent one lakh for wood substitute.

G. **Details of the wood substitutes used in rooms**.

- The living room furniture TV, 46 per cent used particleboard, secondly 32 per cent used plywood , Considering seating Unit, 72 per cent used wood, considering Centre table 36 per cent used plywood, Considering the computer table 62 per cent used Particleboard.
- For TV unit, particle board is used maximum, 36 per cent states particle board is weather resistant, and 22 percent states particle board has strength and durable problem.
- For seating unit, Wood is used maximum, 46 per cent states wood is weather resistant, and 66 per cent states wood is high in cost.
- For computer/ study table 48 per cent states particleboard is weather resistant, 48 percent states Particle board has strength and durable problem.
- For Bed room furniture's, 52 per cent used plywood and 22 per cent used particleboard for Cot, For wardrobe, 46 per cent used plywood, 36 per cent Particleboard, Considering dressing table, 48 per cent used plywood, 34 and particle board.
- For cot, plywood is used maximum, 26 per cent states plywood is resistant to both, and 32 per cent states plywood has no problem.
- For wardrobe, particleboard is used maximum, 26 percent states particle board is weather resistant, and 22 per cent states it has less durability.
- For Dressing table, plywood is used maximum, 24 per cent states plywood is resistant to both, and 26 per cent states plywood has no problem.
- For Kitchen furniture's, For upper and lower cupboard, 42 per cent used plywood, For display or storage unit, 30 per cent used plywood while 24 per cent used MDF.
- For cupboard, plywood is used maximum, 18 per cent states it is resistant to both 18 per cent states plywood has no problem.
- For storage unit, plywood is used maximum, 12 per cent states it is water resistant and 12 per cent states plywood has no problem.

- For dining furniture's, considering dining table 82 per cent used wood, considering dining Chair 98 per cent used wood, considering display unit cum cupboard, 58 per cent used plywood.
- For dining table, wood is used maximum, 38 per cent states wood is resistant to both, 46 per cent states wood cost is high.
- For dining table, wood is used maximum, 54 per cent states wood is weather resistant, 76 per cent states wood cost is high.
- For Door and window frames, considering main door 86 per cent used wood, Considering Middle door 38 per cent used wood, For bathroom door, 64 used plywood, considering Window, 76 per cent used wood
- For main door and middle door, window, wood is used maximum,56 per cent states wood is water resistant,64 per cent states wood cost is high in main door, whereas in middle door, 14 per cent states wood is water resistant, 22 per cent of wood states cost is high and for window, 38 per cent states wood is resistant to both and 64 states there is no problem
- For partition, paneling and flooring in the house, considering partition, 8 per cent used plywood, 2 used particle board, considering paneling 4 per cent used plywood.

D. Specific information of the material used.

- Regarding the preference of wood and wood substitutes, 56 per cent of the natives prefer wood substitute and 44 per cent prefer wood.
- The reason for using wood substitute divulges that 34 per cent states the reason as economical, 28 per cent as Durable, 30 as aesthetic, 8 per cent states because of ease in maintenance.
- Considering the awareness toward Indian standards, 88 per cent are not aware of the standards and 12 per cent are aware of standards. 76 per cent are not aware of the new products and 46 per cent are interested use eco-friendly products.

The major findings of the awareness programme are presented below.

- Knowledge gained has increased comparatively among the natives after attending the awareness programme.
- It was found that ten natives adopted wood substitutes for furniture and interiors in awareness programme.
- Utilization of the adopted wood substitute by the native's maximum all strongly favors the adopted material. considering workability, 72 per cent states it is strongly favorable, considering economic 62 per cent states it is strongly favorable, considering aesthetic, 48 percent states it is strongly favorable Considering ease in maintenance 32 per cent state it is strongly favorable, considering durability and water and weather resistant 38 per cent states it is strongly favorable, considering varied sizes and satisfaction, 56 and 68 percent states it is strongly favorable.
- Regarding suggestion from natives, 28 per cent of the natives require educational campaigns, 34 per cent of the natives states wood substitute must be more durable and 58 per cent of the natives states the wood substitute must be developed with all qualities.

CONCLUSION:

The Awareness programme in the selected cities has made a significant impact on adopting wood substitutes. The natives were highly satisfied with the conduct of the awareness programme and they showed greater interest in learning and adopting new concepts related to adoption of the wood substitute. Thus the native of the city, to whom the programme is launched to attend the awareness programme, was successful with the majority understanding and following the techniques which resulted in the benefits of adoption. The awareness helped the natives adopt the Indian standard, economic and eco-friendly wood substitutes. It would ultimately support

the objective of the “The National Forestry Action Programme” to attain prosperity and support green and eco-friendly nature.

RECOMMENDATIONS:

- Government should advertise the importance of adopting wood substitutes to support the overcome of scarcity of wood and their serious effects.
- The objective of the national forest programme should be made aware to the natives through various awareness programmes.
- The knowledge on building is important, and the features based must be taught from the higher school level to the future generation.
- The economic benefits and the benefits on eco-friendly wood substitutes must be made aware to the natives and people must adopt it.
- People should be advised to use minimum real wood products such as honeycomb board for the protection of environment, which helps in eco-friendly nature.

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APPENDIX I

AVINASHILINGAM INSTITUTE OF HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN, COIMBATORE-641043

DEPARTMENT OF INTERIOR DESIGN AND RESOURCE MANAGEMENT

QUESTIONNAIRE TO ELICIT INFORMATION FROM THE DEALERS ABOUT "FAMILIARIZING WOOD SUBSTITUTES FOR EFFECTIVE INTERIORS".

A. General information

1. Name of the enterprise:

2. General details:

Name of the head owner	Age	Gender	Education	Experience in field.	Annual turnover

3. Contact address:

4. Contact number:

5. E-mail id:

B. details of the wood trade in Enterprise

6. Do you sell real wood ☐ Wood substitute ☐ Both ☐

7. What kind of woods is available in the enterprise used for interior and furniture?

Malaysian Sal ☐ Teak wood ☐

Padak ☐ Venghai ☐

Rose wood ☐ all ☐

8. What kind of wood do customers mostly purchase for interior?

Malaysian Sal ☐ Teak wood ☐

Padak ☐ Venghai ☐

Rose wood ☐ others ☐

9. What are the applications of wood in interior work?

Furniture ☐ Paneling ☐ Flooring ☐

Partition ☐ Door frame ☐ all☐

10. Features of wood:

Material	Quality			Durability in years			Cost /Sqft
	Water Resistant	Termites resistant	Weather Resistant	>20	20-50	<50	
Malaysian Sal							
Teak wood							
Rose wood							
Padak							
Venghai							

11. What are the frequent problems using hardwood in interiors:

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

12. What are the frequent problems using softwood in interiors:

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

13. What are the frequent problems using country wood in interiors:

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

C. **Details of the wood substitutes traded in enterprise**

14. What are the wood substitutes you trade in your enterprise?

Plywood ☐ Medium density Fiber Board ☐

High density Fiber Board ☐ Finger joint Rubber wood ☐

Particle Board☐ All ☐

15. What are the standard thicknesses of plywood?

18mm ☐ 12mm ☐ 9mm☐ 6mm☐ 4mm☐ all ☐

16. What are the standard sizes of plywood?

8x4 ☐ 7x4 ☐ 6x4 ☐ 8x3☐ 7x3 ☐ 6x3 ☐ all

17. Characteristics'/Features of Plywood:

Material	Quality					Durability			Cost /Sqft
	Water Resistant	Termites resistant	Weather Resistant	All	none	>20	20-40	<50	
(Standard)									
(Standard)									
(Standard less)									

18. What are the major applications of plywood in interior works?

Furniture ☐ Paneling ☐ Flooring ☐

Partition ☐ Door frame ☐ all ☐

19. What are the frequent problems using standard plywood in interiors?

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

20. What are the frequent problems using standard less plywood in interiors?

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

21. What are the standard thicknesses of MDF you sell in the enterprise?

18mm ☐ 12mm ☐ 9mm☐ 6mm☐ 4mm☐ all ☐

22. What are the standard sizes of MDF you sell in the enterprise?

8x4 ☐ 7x4 ☐ 6x4 ☐ 8x3☐ 7x3 ☐ 6x3 ☐ all

23. Characteristics'/Features of MDF:

Material	Quality			Durability			Cost /Sqft
	Water Resistant	Termites resistant	Weather Resistant	>20	20-40	<50	
(Standard)							
(Standard)							

24. What are the major applications of MDF in interior works?

Furniture ☐ Paneling ☐ Flooring ☐

Partition ☐ Door frame ☐ all ☐

25. What are the frequent problems using standard MDF in interiors:

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

26. What are the frequent problems using standard less MDF in interiors:

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

27. What are the standard thicknesses of HDF you sell in the enterprise?

18mm ☐ 12mm ☐ 9mm☐ 6mm☐ 4mm☐ all ☐

28. What are the standard sizes of HDF you sell in the enterprise?

8x4 ☐ 7x4 ☐ 6x4 ☐ 8x3☐ 7x3 ☐ 6x3 ☐ all ☐

29. Characteristics'/Features of High density fiber board:

Material	Quality			Durability			Cost /Sqft
	Water Resistant	Termites resistant	Weather Resistant	>20	20-40	<50	
(Standard)							
(Standard)							
(Standard less)							

30. What are the major applications of High density fiber board in interior works?

Furniture ☐ Paneling ☐ Flooring ☐

Partition ☐ Door frame ☐ all ☐

31. What are the frequent complaints using standard HDF in interiors:

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

32. What are the frequent complaints using Standard less HDF in interiors:

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

33. What are the standard thicknesses of Particleboard you sell in the enterprise?

18mm ☐ 12mm ☐ 9mm☐ 6mm☐ 4mm☐ all ☐

34. What are the standard sizes of Particle Board you sell in the enterprise?

8x4 ☐ 7x4 ☐ 6x4 ☐ 8x3☐ 7x3 ☐ 6x3 ☐ all ☐

35. Characteristics'/Features of Particle Board:

Material	Quality			Durability			Cost /Sqft
	Water Resistant	Termites resistant	Weather Resistant	>20	20-40	<50	
(Standard)							
(Standard)							
(Standard less)							

36. What are the major applications of Particleboard in interior works?

Furniture ☐ Paneling ☐ Flooring ☐

Partition ☐ Door frame ☐ all ☐

37. What are the frequent complaints using standard particle Board in interiors:

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐

38. What are the frequent complaints using Standard less Particle Board in interiors:

Cracking ☐ Fixture fitting ☐ Shrinkage ☐

Strength ☐ Pliable ☐ Termite attack ☐ all ☐

39. What are the standard thicknesses of Finger joint Board you sell in the enterprise?

18mm ☐ 12mm ☐ 9mm☐ 6mm☐ 4mm☐ all ☐

40. What are the standard sizes of Finger joint board you sell in the enterprise?

8x4 ☐ 7x4 ☐ 6x4 ☐ 8x3☐ 7x3 ☐ 6x3 ☐ all

41. Characteristics'/Features of finger joint Board:

Material	Quality			Durability			Cost /Sqft
	Water Resistant	Termites resistant	Weather Resistant	>20	20-40	<50	
(Standard)							
(Standard)							

42. What are the major applications of finger joint Board in interior works?

Furniture ☐ Paneling ☐ Flooring ☐

Partition ☐ Door frame ☐ all ☐

43. What are the frequent complaints using standard finger joint Board in interiors:

Weather change ☐ Fixture fitting ☐ Water absorption ☐

Strength ☐ Pliable ☐ Termite attack ☐ none ☐

D. **Additional information on wood substitute**

44. What do the customers mostly prefer for doing interior work?

Real wood ☐ Wood substitute ☐

45. What are the reasons for adopting wood substitute?

☐ Economical ☐ Durable ☐ Aesthetic ☐ available in varied sizes ☐ Eco-friendly

46. What are the new available wood substitutes available in the market ----------?

47. Specific feature of new wood substitute ----------?

48. What are the Eco- friendly wood substitutes available in the market ----------?

APPENDIX II

AVINASHILINGAM INSTITUTE OF HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN, COIMBATORE-641043

DEPARTMENT OF INTERIOR DESIGN AND RESOURCE MANAGEMENT

QUESTIONNAIRE TO ELICIT INFORMATION FROM THE HOME OWNERS ABOUT THE WOOD AND WOOD SUBSTITUTES USED IN HOME.

A. General information

1. Name of the interviewee:

2. Name of the head of the family:

3. Contact address:

4. Contact number:

5. E-mail id:

6. a. General information of the Family:

S.No	Family size		Age (in years)				Gender		Educational qualification			Occupation		
	> 4	<4	> 30	30-40	40 - 50	< 50	M	F	School graduation	UG	PG	*A	* B	*C

*A- employee, B- business, c- homemaker

6. b. Monthly income

☐20-30 ☐30-40 ☐40-50 ☐50-60 ☐above 60

7. Family type:

☐ Joint family ☐ Nuclear family

B. Details of the house:

8. Total built-up area of the house (in sq.ft.) _____

9. Year of construction ☐ 2000-2005 ☐ 2006-2012

10. Type of the house ☐ Individual house ☐ apartment

11. Number of rooms in the house ☐ 2 ☐ 3 ☐ 4

12. Is the house ☐ single storied ☐ double storied?

13. Style of the house:

☐ Traditional ☐ Modern ☐ Contemporary

14. Whether wood substitute is used for interior: ☐ Yes ☐ No

15. Expenditure incurred for wood and wood substitute used in the interior (in lakhs.):

Below 1 ☐ 1-3☐ 3-5☐

C. Furniture details of the room

C.16. Furniture Details of rooms: Living room Sq.ft _____

Items	Material		Qualities		Complaints faced				
	Wood	Wood substitute (specify)	Water Resistant	Termites resistant	A	B	C	D	E
TV unit									
Sofa or seating unit									
Centre table									
Computer/ study table									

A- Budget B- Fittings Problem C- Surface Decoration Problem D-Durability E- no problem

17. Details of rooms: **Master Bedroom** Sqft _____

Items	Material		Qualities		Complaints faced				
	Wood	Wood substitute (specify)	Water Resistant	Termites resistant	A	B	C	D	E
Cot									
Wardrobe									
Dressing table									

A- Budget B- Fittings Problem C- Surface Decoration Problem D-Durability E- no problem

18. Details of rooms: **Kitchen** Sqft _____

Items	Material		Qualities		Complaints faced				
	Wood	Wood substitute (specify)	Water Resistant	Termites resistant	A	B	C	D	E
Upper cupboard									
Cupboards									
Display unit									

A- Budget B- Fittings Problem C- Surface Decoration Problem D-Durability

19. Details of rooms: **Dining area** Sqft _____

Items	Material		Qualities		Complaints faced				
	Wood	Wood substitute (specify)	Water Resistant	Termites resistant	A	B	C	D	E
Dining table									
Dining chair									
Display unit cum cupboard									

A- Budget B- Fittings Problem C- Surface Decoration Problem D-Durability

20. Details of Door and window frames used in your residence.

Items	Material		Qualities		Complaints faced				
	Wood	Wood substitute (specify)	Water Resistant	Termites resistant	A	B	C	D	E
Main door									
Middle door									
Bathroom door									
Window									

A- Budget B- Fittings Problem C- Surface Decoration Problem D-Durability

21. Details of the Flooring, Partition, Paneling used in your residence

Items	Material		Qualities		Complaints faced				
	Wood	Wood substitute (specify)	Water Resistant	Termites resistant	A	B	C	D	E
Partition									
Paneling									
Flooring									

D. Specific information of the material used.

23. What do you mostly prefer for doing interior work?

Real wood ☐ Wood substitute ☐

24. Reasons for using the particular wood/ wood substitute:

☐ Economical ☐ Durable ☐ Aesthetic ☐ Ease in maintenance ☐ Eco-friendly

25. Are you aware of the standards proposed by government to the wood substitute?

Yes ☐ No ☐

26. Are you aware about the new wood substitute products available in the market?

Yes ☐ No ☐

27. Whether you know the information of Eco-friendly wood substitutes available for interiors?

Yes ☐ No ☐

28. Are you interested in using the Eco-friendly wood substitutes for interiors?

Yes ☐ No ☐

29. Are you interested in attending the awareness programme on familiarizing wood substitutes for effective interiors?

Yes ☐ No ☐