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## VISION

The vision of the journals is to provide an academic platform to scholars all over the world to publish their novel, original, empirical and high quality research work. It propose to encourage research relating to latest trends and practices in international business, finance, banking, service marketing, human resource management, corporate governance, social responsibility and emerging paradigms in allied areas of management. It intends to reach the researcher's with plethora of knowledge to generate a pool of research content and propose problem solving models to address the current and emerging issues at the national and international level. Further, it aims to share and disseminate the empirical research findings with academia, industry, policy makers, and consultants with an approach to incorporate the research recommendations for the benefit of one and all.

## **SPECIAL ISSUE**

**UGC SPONSORED NATIONAL CONFERENCE**

**“DESIGNING – THRESHOLD TO ENTREPRENEURSHIP”**

**27.2.2018,**

**Organised By**

**DEPARTMENT OF RESOURCE MANAGEMENT**

**Avinashilingam Institute for Home Science and Higher Education for Women  
Coimbatore-43, TN, India**





Message

26.02.2018

It is with great pride that we are marching ahead towards excellence in this year of the Diamond Jubilee celebrations of the Institution. At the outset, I am happy to hear that the Department of Resource Management is organizing a UGC Sponsored National Conference on "Designing-Threshold to Entrepreneurship" on 27<sup>th</sup> February 2018. The conference I am sure would serve as a platform to converge academicians, researchers, and stake holders in Resource Management and in the designing field to help the organizers arrive at fruitful deliberations. I feel assured that it would open up new vistas to empower designers to take enriching practice oriented knowledge in the field of design and emerge as successful entrepreneurs.

I fervently hope that the deliberations of this conference will be highly useful to the delegates attending the same.

I wish the conference all success and congratulate the organizers for taking it up.

Dr.T.S.K.Meenakshisundaram

Managing Trustee of Avinashilingam Education Trust

## MESSAGE



A design is an interpretation of idea by an individual. Knowledge of how to choose the essential requirement for fulfilling basic sophisticated need is essential.

Design plays a very important role in developing any object is it an art object, a house, equipment or jewelry. I am indeed very happy to know that the department of resource management is organising a one day national conference on Designing – Threshold to Entrepreneurship. The need of the hour is to create successful and innovative entrepreneurs so as to improve the standard of living of the people. It is befitting that entrepreneurship and designing are combined in this conference so that it will open new vistas for entrepreneurship. I congratulate the organizer and wish the national conference a grand success.

**Shri, Dr.P.R.Krishnakumar,  
Chancellor**



**Avinashilingam Institute for Home Science and Higher Education for Women**

(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956)

Re-accredited with 'A' Grade by NAAC. Recognised by UGC Under Section 12 B

Coimbatore - 641 043, Tamil Nadu, India

**Dr. Premavathy Vijayan**

M.Sc., M.Ed., M.Phil., Dip.Spl. Edn. (U.K.), Ph.D.

**Vice-Chancellor**

Date : 26.02.2018

**Message**



It is indeed a great moment of pride, especially in the year of the Diamond jubilee celebrations of the Institution that the Department of Resource Management is organizing the UGC sponsored National Conference on 'Designing – Threshold to Entrepreneurship'.

Being the first department to initiate an Under Graduate programme in Interior Design and Environment, they stand good chances of analyzing design concepts and their influence on varied sectors of production and consumption. With concepts of designing encompassing all aspects of daily living, the ideation to organize a conference focusing on its role in entrepreneurship development is highly appreciable.

I take great pleasure in congratulating the organizers for their concerted efforts towards the successful conduct of the conference.

*Premavathy Vijayan*  
26.2.2018  
**Premavathy Vijayan**  
Vice Chancellor





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Coimbatore - 641 043, Tamil Nadu, India

**Dr. (Mrs.) S. Kowsalya**

M.Sc., M.Phil., Ph.D.

Registrar



Date : .....

26.02.2018

### Message

It gives me immense pleasure to note that the Department of Resource Management is organizing a National Conference on "Designing – Threshold to Entrepreneurship" as an essential component of the Diamond Jubilee celebrations of the Institution.

With advances in science and technology, opportunities for entrepreneurship also keep expanding widely. The role of designing in this context, assumes significance in Indian context. It offers vast scope for designers to shine and benefit economically. With digitalization facilities, the prospects are still brighter. A national conference facilitating encouragement on these concepts to budding interior designers at this juncture is an appreciable endeavor.

I congratulate the Department of Resource Management for organizing this conference and for taking it up in their stride. I wish the conference all success.

*S. Kowsalya*

REGISTRAR



**Avinashilingam**  
Institute for Home Science and Higher Education for Women  
**University**  
(Estd. u/s 3 of UGC Act 1956)  
Coimbatore - 641 043, Tamil Nadu, India  
(Deemed University under Category 'A' by MHRD)  
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Date : .....

26.02.2018

### Message

I am immensely pleased to be an advisor for the National Conference organized by the Department of Resource Management on 'Designing – Threshold to Entrepreneurship'.

Designing in recent years has become an integral part of the production process. Its impact on consumer products ranging from ordinary household things to space craft designing, 'designs' have found an important place.

Interior design is a unique subject where designers have a significant role to play. To my knowledge, more than in planning people have started giving importance to designing of beautiful interiors. A national conference at this juncture is a welcome concept. Being from one of the Departments in Home Science gives me added pleasure.

I congratulate the Department for conceiving the conference on a theme beneficial to many upcoming designers. I hope, as a concerted team we will conduct the conference successfully enabling the participants to have meaningful deliberations.

N. Vasugi

Dean, Faculty of Home Science

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## MESSAGE

26.02.2018



Home Science is a synthesis of six disciplines or branches vouching for the wholesome development of an individual. One of the major discipline and the one to have offered an Undergraduate programme in Interior design and Environment way back in 1973-74, was the Department of Resource Management (Erstwhile Home Management) with a foresight on how the discipline would find shape as a significant aspect in the construction sector. In the four - decade experience, the department had witnessed kaleidoscopic changes in the way interior design perspectives

have been approached.

Today the designer acts as a trendsetter in deciding consumer preferences in aesthetic as well as functional concepts in interior designing. With design and designer finding a lucrative niche in the market, articulating entrepreneurial prospects are galore. In addition, call of the Nation too is 'Make in India'.

The potentials of our students in the designing sector are quite vast. Recognizing their requirements to introduce them to factors that can contribute to their active involvement in entrepreneurial prospects had to be honored. Further inroads to skill development also need to be found out. This National Conference on "Designing – Threshold to Entrepreneurship" is organized with the objectives at par with this spawn head.

As the convenor of this conference, I hope and pray that the deliberations will keep up with the outcomes expected of it.

I congratulate and thank all the members in the organizing team for their hearty cooperation

**Dr. S. Visalakshi Rajeswari**  
**Professor and Head**  
**Department of Resource Management**



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## DESIGNED SPACES AS EDIFICES SHOWCASE FUSION OF ANALYTICAL AND CREATIVE MINDS

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### ABSTRACT

*Improvements in science and technology have brought in its wake several devices that help in optimizing the comfort, communication and energy conservation demands of human beings. Studies have revealed the effects of the physical environment (the space used) up on the attitudes and behavior of the people who use it. Designed spaces and/or buildings must therefore be functional in terms of user behavior and satisfaction. Not only must form follow function, but it must also assist it in every way. With the proliferation of hi-tech devices appearing in the market which add to the aesthetics as well as purpose, building components which qualify for conventional are greatly fading in the superstructure, giving room for the new. In recent years, construction techniques have also improved giving importance to the 'vital organs' the aspects which were of least importance in earlier days. Coupled with the tremendous inflow of customized and flexible building materials which can be molded to suit any design in space planning (**creative mind**) and automation facilities integrating fusion of electronics with electrical and mechanical services (**analytical mind**), the concept of designing spaces for functional use have altered. Incorporation of all these concepts invariably renders a status to the structure as one with Building automation. A building controlled by a BAS is often referred to as an intelligent building, smart building / smart home etc. This paper analyzes such trendy aspects incorporated in select buildings in Coimbatore City*

**KEYWORDS:** *Designed Spaces, Aesthetics, Building Automation.*

## INTRODUCTION:

Interior designing (space designing) emerged and was recognized as a technical field only in last half of 19<sup>th</sup> century. Interior design as a technical reproduction process has increased in sophistication. The designer hitherto must know how to use the vast range of materials and resources available and how to exploit them economically and aesthetically in his or her manipulation of the language of signs and images with which such sophistication emerge.

Need for ensuring safety and security is an important consideration in recent years. A dire need to bring in kinetics further adds to the list of efficient devices in designed spaces. Consumers in recent years are baffled with the array of sensor components that sense any function that is imaginable. They are designed with sensors called MEMS. Of course such sensor driven technologies come handy when designing smart and “greener” energy-efficient buildings. Among them many respond to human sensitive, Intelligent and kinetic characteristics. Incorporation of all these concepts invariably renders a status to the structure as one with Building automation. A building controlled by a BAS is often referred to as an intelligent building, "smart building" or "smart home. Advances in sensor technology surely had benefitted such applications. Motion sensors are used in various systems including home security lights and automatic doors. Devices embedded with an electronic component able to detect and or sense a signal (touch screens) or a physical condition (smoke detectors) is called sensors. Embedded systems for control of common consumer products like card readers to remote car controls, scanner system software which are technologies for access control, are but a few systems gaining access in to buildings as BAS. They also enroll those fitted with alarm capabilities. Systems for surveillance, safety and security (motion sensors) also join the group. In recent years enabling easy parking facilities which are again automated have stolen the show where skillful space designing faces a great challenge

Many such technologies ensuring BAS in constructions thus through the markets benefiting the building industry. It is but an array of choices for the entrepreneurs and the end users – the consumers and in some cases the promoters to select from. In the wake the scenario also has envisaged and patronized, minor and micro (tiny) units to flourish as the major companies rely mainly on outsourcing of products that help in developing and manufacturing such BAS components. People may wonder how and why? All components are primarily designed. Designing always supports diversity – different people, different thoughts. With every new version, models are improvised with innovative designing. Each and every product that rolls out into the market for space designing in buildings showcase blending of both the analytical and the creative minds – a very rich platform for entrepreneurship. Investigatory studies by Hamsathvani and Visalakshi Rajeswari in 2014 and Jannet and Visalakshi Rajeswari in 2017 had hinted on the percolation of such systems in Coimbatore, the industrial hub of Tamil Nadu.

## METHODOLOGY

Such proliferation of technology essentially has to have brought visible changes in the space designing trends in Coimbatore City. With this in view, a micro level study of specific locale in Coimbatore city where they have been incorporated was conducted. The sample selected included 20 samples each from professional centers, commercial units and service providers respectively. *Trends using such technology includes systems for control of egress and access in buildings, inter alia assurance for hygiene, safety and security and ease in circulation and commutation.* The checklist administered requested details on devices incorporated in their built

spaces enabling sensor driven systems, smart access control options, BAS and automated mechatronic systems (interiors and exteriors), which stand testimony to the stated trends in technology. The salient findings are presented below

### Salient findings

The salient findings of the study are discussed under the following headings:

- **Human sensitive devices installed for hygiene and safety**
- **Smart systems installed for access control**
- **Intelligent systems installed for safety and security**
- **Kinetic systems built – in for ease in vertical circulation**
- **Automated parking for ease in ingress and egress**
- **Impact of such systems on space designing and entrepreneurship**
- **Entrepreneurial prospects Vs the spurt in such technologies**
- **Future prospects**
- **Human sensitive devices installed for hygiene and safety:** Table explains relevant data

**TABLE.1. HUMAN SENSITIVE DEVICES INSTALLED FOR HYGIENE AND SAFETY**

Locus of study	Human sensitive devices installed (percent responding)		
	Doorways	Faucets	Hand dryers
Commercial centers (N =20)	45	15	15
Service providers (N = 20)	30	10	45
Professional centers (N = 20)	-	50	30

The study revealed a very slow process in transformation to human sensitive devices in the selected locales selected for the study. Revolving doors was negligibly represented

#### ➤ **Smart systems installed for access control**

Access control through biometric system was ensured only by 72 per cent of the total sample surveyed. Eighty per cent each of the commercial centers, and service providers respectively and 55 per cent of professional centers alone had ensured controlled access into their premises. The option was for biometric system employing fingerprint.

#### ➤ **Intelligent systems installed for safety and security**

The survey had brought to light that consumers are yet to welcome such smart technologies as there still existed an apprehension as to the guarantee they assure for quality in performance among end - users. The study also revealed four important components which ensured safety and security for the inmates to have gained entry into the selected locale, namely surveillance cameras (82%), fire and smoke alarms (70 & 50 % respectively) and smart cards (30 %). Nevertheless, data obtained on installation of such systems in the selected locale is presented in the following Table

**TABLE . 2 SMART SYSTEMS INCORPORATED IN BUILDINGS**

Locus of study	Smart systems incorporated (percent responding)			
	Surveillance camera	Fire alarm	Smoke alarm	Smart cards
Commercial centres (N =20)	90	65	70	30
Service providers (N = 20)	75	75	45	20

Professional centres (N = 20)	80	70	35	40
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An important aspect that ensures safety and security of inmates, namely smart cards had not registered well in the minds of the selected sample.

➤ **Kinetic systems built – in for ease in vertical circulation**

Kinetic systems enabling vertical mobility in interiors are elevators (lift) and escalators. Presence of these two concepts again differed in the studied locales. Among the total sample elevators had obtained entry in 74 per cent of the premises while only 12 per cent had opted for escalators. To be specific only 40 per cent of the commercial centers had appointed escalators. The other groups had not even thought about it. Contrarily 80 per cent each of service providers and commercial centers respectively and 60 per cent of the professional buildings had accommodated elevators in their space designing.

➤ **Automated parking for ease in ingress and egress**

Parking in public places is a headache and a stress booster nowadays. With a steady inflow of automobiles entering into city streets and less or no space allocated for parking, the exercise becomes increasingly cumbersome. While residences and apartments have started designing spaces to accommodate vehicles in their own premises in pre-designated areas, public places still expose a pathetic look. With the advent of automated parking systems which are highly efficient and space saving has found a rich niche in the city. Now designing space has started articulating around parking spaces too. It was not surprising to find many spaces in public areas were also designed to suit consumer needs. Here the need *per se* was ease in ingress and egress, facilitating smooth circulation in the horizontal space. The study revealed three types of vertical parking facilities to be popular in the City. When all the three groups namely, commercial centers, professional groups and service providers preferred to install puzzle parking, the first two groups also preferred vertical rotary system. Stacking of cars was less popular and was offered only by commercial centers

➤ **Impact of such systems on space designing and entrepreneurship**

The entire gamut of techno - gadgets explained above demand precision in housing them in appropriate places. Here just consideration of functional aspects alone does not count. It has to be designed for practical use. Hence, the designers had to be highly analytical than creative. Evidently the whole process of designing space to installing and commissioning the gadgets required skill involvement. In the journey, the field also invites people with potential for investment to embark on enterprises which are outsourced by promoters to enable such facilities in their new buildings. Definitely space designing now is very lucrative.

➤ **Entrepreneurial prospects Vs the spurt in such technologies**

The findings had revealed almost five to seven signature companies to be popular among promoters and the outsourced companies who dealt with wholesale and retail marketing of all the techno – gadgets stated above. Obviously incorporation of such human sensitive, intelligent and kinetic devices ably render for very high prospects in *product designing* and *space designing* as well and promote *creative and analytical thinking* substantially.



### ➤ Future prospects

There is yet another option where such players can have an active role. That is virtual designing which enables the client to see the space designed virtually before launching on a building project. As Visalakshi Rajeswari and Bagyalakshmi (2012) quote through this upcoming technology called virtual designing a building can be created with navigable, interactive, and immersive experience while still being designed when both architect and client can experience the structure and make changes before construction begins.

Another option lies in designing space for the physically challenged where the designer needs to be empathetic with the limitations of the client and design the space not only to suit him/ her with added facilities but also accommodate as many of the client's locomotive devices. A study conducted by Sarasvathi and Visalakshi Rajeswari (2015) shows ample proof for this.

### CONCLUSION

All these justify that space designing evidently is a challenge for interior designers (space designers) both in terms of engaging their creative and analytical minds for a spatial cause.

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## PROVISION OF STORAGE UNITS IN LIVING SPACES

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### ABSTRACT

*Storage is a major problem today. Living quarters have steadily become smaller, while attics, spare rooms, and basements have all but disappeared. More and more storage furniture with different designs, materials and a wide range of cost are made available in the market as readymade/ modular/ knockdown furniture. With this background, the investigator planned for the study on “**Provision of storage units in Living Spaces**”. Coimbatore was the area selected for the surveys. Three survey namely a household survey, a survey among selected showrooms and Architects/Interior Designers were conducted. One hundred households that belonged to the middle and high-income group (50+50) and twenty furniture shops which sold kitchen and bathroom storage units were selected for survey Ten architects/interior designers were also surveyed simultaneously. Maximum numbers of respondents surveyed were educated full-time homemakers, living in their own houses. Special storage system provided in the living rooms were showcases for storing audio-video systems, telephone stands, magazine holders, bookshelf units, special dividers with storage facilities. Walk-in wardrobe with complete storage solutions right from clothes, jewelry, bags to shoes in bedrooms was a special storage unit noticed in the bedrooms. Modular storage systems were seen in the kitchen. The architects informed that their customers considered cost as the major factor while purchasing storage units. Readymade storage units were preferred by their customers. The market survey revealed that storage units were mostly chosen by the customers from the existing ones. Economy, convenience, aesthetics/beauty/appearance, ease of maintenance, suitability, ease of operation and ergonomic design were the factors considered by the clients of the Interior Designers/ Architects surveyed. Customers were highly satisfied with customized units designed by the surveyed architects and*

*designers. This study may help the households to become aware of the available storage units in the market and help them to purchase an efficient storage unit for their living space.*

**KEYWORDS:** *Storage Units, Architects, Homemakers, Modular Unit, Aesthetics, Readymade Units.*

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## INTRODUCTION:

Storage is a major problem today. Living quarters have steadily become smaller, while attics, spare rooms, and basements have all but disappeared. Today people have more things to put away and apparently less time in which to do it. Yet many favor the uncluttered, clean-lined look as per the proverb "A Place for Everything and Everything in its place" by Benjamin Franklin does simplify house-keeping (Faulkner et al, 1986).

Family possessions get accumulated over a period as the family grows. Confusion and irritation among family members thrive when articles or personal possessions could not be found, and much time is wasted searching for misplaced items. Accidents often result from awkwardly stored equipment of all kinds. To serve the family well, storage facilities must be carefully planned with adequate space and accessibility of the space in mind. The size proportion and type of storage units used depend on the type and amount of items to be stored, the frequency of use and the degree of visibility desired.

Traditionally, the norm in India was to have the furniture custom made to specifications by the local carpenter. While this is still widely practiced, even in urban households, there has been a visible shift in people's preferences. This is largely due to the availability of quality readymade furniture, ranging from budget to mid-range to high-end, which eliminates the need for designing, finding a carpenter, supervising and waiting for the finished product with crossed fingers.

The importance of storage units has been realized by the people today. More and more storage furniture with different designs, materials and a wide range of cost are made available in the market as readymade/ modular/ knockdown furniture. Architects also show great concern to decorate the interiors of their clients with adequate and well-designed storage units. With this background, the investigator planned for the study on " Provision of Storage Units in Living Spaces" with the following objectives:-

1. To assess the storage units provided in the selected households.
2. To determine the recent trends in storage units available in the market.
3. To determine the views of architects/ interior designers on storage provisions.

## DESIGN OF THE STUDY

The study consisted of conducting three different surveys. Coimbatore was the area selected for the household survey, a survey among showrooms and Architects/Interior Designers. One hundred households that belonged to the middle and high-income group (50+50) were selected based on convenient sampling method. Direct personal interview method was chosen for conducting the study. A market survey was conducted by the investigator to know the availability of storage provisions in the market. Twenty furniture shops namely ten kitchen shops

and ten shops which sell bathroom fittings and accessories were selected for the survey. Ten architects/interior designers were also surveyed simultaneously. The personal interview cum observation method was adopted by the investigator for conducting the surveys using a well prepared independent interview schedule for conducting the survey in the households, showrooms and architects/interior designers. The Architects were interviewed to gather relevant information on storage units provided for their clients.

## RESULTS OF THE STUDY

The findings of the study are summarized under the following headings:

Phase 1: Findings of the Household Survey

Phase 2: Findings of the Market Survey

Phase 3: Information Obtained from Interior Designers/ Architects

### PHASE 1: FINDINGS OF THE HOUSEHOLD SURVEY

Maximum numbers of respondents surveyed were educated. Fifty seven per cent of the homemakers were full-time homemakers. A majority of 82 per cent were living in the nuclear family. Maximum of 46 per cent of the families belonged to small family. Maximum 48 per cent of the surveyed respondents had constructed their homes whose plinth area ranged between 1001 – 2000 sq.ft. Maximum 65 per cent of them were living in their own houses. Sixty three per cent of the houses of the respondents had two storey's. Maximum 46 per cent had 1-3 bedrooms in their houses. Special storage system provided in the living rooms were showcases for storing audio-video systems, telephone stands, magazine holders, bookshelf units, special dividers with storage facilities, space-saving wall shelves, niches with lighting facilities, etc. Walk-in wardrobe with complete storage solutions right from clothes, jewellerys, bags to shoes in bedrooms was a special storage unit noticed in 42 per cent of the households. Eighty four per cent of the households had separate provisions for storing crockery's in the dining room. The kitchen is the heart of the home, 68 per cent of the respondents had provided a modular storage system. A bathroom is a room for personal hygiene; almost all the respondents of the houses surveyed had installed open-shelves, cabinets, stands/racks, wall shelves, baskets etc...

Solid wood, teakwood, rosewood, plywood, rubber wood, particle board, MDF (medium-density fiberboard), HDF (High-density fiberboard), metal like steel, etc... plastic and glass were the materials commonly used irrespective of the living spaces in the selected households. Majority 92 per cent of the samples surveyed preferred matt and semi-matt finishes to glossy finishes. Sleek and elegant hardware was also used for the storage units in 86 per cent of the households.

### PHASE 2: FINDINGS OF THE MARKET SURVEY

#### A. Furniture Showrooms:

Ninety two per cent of the customers considered cost as the major factor while purchasing storage units. Storage units with in-built lighting fixtures (75 per cent), beds with hydraulic facility for easy storage beneath the beds (70 per cent), and cabinets to display crockery (65 per cent) were indicated as the storage units that had greater demand.

Readymade storage units were preferred by their customers as it helped customers to view the finished units before purchasing them as revealed by 100 percent of the shop keepers. Immediate buying and delivery and good finishing were referred by 95 per cent of the customers



and good quality by 80 per cent of them for their preference. The disadvantages of readymade storage units considered by the customers as perceived by the shopkeepers were availability of the storage units only in standard models, sizes, designs, colors, and finishes. The person responsible for the purchase of storage units as stated by 46 per cent of the shopkeepers of selected showrooms were mainly the users themselves. The surveyed showrooms revealed that 55 per cent of their customer's preferred readymade furniture, 70 per cent of their customers had shown preference even towards customized furniture while 85 per cent opted for both as per the availability/possibility in the showrooms. The market survey revealed that storage units were mostly chosen by 75 per cent of the customers from the furniture that is available in the showroom. It was found out from the survey that 60 per cent of the shops did not extend any after sales services.

According to the view of shopkeepers surveyed, 100 percent of them expressed that among all other living spaces maximum storage space and storage facilities are essential in kitchen and bedrooms. Storage space in bedrooms was felt necessary to store valuable belongings and clothes in the wardrobe. Special storage provisions like corner units, special dividers with storage facilities, niches with lighting facilities, sofas with storage provisions etc. were seen in above 85 per cent of the showrooms surveyed.

### **B. Showrooms which sold Kitchen storage units**

All the selected shops sold kitchen modular units of different styles and designs and brands. Based on the requirements and demands of the customers, 80 per cent of the showrooms provided customized modular units or a combination of modular units in some aspects and non-modular in the others. The common modular units preferred by all the users are cup and saucer rack, built-in plate rack, oil-pullout rack, bottle rack, hanging pots rack, utensils holder, cutlery holder, cookbook storage, sink shutters with detergent holders and overhead cabinets.

### **C. Showrooms which sold bathroom storage units and fittings**

All the bath showrooms provided the common storage options. Hundred percent of the customers preferred waterproof storage units for the bathrooms.

### **PHASE 3: INFORMATION OBTAINED FROM INTERIOR DESIGNERS/ ARCHITECTS**

Economical cost, appropriate size, aesthetics/beauty/appearance, ease of maintenance, suitability, ease of operation and ergonomic design were the factors considered by the clients of the Interior Designers/ Architects surveyed. They expressed that waterproof storage options for kitchen and bathrooms, modular kitchen storage, sliding wardrobes, niche with lighting, bar cabinets were highly on demand when it comes to customized designing of storage units. The advantages of customized units as viewed by their clients were, one can choose size, design, features, and color based on actual requirement and space available. Customers were highly satisfied with customized units designed by the surveyed architects and designers. The Interior Designers/Architect suggested only the most required and best-suited options for the kitchen, living room, bedroom, dining and bathrooms of their clients as per their expectations.

### **CONCLUSION**

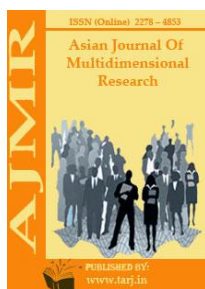
Storage is a major problem faced by almost all the households today as the needs for storage increases every day. People now are more conscious to provide an uncluttered clean look in their houses as it has become a status symbol. The market today is flooded with new trendy and

stylish storage units. The customers are attracted by the new storage units that come to the market. Every day they get latest design in the market. The customers get confused while it comes to the selection of storage units. This study may help the households to become aware of the available storage units in the market and help them to purchase an efficient storage unit for their living spaces. Besides based on the expectations of the consumers the shops could design and sell the storage units according to the taste of the consumers.

**"Provide places for all your things so that you may know where to find them at any time of day or night" – Ann Lee.**

#### **REFERENCE**

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## APPLICATION OF CAD IN APPAREL AND TEXTILE

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### ABSTRACT:

*Deigning has been in creation from the beginning of earth. Man seeing the thing around him made changes in each everything he used. The change was for comfort and beauty. Designing was carried out by hand but with introduction of computers, designing through has gained popularity. CAD, computerized designed development is a big leap in the fields of designing mainly because of the ease in usage and minimization in time. There are various soft wares in the market which help in development of designs for textiles and apparels. Advanced CAD systems provide designers with at least three major benefits like graphics capabilities, design storage and retrieval and automatic evaluation of specifications. Considering these concepts a number of studies are carried out for design development of both textiles and fashion garments. The research paper discusses about the role of computers in designing for textiles, home furnishings and clothing.*

**KEYWORDS:** *Computerized, Popularity, Considering, Furnishings, Retrieval*

## 1. INTRODUCTION

All things bright and beautiful,  
All creatures great and small,  
All things wise and wonderful,  
The Lord God made them all.

The lord created different shapes, designs and colours which have made man sit back wonder and think about the various concepts of design. The word 'design' is an English word from the Renaissance French word designer and the later Italian word disegno, which meant drawing, planning, sketching and designing. The creative arrangement of design elements such as shape, colour, line, mark and texture can be described as design. The aim of a work of art or design is aesthetic. Design is fundamentally concerned with improving the way things are – that is, with adding value more likely to be an improvement on something that already exists. Good design can transform lives (Emmacaprez, 2004).

In the modern digital era computer has become a part of man's day to day life. Almost all his thoughts and actions are digitalised and controlled by a small electronic chip especially in the field of textiles which includes both cloth designing and apparel designing, (Jhala, 2013). Today every second fashion changes and is modified to suit each individual. With these conditions designers have difficulty in keeping pace with the fast changing trends of the market. Sometimes they find that they are not ready to cater the market needs. It is not easy for them to remain competitive, by merely depending upon the traditional way of designing, because today's design becomes out of fashion tomorrow. Hence they lose a share of market, so to keep pace with fast shifting trends of market computer aided designing and manufacturing is very much required.

Dwivedi and Dwivedi (2018) tell that an advanced functional Computer Aided Design (CAD) technology aims on developing high performance apparel products with desirable thermal, biochemical and medical functions. Considering these concepts a number of studies are carried out for design development of both textiles and fashion garments. The research paper discusses about two case studies pertaining to the role of computers in designing for baby bed (Sanjan Koothoor, 2001) and Salwar kameez by (Lalithamagai, 2010).

## 2. METHODOLOGY

### 2.1 SELECTION OF SOFTWARE

Computer aided design and computers aided manufacturing come originally from the production environment. It was here that a direct return on investment could be quantified in terms of time saving, labor saving and improvement in quality. Coral draw, adobe illustrator, adobe photoshop are popular programs used by designers in various fields and several companies publish software. (Goworek, 2007). Coral draw is vector graphic software, allowing the user to produce world class illustrations with 16.7 million colours (Luther, 2008). Photoshop is specially used where the design has to be plotted on the point paper to be transferred to the loom. Adobe illustrator is the designing and pattern making software. Illustrator is not a tailor made fashion application it can also do many things other fashion specific applications can't. Illustrator is a very powerful tool for any graphic design work you can throw at it. Adobe illustrator has long been considered the norm for drawing technically correct and detailed flats. However, some industry individuals comment that the computer generated flats have a sense of looking "too perfect" regardless of your preference, if there is a hand drawn flat that needs to be copied to



look very technically. Considering the importance of designing the above mentioned soft ware and methods were used for creation of designs.

## 2.2 SELECTION OF PRODUCTS

**Salwar Kameeze** is one of the garments which are widely used in India irrespective of age. Home is never complete without textiles, commonly known as home furnishings. This sector includes living room items, bed lines, dinning linens, bath room textiles curtains and kitchen linens. Among these items bed linens are more personalized. Infants are the most vital person of a family. Caring for them becomes the most important work of all the family members. The infant sleeps for about 20-22 hours per day. Therefore a comfortable bed is needed. **Baby bed** is ready made and available in a large variety of shapes colours, and designs. In view of the above points, salwar kameez and baby bed were selected.

### 2.2.1 DESIGN DEVELOPMENT USING CAD.

#### 2.2.1.1 STEPS INVOLVED BABY BED DEVELOPMENT.

Photoshop (CAD) software was used to design baby bed because point paper could be produced for the designs prepared.

- **Sketching:** White background was set and using pen tool motives outline and cartoon was sketched. A grid was used for accurate placement of the motifs.
- **Scanning:** The motif was scanned in order to note the minute details also.
- **Edging:** The designs were edged to create a geometrical effect which in turn simplifies the weaving process.
- **Assembling:** The lines and forms in the edged design was repeated and assembled to suit a baby
- **Weave Application:** Pink colour was applied on the design since it was considered best for infant clothing and accessories. Depending on these points twill and jacquard weave known for their durability and variety were selected from weave catalog in computer and applied at suitable areas.
- **Float Control:** Some designs the form breaks up the mass of the figure to such a degree that no weave is required to be inserted either for stopping the floats of yarn for developing the effect. Hence float control was checked.
- **Proving the Design:** The repeat of the design for the weave was checked, laid and stored.
- **Transferring the design to the point paper:** The design was transferred on to the point paper and then to the punch cars to be used in the jacquard loom.

**Weaving:** Using the point paper, the design was transferred to the loom. The selected design was woven on a jacquard loom. The sketched design for baby bed is shown below;



### 2.2.1.2 STEPS INVOLVED IN SALWAR KAMEEZ DEVELOPMENT.

- **Selection of Grid Lines:** The length is set from the top side of the paper vertically and the width is set from the left side of the paper horizontally with the help of the pick tool in the tool bar. The pick tool is used to select and move the objects in the page of the pattern.
- **Developing Dimensions for Patterns:** The free hand tool was selected from the tool box. Horizontal and vertical dimension tool was used for width and length
- **Drafting Individual Points on Patterns:** Bezier tool was selected and the required the points were marked on the pattern and the neck, shoulder point, arm hole, crotch line were sized and shaped. The front and back of the kameez pattern were drafted individually
- **Marking Pattern Details:** The pattern details such as name of the pattern, grain line, on fold, cut numbers, front or back patterns was specified on the pattern using the text tool.
- **Saving the Patterns:** The pattern was saved in the specified space in the system and noted.
- **Exporting Patterns** The export option was chosen from the file menu. To export a particular pattern and design, the file type such as Bitmap file (or) JPEG (BMP or JPG) file was used and the content was utilized for dress designing.
- **Plotter Print:** The designs were selected and drafted into patterns. Then the actual size of a sample pattern is printed using HP plotter. Some of the created designs are shown below;





### 3. EVALUATION:

The designs and the processes of developing them were shown to hundred students mastering fashion to know the about the use of computers in designing and the constructed baby bed and salwar kameeze were shown to young mothers and college going students for their opinion about the cad designed products.

### 4. RESULTS:

- The students mastering fashion scored 100 percent good for the simple deign technique used. They all felt that both the methods were simple and a lot variations could be created in a simple manner within a short time. Everyone agreed that colours could be changed and view to get an idea as to how the design will look.
- Bed and all the salwar kameez designs scored 80% and 90% good for shape and colour 47%, 72% good for the material used, 70%, 85% good for smoothness and 65%,89% good for texture respectively and for comfort 85% and 90% good.

- Trimmings, seams and accessories scored 80%.

## 5. CONCLUSION:

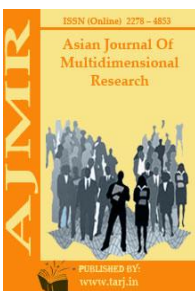
Computer Aided Design in fashion has created high tech styles in short duration boosting the fashion industry. Use of CAD by the fashion industries and fashion designers is increasing day by day. Moreover, CAD has become handy for fashion design students. The designers could explore and create more styles. A design package could be created by the designers with CAD fashion designing. This would be very much suited for custom made garments.

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## ANALYZING THE COST INCURRED ON WOOD IN URBAN RESIDENTIAL INTERIORS

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### ABSTRACT

*Building material is any material which is used for the construction purpose. Many naturally occurring substances, such as clay, sand, wood and rocks, even twigs and leaves have been used to construct buildings. One of the biggest advantages of using wood as a building material is that it is a natural resource, making it readily available and economically feasible. It is remarkably strong in relation to its weight, and it provides good insulation from the cold. Wood is highly machinable and can be fabricated into all kinds of shapes and sizes to fit practically any construction need. Wood carving, wood trim, wooden mural, baluster, armrest, wood floor, skirting line, ceiling and wall body are various forms of wooden components in designing interior. In oriental classical architecture, there are numerous examples employing various forms of wooden components with beautiful structures as the main decoration. In modern building decoration, we also often see various wooden "background wall" and wooden partition decoration which can be produced at the scene or be prefabricated in a factory and then assembled on site. Recently processed wood in the form of MDF, veneer, plywood and particle board has come to the market as an alternative source to meet the needs of the people. Hence this research is to analyze the cost incurred on application of natural and engineered wood in residential interiors.*

**KEYWORDS:** Natural Resource, Processed Wood, Sustainability.



## INTRODUCTION:

Wood has been used as a building material for thousands of years, being second only to stone in terms of its rich and storied history in the world of construction. One of the biggest advantages of using wood as a building material is that it is a natural resource, making it readily available and economically feasible. It is remarkably strong in relation to its weight, and it provides good insulation from the cold. Wood is highly machinable and can be fabricated into all kinds of shapes and sizes to fit practically any construction need.

Technology in manufacturing wood product has led to construction of interiors and exteriors at more cost effective prices. In the 1500's solid timber planks were the only form of timber available. Now over time, many new ways of milling have been introduced. Cabinet makers and carpenters have gained new knowledge and learnt from new craftsmanship abroad and new forms of timber products are still constantly being introduced (Bindra, 2009).

At a time when ecological concerns are high, the trend has been to move away from wood as a building material in order to prevent deforestation, in part as an attempt to manage greenhouse gases. Timber is a natural building material that offers superior performance and environmental advantages. Timber's flexibility and versatility offer a variety of design options that are limited only by imagination. Properly treated recycled wood materials offer a multitude of building and design solutions, creating living spaces alive with beauty, warmth and comfort (Wood Solution, 2015).

The world's forests contain more than 400 billion cubic yards of wood, but relatively little of that is turned into wooden building materials. Globally, there is a virtually inexhaustible supply of wood. The world has come to rely on concrete, steel, aluminum and brick building materials, but only 16% of all the fossil fuel consumed every year is used to turn those raw materials into construction products. Using processed engineered wood products would drastically reduce global carbon dioxide emissions and fossil fuel consumption. If managed properly, this could be done without loss of biodiversity or carbon storage capacity (Journal of Sustainable Forestry, 2015).

Due to increasing cost of natural wood, an alternative source of solid wood in the form of MDF, Veneer, Plywood, particle board has come to the market to meet the needs of the people. Hence the study on “**Analyzing the Cost Incurred on Wood in Urban Residential Interiors**” was taken up with the following objectives: To:

- Conduct market survey to acquire knowledge on the availability of different wood
- carryout household survey on the application of wood in furnishing the urban residential interiors and
- Develop a plan to analyze the cost incurred in utilization of natural and engineered wood.

## Materials and methods

This part consisted of a **market survey, household survey and total cost incurred on use of the natural and engineered wood**. The market study project the present scenario and growth prospects of wood in construction industry. Twenty shops popularly known for availability of building materials with special reference to wood was selected based on purposive sampling method. The outcomes of the study are discussed below:

### Outcomes of Market Survey

Market survey is to gather and analyze market data on consumer preferences, recent trends in market prices and the presence of competitive products. It also helps to know how much money one can spend on certain types of products. The materials available in these shops are shown in Table:

**TABLE 1: AVAILABILITY OF WOOD IN SURVEYED SHOPS**

Type of wood	Total N-20	
	Number	Per cent
Plywood	18	90
Teak	15	75
Veneer	13	65
Laminated	13	65
MDF	11	55
Paddock	11	55
Neem	7	35
OSB-Oriented Strand Board Beach	8	40
	6	30

(\*)- Multiple response

Table 1 indicates that plywood was used by a maximum of 90 per cent of the customers since it is applied commonly for floors, line the roofs and walls, and for wall paneling. It is relatively available in large size and easy in fabrication of curved surfaces also. It is particularly suited for shaping concrete for homes and buildings. Carpenters and cabinetmakers find wide use of plywood in furniture, cabinets and counters. Next priority is teak wood (75 percent), veneer and laminated (65 percent) and paddock (20 percent), was used by the selected residents in their interiors.

### Outcomes of household survey

#### Details of the House

Majority of 43 per cent and 33 per cent of the respondents had the total area of 1,000 to 2,000 Sq.ft and below 1000 sq.ft. Among this the carpet area utilized for the construction was 700sq.ft and above 2100 sq.ft. In the 80 surveyed families, only 33 percent were interested to carry out the renovation. The families did refurbishment within 5-6 years after their house construction-extension of rooms by 15 per cent (as per vastu sashtra), 39 per cent had changed doors and windows. Application of interior finishes was done by 42 per cent and other works like changing entrance was carried out by 24 per cent.

#### Amount spent on wood material

Twenty five per cent of middle income and 27 per cent high income groups spent approximately an amount of Rs.2,00,000/- and 4,00,000/- respectively for below 700 Sq.ft.As income increases, the amount spent on wood also proportionately increased due to the usage of high quality materials and increased space in different areas of the residence.

Wall units, floor units, tall units, doorways, TV units, doors, windows were the areas in which wood was applied by the selected households. The cost incurred for living room of 32-70 Sq.ft

was Rs.92,000 to 2,00,000 if natural wood used . But if engineered will be wood used for the same area nearly 50 per cent of the cost is reduced.

When cost involved for kitchen area was calculated for 60-110 Sq.ft, it was Rs.1,74,000 to 3,14,000 if natural wood used but for the engineered wood it was Rs. 84,000 to 1,44,000. In case of master bedroom, guest bedroom and children's room also the cost was low for engineered wood compared to natural wood.

In pooja room for a limited area of 60-90 Sq.ft the cost incurred was Rs.1,74,000 to 2,17,500 and Rs.80,000 to 1,05,000 for natural wood and engineered wood respectively. Whereas for bathroom, the residents who utilized engineered wood (21-35 Sq.ft) to the minimum extent spent an amount Rs.29,400 to 49,000. Even though natural wood brings out an aesthetic effect as it is comparatively costlier, one can use engineered wood to reduce 50 per cent of the cost.

**REASON FOR SELECTION OF NATURAL AND ENGINEERED WOOD IS DEPICTED IN  
TABLE-2**

Reason for selection	Total N-80	
	Number	Per cent
<b>Natural wood</b>		
Durable	67	84
Ease in maintenance	34	42
Aesthetics	45	56
Attractive colour	23	28
Brand preferences	34	43
Loyalty look	46	57
<b>Engineered wood</b>		
Economical	56	70
Multiple colour	25	31
Easy to maintain	35	44
Light in weight	18	22
Glossy effect	67	84
Availability of more designs	47	59
Durable	33	41

(\*) Multiple responses

Eighty four per cent durability was found to be the most important reason for the preference of natural wood. Other reasons being the aesthetics and loyalty look. But majority of the reasons expressed for the selection of engineered wood was 84 per cent glossy effect, 70 per cent economy of purchase and 59 per cent more designs available in the surveyed shops.

### **Suggesting the approximate amount for the middle and high income groups**

The investigator developed a plan for a middle and high income group to analyze the cost on application of wood in different residential interiors. The total area for middle income group was 857 sq.ft and high income group 1500 Sq.ft. The table below indicates the approximate cost for both the income groups on the utilization of wood:

**COST INCURRED ON APPLICATION OF WOOD FOR MIDDLE INCOME**

Type of room	Area (sq.ft)	Material	Total cost (in Rs.)
<b>Living room</b>	<b>215.16</b>		
Doorway	35(7x5)	Teak	42,000
Tv unit	40 (8x5)	Padak	40,000
Window	20 (5x4)	Wood plastic composite	8,000
Teapoy (2)	6(each 3)(3x2)	(Board)	4,800
<b>M bedroom</b>	<b>203.6</b>	Plywood	
Flooring	200 (20x10)		1,60,000
Tv unit	10 (5x2)	Plywoodand +decolum sheet	8,000
Dressing table	70 (10x7)	veneer	56,000
Wardrobe	63 (9x7)	plywood	50,400
Lamp table(2)	6(each 3)(3x2)	OSB	4,800
Door	35(7x5)	Plywood	7,000
Window	16 (4x4)	Laminated door	6,400
<b>Bed room :2</b>	<b>140(2)</b>	Wood plastic composite	
<b>&amp;3</b>	130 (10x13)		20,800
Flooring	10 (5x2)	Plywood	8,000
Tv unit	70 (10x7)	Plywood	59,500
Dressing table	6 (3x2)	Veneer	4,800
Light lamp	16 (4x4)	OSB	8000
Window	21 (7x3)	Padak	6,000
Door+ edging	<b>120</b>	Laminated door	3,80,600
	35(12x2.5)	Total cost (2 bedroom )	
<b>Kitchen</b>	30 (5x6)		28,000
Wall unit	28 (7x4)	MDF	24,000
Floor unit	16 (4x4)	MDF	22,000
Tall unit	<b>100</b>	plywood	4,600
Window	24 (6x4)	wood composite	
<b>Dining room</b>	25 (5x5)		24,000
Dining table	<b>50</b>		20,000
Show case		Teak	
<b>Bathroom</b>		plywood	14,000
Door (2)		Laminate door	
<b>Total cost</b>			<b>Rs.9,04,600</b>

**COST INCURRED ON APPLICATION OF WOOD FOR HIGH INCOME**

Type of room	Area (sq.ft)	Material	Total cost (in Rs.)
<b>Living room</b>	<b>211.5</b>		
Doorway	35 (7x5)	Teak	45,500
Tv unit	35 (7x5)	Paddock	35,500
window	16 (4x4)	Wood plastic composite (Board)	6,400
<b>M. bedroom</b>	<b>154</b>		
Wall (paneling)	150(15x10)	Plywood +decorum sheet	1,20,000
Wall unit	15 (5x3)	plywood	11,500
Tall unit	70(10x7)	plywood	56,000
Show case	12(4x3)	OSB	4,000
Door	21(7x3)	Laminated door	7,000
<b>Bed room</b>	<b>141</b>		
Tall unit	35(7x5)	Plywood	28,000
Wall unit	10(4x2.5)	OSB	10,400
Window	12(4x3)	Paddock	7,200
Door	21(7x3)	Laminated door	7,000
<b>Kitchen</b>	<b>212</b>		
Wall unit	23(11.5x2)	Neem	600
Floor unit	35(7x5)	Neem	18,000
Tall unit	21(7x3)	Neem	16,800
Window	12(4x3)	Paddock	72,000
<b>Pooja room</b>	<b>14.5</b>		
Door	21(7x3)	Teak	27,500
<b>Bathroom</b>	<b>34 &amp; 32</b>		
Door	21(7x3)	Composite plastic Board	14,000 (each 7,000)
<b>Total cost</b>			<b>Rs.3,88,900</b>

**CONCLUSION:**

As the design practitioners have a significant role to play in the well-being of the communities, wood offers many environmental benefits by being renewable and sustainable. But using wood to the minimum can help conserve the forest. Hence engineered wood products must be used as an alternative to natural wood in wide variety of residential, commercial and industrial construction projects.





## USE OF FURNITURE IN SELECTED HOUSEHOLDS OF COIMBATORE CITY

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### ABSTRACT:

*House is a place built for people to live in; physical, psychological and spiritual needs of a family should indicate the forms and materials of homes. Furniture are movables either for use or for ornaments with which house is equipped. It acts as a mediator between architecture and people. Furniture fulfills the specific function such as sitting, sleeping etc. it provides comfort in things we do. Furniture organizes the space within a room and exhibits one's personal taste. Furniture has become part and parcel of our life. Thus the study on "Use of Furniture in Selected Households of Coimbatore City" is chosen to ascertain the use and importance of furniture in the selected residences. A household survey was done in fifty high income households to assess the availability, use and preference of different furniture, analyze the efforts taken in the care and maintenance of furniture and the level of satisfaction in the use of furniture by the selected households. These households were selected by purposive sampling method. These high income families could afford to buy costly good furniture for various rooms.*

**KEYWORDS:** Furniture, Function, Household

## INTRODUCTION:

A house is a dwelling unit consisting of walls, floors, doors, windows, roofs etc in which human beings live. A house may have number of rooms. Each room will be only an empty space until it is furnished properly. Furnishings give meaning to a house. When the pre-historic man started to build the house to meet his needs, the first step towards settled existence was taken. The use of furniture indicates that people wanted to live permanently in one place and the type of furniture they selected reflected their kind of life (Gandotra et al, 2011).

A huge decorative house is incomplete without appropriate furniture. Furniture can not only make a building look comfortable and luxurious but also useful and complete. It is therefore important to take time to plan furniture which suits the needs in accordance to one's lifestyle (Khanna, 2001).if architecture is the structure or back bone of a house then furniture is the muscle. It makes the empty space habitable and functional. Thus the furniture lends certain character to a room which determines whether we call it "modern" or "traditional" or habitable. Reckitt (2004) claims that the feeling of being "at home" can't be bought, however, because it comes from an intimate relationship between us and our most personal place. One should make sure that the home is comfortable, warm and inviting and is a "lived-in" place.

## METHODOLOGY

A household survey was done in fifty high income households to assess the availability, use and preference of different furniture, analyze the efforts taken in the care and maintenance of furniture and the level of satisfaction in the use of furniture. These households were selected by purposive sampling method. These high income families could afford to buy costly good furniture for various rooms.

## HIGHLIGHTS OF THE STUDY

### A .Selection and Purchase of Furniture in the Houses

#### 1. Selection of Furniture

This heading presents the sources of information and factors influencing the selection of furniture for various rooms of the selected houses.

##### a. Sources of information

The knowledge about selection of furniture helped the households to choose the right furniture for their houses. Table 1 lists sources of information for the selection of furniture for their houses.

**TABLE 1: SOURCES OF INFORMATION**

Sources of information	Percentage (N=50)
Family members	90
Advertisement from newspaper	16
Internet	12
Interior designers	8
Exhibitions	8
Magazines	6
Architects	2
On line	2

A majority of members (90 per cent) were involved in choosing the furniture for their houses whereas 16 per cent obtained information from newspapers and 12 per cent from internet. Less than ten per cent of the families received information from architects, interior designers, exhibitions, magazines and online for purchasing their furniture.

#### **b. Factors influencing the selection of furniture**

This heading presents the factors influencing the selection of furniture for their houses. (Table 2).

**TABLE 2: FACTORS INFLUENCING THE SELECTION OF FURNITURE**

<b>Factors</b>	<b>Percentage (N=50)</b>
Comfort	74
Easy maintenance	44
Cost	38
Quality of product	34
Style	32
Beauty	20
Utility	8

Seventy four per cent of the selected households considered comfort as a criterion for selecting their furniture. The other factors which influenced the selection of furniture were easy maintenance (44 per cent), cost (38 per cent) and quality of the product (34 per cent), style (32 per cent), beauty (20 per cent) and utility (8 per cent) for the selected houses.

#### **c. Purchase of Furniture**

A majority of 54 per cent of the households designed furniture from their own carpenters, while 34 per cent of them purchased from local furniture shops and 24 per cent bought traditionally from only one shop.

#### **Expenditure on purchase of furniture**

The amount spent on purchase of all furniture in the selected houses is given in Table 3.

**TABLE 3: AMOUNT SPENT ON FURNITURE**

<b>Amount spent (in Rs)</b>	<b>Percentage (N=50)</b>
Up to Rs 1 lakhs	4
Up to Rs 2 lakhs	40
Up to Rs 3 lakhs	56

The amount spent for all the furniture bought or designed for their houses ranged between Rs one lakh- Rs three lakhs. Fifty six per cent of the selected houses spent up to rupees three lakhs whereas 40 per cent of them spent up to two lakhs and minimum of four per cent had spent up to rupees one lakh on furniture for their houses.

A majority of 90 per cent of the selected households were having current trend furniture. Fifty eight per cent of the selected households were not having furniture specially designed to suit custom need whereas 42 per cent were having furniture specially designed to suit for their needs.

**A. Information on Current Trends and specially designed Furniture**

Among the families which had custom need furniture, wardrobes were observed in the bedrooms in 12 per cent to keep clothes and other valuable items, eight per cent of them had cupboards in the bedroom to store their things and six per cent of them had diwan and pooja mandapam in the living room. Four percent of them had wall unit in the living room, it consists of TV unit and chest of drawers to keep their belongings. Each two percent had corner sofa and wardrobe in living room for sitting and storing and storage cupboard in dining room for storing the things needed for serving.

**D. Home Furniture based on Materials**

A majority of 88 per cent used wooden furniture in dining room, 86 per cent in living room, 82 per cent in bedroom, 50 per cent in study room and 20 per cent in pooja room, eight per cent in computer room and two per cent in foyer room.

Wooden material is used commonly for all types of furniture like movable, fixed, built-in, folding, multi-purpose, stackable, storage and upholstered. Metal (28 percent) is used for movable furniture. Similarly plastic (40 percent) is also used for movable furniture and very few for folding (16 percent) furniture.

**E. Care and maintenance****1. Extra efforts taken to maintain furniture**

Forty four percent had taken extra efforts for upholstered sofa to clean upholstery material using vacuum cleaning and 46 percent took extra efforts to maintain wooden wardrobes and wooden beds using varnishes and polishes. Ten percent had given extra care for maintaining glass table.

**2. Maintenance of furniture**

Two types of finishes were used such as varnishes (66 percent) and polishes (34 percent) for wooden furniture in the selected houses.

**3. Satisfaction derived using the furniture**

In a majority of 98 percent of the houses the furniture arrangement allowed ease of movement and use. Furniture was well maintained and in good condition in 96 percent of the households. Furniture served its purpose in 94 percent of the families and created aesthetic sense in 88 percent of the houses. Eighty six percent of the households were satisfied for the good selection of furniture for the reason for being proportionate to their rooms

**CONCLUSION**

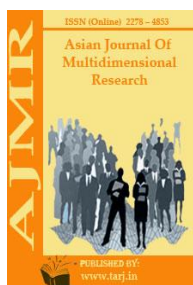
House becomes an ideal place for living when it is furnished with proper furniture. In this fast growing technological world the lifestyle and character of the houses change according to the trend. The households updated their knowledge on recent trends in the market and adopted the trends in the selection and use of furniture for their houses.

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## SOLAR PHOTOVOLTAIC POWER GENERATION-A GREEN INITIATIVE FOR RESIDENTIAL BUILDINGS

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### ABSTRACT

***“If we use our fuel to get our power, we are living on our capital and exhausting it rapidly. This method is barbarous and wantonly wasteful, and will have to be stopped in the interest of coming generations”***

**- Nikola Tesla**

*People have always consumed energy from the sun in many ways. In the present century the utilization of solar energy has been more proficient and successful and it is to be predictable to increase its use in future. It is becoming popular in India mainly due to the availability of sunlight throughout all the seasons at all the locations (Sharma, 2012). Among all the cities of Tamil Nadu, Coimbatore city is the only city, gaining popularity in rooftop solar systems and the Corporation of Coimbatore City won an award for the efficient use of solar energy (Komal, 2015). There is a huge possibility for the generation of solar power using unutilized space on rooftops of buildings. This could be the suitable solution of reducing energy demand and the local grid can use this power for local distribution. Solar photovoltaic was found to be an excellent alternative system for conserving non renewable energy and save on electricity bills. Hence a household survey was conducted among one hundred households in Coimbatore city through purposive sampling technique using a interview schedule.*

**KEYWORDS:** Consumed, Distribution, Photovoltaic,

## INTRODUCTION:

Human beings have always utilized energy from the sun in many direct and indirect ways. For the present century utilization of solar energy has been more efficient and successful and it is to be expected to increase in future. Solar energy is always consistent, free, and clean and it is reliable and the supreme quality of solar energy would be likely to be unending which is a form of renewable energy. There is a big difference between the renewable energy resources and non-renewable energy resources. Non-renewable energy is running out and there is a heavy shortage of non renewable energy as we use them. Usage of solar energy doesn't cause air pollution nor is involved in any kind of damage to the earth's atmosphere. Solar energy is becoming popular in India mainly due to the availability of sunlight throughout all the seasons at all the locations. Among all the cities of Tamil Nadu, Coimbatore city is the only city, gaining popularity in rooftop solar systems and the Corporation of Coimbatore City won an award for the efficient use of solar energy (The Times of India, 2015). There is a huge possibility for the generation of solar power using unutilized space on rooftops of buildings. The generated power in the building rooftop can be utilized and the excess power can be fed to the electricity grid with the solar photovoltaic technology using net metering. This could be the suitable solution of reducing energy demand and the local grid can use surplus power for local distribution. The present architectural design makes provision for rooftop solar photovoltaic system and necessary circuitry while making building design. Solar photovoltaic system produces no pollutants and in particular no greenhouse gases. It is visually unobtrusive and there are no moving parts, which reduces maintenance and also results in zero noise pollution (John and Nick, 2007). Increased utilization of the same would result in an all-round benefit, both in terms of cleaner environment and monetary gain, for the individual users as well as the Nation. Use of solar energy would save a lot of time and money for the user and this could be effectively diverted for increased productive activities and monetary gains which mean better living standards and overall prosperity (Rajeev, 2009).

### The objectives of the research study were:

- To understand the design potentials of Solar photovoltaic system (SPV system) installed in selected residences
- To find out the preference of brands of solar photovoltaic system in selected residential buildings.

## METHODOLOGY

The study was conducted in Coimbatore city because of being one of the smart cities of India, and solar panels have been installed in various residential buildings. The study was done among hundred households by using purposive sampling technique, where the solar photovoltaic has been installed for power generation. An interview schedule was used to elicit information on the type of (structural design) of the SPVs installed and power generation details.

## RESULT AND DISCUSSION

### a. Details of Solar Photovoltaic Power Generator installed in selected households

From time to time, everyone needs some sort of motivation to initiate any new venture. The important motivators for installing a SPV as revealed by the households were personal interest (27%), Government subsidy (26%), media (24%) and friends and relatives (18%).

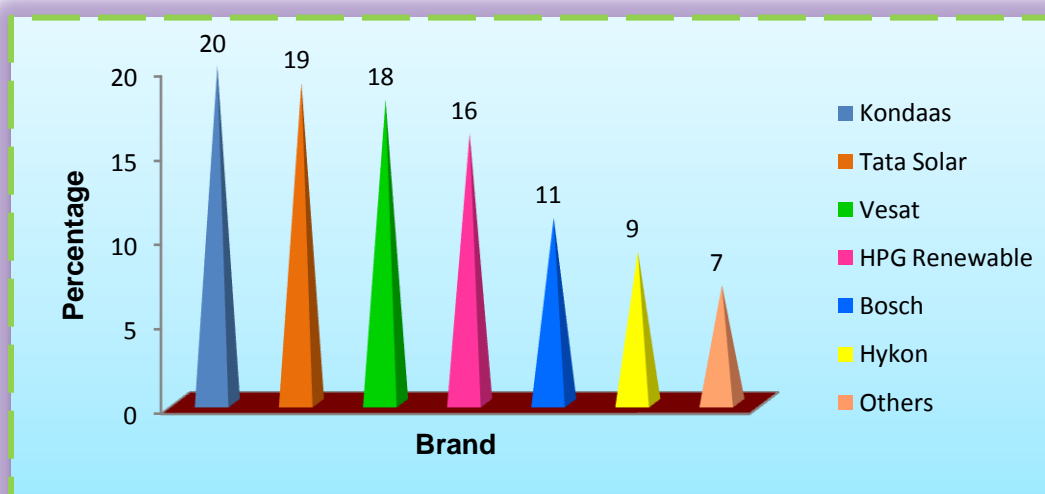
The table below indicates the capacity and amount invested on solar photovoltaic system.

**TABLE I**  
**DETAILS OF SOLAR PHOTOVOLTAIC POWER GENERATOR**

Capacity of installed solar panel (in kW)	Percentage (N:100)
< 1	26
1	28
2	22
3	15
4	07
5 and above	02
<b>Installation of SPV</b>	
Self Initiative	74
Government	26
<b>Cost incurred (in Lakhs) □</b>	<b>(N=74)*</b>
0.5 – 1.00	28
1.00 – 2.00	37
2.00 – 5.00	09

\*Installed with subsidy

Deciding on the capacity of solar photovoltaic system to be installed was mainly dependent upon the energy consumption of particular house, availability of space on rooftop to install solar photovoltaic, climate and intensity of sunlight received in a particular area and affordability of the family for installing the solar photovoltaic system. Maximum 28 per cent of the users had installed solar panel of 1 kW capacity based on the space availability. Minimum 26 per cent of the samples enjoyed a solar panel of capacity less than 1 kW which was mainly installed by the State Government under the scheme Pasumai Veedu Thittam. Seventy four per cent of the households had installed solar photovoltaic system on their own while the rest had depended on the scheme initiated by the State Government. The cost of SPV panels depended up on the capacity installed.



**Figure I**

### Information on the brands of SPV panels installed

A brand is a product, service or concept that is publicly distinguished from other products, services, or concepts so that it can be easily communicated and usually marketed. Brands are usually protected from use by others by securing a trademark or service mark from an authorised agency, usually a Government agency. There are various brands and products of solar gadgets available in the market. The above Figure I represent the brand of solar panels installed among the respondents. Different brands were installed in the households. Kondaas, Tata Solar, VESAT, HPG Renewable were the brands of solar panels installed by above 15 per cent of them. Brands such as Bosch, Hykon and some other brands were found only in few households. It may be that other brands are not popular among the surveyed households.

### Factors influenced in purchasing the Solar panels

Consumers use a well defined evaluation process to select product and vendors. Consumers take into account both how well a product appears to meet the needs and how important they felt those needs to be (www.clickz.com).

**TABLE II**  
**FACTORS INFLUENCED IN PURCHASING THE SOLAR PANELS**

Criteria	Percentage*
Electricity charges	85
Ease of operation	83
Cost	74
Environment consideration	72
Brand	61
Efficiency	53
Shop	36
Designing aspect	17

\*Multiple Responses

The factors influenced in purchasing the solar panels as revealed by the above 50 per cent of households were exorbitant rate of electricity, minimum attention required, reasonable cost, availability of free abundant solar energy, efficient functioning and choice of different brands. The design of the panels was given least importance. Hence it is essential to motivate the designers to create new design which attract the attention of the consumers

### Details regarding electricity consumption

It is noted from the below table that 32 percent of the respondents had to pay the electricity bill of above ₹8,000 whereas only 9 percent of the households had received the electricity bill from ₹500- ₹1,000 respectively. It is noted that after the installation of SPV Panels the households were able to save fifty per cent of their bill amount.

### CONCLUSION

Energy demand is increasing due to the increase in electricity consumption of in our day to day life with various new electronic gadgets available in the market. As a result, the installation of solar photovoltaic system can provide an excellent alternative way for saving electricity. Hence it is imperative that the households should be motivated to install SPV Panels in every household to conserve the energy. This is an upcoming field where new design, new innovations with

advanced features in this field will definitely motivate the entrepreneurs to take up a new venture and come up with new ideas.

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## AVAILABILITY OF GREEN MATERIALS FOR BUILDING CONSTRUCTION

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### ABSTRACT

*A house is a man's private resort, a shelter to protect from the storms and predators, like in stone age and from all the stress and problems that wait as soon as we leave the door. Building a house for family is one of those primordial things that functions as a home, ranging from simple dwellings such as rudimentary huts of nomadic tribes and the improvised shacks in shantytowns to complex, fixed structures of wood, brick, concrete or other materials. The architecture and the interior or exterior design have today reached a level and is considered to be a form of art, and the construction business is done by professionals to provide a secure, comfortable and healthier place to thrive in. As a consequence of globalization, urbanization and other social, economic, demographic and technological factors, the construction trends and techniques have changed over the centuries and the design and structure of houses are also subject to change. Building materials like roofing, insulation and wood products is just the start with for having an eco-friendly living space. Natural materials are always the healthiest alternatives for occupants and for the earth and are always lower emitters. Volatile organic compounds emitted from the green products were much safer and comfortable for human exposure. Hence the study on 'Sustainable Materials for Green Building' was undertaken to find out the availability of alternative building materials available in the market and their usage.*

**KEYWORDS:** House, Building, Green, Materials, Construction

## INTRODUCTION:

Home means sanctuary, the place to rest, relax, enjoy time with friends, learn and grow. Today's home builders use the latest equipment and technology, to make outstanding constructions, providing the stability, endurance and aesthetic value. Natural materials are always the healthiest alternatives for occupants and for the earth and are always lower emitters. Volatile organic compounds emitted from the green products were much safer and comfortable for human exposure (Lorenz, 2008).

As stated by Gautham (2001), green buildings often include measure to reduce energy consumption- both the embodied energy required to extract, process, transport and install building materials and operating energy to provide service such as heating and power for equipment. The green design field is growing, changing daily, can sustainably reduce or eliminate negative environment impacts and improve existing unsustainable design, construction and operation practices. As an added benefit the cost difference in adopting green building concept helps to lift and raise the green consumers ([www.grihaindia.org](http://www.grihaindia.org)).

When more people move into the city in search of employment or for educational purpose, they need quality and affordable living space. After the very large development of commercial property, housing sector in Coimbatore began to multiply manifold. For these residential and commercial sectors, eco-friendly building materials play a vital role ([www.spiritualityhealth.com](http://www.spiritualityhealth.com))

The sustainable supply of a green building material reduces the depletion of natural resources and market is responsible to introduce it to the consumers. This provoked a keen interest to take up the study on Availability of Green Materials for Building Construction with the objectives to,

- Collect information from the market regarding the availability of eco-friendly materials.
- Find about Marketing and selection of eco- friendly materials
- Know about Consumer response and suggestions given towards eco- friendly materials.

## METHODOLOGY

A Market Survey was conducted in 20 shops located in selected areas such as Saravanampatti, Ganapathy, Thudiyalur, Shanthi Gears, Race Course and Saibaba Colony of Coimbatore city to carry out study in this field. Shops selling eco-friendly materials were selected for the study based on purposive sampling method using an interview schedule. The collected data was consolidated and presented under Results and Discussion.

## RESULTS AND DISCUSSION

The findings of the Market survey pertaining to the study on Availability of Green Materials for Building Construction was discussed under the following headings:

### 1. Information of the shop

From the selected samples, 50 percent of the shops were retail type and 50 per cent were whole sale. Around 40 per cent of the respondents had established their firm between the year 2000 – 2010.

**TABLE 1: SPECIFIC INFORMATION OF THE SHOP**

Details	Percentage* (N:20)
<b>Qualities expected from the employees</b>	
Marketing skill	90
Communication skill	70
Technical skill	30
Manual power	20
<b>Nature of purchase</b>	
Outstation	80
manufactures	50
<b>Facilities provided</b>	
Transportation	50
Service	30
Installation	20

\* Multiple Response

It is clear that maximum of the selected shop owners expected good marketing (90 per cent) and seventy per cent were expected communication skill. Place of purchase of green material for shops depend on the quality, quantity and the cost of the materials. The materials were purchased locally, whereas materials like tile, building finishes were all imported and bought from other states. Eighty per cent of the shops were imported material from outstation. Facilities provided by the shop include transportations, installations, and service. Fifty per cent of them provided transportation facilities to their customers to improve their marketing values. The most preferred green materials from the shop include clay tiles for exterior façade, fly ash brick, manufactured sand, stone claddings, and plywood.

## 2. Availability of the green materials

Green materials are categorized into Construction Materials and Finishes

### a. Construction Materials

These materials are categorized into Conventional Materials and Green Building Materials.

**Conventional Materials:** Table 2 depicts the cost of conventional materials used for the construction.

**TABLE 2: CONVENTIONAL CONSTRUCTION MATERIALS**

Materials	Cost Range (Rs.)
River sand (100 cft)	3,800 – 4,300
Brick sun dried (per no.)	5-7
Stone dust (per ton)	816 – 1,904
<b>Blue metal (100 cft)</b>	
20mm metal	1775 – 2,300
40mm metal	1949 – 2,200
Brick (3000 no.)	12,000 – 14,000
Cement (50 kg bag)	274 – 330
Reinforced steel	45,000 – 48,000
<b>Wood (cu.ft)</b>	
Teak wood	2750 – 4,250
Bamboo wood	1775 - 3250

The conventional construction material include river sand, many types of bricks, stone and its dust, metals, cements, steels, woods. All the shop owner gave the same information that the bamboo materials are good to use on buildings because of its durability.

**Green Building Materials:** Table 3 shows the cost of green building materials used for construction.

**TABLE 3: GREEN BUILDING MATERIALS FOR CONSTRUCTION**

Materials	Cost range(Rs.)
<b>Sand</b>	
Manufactured sand (M sand)	2,200 –3000
<b>Bricks</b>	
LTGS brick (low temperature geopolymeric setting) (3000 no.)	3000
Fly ash lime gypsum brick (3000 no.)	15000
Fly ash brick (3000 no.)	14,500 – 15,000
Protherm bricks (1000 no.)	65,000
Cement – ash (50 kg bag)	400 -500
Pre-cast cement concrete block (per block)	30.50 - 47.50
Clay tiles (each)	40 -45

The cost of manufactured sand is from Rs. 2,200 to Rs. 3,000, LTGS brick costs Rs. 10 per number, protherm bricks seem to be costlier (Rs. 65 per no.) and each clay tile costs Rs. 40 to 45.

#### b. Finishes

These materials were given under Conventional finishes and Green finishes.

**Conventional finishes:** Table – 4 depicts the cost of conventional building finishes

**TABLE 4: CONVENTIONAL FINISHES**

Finishes	Cost range (Rs.)
<b>Floor finishes (per sq.ft)</b>	
Tile	47 – 50
Marble	75 – 200
Granite	80 – 150
Mosaic	28 – 30
Wood	79 – 120
<b>Wall finishes (per sq.ft)</b>	
Paint	98 – 150
Distemper	69 – 80
Emulsion	37 – 58
Wall paper	1500 – 2000
Wall tiles	50 - 500
<b>Window / door / ventilator Frames (sq.ft)</b>	
Wood	2750 – 4000
PVC (per length)	2900 – 3000
<b>Glass shutter (per sq.ft)</b>	50 - 100

The cost of floor finishes sold in the selected shops ranged from Rs. 47 to 200 per sq.ft where as wall finishes costs between 37 – 500 per sq.ft and wall paper were comparatively expensive (Rs. 1500 – 2000).

**Green finishes:** Table 5 projects availability of green finishes for building construction.

**TABLE 5: GREEN FINISHES**

Finishes	Cost range (RS.)
<b>Floor finishes (per sq.ft)</b>	
• Cork flooring	102 – 372
• Linoleum flooring	150 – 340
• Bamboo flooring	136 – 340
• Eco-friendly carpeting	204 – 884
• Hardwood flooring	204 – 816
• Recycled hard wood flooring	340 – 2040
• Natural stone flooring	476 – 2380
• Recycled metal tiles	2,040 – 4,760
• Recycled glass tiles	2,380 – 6,800
<b>Wall finishes</b>	
• Zero-VOC paint (100 sq. m)	120-240
• Natural paint	140-300
• Wall paper	40 – 2000
• Wall tiles	45 - 300
<b>Window / door / ventilator frames (per sq.ft)</b>	
• Wood	680 – 1,000
• Aluminium (per length)	1,200 – 1,800

In the material details collected from the shop the bamboo flooring and linoleum flooring were low in cost. Recycled glass tile were more durable and expensive (Rs. 2380 – 6800).

### 3. Marketing tool

Effective marketing tools were followed so as to expand their shop and also meet the competitions in the industry. Web service was used by 80 per cent and newspaper by seventy per cent. Fifty per cent were advertising in the magazine.

### 4. Advantages and suggestions of green building materials

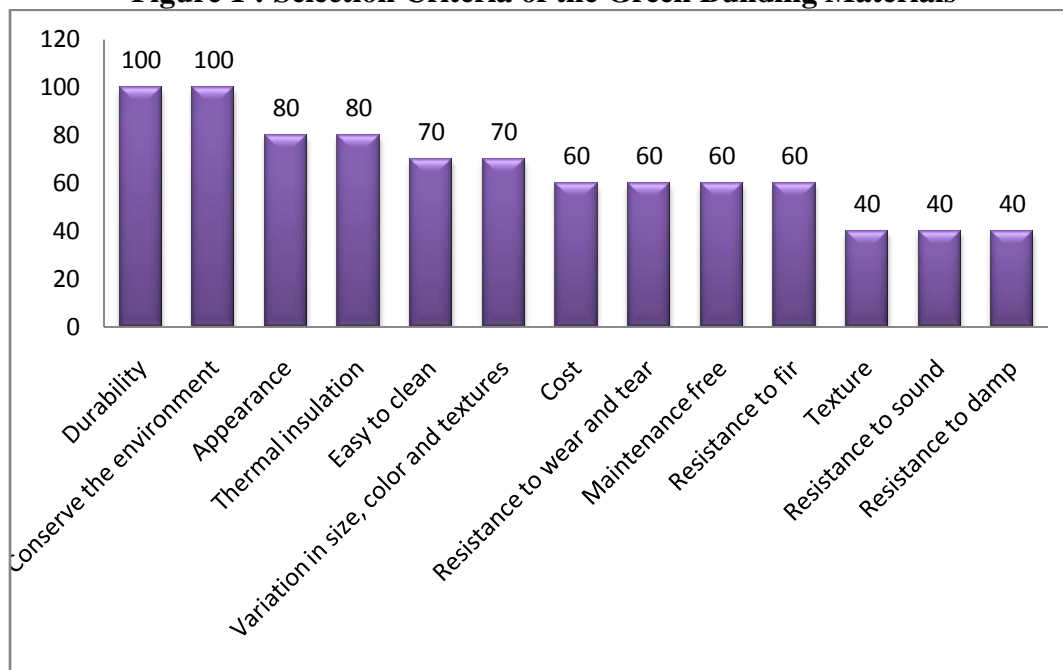
The response of the customer toward the eco-friendly materials differ because of their knowledge and awareness on green buildings. Majority of them responded green materials as reused products. Because the green building materials are friendly to the environment and it does not affect the nature. The common advantages that are given by the shop owners were the green materials are low maintenance and operation cost, energy efficient, and enhances indoor environment at quality. All the shop owners expressed that the cost of given green building is too high and it is the main disadvantage.

The suggestions were collected from respondent about the green building materials when suggesting eco-friendly practices was given by respondents, it was understood that majority of

(90 per cent) them followed planting of deciduous shade tree to reduce energy use and evergreen to save energy and cold winter wind as well as follow xeriscaping in their landscape garden.

## 5. Criteria for selecting green building materials

**Figure 1 : Selection Criteria of the Green Building Materials**



It is clear that, the selection of materials largely depends on the durability, appearance, and thermal insulation. All of them expressed that the selection is based on conserving the environment. Around 80 per cent is selection is due to appearance of the material and thermal insulation is provides to the house. Sixty per cent of the selection criteria are based on the maintenance. Least performance is on the texture of materials and resistance.

## CONCLUSION

It could be concluded that Green Building is the most important and environmentally responsible idea that more and more people need to adopt. This study identified the exciting developments that took place in the technology front and studied the availability of various materials in the market. These green buildings are dynamic environments that respond to their occupants' changing needs and lifestyle and that "greening" will provide a tangible and significant return to the environment.

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## NATURAL FIBRES FOR HOME TEXTILE APPLICATION

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### ABSTRACT

*Natural fibres are obtained from natural source either from plant or animal or mineral source. The fibres extracted from the nontoxic and non edible crops is of great potentiality these days. The products made from these fibres are cent percent eco friendly and bio degradable. The products which are known for cradle to cradle effect instead of cradle to grave effect are also well appreciated. This study focuses on the extraction of the fibres from the abundantly available nonfood crop Agave americana and conversion of the fibres into fabric mixing cotton to it to improvise the properties suitable for home textiles. The ribbed woven structure was prepared. And also it was dyed with natural dye and converted into home tech products. These were evaluated at each stage for the required parameters to fulfill the requirements of home tech. Cotton-Agave Americana ribbed woven madder dyed original sample was noted to have good in general appearance, bright in colour, high in lustre, smooth in texture and uniform in dye shade as per the ratings of majority of judges. The performance studied sample showed decrease in ratings in the above parameters. The colour fastness properties of cotton-Agave americana ribbed woven scoured, bleached, madder dyed and performance studied sample showed a marginal difference to crocking and light, over original sample. The tensile strength, elongation, stiffness, weight and thickness were slightly reduced in performance studied runner samples over original sample in both warp and weft directions. The performance studied samples showed an increase in fabric count, wicking, sinking speed and drop immersion speed.*

**KEYWORDS:** Natural Fibre, Ribbed Woven, Agave Americana, Home Tech Products.

## 1. INTRODUCTION

Natural fibres are obtained from natural source either from plant or animal or mineral source. The fibres extracted from the nontoxic and non edible crops is of great potentiality these days. The products made from these fibres are cent percent eco friendly and bio degradable. The products which are known for cradle to cradle effect instead of cradle to grave effect are also well appreciated. This study focuses on the extraction of the fibres from the abundantly available nonfood crop *Agave americana* and conversion of the fibres into fabric mixing cotton to it to improvise the properties suitable for home textiles. The ribbed woven structure was prepared. And also it was dyed with natural dye and converted into home tech products. These were evaluated at each stage for the required parameters to fulfill the requirements of home textiles.

## 2. MATERIALS AND METHODS

The materials and the methods used are discussed under.

### 2.1 Extraction of *Agave americana* Fibres

The leaves are fleshy and require mechanical decortication for separation of the fibres, the method of decortication was adopted for extraction of the fibres from the leaves<sup>1</sup>. The leaves of equal length were arranged together and fed into the decorticator. The fibres obtained were washed, dried and combed when slightly wet, using a suitable brush. Combing was done to separate the short fibres from the long fibres<sup>2</sup>.

### 2.2 Softening, carding and spinning of Fibres

The oils are often used on fibres as lubricants to help spinning efficiency<sup>3</sup>. Hence, to lubricate and soften, the *Agave Americana* fibres, these were cut into suitable length and then treated with Turkey Red Oil and piled up for 24 hours. Then the treated fibres were carded using breaker cards. Slivers obtained from breaker card were fed into this machine, ten slivers at a time for obtaining uniform slivers. The slivers obtained from the finisher card were fed into intersecting drill draw frames of passage I, II and III subsequently for drawing. Two or more slivers from the finisher card were fed into the passage I. This was passed through passage II and passage III of the drawing machines to obtain more regularity and uniformity in the yarns<sup>4</sup>. The sliver of *Agave Americana* were first drafted in the flyer drafting field which is often designed on a three-roller-two-apron-drafting unit. From the drafting field the drawn sliver was transported over the flyer top into the flyer log which exists at the bottom. The vertical movement necessary for the winding is accomplished by the bobbin. Because the flyer operates at a constant speed, the vertical movement and the revolution per minute have to be adjusted continuously according to the bobbin diameter. The limit of rotation per minute for the flyer is about 1300 to 1500 rpm

### 2.3 Weaving Process

Sizing of the warp threads was done to *Agave americana* to reduce the effect of friction during weaving. Fabrication was done using power loom to prepare cotton-*Agave americana*, ribbed structure.

### 2.4 Processing of Fabrics

The woven fabrics were scoured and bleached for assessing the important property changes. These fabrics were also dyed for making it suitable for different end uses. Scouring is

a pretreatment process that removes the dirt, dust, acquired impurities including batching oil, added in spinning<sup>5</sup>. Hydrogen per oxide bleach as it is free from chlorine atom unlike chlorine and chlorite bleaching, and it also improves product quality<sup>6</sup>. Natural dyes were applied for selected fabrics to make them suitable for different end uses.

## 2.5 Dyeing of Fabrics

For madder dyeing, alum was used as mordant. Pre mordanting technique was used for the study. The madder dye powder was made into a paste, and mixed in water. This mixture was boiled for 30 minutes and the fabric was immersed in the dye bath and left for 30 minutes. The material liquor ratio followed was 1:20. Alum was mixed in water and boiled. The dye dipped fabric was then immersed in the mordant solution and left for 60 minutes. This was then washed using soft cold water and then dried in the shade. The dyed fabric samples were then analysed for the colour fastness to washing, rubbing and light.

## 2.6 Conversion of the Ribbed Woven Cotton-*Agave americana* Fabrics into Products

The ribbed woven cotton-*Agave americana* fabrics were converted into table napkins, mats and runners. The prepared products were subjected to application study by imparting 10 washes after use. These were then evaluated subjectively and objectively, for colour fastness properties. The nomenclatures of the samples are: CARSBM – Cotton Agave Ribbed Woven Scoured Bleached Madder Dyed sample and CARSBMW - Cotton Agave Ribbed Woven Scoured Bleached Madder Dyed Washed sample.

## 3. RESULTS AND DISCUSSIONS

The results of subjective and objective analyses of ribbed woven samples are presented and discussed under.

### 3.1. Subjective Evaluation

The findings of the subjective evaluation of ribbed woven madder dyed samples are given in Table -I

**TABLE – I**  
**VISUAL ASSESSMENT RATINGS OF RIBBED WOVEN FABRIC SAMPLES**  
**ON PERFORMANCE STUDY**

S.No	Sample	Aspects in Percentage													
		General Appearance			Brilliancy of colour			Lustre			Texture			Evenness	
		Good	Fair	Poor	Very bright	Bright	Dull	High	Medium	Low	Smooth	Medium	Rough	Even	Uneven
1.	CARSBM	100	-	-	95	5	-	90	10	-	100	-	-	100	-
2.	CARSBM	90	10	-	90	10	-	90	10	-	100	-	-	85	15

From the Table – I, it is clear that the **general appearance** of sample CARSBM was rated as good by cent per cent of judges whereas the sample CARSBMW was rated as good only by 90 per cent of judges. As for the **brilliancy of colour** the maximum of 95 per cent of judges rated sample CARSBM as very bright in colour whereas the performance studied studied sample

CARSBMW was rated by 90 per cent of judges as very bright in colour. **Lustre** of both the samples was found to be high as rated by 90 per cent of judges. Samples of CARSBM and CARSBMW were rated as soft in **texture** by cent per cent of judges. Cent per cent judges rated sample CARSBM to have **evenness in dye** whereas the performance studied sample CARSBMW was rated to have its evenness in dyeing only by 85 per cent of judges.

### 3.2 Objective Evaluation

#### 3.2.1 Colour Fastness of Cotton-Agave *americana* Ribbed Woven Madder Dyed Fabrics

The samples CARSBM showed good colour fastness rating of 4 to washing, crocking (in dry and wet conditions) and light. The washed sample CARSBMW had good fastness rating of 4 to washing whereas it had fair rating of 3 against crocking and light. Hence it could be concluded that there is a notable reduction in colour fastness of the samples CARSBMW to crocking over their respective original samples. The reduction in colour fastness to light was noted in sample CARSBMW.

#### 3.2.2. Properties of Cotton-Agave *americana* Ribbed Woven Original, Processed and Performance Studied Runner Samples

The result of properties of cotton-Agave *americana* original, processed and studied runner sample is presented in Table – II.

**TABLE – II PROPERTIES OF COTTON-Agave Americana RIBBED WOVEN ORIGINAL, PROCESSED AND PERFORMANCE STUDIED RUNNER SAMPLES**

S.No.	Test details	CAR	CARS	Loss/Gain (%)	CARSB	Loss/Gain (%)	CARSBM	Loss/Gain (%)	CARSBMW	Loss/Gain (%)
1	Fabric count (yarns/inch)	22	24	9.	25	13	25	13	25	13.63
		27	29	7.	30	11	30	11	30	11.11
2	Weight (GSM)	36	32	10	28	22	27	22	27	23.54
3	Thickness (mm)	1.	0.	18	0.	20	0.	17	0.	20.16
4	Tensile strength (N/m <sup>2</sup> )	67	62	6.	64	4.	52	22	50	25.70
		94	91	3.	93	1.	92	2.	90	4.23
5	Elongation (%)	32	29	9.	30	6.	29	9.	30	6.25
		14	12	14	13	7.	13	7.	13	7.14
6	Stiffness (cm)	2.	2.	4.	2	9.	1.	18	1.	31.81
		6.	5.	21	5	26	4	40	3.	48.30

7	Wicking(cm)	6.	6.	11	7.	20	7	12	8.	37.09
		7.	8	8.	8.	12	8	8.	8.	16.21
8	Sinking (seconds)	20	17	15	7	65	7.	62	6	70.00
9	Absorbency (seconds)	19	13	31	10	47	9.	50	8	57.89

The **fabric count** was increased in the sample CARS and CARSB by 9.09 per cent, 13.63 per cent which was retained in rest of the treatments also along the warp direction. The fabric count was increased in the samples CARS and CARSB by 7.4 per cent and 11.1 per cent respectively which was retained in the rest of the treatments also along the weft direction. The **weight** of the fabric was reduced in samples CARS and CARSB by 10.2 per cent and 22.1 per cent respectively. Dyeing of the fabric had further reduced the weight of the sample CARSBM by 22.9 per cent. The sample CARSBMW showed greatest weight loss of 23.54 per cent over the original sample.

**Thickness** of the fabric sample was reduced gradually on CARS and CARSB by 18.4 per cent and 20.1 per cent. The thickness was increased slightly on dyeing as the loss was only 17.6 per cent. In sample CARSBMW, thickness reduction was the highest of 20.16 per cent due to the wear and wash of the sample. The **tensile strength** of the samples CARS and CARSB was decreased to 6.98 per cent and 4.90 per cent respectively over the original sample in warp direction. In samples CARSBM and CARSBMW the reduction in tensile strength was observed to be, 22.13 per cent and 25.70 per cent respectively. The dyed sample showed a gain in strength over bio polished sample. Reduction in strength was 3.19 per cent in sample CARS whereas the sample CARSB showed only 1.06 per cent reduction. The samples namely CARSBM and CARSBMW showed loss in strength of 2.12 per cent and 4.23 per cent respectively over original. **Elongation** in warp direction, the sample CARS showed a decrease in elongation of 9.37 per cent over the original whereas the sample CARSB showed a loss of only 6.25 per cent. The samples CARSBM and CARSBMW showed loss in elongation of 9.37 per cent and 6.25 per cent respectively. In weft direction, a loss in elongation was noted in the sample CARS of 14.2 per cent and sample CARSB of 7.14 per cent in weft direction. The loss further increased in the sample CARSBM by 7.14 per cent respectively which was retained in sample CARSBMW also.

**Stiffness** in sample CARS showed a reduction in stiffness of 4.54 per cent followed by sample CARSB of 9.09 per cent loss which further was lost in the sample CARSBM of 18.1 per cent which was drastically reduced in sample CARSBMW by 31.81 per cent over original sample in warp direction. The stiffness was reduced in sample CARS by 21.7 per cent the sample CARSB exhibited further reduction of 26.1 per cent in the weft direction. Reduction occurred further in sample CARSBM by 40.9 per cent. The sample CARSBMW showed the highest stiffness reduction of 48.30 per cent. This may be due to the wear and washes carried on the fabric.

**Wicking** height was increased after each treatment in samples CARS and CARSB of 11.2 per cent and 20.9 per cent respectively in warp direction. On dyeing a loss of absorbency was noted as the wicking height increased to only 12.9 per cent over the original sample. Sample CARSBMW showed the highest wicking capacity of 37.09 per cent along warp direction. In weft direction also the same trend of increase in wicking was noted in samples CARS and



CARSB of 8.1 per cent and 12.16 per cent respectively over the original sample. The sample CARSBM showed a reduction in absorbency as the wicking height increased only to 8.10 per cent over the original. The sample CARSBMW showed drastic increase in wicking height. **Sinking** time was decreased in samples CARS and CARSB by 15 per cent and 65 per cent respectively over original sample. In dyed sample it was reduced further by 62.5 per cent, sinking time was drastically reduced in sample CARSBMW by 70 per cent over original sample. In the **Absorbency test** the time taken for the fabric to absorb water drop reduced after each treatment in sample CARS and CARSB to 31.5 per cent and 47.36 per cent respectively. The sample CARSBM showed a slight reduction of 50 per cent whereas the samples showed highest absorbency with least time for the penetration of the water droplet into the fabric showing reduction of 57.89 per cent over the original sample.

Hence it could be concluded that though there was a reduction in certain physical properties of cotton-*Agave Americana* ribbed woven sample utilized as runner, and increase in the comfort qualities was observed in the fabric sample.

### 3.3 FINDINGS OF THE TESTS CARRIED FOR WOVEN FABRICS IN HOME TEXTILES AS RUNNER

- Cotton-*Agave americana* ribbed woven madder dyed original sample was rated as good in general appearance, bright in colour, high in lustre, smooth in texture and uniform in dye shade by majority of judges ; whereas the performance studied sample showed decrease in ratings in the above parameters. The colour fastness properties of cotton-*Agave americana* ribbed woven scoured, bleached, madder dyed and performance studied sample (CARSBMW) showed a marginal difference to crocking and light, over original sample.
- The tensile strength, elongation and stiffness were reduced in performance studied runner samples (CARSBMW) over original sample in both warp and weft directions. Weight and thickness were also reduced in the performance studied samples, whereas fabric count, wicking, sinking speed and drop immersion speed increased in the same.

## 2) CONCLUSION

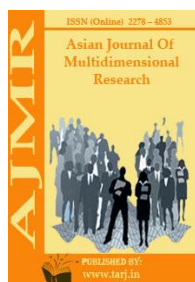
Thus it could be concluded that the fibres obtained from the nonfood crop *Agave americana* has very high potentiality in preparation of the products suitable for home furnishings. Many more products could be made by giving various finishes.

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## DESIGNING TOOLS AND METHODS TO INCULCATE VALUES AMONG SCHOOL CHILDREN

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### ABSTRACT

*Education is necessary for everybody. Education is very vital, deprived of education no one can lead a good life. Inculcation of values among the students can play a very important role by shielding them from negative influences which may be caused due to present day gross consumerism and an aggressive rush for self fulfillment. Value is defined as a “concept which is accepted by the sub-conscious mind, is understood by all and perceived by the individual”. Conceives value as in the broadest sense anything good or bad is a value. This paper, shows an insight on an attempt made to impart values to children by using **designed tools** and methods employed during the training programme in school. Teaching and learning are the important element in education. The teacher uses different approaches substantial to teach their students and their active learning. Visual aids are tools that arouse the interest of learners and help the teachers to explain the concepts easily. They are instructional aids which are used in the classroom to encourage students learning process. The main aim of this study is designing various tools and methods meant for application while teaching values to the children such that it will help them to remember and understand the concept clearly. The knowledge and awareness gained is expected to be practiced in their day to day life and help spread an aura of positive energy around them.*

**KEYWORDS:** Values, School Children, Designing Tools, Visual Aids, Methods

## INTRODUCTION:

*“The function of education is to teach one to think intensively and to think critically. Intelligence plus character - that is the goal of true education.” – Martin Luther*

The need of value education in today's context cannot be overemphasized. These days we are all surrounded by gross consumerism and an aggressive rush for self-fulfillment. (<http://www.ripublication.com/ijepa.htm>)

Education is a systematic attempt towards human learning. All learning is subjective and self-related. Educational activity starts with the individual. What can empower a nation that, in recent times, has earned the credibility of becoming an intellectual capital of the world? It is education. Education that is value-based and one that imparts roots and also gives wings. (Sharma, 2016)

Values permeate the whole of human existence and are a major factor in determining what sort of human beings they are and how one will behave. Values in their nascent stage appear as needs, emotions and interests varying in specificity, intensity and depth. When these acquire certain definiteness, intensity and stability in the affective life of the individual and at the same time obtain objective social approval and validation these comprise the nuclei of value formation. (Mikkili, 2014)

## OBJECTIVE

- To design a course content and plan of action for inculcation of values
- To design tools to inculcate values to the school children during training programme

## METHODOLOGY

For the study a private school was selected in Saibaba Colony, Coimbatore and the school children were selected through purposive sampling to inculcate values to them. A training programme was conducted in the school according to the time table given by the higher authorities of the selected school. A course content and plan of action was designed as shown in Table I to be followed during the training programme. In order to apply these course and actions, tools and methods were designed to teach them about values and how to put them into practice.

### Tools and methods used for inculcating values for school children

#### Approaches and Strategies

There is a general acceptance that education must provide the thrust of nurturing values. It is however, not clear how this is to be achieved in schools. Some organizations/schools prefer to keep as a separate subject while others consider values to be integrated with regular school activities. The focus also varies. While some emphasize on yoga, meditation and education about religions, others focus on democratic and national values. (Rukhela, 2003).

The teaching of certain procedural values, such as logical or critical things, is essential to pedagogical effectiveness. In order to make students able to evaluate rationally various conclusions and recommendations and to which they are exposed during their life, there is a need to teach the children the value of rational analysis and values among students. Lecture was the method use to impart value education

### Some General Strategies appointed

Experiential and participatory modes of learning can be successful only if children have the right attitude and values. Some experiential and reflective strategies which can be used and appropriately integrated with curricular areas and activities in schools are discussed here. Some are more suitable for elementary stage and others are for secondary and senior secondary stages. In view of the complexity of the process of values development and the broad range of values to be nurtured, appropriate strategies for different stage/s need to be identified by schools. In this study the following have been used

- **Silent sitting**
- **Role plays**
- **Visual aids.**
- **Digital learning resources**
- **Stories.**
- **Group singing**
- **Group activities**
- **Questioning**

The course content and plan of action are shown in Table 1

**TABLE 1: COURSE CONTENT AND PLAN OF ACTION OF VALUES**

S. No.	Topic	Course Monographs	Methods/ Aids Used
1	Selection of School	Selection of School, Parents and Teachers Meeting and Framing Questionnaire	Lecture and Discussion
2	Co-operation	Conflict Resolution	Painting, Games, Puppet Show, Group Discussion
3	Freedom	Integration, Co- ordination	Painting, Games, Puppet Show, Group Discussion
4	Happiness	Creativity, Fairness, Feelings, Joy	Lecture, Painting, Stories and discussion
5	Honesty	Truthfulness, Trust	Stories, Lecture, Charts
6	Humility	Good manner, Honor, Hospitality	Lecture, Group Discussion
7	Love	Friendship, Forgiveness, Compassion, Generosity, Service	Lecture cum Demonstration, songs, Drama and stories
8	Peace	Patience, Thankfulness ,Self Acceptance, Self –Discipline	Lecture, stories, Silent sitting
9	Respect	Self respect, Loyalty, Determination	Lecture, stories participatory discussion
10	Responsibility	Citizenship, justice, consideration, patriotism to protect National Property	Lecture, songs, stories.
11	Simplicity	Strength, Hardness, Courageous, Polite, Self –Analysis	Lecture , Group, stories, Participation and discussion
12	Tolerance	Problem solving, faith, helpfulness,	Group discussion, Lecture,

		kindness	stories
13	Unity	Integration, Teamwork, Harmony, Feeling of oneness	Stories, Role Play, Group activities, Games

During the training programme these contents and plan of action were followed while teaching the school children. It was arranged according to the topics and the type of methods or aids to be used.

### CONCLUSION

The tools and methods that were designed and used were of great help in teaching values to the school children. Through these tools and methods incorporated in the training programme, most of the children showed more interest in listening and learning. They even co-operated very well during the training programme. Group discussion and questioning round shows enabled more interaction between the children and the investigator. In this session many values were discussed and the children showed interest to practice them. The tools designed exclusively for this have been of satisfactory use.

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## DESIGN OF KINETIC PARKING SYSTEMS AS VIABLE OPPORTUNITIES FOR SERVICE ENTREPRENEURSHIP

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### ABSTRACT

*India, where the number of parking is not sufficient for private vehicles significant social problems such as traffic congestions, fuel waste, air pollution and vehicle accidents arise because of extra traffic. In all categories of movement, the motor car is the transport mode, and the problem of where to park is a universal constant. Parking pervades one's lives to the extent that one is substantially dependent on cars for everyday mobility. There is no real alternative to an **automatic-parking system**, where large numbers of cars are parked or high-traffic volume is encountered. It is a new approach – a clear focus on parking as a common place activity of everyday life. A range of automated car-parking systems are designed and available to suit various customer needs. For planners and developers seeking solutions, automated systems provide a new perspective. They are quite a beautiful idea of engineering. All the different combinations were designed by bringing engineering and liberal arts closer, putting form and concepts together as massive innovations to make world happier. This paper highlights on the various forms of designs in parking facilities provided in commercial/ essential services buildings'. As this is a blooming industry in the current*

**KEYWORDS:** *Automated Parking Systems, Engineering, Innovation, Entrepreneurs.*



## INTRODUCTION:

Parking is considered as one of the essential elements while planning for any commercial space. In most of the cases the basement includes the car park area. Parking facilities can be in both – indoor and outdoor, public or private. Some buildings have parking facilities for use of the building users (<http://en.m.wikipedia.org/wiki/parking>). Increase in the number of cars on road for one's daily mobility results in high traffic which can cause substantial social problems like traffic congestion, wastage in fuel, air pollution and accidents (Ni et al, 2016).

According to Okulicz- Kozaryn (2015), cities attract people, because people strive for power and status. Big cities have long been centres of power-economic, political and any other. People flock to cities arguably mostly in search of job opportunities and excitement plus all the amenities. People are forced to be close to cities (jobs and amenities). Many smart people are more likely to move to cities especially to get education, jobs and in search of lifestyle. Increase in the number of MNC's in the cities helps the people to improve their standard of living. Thus changing lifestyle, customs and practices leads to innovative and technological products in the market which enhances the quality of people.

Appropriate amount of good quality car parking are an essential ingredient in forming a successful shopping centre. The quantity, quality, location and areas used for car parking are important design considerations opines, Coleman (2006). Parking is said to be smarter when it offers enough safe, convenient parking, mixed uses with shared parking, consideration of pedestrian and bicycles, efficient design and minimum use of non-renewable resources (Pande and Wolshon, 2016).

## CHANGING NATURE OF CARPARKS

The initial model of parking systems were regular platform structures with elevators instead of ramps. The first generation of mechanical systems were very primitive and capital intensive. They had elevators and rotating floor levels in order to align the vehicle with the elevator. These required heavy mechanical devices, rotating floor structure, and required lighter mechanical structures to be designed with advanced expertise. However, when elevators were involved, it was advisable to have valet drivers rather than average drivers to manoeuvre.

The next step in the evolution of parking systems seems to be with the inclusion of automation into the parking systems which is represented as kinetic parking systems. The idea was to process the car automatically without requiring the presence of a driver. They become more credible in the eye of the parking expert because they provided absolute solutions to the problems associated with increasing parking demand and inadequate conventional parking systems (Abboud, 1994). Designing of the automated parking systems involves mechanical components like motors, lifts, elevators to move vehicles from one level to another level and rotating table to turn the vehicle at 360° for easy manoeuvre.

The purpose of this study was to present an overview of the types of parking facilities that are provided in commercial/ essential services buildings' and concerns related to its operation, design, structure and the mechanical components involved. As this is a blooming industry in the current scenario of car parking, opportunities are wide to budding entrepreneurs in this sector.

## OBJECTIVES OF THE STUDY

- To identify the different types of kinetic parking facilities in the selected locale.

- To understand the operating mechanism of the identified parking facilities
- To comprehend needs for structural components where designers have job prospects
- Relate prospects for job in the field

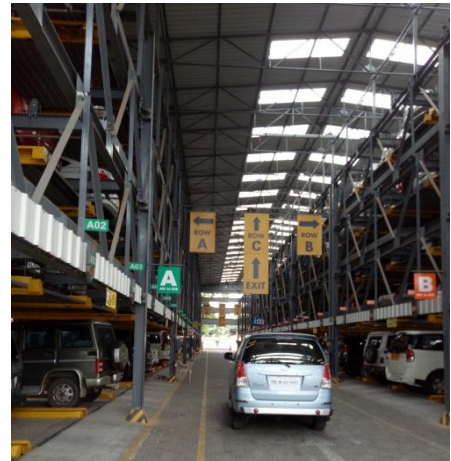
## METHODOLOGY

Coimbatore, a well known destination for production units, educational institutions, hospitality plus commercial / essential service centres was selected for this study. It included a sample of six parking facility providers – both commercial and essential services buildings (one hospital, two offices and three garment shops) as distinct case study. Four types of parking facilities were identified and included in the study by adopting purposive sampling. Face to face interview and observation technique was implemented by choosing interview schedule as the instrument for this study. The findings of case studies to find out the variants of kinetic parking facilities, operating, designing as well as the structural necessities are presented under findings.

## SALIENT FINDINGS

***Delineation on the Four Types of Kinetic Parking Systems installed in the selected samples areas:*** The four different types of innovative kinetic parking systems incorporated in various buildings rendering essential services and commercial operations are as follows:

***Puzzle Parking:*** This method facilitated parking in many levels like ground with level 1 and or level 2 and even more. Size of pallets ranged at 7'x15', which is quite sufficient to park any car. The clearance provided also was above 1' 6" enabling ease in manoeuvrability.



***Plate 1: Puzzle Parking***

Headroom of 7' – 10' was required for efficient use. This parking system has been designed to park a number of upto 100 no's, 150 no's and 50 no's in hospitals, garment shops and offices respectively. Hospitals were more generous and had provided for parking more than 100 cars at a time. Puzzle parking had four decks apart from the ground level. It afforded parking of all types of cars, namely, hatchback, sedan, MPV, MUV and convertibles in all decks inclusive of ground level. SUV's alone were parked only in ground level. Being a horizontal system in a circular pattern as the number of decks increased, the cars that could be parked at a time also increased; hence this was found to be more efficient. This has emerged as one of the ***user –friendly parking system of the future.***



**VRS Vertical Rotary System:** It was found to be constructed in the open space, adjacent to a building. Since this is a vertical, stand-alone type it could accommodate parking only in the ground level. Size of each car pallet was a standard 7'x 11'. They werenot customized. This type of parking needed only life size headroom (upto 7'). Along with pedestrian and driving lanes, these catered to ramps and turntable to make access easier. The system is fully automatic. As this is a stand alone type it catered to parking only vertically in **Plate 2: Vertical Rotary System** different decks as provided by the fabricators. Specially designed pallets can be installed especially for accomodating SUV vehicles.

**Stacked System:** This type of parking facility was found to be installed only in a garment shop. This system was accommodated in basement level, hence could facilitate parking in both ground and level 1. They were not customized. stacked parking required only life size headroom (upto 7'). This stacked all cars in two levels, except SUV's. **Plate 3: Stacked System**



**Car Lift:** This system was provided as an additional parking space by a garment shop. This was the only parking facility that was found to be customized as per the requirement of the parking providers and restricted to space availability.

**MECHANICAL COMPONENTS IN THE SYSTEM:** Mostly in all the parking spaces the mechanical components like ball bearing, chain drive, gear wheels, roller chain, shafts- main and counter and **Plate 4: Car Lifts** sprockets were found and are serviced or overhauling done on a monthly, weekly and quarterly basis for a long smooth run.

#### JOB PROSPECTS IDENTIFIED FOR DESIGNERS

This technology – based change welcomed by all commuters have brought in their wake a few viable fields in which designers can find lucrative job prospects. Major few are presented below

- Designers who have done a course/ diploma in technical drawings, practical training in CNC have a great opportunity in the field of designing such mechanical components needed for the system
- Designers with high investment potential can commission such parking facilities
- Innovative designers can either improvise existing systems or innovate and bring out better versions
- Interior designers can design an attractive office design to attract commuters to particular parking systems on the one hand and reduce the mundane effect that can impact office personnel who spend hours together in such isolated areas

- Designers can contribute to commercial art by designing catchy signages and hoardings and advertisement layouts
- Can shine as custom - designer manufacturers (MSMEs) or traders of outsourced assembly products cables, chains, mirrors, nuts and bolts, belts etc

## CONCLUSION

Automated kinetic parking systems reduce the risk of parking manually. Instead, cars are positioned into the parking facilities which were enhanced by designing hardware, software and structures. By preferring customized parking systems which are produced and installed locally, opportunities to the small scale entrepreneurs like supplying the cables, bearings, chains, mirrors, safety devices and other mechanical components would peak high. ***Different combinations of parking systems were designed by bringing engineering and liberal arts closer, putting form and concepts together as massive innovations to make world happier.*** As this is a blooming industry in the current scenario of car parking, opportunities are wide also to budding entrepreneurs in this sector. Hopefully this huge innovative industry flourishes with new scope and ideas, goods and services which would inspire growing entrepreneurs to shine bright.

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## SUSTAINABLE FURNITURE DESIGNING – AN ENTREPRENEURIAL AVENUE

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### ABSTRACT

*Interior design is considered as an art and science of creating a more functional interior environment which includes designing all aspects of the interiors like walls, flooring, ceiling, windows, doors, colour schemes, lightings, furniture, soft furnishings and accessories. The nature of interior design profession offers brilliant prospects for individuals who want to work full time, part time and those who desire to be self-employed. Furniture designing is one such a specialized field that combines both function and aesthetic. Furniture plays a vital role in our day to day life as we need furniture for comfort, rest, relaxation, work, storage, convenience and also for aesthetic purpose. But furniture can also have an adverse impact on the environment. Most of the furniture are manufactured with materials containing volatile organic compounds, flame-retardant fabrics, and stain-resistant coatings. Studies suggest that exposure to these chemicals may lead to harmful health problems. Today a great attention is given by the furniture designers and consumers to the factors like sustainability, ergonomics, efficiency, attractiveness and practical use of furniture. The term Sustainable furniture describes eco-friendly, good for earth, or environmentally safe. Making and choosing environment friendly furniture can make a big difference in impact on the planet and health of people. Hence this paper highlights the necessity of manufacturing sustainable furniture, the variety of materials that are used to construct furniture that make it sustainable, and how this latest changing trend helps the furniture designers to become entrepreneurs.*

**KEYWORDS:** Sustainable Furniture, Volatile Organic Compounds, Eco-Friendly And Entrepreneurs

## I. INTRODUCTION

Today, we are living in the green world where everything from the smallest bell pins to the largest vehicles needs to be environmentally friendly. Sustainable furniture design is an effort to living green and to reduce the impact of a piece of furniture on the environment by considering all aspects of the furniture design, construction process, maintenance, renovation and transportation with less carbon footprint. Environmentally conscious furniture is designed with the principles of economic, social and ecological sustainability. Although new technologies are constantly being developed to complement current practices in creating furniture, the major objective of making sustainable furniture is to design furniture that can be used throughout its lifetime or that can be continually reused again without destroying the precious natural resources. If a designer would like to become an entrepreneur, undoubtedly sustainable furniture designing is one of the most rewarding careers in the current scenario.

## II. BENEFITS OF SUSTAINABLE FURNITURE

The reason for opting sustainable furniture designing as an entrepreneurial avenue is manifold. One of the important aspects is that the benefits offered by sustainable furniture. They are

- Sustainable furniture are made from bio-based or easily renewable resources and constructed with recycled or re-purposed materials thus reduce the consumption of nonrenewable resources. This eco-friendly furniture possesses the advantages like easy to repair, disassemble, and rapid recycling.
- It is good for health because it contains no- or low volatile organic compounds (VOCs). More number of furniture are manufactured with volatile organic compounds (VOCs) and perfluoro chemicals (PFCs), that are chemicals used in things like paint, treated leather, plywood, pressed wood and upholstery products. Exposure to these kinds of chemicals has been associated with several health problems. Using sustainable furniture is a great way to maintain good indoor air quality.
- Its initial cost is more expensive but this could be compensated in the long run.
- Environmentally preferable manufacturing practices reduce carbon emissions, thereby reducing environmental pollution while keeping the earth green.
- Sustainable furniture made from locally available materials helps to reduce transportation waste, greenhouse gas emissions and fuel consumption. This will support the local economy, and decrease the transportation cost.
- It offers maximum functionality, comfort, ease of use and durability. Strong and durable furniture need not to be replaced quickly will have a longer functional lifespan.
- Much sustainable furniture are multipurpose which are designed specifically to suit smaller spaces, increases efficiency and providing greater utility for the consumers.
- The sustainable furniture design movement focuses on small, lightweight and flexible furniture, so that it doesn't cost much to move.

## III. SUSTAINABLE FURNITURE MATERIALS

Sustainable furniture design focuses to create a closed-loop cycle in which materials and products can be recycled so as to avoid dumping waste on lands. The materials used for making sustainable furniture include the universal wood, fast-growing bamboo, plastic, steel and many combinations of new unconventional materials which improve the visual appeal, easy to



maintain, better workmanship, and more comfort. According to one's taste and preferences, it is quite possible to create traditional, contemporary, modern and even futuristic style of furniture. .

Recycled and reclaimed furniture materials are increasingly popular and an entire furniture manufacturing industry has shown keen interest in re-manufacturing and refurbishing of a piece of furniture. Sustainable furniture materials have certain unique characteristics of their own that attracts the users and furniture manufacturers towards sustainable furniture. They are categorized as follows:

#### **A. Renewable and biodegradable materials**

Biodegradable furniture materials include plant products.

##### **1. Wood**

Environmentally conscious designed furniture are often made out of wood because wood is long lasting and is still being chosen as the basic and universal material for making furniture. The trees keep the surface of the earth cool by absorbing carbon di oxide, producing oxygen and providing habitat for numerous living organisms. Cutting of trees for making furniture leads to deforestation which produces in turn a huge ecological impact. There are sustainable ways to harvest wood from forests and tree farms. This ensures that the natural ecosystem remains in place, the forest continues to grow and produce wood.

##### **2. Wood based products**

Nowadays solid wood is being replaced by artificial layered wood that is less expensive.

- **Veneer** is a thin layer of good quality wood applied over cheaper wood.
- **Plywood** is made up of veneers or layers of wood glued together.
- **Particleboard** is made from flakes of wood and sawdust molded together by high pressure and glue
- **Fiberboards** are manufactured like particleboard but wood-pulp fibers are used instead of wooden flakes.
- **Laminated wood** is a flexible type of plywood which comprises mainly thin layers of wood.

##### **3. Bamboo**

Bamboo comes from a family of grasses, incredibly grows so well and versatile and has become the popular choice of environmental furniture designers and builders.

##### **Advantages of Bamboo Furniture are**

- Fast growing grass and renewable resource. Grows upto 5 Feet or more per year
- Stronger, durable, warp and chip resistant
- Stronger than mild steel and solid oak.
- Reducing greenhouse gasses and releases 35% more oxygen than traditional wood
- No carbon emissions.

**4. Cane, Wicker and Rattan** are also used as a popular furniture material in India. Cane is termed as sustainable because it is relatively easier to reforest and replenish. Rattan grows much more rapidly like bamboo.

**5. Leather** can also be a green option. It breathes well, lasts forever, and is durable.

**6. Textiles** that have been made out of organic cotton are pesticide-free and easily degradable

#### B. Reclaimed Materials

Reclaimed materials usually come from old furniture, houses, or other built things that are ready for some friendly modification. This may include flawed wood pieces, wood scraps from factories, wood logs, glass and iron, and are used by the designers to create sustainable furniture. Reclaimed materials have resource recovery, it usually comes in shorter supply.

#### C. Recycled Materials

More furniture are being made from recycled metal and plastics. These recycled materials require fewer resources and less manufacturing processing.

##### 1. Metal

The manufacturing of metal furniture may not be so eco-friendly as it often requires tons of electricity. But metals like wrought iron, steel, and aluminium can be easily recycled and they can be used to make new and durable furniture.

##### 2. Plastic

Plastics are made from petroleum, which can hardly be considered a sustainable source. However, pieces made from recycled plastic serve as reliable go-to materials for sustainable furniture design

#### D. Non-Toxic Lacquers

Solvent-based lacquers that are used as furniture finish cause pollution in the interiors by emitting volatile organic compounds like formaldehyde. Use of natural wood finish, water- or bio-based lacquers or sealants that do not release toxic chemicals, varnishes with low VOC and unfinished furniture are the green alternatives to treat wooden furniture.

### IV. CAREER PROSPECTS IN FURNITURE DESIGNING

Modernization in designing, use of newer materials, advanced technology and need of mass production will decide the growth of furniture manufacturing industry. A furniture designer is the one who creates pieces of furniture and gives shape to consumer's creative ideas and thoughts. There are huge employment opportunities awaiting the sustainable furniture designers in various fields.

#### A. Work with several different furniture manufacturers

As a furniture designer one may find career opportunities in

- Public and private corporate companies
- Consultancy services
- Practicing with architectural firms
- Trade shows and exhibition organizers

- Furniture manufacturing companies
- Interior design studios
- Private buyers
- Retail interior designers

When employed in large firms, a furniture designer can have the chance to become a senior consultant designer, or even reach the level of manager or company director.

### **B. Entrepreneur**

Another avenue for skilled and experienced eco-friendly designers is becoming an entrepreneur. If any designer chooses to be self-employed, either working from a studio or in a workshop, the job prospects are

- Undertake freelance work for corporate or domestic clients.
- Creating good designs to selected clients and getting professional reputation.
- Becoming a furniture buyer for a large firm, or on behalf of private individuals.
- Experienced furniture designer, can also move into other fields, such as journalism, where furniture design knowledge is required.
- Teaching and lecturing also considered either as a form of career development or along with regular design work to supplement income.
- Furniture designers may even move on to opening their own furniture shop.
- Purchase old pieces of furniture and restore it in stylized design and update the appearance of it to suit the modern trends and sell as vintage furniture. There is big market for vintage furniture, and designers should take advantage of it by using their skills.
- Self –employed designers may also need to perform as a designer, buyer, maintenance engineer, accountant, production manager, salesperson, and business administrator.

### **V. CONCLUSION**

It is clearly evident that employment opportunities are abundant for sustainable furniture designers. Interior design companies may also need more number of furniture designers to work closely with their company in order to provide unique and eco-friendly pieces to their clients. To be sustainable, furniture should be high quality and support a lifestyle with reduced energy and resource needs. Undoubtedly, sustainable furniture making is a good avenue for a designer who has much concern over the health of people and earth, aspiring for a creative field of work and gets to use artistic and spatial skill in an interesting and remunerative way.

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## WEANING FOOD UNITS – A LUCRATIVE ENTREPRENEUR FOR WOMEN

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### ABSTRACT

*Women entrepreneurship has gained momentum in the last three decades with the increase in the number of women enterprises and their substantive contribution to economic growth. Food processing industry is dominated by unorganized, micro, small and medium enterprises (MSMEs) in India. One of the sub division of food processing is weaning food. This study deals with the perspective of women as entrepreneurs in small scale weaning food units trained by two colleges namely Community Science College and Research Institute and Post Harvest Technology Centre under Tamil Nadu Agricultural University. Eighty nine women workers employed in seven small scale weaning food units in Madurai were selected based on purposive sample selection for the study. The mean age of the weaning food women workers was  $41 \pm 8.60$  years, married (66.3%), educated up to higher secondary school (55.1%), belonged to nuclear family type and had small family size (64%). The number of earners in the workers' family were two (80%) and the average total monthly family income was Rs.19,528.09  $\pm$  5263.70. The mean work experience of the workers was  $13 \pm 9.55$  years, undergone training for a period of 11 to 20 days (84.3%) and the mean monthly income was Rs.4994.38  $\pm$  1527.20. The different type of products prepared in the weaning food units were Health mix, Multi grain mix and various millet mixes. Although the whole process was mechanized but monitoring the machines were mainly carried out by the women workers. The findings of the survey revealed that women could take up weaning food preparation as entrepreneurship.*

**KEYWORDS:** Women Entrepreneurs, Food Processing, Weaning Food, Msmes

## INTRODUCTION

Soundarapandian in 1999 quotes the words of Pundit Jawaharlal Nehru – “When women move forward, family moves and the village moves and the Nation moves.” Employment gives economic independence to women<sup>1</sup>.

Women entrepreneurship has gained momentum in the last three decades with the increase in the number of women enterprises and their substantive contribution to economic growth<sup>2</sup>. It is estimated that women entrepreneurs comprise about 10 per cent of total entrepreneurs in India. Further this is growing as in recent times, women have begun to participate in different economic activities including business and industry. Elite women in cities and urban areas are entering the modern fields of economic activities such as consultancy, marketing, advertising, export of garments, interior decoration, handicrafts, dyeing and printing, food processing etc<sup>3</sup>.

According to Sectorial Report June 2017, the Indian food processing industry accounts for 32 per cent of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. Food processing industry is dominated by unorganized, micro, small and medium sectors in India<sup>4</sup>. The role of Micro, Small and Medium enterprises (MSMEs) in the economic and social development of the country is well established. As per the Report of the Working Group on Micro, Small and Medium Enterprises (MSMEs) Growth for 12th Five Year Plan (2012-2017), the sector accounts for 45% of the manufacturing output and 40% of total exports of the country<sup>5</sup>. There are nearly 12.94 lakh registered MSMEs in Tamil Nadu as on 31.03.2016 providing employment to more than 80 lakh with a total investment of Rs.1,32,110 crore. Further, this sector is a major employment provider next to Agriculture<sup>6</sup>.

One of the sub division of food processing is weaning food. The term "weaning foods" is used to refer to semi-solid or solid foods offered to infants when the breast milk (or liquid substitutes based on animal milk preparation, either made domestically or industrially "formulae") are no longer sufficient nutritionally<sup>7</sup>. Hence weaning food is intended to bridge the wide gap between an infant breast feeding and an 'adult' family<sup>8</sup>. Complementary foods are defined as the foods that are provided along with breast milk. In the past, such foods were often called 'weaning foods'. However, the term 'complementary foods' is preferred because weaning implies the cessation of breastfeeding, whereas the goal is that such foods should complement breast milk, not replace it<sup>9</sup>. In other words, Complementary feeding is the provision of foods or fluids to infants in addition to breast milk. Complementary foods can be subdivided into: Transitional foods that are complementary foods which specifically designed to meet particular nutritional or physiological needs of infants and broadly the same as those consumed by the rest of the family<sup>10</sup>.

The Community Science College and Research Institute, Tamil Nadu Agricultural University, Madurai and Post Harvest Technology Centre, Tamil Nadu Agricultural University, Coimbatore are pioneer in education, research and extension activities. They jointly impart training on processing of agricultural products such as cereals and millets and processing of horticultural highly perishable commodities such as fruits and vegetables for value addition to women Self Help Groups (SHGs), active entrepreneurs, farmers, unemployed youth and Non Governmental Organizations (NGOs) and establish model pilot plants to promote small scale entrepreneurs. They were also trained and insisted to have food licensing and registration of their food products for FSSAI- Food Safety and Standards Authority of India.

The present paper deals with the perspective of women as entrepreneurs in small scale weaning food units trained by the above mentioned colleges.

## MATERIALS AND METHODS

The study was conducted in Madurai district which is located in the South Indian State of Tamil Nadu. Seven small scale weaning food units were selected randomly in and around Madurai district. The researchers approached personally District Industry Centre (DIC), Madurai to explain the purpose of the study and collected details of small scale unit. Later oral consent was obtained from each of the weaning food proprietors to carry out the study.

Eighty nine women workers employed in seven small scale weaning food units in Madurai were selected based on purposive sample selection for the study. A pre-structured interview schedule was framed to obtain baseline information of the women worker's socio-demographic characteristics and job history employed in selected small scale weaning food units. The interview schedule was pre-tested among 10 per cent of the total sample of the study who was not a part of the study sample and modified accordingly to arrive at a final interview schedule. The samples of the study were contacted during their break time for data collection by communicating with them in the local language, Tamil. The data collected were tabulated, coded, and entered in SPSS software (version 16.0) for further statistical analysis.

## RESULTS AND DISCUSSIONS

The details of selected weaning food units located in Madurai revealed that nearly half of the weaning food units (50.6%) established before the year 1990 followed by between 1991 and 2000 (42.7%) and only seven per cent after the year 2010. One male worker (55.1%) and more than 6 female workers (91.0) were employed per unit. All weaning food units were provided with drinking water to the workers. Ninety five per cent of the units had the provision of washing area, toilet and lunch room and safety and first kit (94.4%) in their workplace premise. Also ninety one per cent of the units provided workers with personal protective equipment such as apron, cap, face masks, hand gloves and socks. Seventy one per cent of the units had various machineries operated by the workers such as destoner machine, roasting machine, pulverizing machine, blending machine, sealing and packing machine. The different products manufactured in selected weaning food units were Health mix, Multi grain mix and various millet mixes. These products were exported to most of the cities in Tamilnadu for marketing.

The socio-demographic profile of 89 weaning food workers are shown in Table 1.

**TABLE 1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF WEANING FOOD WORKERS**

Particulars	Number (N=89)	Percentage (%)
<b>Age (in years)</b>		
21- 30	12	13.5
31- 40	31	34.8
41- 50	35	39.3
>50	11	12.4
<b>Marital status</b>		
Married	59	66.3
Unmarried	1	1.1
Divorced	1	1.1
Widow	28	31.5



<b>Education status</b>		
Illiterate	1	1.1
Can read and write	36	40.4
Primary school	15	16.9
High school	24	27.0
Higher secondary	10	11.2
Degree	3	3.4
<b>Family type</b>		
Nuclear family	57	64.0
Joint family	32	36.0
<b>Family size</b>		
Small (1-3)	57	64.0
Medium (4-6)	26	29.2
Large ( $\geq 7$ )	6	6.7
<b>Community</b>		
B.C.	40	44.9
M.B.C	27	30.3
S.C.	22	24.7
<b>Religion</b>		
Hindu	88	98.9
Muslim	1	1.1
<b>Number of earners in the family</b>		
One earner	3	3.4
Two earners	71	79.8
Three earners	13	14.6
Four earners	1	1.1
Five earners	1	1.1
<b>Monthly family income</b>		
<Rs.5000	2	2.2
Rs.5001-Rs.10000	4	4.5
Rs.10001-Rs.15000	9	10.1
Rs.15001-Rs.20000	35	39.3
>Rs.20000	39	43.8

The age of the weaning food women workers ranged from 24 years to 57 years with a mean of  $41 \pm 8.60$  years. Marital status of the workers showed both married (66.3%) and widow (31.5%). Workers had education level up to higher secondary school (55.1%) and 3.4 per cent had a degree holder. Sixty four per cent of the workers belonged to nuclear family type and small family size (64.0%) comprising of 1-3 members in the family. Workers belonged to backward community (44.9%) followed by most backward community (30.3%) and schedule caste (24.7%). Majority of the workers were Hindu (98.9%) by religion and only (1.1%) were Muslims. Eighty per cent had two earners in the family and the average total monthly family income was Rs.19,528.09 $\pm$ 5263.70.

The job history of women workers employed in weaning food units is given in Table 2.

**TABLE 2. JOB HISTORY OF WEANING FOOD WORKERS**

Particulars	Number (N=89)	Percentage (%)
<b>Age of entry (in years)</b>		
<20	15	16.9
21-30	53	59.6
31-40	17	19.1
41-50	4	4.5
<b>Work experience (in years)</b>		
<10	40	45
11-20	21	23.6
>20	28	31.5
<b>Source of motivation</b>		
Friends	29	32.6
Relatives	46	51.7
Advertisements	30	33.7
Job security	25	28.1
Indoor work	47	52.8
Work spot nearby	48	53.9
Regular work	36	40.4
Facilities provided	2	2.2
Attractive bonus	2	2.2
Economic necessity	35	39.3
<b>Employed previously</b>		
Yes	2	2.2
<b>Undergone training</b>		
Yes	89	100.0
<b>Period of training (Days)</b>		
<10	13	14.6
11-20	75	84.3
21-30	1	1.1
<b>Work hours during regular days (in hours)</b>		
9-10	46	51.7
>10	43	48.3
<b>Work hours during peak days (in hours)</b>		
<10	40	44.9
11-12	32	36.0
>12	17	19.1
<b>Monthly worker income</b>		
Rs.3001-Rs.6000	87	97.8

Rs.6001-Rs.12000	-	-
>Rs.12000	2	2.2

The minimum age of entry into the weaning food unit was 16 years and maximum 48 years with a mean of  $27 \pm 6.36$  years. Their work experience ranged from one to 28 years with a mean of  $13 \pm 9.55$  years. Nearly half of the workers' source of motivation to work in the present occupation was workspot nearby (53.9%), indoor work (52.8%) and relatives (51.7%). Only two per cent of the weaning food worker employed previously prior to the present occupation. All the workers had undergone training for a period of 11 to 20 days (84.3%). During regular days, nearly half of the workers spent between 9 and 10 hours (51.7%) for making weaning food as well as other various food processing and during festival occasion, workers spent between 11 and 12 hours (36.0%). The monthly income of the weaning food workers ranged from Rs.4000 to Rs.15000 with a mean of Rs.4994.38  $\pm$  1527.20.

Table 3 describes the nature of the activities performed by the weaning food workers.

**TABLE 3. NATURE OF THE ACTIVITIES PERFORMED BY THE WORKERS**

Activities in Weaning Units	Participation	
	Men	Women
Unloading wheat/millets in the unit	X	-
Destoning wheat/millets	-	√
Roasting wheat/millets	-	√
Putting logs inside the furnace	-	√
Carrying roasted wheat/millets to pulverizing section	-	√
Pulverizing wheat/millets	-	√
Carrying wheat/millet flour to blending section	-	√
Blending wheat/millet flour and sweetener	-	√
Packaging	-	√
Carrying packed items and storing it in store room	-	√
Transporting it in truck to same or other city	X	-

The different type of products prepared in the weaning food units were Health mix, Multi grain mix and various millet mixes. The nature of the activity of men workers were unloading wheat/millets in the unit and transporting the packed weaning food in truck to same or other city. The women workers were involved in all the activities in the unit such as destoning wheat/millets, roasting wheat/millets, putting logs inside the furnace, carrying roasted wheat/millets to pulverizing section, pulverizing wheat/millets, carrying wheat/millet flour to blending section, blending wheat/millet flour and sweetener, packaging and carrying packed items and storing it in store room.

Few studies have been conducted on the entrepreneurs on food product as well as other nature of business. In a study<sup>11</sup>, 90 women entrepreneurs availed loan from the District Industries Center of Madurai district to start the business under Unemployed Youth Employment Generation Programme (UYEGP) Scheme. The nature of business of the women entrepreneurs in the study area revealed that more number of respondents (31.1%) were having readymade cloths store followed by 16.6% indulged in Textile fabric/ Handlooms / garments. Respondents having Tailoring / Button Stitching, units of food product and running beauty parlor constitutes 13.3%, 12.2% and 10% respectively. Of the remaining 6.6%, 5.5% and 4.4% of the respondents

maintaining flour Mill, Xerox/computer centre and Hotel / Restaurant. The women entrepreneurs thus have taken up the traditional oriented business activities as it was risk free comparatively for their entrepreneurial activities.

A study<sup>12</sup> was done on a sample of 300 women entrepreneurs engaged in food processing of Rajkot city of Gujarat who were divided into five categories namely snacks unit, food services unit, thepla and khakhara making unit, papad making unit and other food processing units. The following variables such as education, training, religion, age and type of family had significant influence on the selected women entrepreneurs.

A study<sup>13</sup> on food processing in 1998 in Bombay unveil the relatively invisible type of food processing. Food processing involves the use of labour to transform raw or partially processed food material into a ready for eating. In most cultures, women have had the major responsibility in food processing for family consumption. With the development of a market economy, women have extended their household food processing activities in various ways.

Researchers<sup>14</sup> while studying use of instant mix food reported that more and more women are coming out to work and in search of materials that can be cooked and stored easily. They found that use of instant mix reduced the burden of cooking and satisfied the taste of people who were fond of diversity.

A study<sup>15</sup> was conducted in three backward dwellings in Bikaner city of Rajasthan. From each dwelling twenty women were selected purposively who wanted to start income generating activities as an enterprise. Most of the respondents expressed need for the training in preparation of pickle, squash, cooking and bakery products. In the area of clothing and textile, need of majority of women were related to tie and dye, stitching, embroidery. Training was also needed in making soft toys and effective child rearing practice for starting crèche. In the area of family resource management, training needs by majority were pot painting, flower making and utilization of waste materials to decorate home. It can thus be concluded that intensive training need for women was identified which could really help them in starting of an enterprise.

There was another study<sup>16</sup> on motivating slum women for entrepreneurship through training. Entrepreneurship can help women's economic independent and improve their social status. Through economic independence, women automatically get empowerment. Development of women entrepreneurship enables men to understand and appreciate women abilities.

## CONCLUSIONS

Food processing is a means to reduce post-harvest food losses, to enable longer storage and thus generate increased income. Food can be either processed for immediate consumption (as in food service establishments) or it can be processed to add value to basic raw materials and generate an income for entrepreneurs and their workforce. The saying entrepreneurs are born and not made has little sense today as many evidences imply that they are successfully made. Entrepreneurship is an important task for women in India but if carried successfully can inculcate confidence among them. The findings of the survey revealed that women could take up weaning food preparation as entrepreneurship.

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## NUTRITIONAL AND ENTREPRENEURSHIP ADVANCEMENT FOR MILLET BASED COMMERCIAL FOOD PRODUCTS

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### ABSTRACT

*An appropriate food processing technology stimulates entrepreneurship, production capacity, ensures availability of nutritional quality of food products, value addition and helps in creating jobs and thus plays a crucial role in the economic progress and industrial development in the rural areas of India. Millets are small seeded cereals that are indigenous to India from prehistoric times. Its importance as food can be realized from the fact that millets are being cultivated in an area of 30 million acres in India. Millets require 70% less water than rice. They require no pesticides and minimal chemical fertilizers making them mostly organic and environment friendly. They are low cost crops and can be grown well even in marginal lands, with low rainfall. Small seeded little millets showed an advantage over rice due to several technological features like less water uptake, less soaking, grinding, and baking time and high product yield. The food habits of the people both in India and abroad are being oriented towards natural foods and high fiber diet with increasing awareness on health care and fitness. This change has brought in focused thrust to organic farming and a renewed interest in the consumption of Millets. India is becoming a major exporter of Millets. Millets are commonly known as “Super Food” as they are nutritional power houses high in proteins, dietary fiber, B complex vitamins, essential amino acids, folic acid, vitamin E and minerals such as iron, magnesium, copper, phosphorous, zinc, calcium and potassium. The nutritional and health benefits of millets have created a surge in demand for a variety of millet based ethnic and novel food product development with sorghum, kodo millet, pearl Millet, little millet and foxtail millet etc. The present article focus on entrepreneurship development of millet based food which is harmless to health, has cost effective preparation and requires less laborious technology. The*



*overall value addition to millet based ready- to- cook (RTC) and ready –to-eat (RTE) food products is a highly strategic intervention in the present scenario, in the popularization of nutritionally rich ethnic food and to enhance women empowerment through entrepreneurship.*

**KEYWORDS:** *Millet, Nutritional Power Houses, Value Addition, Women Empowerment, Ready to Cook, Ready To Eat, Entrepreneurship.*

## INTRODUCTION

Millet is considered as a highly palatable and good source of energy, protein and minerals. Millet is the fifth most important cereals in the world ranging from wheat, maize, rice and barley (Shayo et al, 2001). Millets are symbolized now-a-days for traditional as well as novel foods. Millets exhibit beneficial effects on cholesterol levels, because of its high dietary fiber and phytochemical content. The value addition of food has assumed significant importance in the last decade due to socio-economic and industrial factors. Now- a –days, ready – to- cook and ready – to – eat products plays an important role on daily nutrient and calorie intake of many consumers. Ready –to- cook food products are generally made from corn, wheat, rice and oats, while other cereals such as pearl millet, finger millet, barley, rye sorghum have not been used extensively. Therefore, it becomes important to focus on promoting maximal use of locally available inexpensive foods rich in protein, calcium, iron, fiber etc (Barrett AH et al, 1992). In order to produce good quality flour and to overcome cumbersome and time-consuming food preparation of millets, ready-to-cook and convenient food process should be developed. Ready –to- cook millet products has dramatically transformed the cereal industry, the key thing being quality extruded products offered to consumer at competitive price. Ready-to-cook millet based food products made by adopting traditional processing methods gives a healthful addition for a fittest lifestyle.

Millets have remained the food for the people of the lower economic strata and traditional consumers, because of their coarse texture, characteristic flavor, intensely colored seed coat and cultural attachments. However, the non-availability of processed products similar to rice or wheat is the primary reason for their consumption being confined to traditional consumers. Culture has preserved the significance of millets through the promulgation of their use in the preparation of traditional ethnic dishes during special occasions and rituals (Yenagi et al., 2004). Ethnic foods made out of small millets have excellent taste, crispy texture, light and fluffy characteristics and superior textural quality of cooked starch. They are also highly acceptable for taste and texture by both rural and urban consumers. The promotion of indigenous and value added products through different communication techniques enhanced the consumers knowledge and readiness to incorporate millets in their daily diet. An appropriate food processing technology stimulates agriculture production, ensures availability of quality products, value addition and helps in creating jobs. Such an approach is thus strategic in supporting both the economic progress and industrial development in rural areas of India (Yenagi, 2007). Because women are the main actors behind the knowledge, production and consumption of genetic resources of small millets, the enhanced use of these crops also provides an opportunity of empowerment of this marginalized sector of the Indian society.

**READY- TO- COOK or INSTANT MIXES****INSTANT SORGHUM IDLY MIX**

In the modern days where the life is at fast pace with the time very valuable to every person, "Instant Foods" play an important role in everyone's day-to-day life. Instant and ready to reconstitute foods have become well established products.

Idly is an indigenous traditional breakfast food in mostly southern Indian cuisine, which is a steamed product, made from rice and ground pulses and typically served with a spiced vegetable filling or chutney. A home based attempt was made to prepare instant sorghum idli mix- Finely grinded Sorghum Rava, blackgram dhal, salt and sodium bicarbonate were used as main ingredients. All the ingredients were mixed accordingly and stored in an air tight jar. Instantly sorghum idli can be prepared reducing the cumbersome time for fermentation. It is rich source of phenolic compounds and causes satiety resulting in slower digestibility. Reduces oxidative stress (Antioxidant). Shelf life may be 3 months when stored in proper condition.

**INSTANT SORGHUM IDLY MIX**

Finely grinded Sorghum Rawa and Blackgram dhal (1:4)ratio

↓  
Sieving

↓  
Add salt and sodium bicarbonate (during dough preparation)

↓  
Allow for fermentation

↓  
Steam cook for idly making

**Nutritional Composition of Instant Idly -**

Based on ICMR Nutritive Value Book for Indian Foods

Nutrients (100g)	Values
Energy (kcal)	364
Carbohydrates (g)	71.7
Protein (g)	12.4
Fat (g)	1.6
Riboflavin (mg)	1.5
Folic acid (µg)	45.7
Calcium (mg)	10.2
Iron (mg)	7.2

**MILLET INSTANT LADDU MIX**

Description of the technology

Laddu- An Indian sweet made from a mixture of flour, powdered sugar, and shortening like ghee, which is shaped into a ball. Millet laddu mix is developed from roasted sorghum fine rawa, finger millet flour, pearl millet flour; powdered sugar, dry fruits and cardamom are added. The mix has to be mixed with ghee to make round balls before serving. The formulated mix can be stored in an air tight jar.

**Advantages and Uniqueness of Product:**

Instantly laddus can be prepared with added flavor and taste. It is Gluten Free and safe for Celiac Patients.

**INSTANT LADDU MIX (MILLETS)**

Millet Flour-coarse (Sorghum)

↓  
Millet Flour-fine (Finger Millet & Pearl Millet)

↓  
Sieving

↓  
Roasting

↓  
Cooling

↓  
Add powdered sugar

↓  
Add fried dry fruits and cardamom

↓  
Add required amount of heated ghee

↓  
Shape into fine ladoos

**Nutritional Composition**

Nutrients (100g)	Values
Energy (kcal) (g)	348
Carbohydrates (g)	69.4
Protein (g)	13.2
Fat	3.1
Fibre (g)	1.54

Demand for millets for direct consumption has been declining due to change in food habits and inconvenience attached with food preparation. Further, lack of processing technologies, the consumption of these food items has also been traditionally restricted mainly to growing areas. Millets are known for nutria-rich content and having characteristics like drought tolerance and resilient to climate change etc. Hence developing technology that makes millet value added products available as convenient to make and easy access at reasonable prices will find great demand and market particularly in urban places where there is growing conscious for nutritive intake of food. In order to make millet value chain sustainable, the production and promotion of various products in the market is very much essential.

ICAR-IIMR, ICRISAT, IFAD and Government of Karnataka-as an initiative to create an environment that will foster the part of entrepreneurial spirit among women and youth, through consultancy, research, training and promoting entrepreneurship in processing and value addition of millets leading to the self-employment.

Creation of concept that promotes the growth through innovation, wealth and social values and application of technology, support, economic development strategies for Small Business Development. They play a vital role to create successful, viable and free standing business within a certain time frame.

The broad objective is

- To promote Entrepreneurship/start up Awareness Camps at knowledge-based and innovation driven millets several venues across the country.
- To provide and create a congenial situation for various training programs to boost up potential entrepreneurs and graduating startups.
- To motivate the would-be entrepreneurs to transfer knowledge and innovations into creation of successful entrepreneurs through mentoring.

## CONCLUSION

Millets are being pursued to explore the inherent technological opportunities for better utilization of these resources in designing value added and sustainable foods in different sectors of entrepreneurship based food industries in India.

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## DESIGNING MODULAR KITCHEN

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### ABSTRACT

*Kitchen is considered the heart of the house. The process of designing is not a job that can be done in a single sitting, it takes minimum of 4-5 sittings. The modular kitchen company known as Nolte Company had tied up with a shop known as KIBA–Kitchen & Bath Studio in Coimbatore. For conducting a case study, the investigator used NOLTE software as she got trained in the software. Brief information on the Designs of the Modular Kitchen she had developed for the client is given. Among the selected brands available in the shops surveyed the investigator selected a particular brand of modular kitchen company known as Nolte. It is a famous upcoming brand in Coimbatore. From the above done research, we could conclude that each and every kitchen varies according to the taste and preferences of the client. Though the women were full time homemakers, they were engaged in other social activities and cooking was only a hobby for them. The homemaker did not prefer corner units. She also requested for a small breakfast table in kitchen. She had a colour preference, and opted for a pastel bluish green colour. In spite of the kitchen being too small, a perfect planning of space was done to provide space for all their needs. They did not prefer to spend too much for the kitchen. It was also an L shaped kitchen, out of the two sides, they wanted wall and tall units on one side and the other side they required the base units. Thus the investigator chose that samples for whom she had designed the kitchen. She conducted the case study among the selected homemakers.*

**KEYWORDS:** Modular Kitchen, NOLTE, KIBA, Case Study , Low Height Counter, Inbuilt Appliances

**INTRODUCTION:**

Kitchen is considered the heart of the house. It reflects the likings of the housewife, health and satisfaction of the family members. A good kitchen provides smiles and of course a nice and comfortable nights. The modern kitchen today is considered to be the cockpit of the dwelling, its high-tech gadgets and stainless steel fittings and electronics confirm its status as the nerve Centre. Not-yet-built apartments are sold on the basis of up market kitchen specifications and pictures of expensive-looking, restaurant-quality cookers and fittings, rich marble work surfaces and fitted cabinetry designed by professional interior designers. (Heath cotte, 2012). According to Malini (2002), the modular kitchens featured are not just superbly functional and fully equipped; they are also aesthetically designed and extremely utilitarian.

Among the selected brands available in the shops surveyed the investigator selected a particular brand of modular kitchen company known as Nolte. It is a famous upcoming brand in Coimbatore. This company is a German based company which has 15 branches in India and many branches all over the world. This company had tied up with a shop known as KIBA–Kitchen & Bath Studio in Coimbatore to introduce their brand of kitchens in Coimbatore. They are the only distributors for Tamilnadu.

Nolte offers a comprehensive choice of materials, styles, designs, accessories, and combinations, which helps in making every kitchen unique, customized and one of its kinds. Nolte has over 150 models to offer with more than 200 color options and over 250 handle designs, with more than 1,000 permutation and combination options. The in-house visionary, designing and operation team at all their studios; help one to turn their dreams of the customers into reality. Nolte assurance can delight individual, due to its 100% German make and the modules are produced in their factory at Löhne. The study was carried out with the following objectives: To

- 1) Design few kitchen for their customers using the NOLTE software
- 2) Finalizing the design and estimating its cost and
- 3) Obtaining the feedback from the clients.

**Process involved in designing:**

The process of designing is not a job that can be done in one shot. The process needs a minimum of 4-5 sittings to customize it according to the need of the clients. The process of designing a modular kitchen is as follows:

- First time when the clients come to check the brand. A brief explanation about the brand is given. The sales person tries to understand the needs and the taste of the client. To get more precise information about the kitchen, a form is prepared by the industry which questions them on different aspects of the kitchen such as type of units, what are the appliances they require, budget etc. The sales person will also receive the floor plan of the house as they customize the kitchen and design it according to their needs.
- Then the designer needs a minimum of 3 days time to do the 3D design as per the client's requirements. Several designs will be prepared by the designer. Different aspects like vastu, ergonomics are taken to consideration while designing it.
- Then in the next meeting, the client will be showed their kitchen designs and brief explanations of the units are given. The changes which the clients want to make in his kitchen are noted down.



- For the next meeting, the changes are done and after the layout is freezed, a quote of their kitchen is given to the client. And after finalizing the kitchen, the order is then been processed.
- It takes 90-120 days for the kitchen to reach as they are customized and imported from Germany.

### METHODOLOGY:

For the study the investigator conducted a case study among the homemakers who had opted for modular kitchen in the particular showroom **KIBA solutions**. According to Kothari, (2011) the case study method is a very popular among qualitative analysis and involves a careful and complete observation of a social unit, be that unit a person, a family, an institution, a cultural group or even the entire community. It is essentially an intensive investigation to catch the complexity of a single case. This method studies the problem in depth. For conducting a case study, a schedule prepared by the industry to know the preference of the client was given to the homemakers in order to get more precise information about their expectation in designing the kitchen. Based on the needs specified the designer/ investigator planned the kitchen for their respective clients. Thus the investigator chose that samples for whom she had designed the kitchen. She conducted the case study among the selected homemakers.

### RESULTS OF THE STUDY

The Modular kitchen was designed according to the requirements of the clients who preferred NOLTE kitchens a German based company. The Kitchens were designed by the investigator using NOLTE software as she got trained in the software. Brief information on the Designs of the Modular Kitchen she had developed for the client is given below. Generally several designs will be created for the clients according to their expectation. Ultimately the set designs selected by the clients only will be installed. Table I presents basic information of design developed for the clients.

**TABLE I: CRITERIA'S OF THE CASE STUDY CONDUCTED**

	Case study						
Criteria	1	2	3	4	5	6	7
Brand	Nolte	Nolte	Nolte	Nolte	Nolte	Nolte	Nolte
No;Of Sitting	7	4	4	5	6	7	6
No;Of Days for Importing	90 - 120 days	90 - 120 days	90 - 120 days	90 - 120 days	90 - 120 days	90 - 120 days	90 - 120 days
No;Of days for Installation	3 - 4 days	3 - 4 days	2- 3 days	3 - 4 days	4 - 5 days	4- 5 days	3 - 4 days
Size of the Kitchen	11'x16'	10'X13'	8'X8'	10'X9'	20'X20'	20'X22'	11'x11'
Quoted rate	13,00,000/-	7,96,000/-	5,12,000/-	17,79,000/-	12,48,700/-	15,42,300/-	5,60,800/-
Final rate	12,66,000/-	7,23,000/-	4,62,800/-	17,56,000/-	12,00,000/-	15,00,000/-	5,00,000/-

**CASE STUDY 1:**

The kitchen designed for Nitin was 11'x16' in size. It was his mother who was involved in setting up the kitchen for her son. She had already spent a lot of her time and energy in searching the internet to understand the current trends of the kitchen and the different models available in market. She gave lot of specifications in the kitchen such as ductless chimney but not an Island kitchen, provision for inbuilt appliances such as fridge and oven, height of the worktop and stand-alone hob which has a leg of height 2'-3". She also wanted a modern kitchen and a finish that is easy to maintain. Hence they went for lacquer finish.

**The final rate of the designed Kitchen was: Rs.12,66,000/**

**Feedback: Perfect working height and very user friendly.**

**CASE STUDY 2:**

This kitchen was spread over an area of 130sq.ft. This person had no idea about her kitchen she just wanted a modular kitchen as she was not aware of modular kitchen and its uses. She gave us her budget. The investigator had freedom to design the kitchen according to her taste. The kitchen was a compact L shaped kitchen. So we did explain her about the benefits of each and every units and its usage. She wanted all the appliances to be free-standing. The homemaker preferred stone finish for the kitchen shutters.

**The final rate of the designed Kitchen was: Rs.7, 23,000/-**

**Feedback: Perfect utilization of space and every need is satisfied**

**CASE STUDY 3:**

This client wanted the kitchen in a wooden finish as per the theme followed in other part of the house. So they opted for a polymeric finish. They did not prefer to spend too much for the kitchen. It was also an L shaped kitchen, out of the two sides, they wanted wall and tall units on one side and the other side they required the base units. They wanted lot of storage units as they don't have a separate store room and they did not prefer any modern units.

**The final rate of the designed Kitchen was: Rs.4, 56,000/-**

**Feedback: A full-fledged modular kitchen in their price with all needs satisfied.**

**CASE STUDY 4:**

Mr.&Mrs. Niranjith had a kitchen of about 90 sqft. They had an open kitchen. So they wanted a finish that is easy to maintain and at the same time demanded it to be of a contemporary style, so that it would match the theme of the house. The homemaker was tall so they wanted the worktop to be at a height of 90cm. They wanted inbuilt appliances like fridge, oven, an oven toaster griller(OTG), an inbuilt hob with two burners and a flash induction. The homemaker also wanted accessories like tissue holder, foil cutters, plate organizers etc. She also specified to provide some open units in the kitchen. It was a U shaped kitchen with a breakfast counter. They wanted more of white colour in the kitchen and a finish that is very easy to maintain. So they opted for a lacquer finish. As they did not have a separate utility or store room, maximize utilization of space was designed so as to provide adequate space for storage purpose.

**The final rate of the Kitchen was: Rs.17, 56, 000/-**

**Feedback: They were satisfied with the complete storage solutions in the kitchen and provision made for all modern accessories.**

#### **CASE STUDY 5:**

The total area of the house of the client Mr Cherala than was 5200 sq.ft and the area of the kitchen was 400 Sq.Ft. They had two kitchens. One is the main kitchen where the homemaker would work, whereas the other one is for servant to cook. Both kitchens had storage units and hobs. The client was so concerned about the space to be allotted for storing all the vessels and appliances. She even preferred open units with rolling shutters to store mixer and grinder. She opted for classical style of kitchen made of solid wood for dry kitchen and for easy maintenance; the wet kitchen would be used by the maid. It was their architect Mr. Manoraja who gave us details about their kitchen floor plan. They demanded for teak wood finish as option 1 and rosewood finish and white wood finish combination as option 2. Finally they chose red and white and the kitchen was designed with red wood and white wood. They chose a melamine finish for their utility area due to its easy maintenance. They selected beige colour for their servant kitchen.

**The final rate of the kitchen was Rs.12,00,000/-for the main kitchen alone.**

**Feedback: Even though it's wood it's easy to maintain and it perfectly suits the theme of the house.**

#### **CASE STUDY 6:**

The client Mr.Senthil Kumar whose plinth area of the house was 6000 sq.ft and the area of the kitchen was 440 Sq.ft. They were so specific that they don't want any inbuilt appliances on their counter tops. The only inbuilt appliances they wanted were oven and oven toaster griller. They demanded an island kitchen with a breakfast table. Their Architect Deepika helped us in providing their floor plan .As the client's wife was short, they did not want much of tall units and they also opted for shelves made of particle board other than glass racks or pullouts inside the units. They wanted adequate space for storage. They preferred a kitchen with handle because they felt that if it is a handle-fewer kitchen the maintenance will be a problem. They also requested for a separate servant kitchen for which they preferred a polymeric finish. The architect suggested them to use frosted glass for their top of the wall units but the homemaker did not prefer glass. For their main kitchen, they preferred a beige colour tone. They did not prefer too many modern appliances in the kitchen.

**The final rate of the kitchen was Rs.15, 00,000/- for the main kitchen.**

**Feedback: They appreciated the kitchen as it could store all of the vessels and the soft closure is an added advantage.**

#### **CASE STUDY 7:**

The client Mr.Ritesh whose plinth area of the house was 4000 sq.ft and the area of the kitchen were 121 Sq.Ft. The homemaker Mrs.Madhu Ritesh had a passion for baking. She wanted special space for baking and for other type of cooking separately. The kitchen was a very small one. So according to her suggestion two 'L' shaped kitchen was planned, one for regular cooking and another for baking. For the storage purpose, she opted for 2+1 drawers in their base units. The homemaker did not prefer corner units. She also requested for a small breakfast table in

kitchen. She had a colour preference, and opted for a pastel bluish green colour. In spite of the kitchen being too small, a perfect planning of space was done to provide space for all their needs.

**The final rate of the kitchen was Rs.5, 00,000/-.**

**Feedback: Very easy to bake and cook at the same time as I have separate counters for both.**

#### **CONCLUSION:**

From the above done research, we could conclude that each and every kitchen varies according to the taste and preferences of the client. Though the women were full time homemakers, they were engaged in other social activities and cooking was only a hobby for them. Modular kitchen is one of the considerable triumphs for the professional designers today. Though it was a great achievement in designing interiors, unless the general public could afford to buy or install one it could not be considered as a real success. A time should come when the cost of modular kitchen could be brought down by the designers and even middle income homemakers could afford one. Only then we could congratulate the designers. It is only a hope that the day will be reached soon when the designers could design a low cost modular kitchen with durable material and minimum labour cost that is affordable for an average homemaker.

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## “USER CENTRED” APPROACH TO DESIGN –A BOULEVARD TO ADAPTABILITY OF PROSTHESIS

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### ABSTRACT:

*Rehabilitation is important for enhancing the mobility of affected individuals and improving their health and vocational prospect. Prosthesis is bio mechatronics field, where an artificial extension replaces a missing body part such as an upper or lower body extremity. To provide the patient with the chance to try a diversity of socket systems, with different load-bearing and suspension characteristics, it is necessary to custom formulate each separate socket. The prosthetic leg (PL) is a typical human-machine system in which the lively interaction between the human body and prosthetic leg (machine) determines a high requisite of ergonomics design for prosthetic leg and subsequently needs to consider a sign of usability representing the performance of gait biomechanics. Biomechanical principles regarding the lower limb prosthesis fabrication highlight the fundamental rules to be applied to the socket construction, components assembly in the assembly stand, and the static and dynamic assessment of prosthesis. An accurately fabricated and adjusted prosthetic device is a significant factor to the reintegration of the patients into their family, social, and working environments. Usability contains various components, and actually has no uniform specific indexes. The usability of product is actually used to evaluate the products for meeting comfort, efficiency and other demands from users, which are consistent with the design goals of ergonomics.*

**KEYWORDS:** *Rehabilitation, Prosthesis, Bio mechatronics, Suspension*

## INTRODUCTION

### OVERVIEW

**Prosthesis** is an artificial extension that replaces a missing body part such as an upper or lower body extremity. Prosthesis can improve the results of rehabilitation of the person with a limb amputation. *The prosthesis socket*, a human-machine interface, has to be designed properly to achieve satisfactory load transmission, stability, and efficient control for mobility. The biomechanical understanding of the interaction between prosthetic socket and the residual limb is fundamental to such goals. *Successful design* of prosthetic devices hinges upon a research and development process that intimately combines end-users with device developers (Biddiss, 2007). This process focuses on the usability of the product in what is sometimes called a “*user centred*” approach to design. The concept of usability and the design and conduct of usability testing studies may be unfamiliar to many in prosthetics and rehabilitation because of the dearth of studies published in these areas. The field of usability engineering originates from the disciplines of human factors science and ergonomics (<http://www.rehab.research.va.gov/jour/11/486/pdf/resnik1486.pdf>). With regard to the usability concept, Jin et al., (1997) refer it to the technical capacity (in terms of human features), i.e., its use and effectiveness to be used by a specific range of users, to complete a specific range of tasks through specific training and user support in a particular environment scenario. *The resourcefulness of a person is highly dependent upon his ability for mobility*. This again is an ergonomic concept, where the person has to interact with the device and find satisfaction with the same. As Ergonomics deals with the health, safety and satisfaction of the human being, anything that is designed, has to be user friendly.

**Selection of Method, Tool and Sample:** Of the three types of observational research, overt observation was chosen as the researchers identify themselves as researchers and explain the purpose of their observations to the samples without deceiving them ([https://en.wikipedia.org/wiki/observational\\_techniques](https://en.wikipedia.org/wiki/observational_techniques)). The prosthetic team from the three selected Centers comprised the sample for the study. The centers being the fabricators of this human-machine interface, the so called prosthesis, data was collected from them. Details on the matters were collected for the 142 samples (Those out of 150 who had filled in the Schedule), who were the clients benefiting from the services of these centers. Frequent visits to the centers enabled collection of the required data.

### PROSTHETIC PRESCRIPTION

*Biomechatronics* is an applied interdisciplinary science that aims to integrate mechanical elements, electronics and parts of biological organisms (<https://en.wikipedia.org/wiki/Biomechatronics>). Keeping these points in view, the study analyzed the role of prosthetists - the practitioners in these fields of science - in recommending ‘prosthetic wear’ to their clients, the samples of the study, in the proper sequence on the following lines:

- a. Type of Prosthetic Limb Donned
- b. Biomechanics of Transtibial Prosthesis
- c. Biomechanics of Transfemoral Prosthesis
- d. Prosthetic Requirements of the Bilateral
- e. Type of Knee Prescribed
- f. Type of Foot Prescribed
- g. Alignment Techniques Practiced



**a. Type of Prosthetic Limb Donned:** Prosthetic limbs have two basic types of designs, exoskeletal and endoskeletal. Even though they provide many of the same functions, they are made very differently. The study revealed 51 per cent among transtibial patients and 28 per cent among transfemoral group to have been fitted with exoskeletal limbs. The below-knee prosthesis has been designed indigenously. The shank is made-up from locally manufactured, durable, high-quality, high-density polyethylene pipes (HDPE). The socket design used is either total contact, which is vacuum-formed using a polypropylene sheet, or open-ended, using HDPE. This custom-made socket is fitted with the so called Jaipur Foot. The sockets of above knee are of both ischial bearing and ischial containment types fabricated using HDPE. Rest of the samples had modular prosthesis sockets made of Polypropylene and Resin. The finished prosthesis had custom made socket, a knee joint, a shank section, a torque absorber and an ankle/foot unit.

Both types of prostheses should be individually and dynamically aligned to the amputee; however, once constructed and finished, exoskeletal prostheses are permanently set, requiring significant effort and the actual cutting apart of the prosthesis to make changes. On the other hand, endoskeletal prostheses have the ability to be adjusted greatly after construction and finishing and are generally more adaptable to a changing amputee. They tend to be lighter in weight, offer more component options with more adjustability, but the cosmesis is less durable and sometimes they cost more.

#### **b. Biomechanics of Transtibial Prosthesis**

Significantly of two different biomechanical elements found imperative in fitting the prosthetic on an amputee. They are the socket and the suspension. A variation in the type and designs of sockets and suspensions was noticed, as available with the sample prosthetists who designed the prosthesis for the selected sample. The study was the same 142 amputees who had gone in for prosthesis among whom 89 per cent - 59 and 30 per cent were Transtibial and transfemoral (unilateral) respectively and 11 per cent were bilateral.

##### **i). Transtibial Prosthesis Prescribed:**


This aspect group of the study analyzes the fitment details entailed with prescribing transtibial prosthesis under:

##### **☞ Transtibial Sockets Donned**

##### **☞ Transtibial Suspension Fitted**

**☞ Transtibial Sockets Donned:** Table and Figure (1) enlightens on the concerned topic. This aspect group of the study analyzes the fitment details entailed with prescribing transtibial prosthesis. An important factor that surfaced was that totally there had been 84 samples with transtibial amputation (during the study period) among whom 51 per cent had preferred to approach Center 1 for their prosthetic needs followed by 38 per cent who preferred Center 2.

**☞ TABLE: 1. TRANSTIBIAL SOCKETS DONNED**

Type of socket	Options available	Prosthetists (Centers) represented			
		Percent responding			
		1 (n=43)	2 (n=32)	3 (n=9)	
Patellar Tendon Bearing Socket	Silicone Suction Socket (SSS)	-	91	89	

(PTB socket)	Suction socket (SS)	-	9	11	TT socket
	Total Contact (TC)	100	-	-	

Obviously the rest went to the third Center. The latter two groups preferred SSS type as represented by almost 90 per cent each of them, while the first prosthetist had suggested the total content socket for obvious reasons. The material used, cost of the human –machine unit including fabrication and /or affordability of the sample users could be attributed as reasons. Silicone suction socket found to be the most expensive was prescribed by the other two prosthetists, though they had also given an option in the other type called SS.

☞ **Transtibial Suspension Fitted:** The following Table projects details on the type of suspension fitted by prosthetists to the sample donned with sockets.

**TABLE: 2 TRANSTIBIAL SUSPENSIONS FITTED**

Type of suspension	Options available	Prosthetists (Centers) represented		
		Percent responding		
		1 (n=43)	2 (n=32)	3 (n=9)
Transtibial suspension	Cuff suspension strap/ sleeve	70	78	78
	Waist belt	2	3	11
	Thigh corset	28	19	11

With regard to options given for suspension the prosthetists were not found to differ much. The cuff suspension strap or sleeve was the maximum prescribed one, followed by the thigh corset. Here again the third center tended to showcase a tendency to equally patronize waist and thigh corset, while the first two preferred the thigh corset more. The appropriate suspension system results in safe and well functioning lower extremity prosthesis. Residual limb length, joint ligament stability, and limb volume determine suspension methods. Also activity level, dexterity, success of previous suspension, and cosmetic requirements were considered in prescribing one. These facts highlight two aspects that gain significance in prosthetic fitting:

- ☞ *The extent of support needed to don the socket such that it can be retained in place by the wearer which is purely an individualistic concept differed from one to the other and is a crucial factor*
- ☞ *The etiology of amputation which lays individualistic constraints in fitting the prosthesis is another.*

### c. Biomechanics of Transfemoral Prosthesis

Among the total sample studied 30 per cent were transfemoral amputees (unilateral). Details on the type of prosthesis prescribed by the Centers are explained under:

i. **Transfemoral Prosthesis Prescribed:** As is expected the sockets and suspension provided for this group was entirely different from those provided for their counterparts. Hence this part of the study analyzed the matter in terms of the following:



**Figure: 2 TF Socket**

### ☞ Transfemoral Sockets Donned

### ☞ Transfemoral Suspension Fitted

☞ **Transfemoral Sockets Donned:** Table 3 explains the aspect under consideration

**TABLE: 3 TRANSFEMORAL SOCKETS DONNED**

Type of socket	Options available	Prosthetists (Centers) represented		
		Percent responding		
		1 (n=12)	2 (n=5)	3 (n=26)
Transfemoralso cket	Quadrilateral socket	25	-	23
	Ischial Containment	75	100	87

The survey revealed two types of transfemoral sockets to be used by the sample Centers, namely, quadrilateral and ischial containment sockets (Figure-6). Between the two the latter was found to be well recognized as even the first Center which fabricates the basic module (conventional type of prosthesis) was even found to be using them for three fourths of their sample. The second Center was found to resort entirely on this type of socket. Another type called quadrilateral socket was prescribed by 25 and 23 per cent of the first and third Centers respectively. Evidently the reasons can be attributed to the quality variations, functional requirements (based on amputee status), material differences and above all amputee preferences. Another important feature was that despite availability of the sockets from the first Center, which may be accessed at a comparatively lesser cost or free of cost as the case may be, it was found that a majority of 60 per cent from among the 43 reported as transfemoral (above knee) amputees to have approached the third Center. Whether to pin the preference to quality in product preferred, to affordability or to an attitude of neglect (among those groups in the socio economically weaker section) due to reasons best known to them is a big question that looms in the forefront.



**Figure: 3 Quadrilateral and Ischial containment socket**

☞ **Transfemoral Suspension Fitted:** This aspect of the findings is explained under Table 4

**TABLE: 4 TRANSFEMORAL SUSPENSION FITTED**

Type of suspension	Options available	Prosthetists (Centers) represented		
		Percent responding		
		1 (n=12)	2 (n=5)	3 (n=26)
Trans Femoral Suspension	Pelvic band/ belt	17	20	15
	Total elastic	83	80	85

Unlike wide choice discretion exhibited by the selected Centers for transtibial sockets/suspensions, opinion of the three Centers on prescribing transfemoral sockets was found to run in unison. A majority had opted for total elastic suspension, probably the one which could give

maximum user comfort for the amputees. As transfemoral amputees have exclusive requirements warranted by their anatomical disparities, it could also be argued that they are most preferred to render support on those lines.

There are many types of above knee prostheses. The type that an amputee is fit with depends on the shape of the residual limb, the length of the residual limb, activity level, prognosis, and individual preference. Transfemoral (above Knee) amputee is unable to bear weight on the bottom of his/her residual limb. In order to keep the weight off the bottom of the limb, the amputee must support his body weight on the ischial tuberosity (seat bone), the soft tissue of the limb, and the gluteal tissues.

### b. Prosthetic Requirements of the Bilateral

Prescribing a proper fit in prosthetics for the bilateral amputees evidently is a challenging one as anatomical, physiological and biomechanical aspects have to put forth interplay of distinct roles in perfect coordination.

**TABLE: 5 BILATERAL SOCKETS DONNED**

Particulars		Prosthetists (Centers) represented							
		Percent responding ( n=15)							
		1 (n=55)		2 (n=37)		3 (n=50)			
Bilateral		Percent responding ( n=15)							
Options available		TF/T F		TT/TT		TF/TT		TT/TF	
Transtibial PTB	Silicone Suction Suspension	-	-	13	17	-	10	3	-
	Suction socket	-	-	3	-	-	-	13	-
Transfemoral	Quadrilateral Socket	-	-	-	-	3	-	-	-
	Ischial Containment	7	7	-	-	7	-	-	17




Figure: 4



**Figure: 4**

#### i). Types of Sockets Prescribed for Bilateral:

The findings revealed 15 samples with both the limbs amputated. As good as 13 per cent of them had chosen the SSS socket for their limbs, a few had opted for suction socket. Individualistic differences in terms of residual limb and stump had forced them to go in for different sockets for their left and right limbs. Similarly, Ischial containment socket, the most advanced pattern, was the one preferred by maximum numbers. It is evident from the study that the samples were quite aware of their requirements. Another feature noticed was that only the third center was approached for this dual requirement.

ii). **Suspension Prescribed for Bilateral:** Preference for two types of suspension for the transtibial amputees and four types of suspension for the other group came to light. As with sockets, the samples were found to have donned different suspensions for each limb based on the residual limb length, and limb volume. Their physical activity determined suspension methods demanded. All these factors deliver that ample research and development activities happen before the parts reach the consumer.

**TABLE: 6. SUSPENSION PRESCRIBED FOR BILATERAL**

Particulars		Prosthetists (Centers) represented							
		Percent responding ( n=15)							
		TF/TF		TT/TT		TF/TT		TT/TF	
Transtibial Suspension	Cuff Suspension strap/sleeve	-	-	7	17		3	17	-
	Waist belt	-	-	10	-	-	3	-	-
Transfemoral Suspension	Thigh Corset		-	-	-	-	3	-	-
	Pelvic band/Belt	3	-	-	-	7	-	-	-
	Silesian bandage	3	-	-	-	-	-	-	
	Total elastic	-	7	-	-	3	-	-	17

**b. Type of Knee Prescribed:** This aspect of the study is explained in the following Table

Various types of knee joints were fitted in the modular prosthesis by the selected three prosthetist Centers. In the prosthetist Centre -1, prosthesis provided to the users were Crustacean type because it is composed of a shell that replicates the external shape of the limb, and eventually contains functional components inside. Where two or more segments of a limb are substituted, the corresponding shells are joined by hinges or other connecting mechanisms (IRMA, 2013).

**TABLE: 7 TYPE OF KNEE PRESCRIBED**

Type of Knee fitted	Options available	Prosthetists (Centers) represented		
		Percent responding		
		1 (n=12)	2 (n=5)	3 (n=26)
Transfemoral Prosthesis	Crustacean /Conventional	100	-	-
	Modular	-	100	100

Prosthetist Centers 2 and 3 were providers of modular prostheses. Hence the knee provided to their customers was modular knee which is vital to the overall performance of prosthesis. During stance phase knee stability is the key, and the knee must not buckle at heel strike.

**b. Type of Foot Prescribed:** This aspect of the study is explained in the Table given below

**TABLE: 8 TYPE OF FOOT PRESCRIBED**

Type of foot fitted	Options available	Prosthetists (Centers) represented		
		Percent responding		
		1 (n=12)	2 (n=5)	3 (n=26)
Transfemoral and Transtibial Prosthesis	Jaipur Foot	100	-	-
	Modular Foot	-	100	100

A variety of artificial foot designs are available, each having its advantages and disadvantages. Feet currently available can be divided into two classes: articulated -those with moving joints, and non-articulated. (<http://www.oandp.com/resources/patientinfo/manuals/ak10.htm>). The prosthetist Centre -1 provided their prosthesis with Jaipur Foot that is made of polyurethane, and

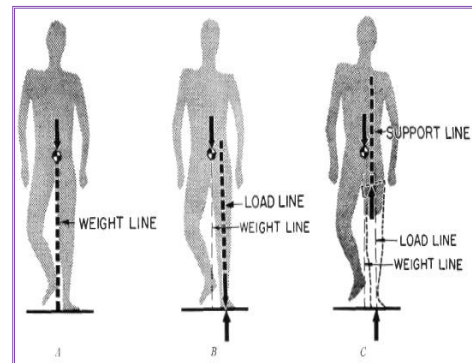


is superior to its SACH mainly in the range of movements it offers. In the other two prosthetist Centers the foot was selected based on the individual's activity level, age and requirements. The Dynamic Motion foot is fitted for people with transtibial, transfemoral amputation with a low to moderate level of activity, and who require a foot with comfortable heel strike, physiological rollover, and good energy return. Carbon feet are prescribed for amputees who walk at various speeds, run, and young customers who wished to climb hills or descending stairs with a secured feeling.

The steps practiced in prescribing prosthesis follows this sequence, choice of type (exoskeletal or endoskeletal), socket, suspension (based on transfemoral, transtibial), knee and foot. After deciding on these and once when the fabrication is completed, the samples are donned with the prosthesis to prepare them for the next stage- a very important stage- which determines the success of the prosthesis that is their ability to walk/ ambulate -called alignment.

### b. Alignment Techniques Practiced

Alignment of prosthesis is defined as the position of the socket relative to the other prosthetic components of the limb (Zahedi et al., 1984). It refers to the spatial relationship between the prosthetic socket and foot. The main purpose of alignment is to position the prosthetic socket with respect to the foot so that undesirable patterns of force applied to the residual limb are avoided. A second purpose is to produce a normal pattern of gait (Bowker et al., 2002). If an acceptable alignment of lower-limb prosthesis cannot be achieved, the limb may be rejected by the wearer. Often the patient complains of discomfort or pain associated with the socket when in fact the alignment of the prosthesis is the root cause. Failure to provide a satisfactory alignment may result in problems for the amputee, such as difficulty in walking, stump pain, or tissue breakdown. It is therefore important to make every endeavor to provide an acceptable alignment to the patient on every occasion that the need arises and that the alignment arrived at be the "optimum alignment" (Zahedi et al., 1986). The study revealed the prosthetists in the selected Centers to be practicing three different techniques for aligning the socket to foot fit before finalizing the prosthesis prescribed for every client (here, the selected sample). The findings revealed the first Center to be practicing only Bench alignment, while the other two Centers practiced all the three types on their samples at different times.



**Bench Alignment:** Prosthesis is so aligned, as it has been for a great many years, by the simple expedient of "aligning by eye" in the Prosthetists Centre -1 (that is, simply by trial and error and by observation of the static and dynamic ambulatory behavior of the amputee-prosthesis combination). The other two Prosthetist Centers possessed the L.A.S.A.R. Assembly that is designed for bench alignment of modular lower limb prostheses (Floor model 743L200/20 and as a Bench Top model 743L300/30).

**Static Alignment** is the condition of the machinery at rest. This process of alignment is adopted by the Prosthetist Centers 2 and 3, where modular prosthesis was being fitted to the amputees. The L.A.S.A.R. Posture (743L100) was used to optimize the static alignment of modular limb prosthesis during trial fitting, as it helped to visualize the position of the body's center of gravity line, or load line while standing.



**Dynamic Alignment** is the condition of the machinery during sustained operation. This process of alignment was adopted by the Prosthetist Centre -2 and 3, where modular prosthesis was fitted to the amputees. Dynamic alignment begins when the coupling is reassembled and "locked" in the neutral position.

#### CONCLUSION:

Rehabilitation of people with disabilities is a procedure directed at empowering them to reach and maintain their optimal physical, sensory, intellectual, psychological and social functional echelons. Rehabilitation offers disabled people with the tools they need to accomplish independence and self-determination. *Prosthetic leg is a typical man-machine system. Empirical data on individual anthropometry is highly significant in prosthesis designing – a human – machine interface. Evidently the rehabilitative process is indeed a good participatory ergonomic process.* The dynamic interactivity between the human body and the prosthetic leg (machines) brings about *higher requirements for ergonomics design of prosthetic leg*, in particular, proposes a special usability indicator of gait symmetry. However, currently a uniform standard for ergonomics evaluation of prosthetic leg function has not been established. According to the design mechanism of human engineering and prosthetic leg bionics, three major usability indexes, including comfort, safety and efficiency are generally used for ergonomics design evaluation. One can state that prosthesis is definitely *a symbol of amputee empowerment*, as they are fabricated after repeated dialogues between the prosthetist team and the amputee. *Adaptability* should come from the self and accessibility from the providers, because *accessibility refers to the design of products, devices, services, or environments* (especially for people with disabilities).

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## DESIGNER STAKEHOLDERS IN CUSTOMISATION OF CARS

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### ABSTRACT

*The automotive industry is a prodigious industry with multiple ranges of sectors involved in the design, development, manufacturing, and marketing of the products. The automotive ecosystem is vast and deals with one of the country's most important sectors – The Economic sector. The design sector of the industry comprises of interior space designing for the product by considering anthropometric norms, incorporation of technical textile (mobiltech) and furnishings plus innumerable control mechanisms – some embedded and others mechanical. Further the sector deals with innovation and value additions to the product. The advent of science and technology has made possible for this design sector to launch numerous prototypes according to the customer's desires through customisation. The true motto of the sector therefore is to enable customisation of several changes and adoptions to every product by keeping pace with the changing customer's demands and on road needs. So this becomes the challenging yet, never-ending phase for the automotive sector. This article enlightens on such aspects like innovation and value additions to various car interiors and functional components in different car segments currently in vogue. Any new addition opens up an enriched field full of opportunities for the technical designers specialising in customisation of cars as a consumer product.*

**KEYWORDS:** Anthropometry, Innovation, Mobiltech, Prodigious, Prototypes.

## INTRODUCTION

Among the developing countries like India, the automotive industry becomes paramount of the global economy. The introduction of new concepts and innovations in the automotive ecosystem is due to the recent pinnacle achievements of science and technology. This leads to the spread of many ancillary industries to the automotive industry and brings about macroeconomic stability and growth in India.

According to the Society of Indian Automobile Manufacturers (SIAM), India's Auto Industry scores sixth position in global level in terms of larger level producer of automobiles with increased volume and value. The automotive industry is trying to forecast the never ending rapidly changing framework conditions of consumer demands – particularly to the megatrends such as the transition to cleaner energy sources, new innovative mobility products and services and value additions (Windisch and Nagaraj, 2016). Kearney (2013) opines that these innovations and megatrends also have an immense potential and they contribute several national building activities such as, creating entrepreneurial avenues for technical designers, generate government revenue and fostering the R & D sector of the auto industry to develop prototypes for future endeavours.

With this as a backdrop, this study was felt imperative to study on innovations and value additions side made in various car segments with the fusion of multiple ancillary industries such as technical textiles, embedded systems, and mechanical industry etc to the automotive ecosystem. Its immense potential for creating entrepreneurial platform for technical designers in *customisation of cars* considering user's desires and demands is infinite.

Customization is the act of configuring a certain product or service according to the customer's requirement, thus adding specific value addition and implementing an innovation in that product (Sadiq and Racca, 2003)

## METHODOLOGY

Coimbatore, the *heart of Kongunadu* is functioning as the fulcrum of the State of Tamil Nadu and is quite known for its industrial, trade, economic and financial wealth and growth. The fast growing Coimbatore tier – II city is surrounded by many automobile industries and auto components' manufacturing units. The agglomeration of many automotive industries in Coimbatore renders it as the hub for many multinational as well as national automotive companies for launching new concept car models and trying out new arrivals of automotive products. Hence, by adopting purposive sampling method with Coimbatore as major study area, the researcher had attempted a study to understand the psychology of car users as well as the car dealers dealing with both the MNC and Indian make cars. Sample comprised of 100 users, belonging to different occupational backgrounds (such as Doctors, Professors, IT and Government Employees, and Business Persons) and 12 car showrooms willing to disclose opinion on new arrivals. Required data was collected through face

**Innovation:** Innovation consists of the generation of a new idea and its implementation into a new product, process, or service, leading to the dynamic growth of the national economy and the increase of employment as well as to a creation of pure profit for the innovative business enterprise (Urabe and Child et. al., 1988)

to face interview administering a structured interview schedule. *This enabled understanding the involvement off - shoot companies as designer stakeholders enabling customisation in the products.*

## FINDINGS

The salient findings of the study are presented under the following headings

### 1. Segment classification in cars

The study revealed that consumers have multiple options and possibilities of selecting their cars based on the length of the automobiles, from the segments of A, A1, A2; B1, B2; C1, C2; D1, D2, and SUV Segments (as per SIAM classification).

### 2. Customization: The Business Strategy

The automotive ecosystem launches products that can be partially or entirely customized as the demand for customized products is getting wide attention in today's global market.

With the advent of science and technology, digitalized versions (using virtual reality) of the products are presented to customers' view and choices are easily enabled. The customization activity provides many benefits to the manufacturer's side as well as the consumer's side, in terms of price premium to the products and emotional attachment to the product to the latter respectively. Evidently, the *manufacturing groups (designer stakeholders) too benefit from the array of opportunities put forth for customising product components in their off shoot factories.*

### 3. Innovations and Value Additions commissioned

Innovation and value additions made to car segments during the year 2015-2018 by the selected car companies was studied, the findings of which are presented under Table 1.

**Value addition:** Value added means the enhancement a company gives its product or service before offering the product to customers. Value added is used to describe instances where a firm takes a product that may be considered a homogeneous product, with few differences (if any) from that of a competitor, and provides potential customers with a feature or add-on that gives it a greater sense of value .(www.investopedia.com)

**TABLE.1 INNOVATIONS AND VALUE ADDITIONS MADE IN CARS**

S.No	Innovations & Value Additions made	Placement in the car	Purpose
1	UV Cut glass	Glass (Front, Rear, and side)	Safety and fuel Efficiency
	Anti-Pinch power window	Car side windows	Safety & Protection
	Innovative new platform	Car body	Safety & Protection
	Total effective control technology	Car body	Safety & Protection
2	Smart Phone connect/Apple car play	Infotainment system	Connectivity, Convenience & Entertainment
3	Dusk sensor	Head lights	Safety
	Rain sensor	Wipers	Convenience & Safety

	Rear glass electric defrosting	Rear glass	Convenience, Safety
	Hill descent control	Brake system	Smooth driving, safety
	Hill start assistance	Brake system	Smooth driving, safety
4	Man maximum & Machine minimum	Cabin allocation	Ergonomic comfort, and Convenience
	Heat absorbent wind screen	Windows	Fuel efficiency, Comfort
	Eco drive indicator	Front Display	Fuel efficiency, Smooth driving
5	Electric boot release	Foot space	Safety & Protection
	Fire prevention system	Engine	Safety & Protection
	Programmed service remainder	Front Display Monitor	Convenience Customer Care
6	Speed sensing auto door lock	Doors	Safety & Protection
	Low fuel level warning	Front Display Tachometer	Convenience & Caution (Warning)
	Pollen filter	Air conditioning vent	Safety & Comfort, Health care
	Pro Pilot Assist	Steering area	Comfort, Safety & Protection
7	Infotainment system	Front Display Monitor	Convenience and safety
	Crumple zone	Car body	Safety & Protection
	Puddle lamp	Door	Safety and convenience
8	Head lamp ON Warning	Front Display Tachometer	Convenience and Caution
	Head lamp with washer	Head light	Convenience and Safety
	Automatic head lamp levelling	Head light	Convenience, Safety & Protection
	Power seat	Seats	Ergonomic and Comfort
	Head up Display	Front glass	Ergonomic and Comfort

Eight branded cars had introduced innovative and value additions in their models of cars, among which five innovations and value additions have been introduced in one of their models. Components were, introduced either in the internal and/or external parts of the cars as the situation and the components required.

Good intentions thought of were to enhance safety and protection, fuel efficiency, comfort, convenience, smoothness in driving, customer care and ergonomic aspects, ultimately leading to customer satisfaction. Incorporation of the digital setup, enabling cloud computing and connectivity were also highlighted.

*Highlight of the study is the emergence of multiples of designer stakeholders either in drafting or production units who had showcased their design talents in bringing out these real times innovative or value added components. It is quite heartening to record that such invisible talents will remain sustainable as long as consumers ask for more comfort zones.*

## CONCLUSION

Manufacturers of cars are definitely ever conscious and cautious about delivering quality augmented products (cars) and prove that their deliverables are brought out with customer centric innovations and value addition. *Evidently, the automobile sector is one which can guarantee sustainable entrepreneurial prospects for designer - stakeholders (from trading, manufacturing as well as consuming public) in all times to come.*

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## APPROACHES IN TEACHING PEDAGOGY FOR UNDERSTANDING SIGNIFICANCE AND APPLICATION OF COLOUR IN INTERIOR DESIGN

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### ABSTRACT

*Interior Design has various facets to strengthen its content and advances. And one very significant but often overlooked component is Colour and its relevance in the development of design. The absence of any structured study and approach to colour in interior design in specific has given it a non-substantial value in the design planning stages. Hence there emerges a need to cultivate a channelized approach to perceiving colour through the initial stages of designing and planning spaces. Colour reflects a space psychologically, aesthetically and physically. The scientific understanding and advances in the field of colour have been often researched and well documented with specifics to fields other than interior design. Thus the pedagogy initiated to capsule the theory and practical understanding of colour approaches stands relevant.*

**KEYWORDS:** Colour, Interior Design, Teaching Pedagogy, Design Planning

## INTRODUCTION

**“Colour does not add a pleasant quality to design-it reinforces it”**

**- Pierre Bonnard**

Colour is an inherent visual property of all forms and its appeal is universal. Tangaz( 2006) opines that colour is more than an aesthetic tool. It is vital for providing information about our environment as well as navigate around it. When it comes to Interior Design, colour is perhaps one of the most important among all the other elements of design- one that creates the first and also lasting impression. It is often referred to as the designer's pet with the power to quickly transform the mood and personality of any space. Applied colour in the field of design can be used practically, decoratively or architecturally giving a sense of place and identity. Although colour has been long considered a fundamental for Interior Design, only recently has one become fully aware of its potential beyond pleasantness and unpleasantness (Nissen.et al, 1994). Pile (1998) declares that colour planning involves some complex issues that require some study in order to master good colour use. Colourists have researched on the optical, physical, chemical, biological, psychological aspects of colour (Gandotra et al.,2011). However an Interior designer needs to take a combined approach to study colour systematically as a science and art. Pile (1997) observes that in Interior design education, some schools offer a colour course based on general colour theory as a part of foundation art program. Others do not make colour the subject of a particular course, rather expect quite optimistically that it will be adequately treated as a part of general interior design courses that must deal with planning, drawing, rendering and many technical aspects that the design of a complex interior space involves. As a result colour often comes as an afterthought. Hence the Approaches in Teaching Pedagogy for Colour in Interior Design were explored with a view to go beyond colour theory to understanding colour in a more functional context for Interior Designers.

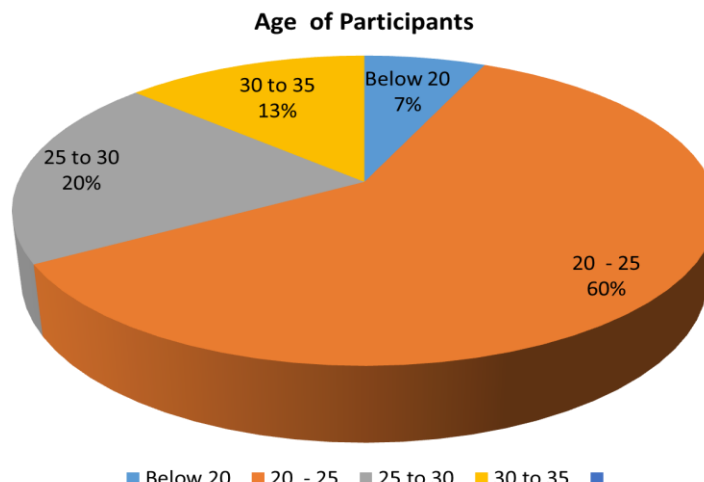
## METHODOLOGY

Interior Designing has become an extremely popular choice among the youth of Kerala and is a growing market where job opportunities are abundant. The colour training was conducted for the students of PG and Diploma Interior Design at Cindrebay School of Design, Trivandrum. Established in 2006, in Calicut, Kerala, Cindrebay has become one of the premier institutes in the field of Interior Designing in South India(<http://www.cindrebay.com>). Breaking traditional concepts of education, Cindrebay follows a through and through experiential learning style of education which makes it a perfect platform for introducing new approaches in design pedagogy. A structured coursework was developed with a view of presenting the basic colour theory with a more practical approach to colour planning and execution of colour schemes. All relevant topics under colour were discussed apart from those already listed out in the existing course syllabus. The instructional hours were merged into the regular class schedule during the first 6 months of the 14 months program. The initiative paved way for a two way approach of theory and practical application of colour in interiors.

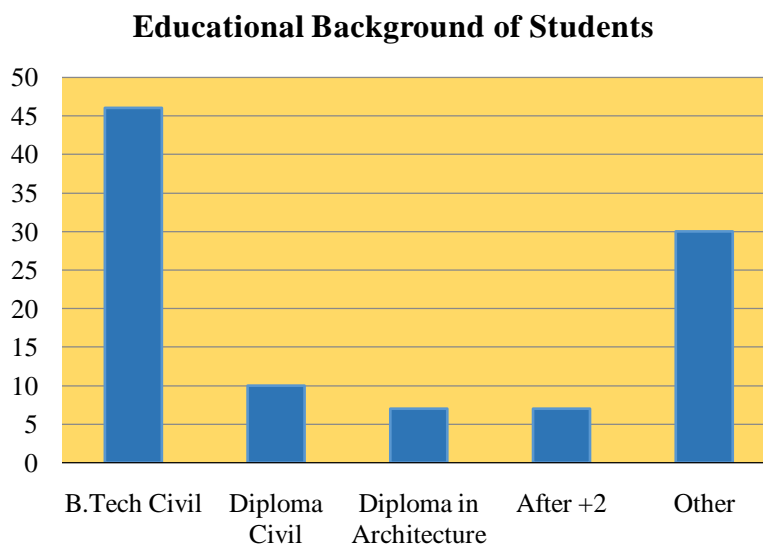
## HIGHLIGHTS OF THE STUDY

The target group selected consisted of 30 students who varied in age groups and educational backgrounds as shown in Figure 1 and 2. A majority of 60 per cent of the students were between the age group 20-25 years and during the first stage a series of lectures were conducted on all important aspects of colour and colour schemes for interior designers. Teaching resources and methods included Power Point and video presentations, worksheets/hand-outs, group

discussions, activities and games. Art projects and assignments(Plate 1) were included after each major topic for students to experiment the knowledge learned. A summary of the topics addressed with details of assignments for each has been presented in Table 1



**Fig 3: Age of Selected Students**



**Fig. 2: Educational Background of Students**

**TABLE 1: A SUMMARY OF ASPECTS ADDRESSED UNDER COLOUR IN INTERIOR DESIGN**

S.No	CLASS SUMMARY	Assignments
Session 1	Meaning and Introduction to Colour, Importance and General functions of colour, Approaches to the study of colour, Colour Systems- Prang, Munshel, and Ostwald	

Session 2	Dimensions or Qualities of Colour, Steps in the Value Scale, Understanding shade, tint and tone, popular colour names The Prang's Colour Wheel, Classification of Colours	Sketchbook activity, art project using colour wheel and art installation
Session 3	Colour Temperature, Warm and Cool colours and their effects, Spatial illusions with colour	Art project and worksheet
Session 4	Colour Harmonies- Mechanical Colour Schemes with examples	Art project for each colour scheme
Session 5	Colour Harmonies- Non- Mechanical and Creative colour schemes with examples	To develop a unique non-mechanical colour palette by taking photographs of objects and landscape
Session 6	Colour Psychology, colour symbolism and colour association	Study of colour symbolism based on historical evidences
Session 7	Impact of colours for Interior Designers, Colours for Residential, Retail and Commercial interiors, Impact of specific hues in interiors. Effect of light on colour	
Session 8	Choosing the right colour and factors affecting choice of colours, Application of colours schemes. Law of areas for colour application	Activity to select suitable colour scheme for the given room and present with a neat sketch
Session 9	Colour dissonances and discord, Colour Accents, Problems associated with colours	Discussion for solving colour mistakes in given examples
Session 10	Colour Inspiration, Colour Palettes, Colour Presentation through mood boards Conclusion	



Plate 1: Art Projects on Colour Schemes

After inculcating a clear theoretical understanding of colour and its application among the students, the next stage involved a systematized colour project for students to explore and experiment colour decisions in its various stages

The project was categorised into certain phases as seen in Table 2 starting with a Case study on colour in the interiors of a branded store. Students selected different typologies of retail stores within Trivandrum city. The colour scheme of selected store was analysed in the form of abstract colour charts and psychology of colours with relation to brand identity was also examined. Redesign of the interior with a new brand logo and colour palette was the aim of Phase II. The development of creative colour palettes was the most interesting part of the process where students were individually guided through experimental choices of colours rising out from unique design concepts and inspirations. Phase III was aimed at familiarising students with the tools of presentation of colour in design through colour moodboards, conceptual sketches and maquette models (Plate 2 and 3). The project was concluded with an in house-student seminar presentation event 'Palettes, 2018' which brought out colourful outcomes of the applied pedagogy. Each student presented a summary of their work through all stages of the Colour project with a PPT presentation and other visual tools. The jury consisted of experienced persons from the field of Architecture, Interior Design and Visual Merchandising. Overall Assessment was done on the basis of various criteria such as originality of ideas and work, student input and efforts, presentation style and techniques, colour aesthetics and application, innovative thinking, understanding of colour psychology, design approach and functional aspects of space design.

**TABLE 2: PROJECT DESIGN FOR PRACTICAL APPLICATION OF COLOUR**

<b>PROJECT DESIGN</b>		
<b>Sno.</b>	<b>Particulars</b>	<b>Requirements</b>
Phase I	<b>Case Study ( Study on colours in the selected Retail store)</b>	1. Descriptive Analysis Colour Characteristics Colour Temperature Effect of light, patterns and textures Physical Elements and Materials Psychology Functional Context 2. Photo Analysis Photograph Colour chart Position in the colour wheel
Phase II	<b>Development of Colour Scheme</b>	1. Name and logo of the new brand 2. Brand Description and typology 3. Concept, symbolism and colour psychology 4. Colour scheme. 5. Mood Board with colour palette



Phase III	<b>Application of colour scheme and Maquette Model</b>	1. Inspiration images 2. Conceptual sketches/representations of ideas 3. Material samples/reference images Layout of the proposed retail space Colour Maquette (Presentation model)
Phase IV	<b>Formal Presentation with Viva.</b>	1. PowerPoint presentation. 2. Visual tools ( Prints, hand-outs, material samples, photographs, sketches, colour swatches) 3. Oral explanation



**Plate 2: Colour Maquette for Proposed Design of Fitness Studio**



**Plate 3: Interior Colour Moodboards developed for proposed designs for retail stores**



## CONCLUSION

Selection of colours could be frustrating and intimidating for amateur interior designers. When the in depth training of colour use and application is overlooked in design education, amateur designers are forced to deal with colour through trial and error methods and poor colour choices could become a primary territory of disappointment during the career. The suggested approaches were successfully implemented showing increased confidence among students in developing creative and unique colour schemes.

It is only a myth that 'good taste' or inborn talent is an absolute requisite for good colour judgements. The complexities of colour specification can be demystified through better pedagogy for colour in design education. One need not dread colour planning when it can become the most enjoyable and rewarding aspect of a design project. Finally, good colour is within the reach of anyone who cares to give the matter some serious thought.

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## DESIGNING FOR SOCIAL MEDIA ADVERTISING – A NEW BEGINNING

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### ABSTRACT

*The first major breakthrough in the presentation of advertising messages was the printing technology which facilitated mass reproduction of graphic images followed by introduction of computers for designing advertising content. The number of people who regularly use various social media channels has grown dramatically and more people are getting highly involved with social media to grow their businesses and to build relationships with other people all of the time. Face book enables extensive targeting options like the custom audience and look like audience for their advertising. Whilst in Pinterest, targeting is more on the interests expressed through keywords by the users. The presence of digital technology has changed the ways we handle the information and graphic design. The intrinsic quality of flexibility in the social media, urges for dynamism in design and as well as content creation. The most important consideration whilst creating social media advertisements is that, it should be designed with mobile phone users in mind. With the digital revolution turning more mobile phone oriented especially the social media; the content for such social media should be specifically designed for small screens. Ever since the evolution of man as a social animal, graphical descriptions have been the way for him to analyze the world and make inferences. It becomes important to understand that such designs have served both decorative and communicative purposes.*

**KEYWORDS:** *Communicative, Presentation,, Graphical, consideration*

## INTRODUCTION

*We can't not communicate.* Just as communication is inevitable, design cannot be eliminated. We continuously interact with the visual input around us and start making interpretations based on our past experiences, social and cultural background. Ever since the evolution of man as a social animal, graphical descriptions have been the way for him to analyze the world and make inferences. It becomes important to understand that such designs have served both decorative and communicative purposes. At its best, design becomes inseparable from communication. Form becomes content, and as Marshall Mc. Luhan says Medium becomes the message.

Industrialized production witnessed abundance in the availability of products which initiated the need for advertising. From the early ages of advertising where it was purely informational, several transformations has happened like considering it as promotional and now in the digital era being more interactive. The first major breakthrough in the presentation of advertising messages was the printing technology which facilitated mass reproduction of graphic images followed by introduction of computers for designing advertising content. At present, the World Wide Web has enormously changed the way we deal with information and the way advertising presents the information.

With the manifold changes in science and technology, our lives are surrounded by a plethora of digital platforms. From business to personal, advertising to banking, teaching to learning, the presence of the World Wide Web for information and communication is found to be more revolutionary. The new media society has an intense use of the social media networks available for communication and information purposes. This necessitates for a fresh outlook and newer perspectives in the use of such social media networks and thus we see the presence of social media advertising.

## SOCIAL MEDIA ADVERTISING – AN INTRODUCTION

Social media advertising has become a popular and booming industry as most of the masses belonging to all age groups are on social media. The number of people who regularly use various social media channels has grown dramatically and more people are getting highly involved with social media to grow their businesses and to build relationships with other people all of the time. It is one of the easiest, least expensive, and most effective ways to gain exposure and to strengthen your business's reputation. This has opened doors to not only the business segment, but there are several avenues to be capitalized by the creators of advertisements too.

## SOCIAL MEDIA ADVERTISING – A BUSINESS PERSPECTIVE

Digital advertising is a key part of most of the advertising campaigns now. In 2013, internet overtook newspaper advertising and now it is history repeats, social media advertising will overtake television advertising by 2020.

Until now, the social media is looked at just a medium for personal communication. However, businessmen have started using this highly personal medium to their advantage and advertisements are now floating in the social media such as Face book, Twitter, Instagram, etc. The main advantage of social media advertising is the accuracy in which it can reach its target, as data including their age, interests, and consumption patterns is easily and instantly available. Advertisements are created with variations on a single theme, so that it will match the kind of consumers they have predicted to respond to it.

The most common social media platforms which are used for advertising are Facebook, Twitter, Instagram, LinkedIn, Pinterest, and Snapchat. For many advertisers Facebook offers the best return on investment (ROI), followed by Twitter and Instagram.

The social media platforms offers varieties of advertising forms which can be used based on the needs and objectives of the advertising campaign. Facebook offers advertisements like photo advertisements, video advertisement, carousel advertisements, slide shows, canvas advertisements etc. Twitter offers promoted accounts, promoted trends and promoted tweets. Instagram, owned by Face book offers advertisement options similar to that of Face book itself. Advertisements in Pinterest are called as Promoted pins but distinguished by whether they run an awareness campaign, engagement campaign or a traffic campaign. LinkedIn, a platform more for professional associations offers display ads like Rectangle advertisement, Skyscraper and Leader board.

Social media advertising also has enriched and effective targeting capabilities. The target audience in social media is highly relevant and active users. The face book has an average of 1.55 billion active users, Twitter with 320 million active daily users and LinkedIn influences professionals and industry leaders. Face book enables extensive targeting options like the custom audience and look like audience for their advertising. Whilst in Pinterest, targeting is more on the interests expressed through keywords by the users.

In traditional media advertising, repetition of advertisements influences the recall ability of the audience. Whilst in social media advertising, repetition indicates boredom and hence the advertiser needs to rotate the ads frequently. Once the audience view the advertisements in social media, their feedback is instant which allows for effectiveness of a sponsored post in minutes. The content of advertisements hence should be kept minimal and all should aim at calling for action.

In addition, the space for advertisements in all social media platforms is restricted and is measured by pixels. In this limited space, the headlines, content, graphics should be incorporated in a way that is attractive, engaging, interactive and more keenly should be calling for action. For call to action, there is a need for a simple and easy to remember the Uniform Resource Locator (URL) of the advertiser's webpage. In twitter advertisements, the use of hash tags will make it more interactive and hence the URL should be optimized.

The cost of posting advertisements in such social media is measured through Cost Per Click (CPC), Cost Per Engagement or Cost Per Impressions (CPI). The advertiser needs to be vigilant in identifying the best payment options, as the way the audience engages in each of these social media is unique and distinct.

### **SOCIAL MEDIA ADVERTISING – A DESIGN PERSPECTIVE**

The evolution of social media reflects the evolution of the design industry and those who embrace it will find themselves with more opportunities – the same way we moved from paste up artwork to digital print production. The presence of digital technology has changed the ways we handle the information and graphic design. The intrinsic quality of flexibility in the social media, urges for dynamism in design and as well as content creation.

Using creative graphics will effectively grab the attention of social media users, the prime objective of any advertisement. The graphics should be simple, bold and bright graphics to convey and nail down the concept. Along with these graphics a value proposition or single call

to action will enable the social media users to know what the advertisement holds in store for the users and also what has to be done(action) .

The Facebook's 20% text rule promotes only limited usage of text on the graphics which warrants inclusion of short and powerful copy. To surpass the constraints by such restrictions, the used of logos and icons can facilitate direct and powerful communication of messages. In addition, such logos should be placed in the minimal size so that it does not refract the attention from the image. When photographs are used in the ads, image enhancement has to be done to make the picture look more clear, attractive and powerful. Enhance the human element of the design by adding people in the image. The users relate to the image of the people and establish connections with the advertisements.

The most important consideration whilst creating social media advertisements is that, it should be designed with mobile phone users in mind. With the digital revolution turning more mobile phone oriented especially the social media; the content for such social media should be specifically designed for small screens. This mobile revolution provides the advertisers with multitude options like geofencing, where the advertisements can be prompted when the mobile users enter a specific geography or a specific zip code.

The power of social media lies in its strength of building relationships. The more effectively the relationship is built, the more strongly the trust and credibility is established. As advertising enrolls into the inevitable revolution of internet and social media, it has to focus on building such relationships rather than mere selling. The trust and credibility is gained through effective discussions on personal problem solving issues. The process of social media advertising is lengthy where the effect is more subtle, but a long standing one.

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## SERVICE DESIGN IN TOURISM INDUSTRY: A KEY FOR SUSTAINABLE ENTREPRENEURIAL BUSINESS

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### ABSTRACT:

*Service design is the activity of planning and organizing people, infrastructure, communication and material components of a service in order to improve its quality and the interaction between the service provider and its customers. It is an innovative way of thinking which creates the experiences your organization delivers useful, usable, efficient, effective and desirable to the customers. Emotional engagement and authentic interactions between the hotel, staff and guests has become the new benchmark in Hospitality industry. To facilitate these key drivers of change, more hoteliers are looking to design their services that find solutions to these challenges. Understanding tourists and tourism industry processes are the principal phase to empower the educated youth to commence tourism entrepreneurship business. The tourism industry has been viewed as the agent of change in economic and social status of the society at large. More and more of the Entrepreneurs in hospitality industry are blending service design into their strategies, recognizing that change and adapting to new approaches and methods of thinking are no longer an option, has become a necessity. Services are highly perishable and they have to be produced and consumed simultaneously. There might be many service providers offering same service in same destination at the same time. It's a great challenge for the service providers to design their product in such a way to attract new customers and to retain their existing customers. This paper explores Service design and its relationship on Entrepreneurship development in Hospitality Industry.*

**KEYWORDS:** Service Design, Entrepreneurship, Tourism, Hospitality Industry, Unemployment, Tourism Development, Customer Satisfaction.



**INTRODUCTION:**

Tourism is a service-intensive industry focusing on the customers service experiences not only during their stay, but also prior and subsequent to it. Since most tourism products are booked and paid for in advance, customers have to rely on the accuracy of accessible information. Service design is the activity of planning and organizing people, infrastructure, communication and material components of a service in order to improve its quality and the interaction between the service provider and its customers. Service design is all about taking a service and making it meet the user's and customer's needs for that service. It can be used to improve an existing service or to create a new service from scratch. It may function as a way to inform changes to an existing service or create a new service entirely. The purpose of service design methodologies is to establish best practices for designing services according to both the needs of customers and the competencies and capabilities of service providers. If a successful method of service design is employed, the service will be user-friendly and relevant to the customers, while being sustainable and competitive for the service provider. However, besides the information provided first-hand by tourism service providers, communication technologies enable customers to share product reviews through respective websites. The hospitality industry has undergone tremendous changes in the last five years. Competitive pressures, shifting consumer preferences and consumption patterns, technological advances, consolidation, price discounting, and new distribution channels are but a few of the changes in the business landscape.

**OBJECTIVES OF THE STUDY:**

- To understand the importance of service design in tourism industry.
- To study the various approaches to service design in tourism industry
- To study service design in technology information and feedback
- To evolve the best practices of service design in tourism industry for entrepreneurial business.

**REVIEW OF LITERATURE:**

Service design is a process in which the designer focuses on creating optimal service experiences. Service design often involves the use of customer journey maps, which tell the story of different customers' interactions with a brand, thus offering deep insights. In early contributions to service design (Shostack 1982; Shostack 1984), the activity of designing service was considered to be part of the domain of marketing and management disciplines. For instance, Shostack (1982), proposed the integration of the design of material components (products) and immaterial components (services). This design process, according to Shostack, can be documented and codified using a "service blueprint" to map the sequence of events in a service and its essential functions in an objective and explicit manner. In 1991, service design was first introduced as a design discipline by Prof. Dr. Michael Erlhoff at Koln International School of Design (KISD). In 2001, Livework, the first Service Design and Innovation consultancy, opened for business in London. In 2004, the Service Design Network was launched by Koln International School of design, Carnegie Mellon University, Linkopings Universitet, Politecnico di Milano and Domus Academy in order to create an international network for service design academics and professionals. Several authors (Eiglier 1979; Normann 2000; Morelli 2002) emphasize that services come to existence at the same moment they are being provided and used. In contrast, products are created and "exist" before being purchased and used. While a designer can prescribe the exact configuration of a product, s/he cannot prescribe in the same way the

result of the interaction between customers and service providers (Holmlid, 2007), nor can s/he prescribe the form and characteristics of any emotional value produced by the service. In 2012, the Savannah College of Art & Design became the first college in the United States to offer an accredited BFA program in Service Design. Innovation has been championed as a way to cope with these and other changes in the industry. For this purpose, service design uses methods and tools derived from different disciplines, ranging from ethnography (Segelström et al., Ylirisku and Buur, 2007, Buur, Binder et al. 2000; Buur and Soendergaard 2000) to information and management science (Morelli, 2006) to interaction design (Holmlid, 2007, Parker and Heapy, 2006). Service design concepts and ideas are typically portrayed visually, using different representation techniques according to the culture, skill and level of understanding of the stakeholders involved in the service processes (Krucken and Meroni, 2006, Morelli and Tollestrup, 2007). Service design is addressed among the strategic activities of businesses, while it continues to develop as a discipline (Larsen, Tonge & Lewis, 2007; Zehrer, 2009). As seen in the hotel sector, even though service quality is increasing gradually, some decreases could be observed in the quality perception of the customers, due to reasons that include poor structuring of services and the inability to fully meet customer expectations (Zeithaml & Bitner, 2003). New service is one of the main solutions to strengthen the competitive position of service businesses (Cooper & Edget, 1999; Menor, Tatikonda & Sampson, 2002; Stevens & Dimitriadis, 2005; Smith, Fischbacher & Wilson, 2007; Weissenberger-Eibl & Koch, 2007). Customers perceive hotel services as mostly similar to, and substitutable with, each other (Victorino, Verma, Plaschka & Dev, 2005). Gummesson (1994) argues that the deficiencies in service design would constantly cause problems, especially in service delivery. The hotels taking advantage of service design and implementing it systematically (Ottenbacher & Gray, 2004) are mostly the chain hotels (Ottenbacher, Shaw & Lockwood, 2005). The main reasons for unsuccessful efforts are not handling design systematically, lack of service design knowledge and skills (Zehrer, 2009).

### **Tourism Business:**

The tourism business has been acknowledged as one of the main businesses for lashing economic expansion and economic revolution in developing countries (Filipovski & Sc, 2011). The tourism industry generates employment opportunity for large numbers of populaces, both skilled and unskilled workers. Tourism endorses nationwide amalgamation by generating foreign exchange, encourages cultural activities and customary and traditional handicrafts segment (Patel, 2012). Tourism business augments a major impact to the survival of various service sectors such as resort, rest house, services, hotels, handcraft business development centers and travel agents. Different types of tourism business have been distinguished based on the following criteria (Tureac & Anca, 2008): The conditions of the primary region and the destination: a) Domestic tourism business, b) International Tourism business; The standard quantity of members: a) Individual tourism business, b) Group tourism business; Organizational standard: a) Organized tourism business, b) Unorganized tourism business c) Semi-organized tourism business; Seasonal Criterion: a) Continuous tourism business, b) Discontinuous tourism business; Temporal Standard: a) Tourism for very extensive period of time business, b) Tourism of long period business, c) Tourism of compact period business; Transportation vehicles criteria: a) Train Tourism business, b) Auto Tourism business, c) Maritime tourism business, d) In-flight tourism business, e) Other forms of tourism business such as cycling, walking, etc.; Societal criterion: a) Private tourism business, b) Social tourism business; Age and occupation standard: a) Youth Tourism business, b) Specific to grown-ups' tourism business, c) Specific for adult

group tourism business; Destination criterion: a) Mountain tourism business, b) Season tourism business.

### **Why Service design Important for Tourism Industry?**

- For tourism destinations, service design is a framework to achieve an empathic understanding of the tourist experience.
- The better the organization understands the overall service experience, the better they can make the experience for their customers.
- As tourism destinations worldwide adapt to new roles within the travel planning cycle, clear and profound knowledge spanning the entire tourism experience will gain greater value than traditional roles in distribution and promotion of their services.
- Knowledge creates expertise--Expertise builds relevancy--Relevancy delivers value.
- If the organization and staff are the experts on the destination's tourism ecosystem, then they are valuable to the people and businesses within the ecosystem.
- Service design methodologies provide the structure that will help shape the role and relevancy of the future DMO.
- Service design is human -centered approach which is different from other business and consulting approaches by placing the organization at the center. This customer-centric approach is particularly relevant to tourism industry, which has changed greatly due to the growth of the Internet.

### **Principles of Service Design:**

The general principles of service design are to focus the designer's attention on generic requirements of all services. They are complemented by principles that relate to process design, organizational design, information design and technology design –The general principles of service design are:

- Services should be designed based on genuine comprehension of the purpose of service, the demand for the service and the ability of the service provider to deliver that service.
- Services should be designed based on customer needs rather than the internal needs of the business.
- Services should be designed to deliver a unified and efficient system rather than component-by-component which can lead to poor overall service performance.
- Services should be designed based on creating value for users and customers and to be as efficient as possible.
- Services should be designed on the understanding that special events (those that cause variation in general processes) will be treated as common events (and processes designed to accommodate them).
- Services should always be designed with input from the users of the service.
- Services can and should be prototyped before being developed in full.
- Services must be designed in conjunction with a clear business case and model.

- Services should be developed as a minimum viable service (MVS) and then deployed. They can then be iterated and improved to add additional value based on user/customer feedback.
- Services should be designed and delivered in collaboration with all relevant stakeholders (both external and internal).

**Approach to Service Design:**

- meeting the needs of service organizations so that they may be competitive
- meeting the rising expectations of customers regarding choice and quality
- making use of the technological revolution, which has vastly expanded the possibilities for creating, delivering and consuming services
- addressing the pressing environmental, social and economic challenges of sustainability
- fostering innovative social models and behaviors
- sharing knowledge and learning

**Qualities of a Service Designer:**

- Visualize, express and choreograph what other people can't see, and envisage solutions that do not yet exist.
- Transform observed and interpreted needs and behaviors into service possibilities.
- Express and evaluate the quality of design in the language of experiences.
- Service designer uses a wide range of design tools for exploration and creation.
- Service designers can foresee a spectrum of situations in which users may interact with brands, from discovery to conversion and attendant issues such as customer reengagement.

**Service Design Process:**

Service Strategies can help design service processes from scratch or reengineer existing processes to take organization to the next level of performance. We leverage our expertise and experience to align your new processes with industry standards and best practices, thereby ensuring your success. Processes and operating procedures have to be examined to identify opportunities for improvement that will enable the organization to deliver the most efficient service at the right level of quality to customers. Service design process and reengineering projects typically include:

- Complete review of all detailed processes
- Analysis and identification of failure points in current processes
- Process redesign and creation of new process flows and descriptions
- Alignment of new processes to industry standards and best practices
- Determination of any systems impact and required enhancements
- Analysis of resource requirements necessary to execute new processes
- Change management training and roll out to the organization
- Creation of measures of success and key performance indicators

- Monitoring and tracking of performance to ensure success

Service Strategies consultants stay engaged to monitor the organizational and process changes and provide fine tuning and ongoing assistance to ensure continues success.

### Service Design and Organization:

People are the key to service delivery and some basic principles for organizations can help them realize their full potential:

- Work groups to be organized so they match the processes and the competencies required
- Individual workers will be given sufficient autonomy to make useful decisions
- Work will take place in a location where it is done with the most efficiency

### Service Design and Information:

Information flow is key to delivering high quality services; if people don't know what they're supposed to and when they're supposed to know it – service suffers. These are simple principles for information design in service design:

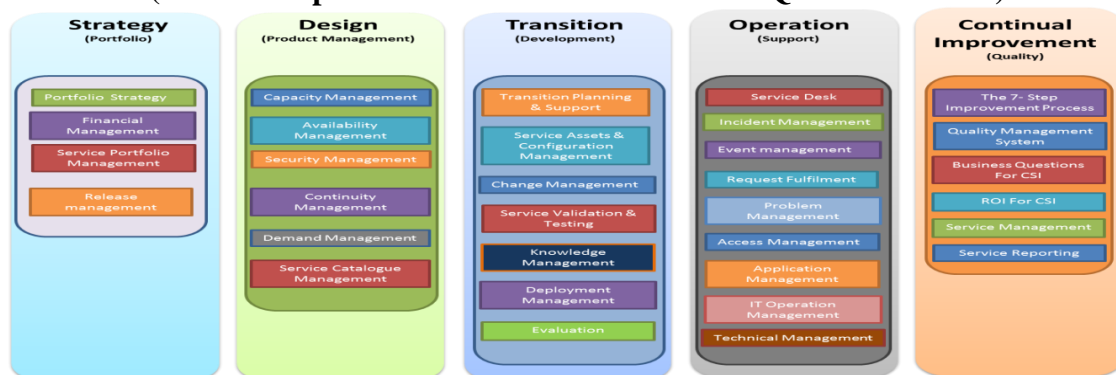
- Data shall be normalized between the organization and its customers and within the organization itself.
- Data shall be easy to transfer and be reusable within the organization and within the partner network.
- Wherever possible data entry shall be avoided and be replaced by data lookup, selection and confirmation utilities instead.

### Service Design and Technology:

Technology design principles are used to support the delivery of service. They include:

- Technology should always be used to enable a service; it should not be the driver of a service.
- Technology should be pulled into a service design rather than pushed into it.
- Technology design is to be flexible enough and agile enough to allow fast modification in the face of changing customer requirements.

**Fig.2 Change Management-Guidelines for Service design and Technology**  
(Source: <https://www.emaze.com/@ACTCZFQT/Presentation>)



**Service Design and Customer Feedback Programs:**

Service Strategies can help you enhance your customer feedback programs to enable effective measurement of satisfaction and loyalty. It leverages the expertise and experience to align the customer feedback program with industry standards and best practices, thereby ensuring to collect accurate, actionable data that leads to changes that drive increased satisfaction and loyalty among the customers. Service Strategies Consultants can review existing customer feedback processes in detail and can make recommendations designed to streamline the processes, enhance survey instruments and tools and ensure the program adheres to industry standards and best practices. The customer feedback engagement typically includes:

- Review existing customer satisfaction feedback processes
- Design event and periodic surveys for services
- Analyze feedback data and determine if results are statistically valid
- Create a process to develop action plans customer feedback
- Recommend communication processes to share improvements with customers
- If appropriate, assist in the selection of third party Survey tool or vendor
- Provide recommendations for creating a customer loyalty and retention program
- Create customer satisfaction and loyalty measurement scorecards

**CONCLUSION**

Service design is an ever-expanding key in tourism industry for driving the national economy through entrepreneurial development. Entrepreneurs and entrepreneurship in service industry promotes business innovation and economic growth through effective service designing. To sustain in tourism industry, a substantial long term government support, extensive training, proper service design, research and planning processes is required in order to grow and flourish as an Entrepreneur. Entrepreneurial development leads to upliftment of the weaker section through employment generation. In a nutshell, service design in tourism industry must put people first to be a successful entrepreneur. In order to generate a relevant, integrated and attractive customer experience, it's necessary to consider the entire span of the customer's journey through service product design to understand both their needs and their expectations; the value this awareness can add to a tourism business is immeasurable. Service design is not new, but it is of critical importance in the hotel and tourism sector. Service design has become a core competency for hotel managers; they should ensure that the related design proficiencies, organizational arrangements, coordination, and resources required for service design has to be supplied. To quick design and launch new services to meet customer expectations, service design should be conducted as a continuous activity. The better the tourism organisation understands the overall service design experience by the customers, the better they can make this experience as opportunities to introduce new services towards the development of a successful Entrepreneur.

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## SCRUTINIZING THE EXCEPTIONAL ARCHITECTURE OF CHOLA AND PANDYA DYNASTY

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### ABSTRACT:

*Religion has been an imperative part of the country's culture throughout the history. Religious diversity and religious tolerance are both reputable in the country by law and custom. The western and northern part of India has been the home of one of the most ancient civilization of the world called Indus Valley Civilization, which ultimately culminated to Vedic Civilization. India is the place of shrines, ancient temples and the birthplace of Hindu saints. The main purpose of the early building art in the India was the representation of the existing religious perception of the people in a tangible form. Therefore, early Indian Architecture in the form of various sacred monuments represents religious beliefs and symbolizes Hindu Philosophy. The main objective was to explore the views and preferences of the people of different dynasties towards the ancient temples of India. Temple architecture defines the various periods and the reign of various dynasties. Every pillar and wall are carved to represent a scene from the life of deity or even an ancient scripture. Diverse types of Indian architectural styles comprise a heap of expressions over space and time, distorted by the forces of history considered unique to India. As a result of enormous diversities, a vast range of architectural samples have developed, retaining a certain amount of continuity across history.*

**KEYWORDS:** *Hindu philosophy, Temple Architecture, Dynasties, Enormous Architectural Style.*

**INTRODUCTION:**

**“Religion is the frozen thought of man out of which they build temples”**

**- Krishnamurthy**

Religion has been an imperative part of the country's culture throughout the history. Religious diversity and religious tolerance are both reputable in the country by law and custom. The western and northern part of India has been the home of one of the most ancient civilization of the world called Indus Valley Civilization, which ultimately culminated to Vedic Civilization. India is the place of shrines, ancient temples and the birthplace of Hindu saints. The main purpose of the early building art in the India was the representation of the existing religious perception of the people in a tangible form. Therefore, early Indian Architecture in the form of various sacred monuments represents religious beliefs and symbolizes Hindu Philosophy.

Temple architecture defines the various periods and the reign of various dynasties. Every pillar and wall are carved to represent a scene from the life of deity or even an ancient scripture. Reasons for constructing a gopuram could be as follows: In ancient times devoid of tall buildings, a gopuram could easily be seen from kilometers away thus leading a lost traveler to the 'nearest city'. It was believed to be a source of positive energy.

**OBJECTIVES OF THE STUDY:**

- \* To understand the basic concept of Hinduism and its relevance on the design and construction of Hindu temple architecture.
- \* To elicit the concept of a Hindu temple, its evolution, development of its architectural styles, the materials of construction, its characteristics with main focus on the South Indian Style.
- \* To explore the views and preferences of the people of different dynasties towards the ancient temples of India.

**METHODOLOGY:****CASE STUDY:**

A case study is a research strategy and an empirical analysis that investigates a experience within its real-life context. Case studies are based on an in-depth inquiry of a single group to discover the causes of underlying moralities. The case study was conducted among the ancient temples of India with the following steps:

- Selection of Area
- Selection of Sample
- Tools for Data Collection

**SELECTION OF AREA:**

Investigator wished to execute her study to Tamil Nadu, Land of Temples. In South India, five temples were built for Five elements – Earth, Fire, Air, Water and Space. These are Known as *Panch Bhuta Sthalas* (4 in Tamil Nadu & 1 in Andhra Pradesh)

***Panch Bhuta Sthalas***  
***Space – Chithambaram***  
***Water – Thiruvanaikaval***  
***Earth – Kanchipuram***  
***Air – Kalahasti***  
***Fire - Thiruvannamalai***



Almost 33,000 ancient temples are found scattered all over the state which are atleast 800 to 1200 years aged. Studded with intricate architecture, variety of sculptures, and rich inscriptions, the temples remain the very soul of the culture and heritage of Tamil Land, with historical reports dating back to at performed in the following ancient temples of Tamil Nadu in the city of Tanjore, Madurai, Trichy and Perur.

**Tanjore:** Thanjavur, the Rice Bowl of Tamil Nadu, is the important center of South Indian religion, art and architecture. Great Living Chola Temples were located here, which defines the reign of Chola Dynasty. Brihadeeswara Temple, a UNESCO World Heritage Monuments is located in the center of the city.

**Madurai:** Second largest in state and 31<sup>st</sup> largest urban agglomeration in India is Madurai which has the well known landmark, Meenakshi Amman Temple. The temple shapes the heart and lifeline of the 2500 year old city.

**Srirangam:** Srirangam (in earlier times Vellithirumutha gramam) is an island and a component of the city of Tiruchirappalli, in South India. Srirangam is famed for its Sri Ranganathaswamy Temple, a major pilgrimage intention for Hindus.

**Perur:** Perur is very famous for its very old Perur Pateeswarar Temple, which was constructed by Kaikala Cholan. The bank of Noyyal River is just 500m away from temple. The rituals of deceased people are performed here.

#### SELECTION OF SAMPLE:

The temples that were analyzed as sample are listed as follows:

- ♠ Brihadeeswara Temple.
- ♠ Meenakshi Amman Temple.
- ♠ Sri Ranganathaswamy Temple.
- ♠ Perur Pateeswarar Temple.

These temples are deemed to be the antique temple with intricate work in the sculptures, paintings, architectural elements and beliefs and myths.

In this case, the sample size is four temples, which belong to the historic era that marks the period of art and architecture.

#### TOOLS FOR DATA COLLECTION:

The details regarding each temple, its architecture significance, sculptures of the temple are gathered from ancient times and are transferred from generation to generation by the roots of Hindu Philosophy, that is, *Vedas*. The data used for analysis are secondary data which have already been collected by other research scholars.

#### RESULTS AND DISCUSSION:

##### CHOLA DYNASTY ARCHITECTURE:

The Kings of Chola Empire had a immense interest in the field of art and architecture and accomplished a lot in the same field. The Tanjore Shiva Temple by Rajaraja Cholan the Great, is the most bravura instance of the Chola architecture. The temple is well-known for its spacious

courtyards and massive tower. Their towers mount to a height of 190 feet. The tower top is circlet by a solo block of stone, 25 feet high and weighing about 80 tones. The matter of great astonish is to how such a weighty piece of stone was taken to such a great stature. The entire deed must have need a great technical and engineering cleverness.

Another beautiful sample of Chola architecture is afforded by the temple which was constructed by Rajaraja's son and descendant Rajendra I in his new capital, Gangai-Konda Cholapuram. This temple is famous for its immense size huge "lingam" of solid granite and delicate carvings in stone. These structures of the Cholas were ornamented with minuscule sculptures involving "immense manual labor and immeasurable pains." The fine art of sculpture also made a great advancement under the Cholas. Their temples are full of some of the best specimens of carvings and sculptures. The Chola artists also made some of the extraordinary specimens of images and statues of Gods and life-like portrait-images of their kings. The Chola rulers are still remembered for their vast irrigation plans, massive embankments and dams, well designed cities and above all for their temples whose towers mount on their foundation like a pyramid.

### **PANDIYA DYNASTY ART AND ARCHITECTURE:**

The Pandyas donated more for the progress of architecture. Gopuras, Prakaras, Vimanas, Garbagrahas are the unique features of the Pandya temple architecture. Temples at Madurai, Chidambaram, Kumbakonam, Thiruvannamalai, Srirangam are excellent instances for the improvement of Pandya architecture. The metaphors of horses and other animals are imprinted on pillars. According to historian A.L .Basham, the zeniths of Pandya architecture are Meenakshi temple and Aranganathar temple at Madurai and Srirangam respectively.

Their temples were simple in manner. Each and every temple is constructed with Garbagraha, arthamandapa and mahamandapa. Pandyan sculptures are gorgeous, dazzling and decorative patterned. Some sculptures are engraved on single stone. Every sculpture has got more messages and ethics. Pandyan era has witnessed renaissance in the skill of sculpture. Sculptures of Somaskandar, Durgai, Ganapathy, Narasimha, Nataraja are very superior examples. The beauty of the mural paintings and oil paintings are on par excellence with pandya dynasty.

Pandya rulers added more for the progress of literature, art and architecture. Their aids shaped a unique and enduring cultural impact upon the Tamil society.

### **Main Features of Pandya Dynasty:**

- Sanctum Sanctorum- Garbha Griha
- Massive Gopurams
- Elevated outer walls
- Towering Pyramidal Vimanas full of sculptures and decorations.
- Pillared hallway
- Antaralya- the passageway between the hall and Garbha Griha

### **Meenakshi Temple:**

It is the most well-designed illustration of the Dravidian architecture. This temple was formerly built by the Pandyan King Kulasekarer Pandya. It is an outstanding architecture, a master piece which is the center of activity for the encouragement of art and culture in Madurai. It is the main magnetism of the city. There are breathtaking views of stone carved sculptures of

special deities on the wall of temples. The temple is devoted to the Goddesses Meenakshi (Parvati) and to the Lord Sundareswara (Shiva).

#### **CONCLUSION:**

The Hindu Temple Architecture is an open, symmetry driven structure, with many variations, on a square grid of padas, deploying perfect geometric shapes such as circles and squares. The Hindu temple architecture reflects a synthesis of arts, the ideals of dharma, beliefs, values and the way of life cherished under Hinduism. "Hinduism is not a sole religion, it is the collection of costumes of various religions which are native and predominant in India, does not believe in any one philosophic concept or any single God, thus may be broadly described as a way of life." states Rowland (2002). Diverse types of Indian architectural styles comprise a heap of expressions over space and time, distorted by the forces of history considered unique to India. As a result of enormous diversities, a vast range of architectural samples have developed, retaining a certain amount of continuity across history.

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## AVENUES FOR TRAINING AND DEVELOPMENT OF WOMEN IN ENTREPRENEURSHIP

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### ABSTRACT

*The new industrial policy has stressed the need for conducting special Entrepreneurial Development Programmes (EDPs) for women. Besides this, today, a network of institutions exists in the country to promote women entrepreneurship. Majority of them are engaged in the recognized sectors like agriculture, handicrafts, handlooms and cottage based industries. The major objectives of STEP are to forge linkages among academic and R&D institutions on one hand and the industry on the other and also promote innovative enterprise through S&T persons. Since such women are not able to have an easy access to credit, it has been envisaged that the credit will be made available to women applicants through NGOs who would be capable of handling funds in an appropriate manner. For example if a mention institution or eligible NGO wants to conduct a pre or post project training programme for a group of women then the maximum GOI grant can be Rs.1.0 lakh provided the NGO also raises 25% of the requested grant i.e. the total expenditure of the training expenditure can be up to Rs. 1.25 lakhs for availing full assistance of GOI grant. Highly educated, technically sound and professionally qualified women should be encouraged for managing their own business, rather than dependent on wage employment outlets. The unexplored talents of young women can be identified, trained and used for various types of industries to increase the productivity in the industrial sector. Hence, the budding entrepreneurs must be aware of the institutions which are providing assistance and guidance in various aspects such as skill building, fund mobilization, drafting business plan, marketing, legal and technology usage.*

**KEYWORDS:** Entrepreneurship, Mobilization, Drafting, Expenditure

*“A wise man will make more opportunities than he finds” – Francis Bacon*

## INTRODUCTION:

Entrepreneurship has been a male-dominated phenomenon from the very early age, but time has changed the situation and brought women as today's most memorable and inspirational entrepreneurs. In almost all the developed countries in the world, women are putting their steps at par with the men in the field of business. In India the self-employed women account for only meagre percentage of the self-employment persons in the country. Majority of them are engaged in the recognized sectors like agriculture, handicrafts, handlooms and cottage based industries. As per the ILO, “Sustainable enterprises should innovate, adopt appropriate environment friendly technologies, develop skills and human resources and enhance productivity to remain competitive in national and international market”.

Awareness on women entrepreneurship is higher in urban areas than in rural areas. The reason may be lack of infrastructure, varied life styles, lower income, less literacy level and lack of technological awareness, but rural women also empowering slowly but significantly during last decade due to the intervention of government, NGOs and Media in this regard. The new industrial policy has stressed the need for conducting special Entrepreneurial Development Programmes (EDPs) for women. Besides this, today, a network of institutions exists in the country to promote women entrepreneurship. Hence, the budding entrepreneurs must be aware of the institutions which are providing assistance and guidance in various aspects such as skill building, fund mobilization, drafting business plan, marketing, legal and technology usage.

## OBJECTIVES OF THE STUDY:

In the light of the above background the paper covers the following objectives

1. To identify the training needed areas to start an entrepreneurship
2. To find out the agencies/ organizations which are providing training to the needy people
3. To create the ways to networking of women entrepreneurs at the regional level.

**METHODOLOGY:** The present study is mainly based on secondary data only. Secondary data has been collected and obtained from various published sources such as Government publication, reports, journals and other published materials.

**Training Needed Areas:** Trainings can be given in the following aspects would give an insight to the women entrepreneurs to become more in numbers and they can be brought to the light in the world of business.

- Skill development through educational institutions and industrial training institutes.
- Vocational training to understand the production process and production management
- Training on professional competence such as leadership skill and organizational skills
- Another important area is digital marketing of products and making profit.
- Training may be given by the financial institutions about the sourcing of funds.
- Training on awareness on micro credit system and enterprise credit system to the women entrepreneurs.
- Assistance with respect to trade and business registration process through online.

**Avenues for Training and Development of Women in Entrepreneurship:** The science parks and similar initiatives help in creating an atmosphere for innovation and entrepreneurship, for

active interaction between academic institutions and industries for sharing ideas, knowledge, experience and facilities for the development of new technologies and their rapid transfer to the end users. The following are some of the Governmental Institutes / organizations working for Training and Development of Entrepreneurs.

### 1. National Science & Technology Entrepreneurship Development Board (NSTEDB)

The National Science & Technology Entrepreneurship Development Board (NSTEDB), established in 1982 by the Government of India under the aegis of Department of Science & Technology, is an institutional mechanism to help promote knowledge driven and technology intensive enterprises. The Board, having representations from socio-economic and scientific Ministries/Departments, aims to convert "job-seekers" into "job-generators" through Science & Technology (S&T) interventions.

#### Objectives:

- ✓ To promote and develop high-end entrepreneurship for S&T manpower as well as self-employment by utilizing S&T infrastructure and by using S&T methods.
- ✓ To facilitate and conduct various informational services relating to promotion of entrepreneurship.
- ✓ To network agencies of the support system, academic institutions and Research & Development (R&D) organizations to foster entrepreneurship and self-employing using S&T.
- ✓ To act as a policy advisory body with regard to entrepreneurship.

**Training Programmes of NSTEDB:** Entrepreneurship Awareness Camp (EAC), Entrepreneurship Development Programme (EDP), Faculty Development Programme (FDP), Technology Based Entrepreneurship Development Programme (TEDP) ([www.ediindia.org](http://www.ediindia.org)).

**Institutional Mechanism :** National Initiative for Developing and Harnessing Innovations (NIDHI), NewGen Innovation and Entrepreneurship Development Centre ( NewGen IEDC), Science & Technology Entrepreneurship Development (STED) Project, Innovation - Science and Technology based Entrepreneurship Development (i-STED), Science & Technology Entrepreneurs Park (STEP), Technology Business Incubator (TBI).

### 2. Science & Technology Entrepreneurship Park (STEP)

The Science & Technology Entrepreneurs Park (STEP) programme was initiated to provide a re-orientation in the approach to innovation and entrepreneurship involving education, training, research, finance, management and the government. A STEP creates the necessary climate for innovation, information exchange, sharing of experience and facilities and opening new avenues for students, teachers, researchers and industrial managers to grow in a trans-disciplinary culture, each understanding and depending on the other's inputs for starting a successful economic venture. The major objectives of STEP are to forge linkages among academic and R&D institutions on one hand and the industry on the other and also promote innovative enterprise through S&T persons.

**Facilities and Services Provided by STEPs:** It offers facilities such as nursery sheds, testing and calibration facilities, precision tool room/central workshop, prototype development, business facilitation, computing, data bank, library and documentation, communication, seminar hall/conference room, common facilities such as phone, telex, fax, photocopying. It offers services like testing and calibration, consultancy. Training, technical support services, business



facilitation services, database and documentation services, quality assurance services and common utility services (<http://www.nstedb.com>).

### 3. Trade Related Entrepreneurship Assistance and Development (TREAD):

Trade Related Entrepreneurship Assistance and Development" (TREAD) during the 9th plan period which has slightly been modified and is now put in operation. The scheme envisages economic empowerment of such women through trade related training, information and counseling extension activities related to trades, products, services etc.

**Objectives:** Experience has revealed that apart from counseling and training, delivery of credit poses the most serious problem for the poor women. There is also dearth of information with regard to existing status of women and their common needs for providing necessary support. Since such women are not able to have an easy access to credit, it has been envisaged that the credit will be made available to women applicants through NGOs who would be capable of handling funds in an appropriate manner. These NGOs will not only handle the disbursement of such loans needed by women but would also provide them adequate counseling, training and Assistance in developing markets.

**Training & Counseling:** Training organizations viz. Micro, Small and Medium Enterprises (MSMEs), Entrepreneurship Development Institutes (EDIs), NISIET and the NGOs conducting training programmes for empowerment of women beneficiaries identified under the scheme would be provided a grant up to maximum limit of Rs. 1.00 lakh per programme provided such institutions also bring their share to the extent of minimum 25%(10% in case of NER) of the Government grant. The batch size for such a training activity will be at least 20 participants. Duration of the training programme will be minimum one month. For example if a mention institution or eligible NGO wants to conduct a pre or post project training programme for a group of women then the maximum GOI grant can be Rs.1.0 lakh provided the NGO also raises 25% of the requested grant i.e. the total expenditure of the training expenditure can be up to Rs. 1.25 lakhs for availing full assistance of GOI grant.

#### Other Associated Agencies

- ✓ National Small Industries Corporation (NSIC) for technology and marketing support
- ✓ Small Industries Development Bank of India (SIDBI) an apex bank set up to provide direct/indirect financial assistance under different schemes to meet credit needs of the small-scale sector and to coordinate the functions of other institutions in similar activities.
- ✓ Khadi and Village Industries Commission (KVIC) assists the development and promotion and disbursal of rural and traditional industries in rural and town areas.

#### State Level Institutional Support

- ✓ State Government executes different promotional and developmental projects/schemes and provide a number of supporting incentives for development and promotion of MSME sector in their respective States.
- ✓ These are executed through State Directorate of Industries, who have District Industries Centers (DICs) under them to implement Central/State Level schemes.
- ✓ The State Industrial Development & Financial Institutions and State Financial Corporations also look after the needs of the MSME sector (<http://www.dcsmse.gov.in>).

#### 4. Training of Rural Youth for Self Employment (TRYSEM)

TRYSEM was launched in 1979 as a separate national scheme for training rural youth for self employment. The compelling reasons for launching the programme being the huge backlog of unemployment and under employment among the rural youth. It was generating activities in the rural areas as, the influx of rural youth to urban areas could be curbed. Moreover, local needs could also be met with local resources, thereby giving a fillip to rural development.

**Objectives of TRYSEM :** To provide rural youth (18-35 years) from families below the poverty line with training and technical skills to enable them to take up self-employment in agriculture, industry, services and business activities. Training is perceived not only in terms of provision of physical skills. But also change in attitude, enhancement of motivation and skills in human relations etc., are also ought to be imparted.

**Beneficiaries of TRYSEM:** Members of the poorest family first, Priority should be given to members of SC's and ST's, At least 1/ 3 of candidates should be women, and Preference should be given to persons who have completed the 12 month course under the national Adult Education programme.

#### 5. Swarna Jayanti Gram Swarozgar Yojna (SGSY):

The Swarnjayanti Gram Swarozgar Yojana (SGSY) was launched as an integrated programme for self-employment of the rural poor with effect from 1 April 1999. The objective of the scheme is to bring the assisted poor families above the poverty line by organizing them into Self Help Groups (SHGs) through the process of social mobilization, their training and capacity building and provision of income generating assets through a mix of bank credit and government subsidy. The scheme emphasizes establishment of activity clusters through selection of key activities based on aptitude and skill of the people, availability of resources and market potentiality. The scheme adopts a process approach and attempts to build the capacities of the rural poor. It provides for involvement of NGOs/CBOs/Individuals/Banks and Self Help Promoting Institutions in nurturing and development of SHGs, including skill development. The scheme provides for the cost of social intermediation and skill development training based on the local requirement. Flexibility has been given to the DRDAs/States in the utilization of funds for training, sanction of Revolving Fund, subsidy for economic activity based on the stage of development of groups.

The focus of the programme is on establishing a large number of micro-enterprises in rural areas based on the ability of the poor and potential of each area, both land-based and otherwise, for sustainable income generation. Due emphasis is being laid on different components such as capacity building of the poor, skill development training, credit, training, technology transfer, marketing and infrastructure.

#### 6. The District Industries Centre (DIC):

The District Industries Centre (DIC) comes under the Department of Industries and Commerce. The primary objective of the DIC is to generate employment by way of promoting Micro, Small and Medium Enterprises (MSMEs), Cottage and Handicrafts Industries. The packages of services offered by the District Industries Centre are Multidimensional and need based for facilitating industrial growth in respect of new and graduating enterprises. All the schemes of the Department, especially MSMED Act 2006, MSMI Policy 2008 Subsidy schemes, New Entrepreneur-cum-Enterprise Development Scheme (NEEDS), Unemployed Youth Employment Generation Programme (UYEGP), Prime Ministers Employment Generation Programme

(PMEGP), Quality Control Order, EDI Training Programmes etc., are implemented through this DIC.

#### **Functions of DIC: As registration agency**

- ✓ Online registration.
- ✓ Issue Acknowledgement for Entrepreneur Memorandums filed under Part I & II.
- ✓ Issue of Cottage Industries Registration Certificate.
- ✓ Issue of Handicrafts Registration Certificate.

#### **As developmental agency**

- ✓ Employment Generation.
- ✓ Motivating and guiding the entrepreneur.
- ✓ Rendering escort services to set up an Enterprise
- ✓ Conducting of motivation camps and dissemination meetings.
- ✓ Implementation of Central / State Government Schemes for setting up of Enterprises.
- ✓ Project Profiles.
- ✓ Technical Feasibility report to Banks
- ✓ Export Guidance Cell.
- ✓ Micro Small Enterprises Facilitation Council

#### **Non-Governmental Organizations (NGOs):**

A non-governmental organization (NGO) is a legally constituted organization created by the natural or legal persons that operated independently from any form of government. It is normally used to refer to organizations that are not a part of the government and are not conventional for profit business. In the cases in which NGOs are funded totally or partially by governments, the NGO maintains its non-governmental status by excluding government representatives from membership in the organization. NGOs are working with non-profit concepts. So, they can reach to the bottom level of the society. The activities which include human rights, environmental, or development work. With respect to entrepreneurship development and training the following activities are performed by the NGOs according to the needs and wants of the respective regional public. The activities are:

- ✓ Identifying the target groups and helps to aware of the government schemes and supports.
- ✓ Providing training to the entrepreneurs with regard to marketing, writing proposals for getting financial assistance from banks, drafting business plans etc.
- ✓ Arranging skill training to rural women and youth for their economic development.
- ✓ Competence development and process innovations related firm / business.
- ✓ Providing EDP training designed by various governmental organizations such as Women Development Corporation and District Industries Centre, STEP, etc.

**Networking of Women Entrepreneurs:**

Women entrepreneurs themselves can form a federation of regional, stat, county and international level and support for budding women entrepreneurs by conducting workshops, meetings and training programmes periodically by presenting real cases. So, that the awareness can be made at all parameters such as planning, implementing and outcome of the projects. This would also pave the way to get awareness to access finance, markets, marketing, training and their overall development.

**Suggestions:**

- A separate Bank for women entrepreneurs should be opened.
- Common Training body should be formed to give training periodically to develop professional competencies in managerial, leadership, marketing, financial, production process, profit planning, maintaining books of accounts and other skills. This will encourage women to undertake business.
- District level Skill development centres can be put up by the State / Central Government
- Educational institutes should tie up with various government and non- government agencies to assist in entrepreneurship development mainly to plan business projects.

**CONCLUSION:**

The role of women entrepreneur in economic development is inevitable. Now-a-days women enter not only in selected professions but also in professions like trade, industry and engineering. Women are also willing to take up business and contribute to the Nation's growth. Rebirth of entrepreneurship is the need of the hour. Highly educated, technically sound and professionally qualified women should be encouraged for managing their own business, rather than dependent on wage employment outlets. The unexplored talents of young women can be identified, trained and used for various types of industries to increase the productivity in the industrial sector. Women entrepreneurship must be moulded properly through entrepreneurial training with entrepreneurial traits and skills to meet the changes in trends, challenges in global markets and also be competent enough to sustain and strive for excellence in the entrepreneurial field.

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## SCOPE OF ENTREPRENEURSHIPS AMONG WOMEN ENTREPRENEURS

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### ABSTRACT

*Entrepreneurship is about producing and marketing the intellectual properties of a viable concept in terms of assuming risks, financing and managing and become entrepreneurs simply by virtue of their ability to think creatively, generate ideas and help clients bring those ideas to market by creating and executing commercialized branding programs. The business acumen or experiences to translate the original ideas into viable business opportunities. The system of thinking and discipline of management supports the integration of business and the trends to focus on success at the organizational level, rather than the individual level. This helps to bring their own ideas to market, they need to know what to do, to find the network and for resources recovery to launch and build up sustainable businesses. They need to understand the concept of risk, and in order to pursue entrepreneurial ventures, as well as to understand the common traits of entrepreneurs. The assuming of business in terms of knowledge coupled with the ability to think creatively and innovatively, will be the driving force in helping to become successful Entrepreneurs.*

**KEYWORDS:** *Entrepreneurship, Management, Intellectual Properties, Business Opportunities*

## INTRODUCTION

In India there is a dearth for quality people in industry, which demands high level of entrepreneurship development programme throughout the country for the growth of Indian economy. India, a country with a strong social system, and large variety of intellects has its own scope for the giving new entrepreneurs to the global economy. The scope of entrepreneurship development in country like India is tremendous.

Today's knowledge-based economy requires people with entrepreneurial capacity – individuals with the ability to seize opportunities, take the initiative and solve problems in creative ways. Entrepreneurship is a multi-faceted phenomenon. It is an individual who establishes and manages a business for profit and growth. Entrepreneurship is more than mere creation of business. It is a dynamic process of vision, change, and creation. It requires an application of energy and passion towards the creation and implementation of new ideas and creative solutions. They supply goods and services, which increase the standard of living of the entire population substantially and self-created wealth insulates the economy from recession and helps strengthen local economy. Entrepreneurship needs to gain firm ground to change the face of the economy. It is only under such a scenario that would witness a longer queue of job providers than job seekers and it show to productive and efficient, par excellence. Design entrepreneurship is about creating business and new opportunities by the help of design. It is a natural outgrowth of the typical design practice yet it is not limited by creating viable concepts but marketing their intellectual rights and to motivate industrial design activity to be more entrepreneurial for to take a product from concept to market which require giving the design crucial and extra insights about the total product development process, (Heller et, al.,2008).

Entrepreneurship is gaining significance in the modern era. It is a global phenomenon. The developed countries are already enjoying the fruits of the entrepreneurship development. On the contrary, in the developing economies like India, entrepreneurship has gained importance in the recent past. In developing countries it is considered as method of promoting self-employment. Entrepreneurship should viewed a way of not only solving the problem of unemployment but also of overall economic and social advancement of the nation. Wide-scale

development of entrepreneurship can help not only in generating self-employment opportunities and thereby, reducing unrest and social tension amongst the unemployed but also in introducing small business dynamism, encouraging innovative activities and facilitating the process of balanced economic development, (Bharti, 2008).

Thinking is a system that begins with an open approach to the people, the problem and the possibilities involved in creating innovative solutions. In practice it combines the empathy to enable deep understanding and reframing of a problem, and creativity to generate insights and solutions, visualization and prototyping to document, connect and test ideas (The Design Management Institute, 2014).

## OBJECTIVE OF THE STUDY

- To assess the scope of entrepreneurship
- To motivate towards successful women entrepreneurs



## METHODOLOGY

The area of the study was Coimbatore city. Information was gathered through the structured questionnaire designed for the purpose of the study. A sample of 250 Women entrepreneurs were selected by purposive sampling for the study. The collected data was consolidated, tabulated and analyzed using percentage analysis.

## FINDINGS

### Scope of Entrepreneurship

Entrepreneurship provides employment and source of earning to people. It helps in reducing the monopoly rich business and achieving a balanced regional development and growth in economy. Table I presents the scope of entrepreneurship by the selected samples.

**TABLE 1. THE SCOPE OF ENTREPRENEURSHIP BY THE SELECTED SAMPLES**

Scope of Entrepreneurship	N-250	Percentage
Self-reliance and self-confident	173	69.2
Feel of the internal need to success and permanent progress	156	62.4
Opportunities and ability of productivity from obvious and hidden opportunities	142	56.8
Having aspirational goals and clear and of course beyond the customary goals	108	43.2
Acceptance of risk and tolerance of failure	91	36.4

Table I indicates that the majority of the respondents (69.2 per cent) were self-reliance and self-confident, (62.4 per cent), Feel of the internal need to success and permanent progress, and followed by (56.8 per cent) were opportunities and ability of productivity from obvious and hidden opportunities, (43.2 per cent) respond the having aspirational goals and clear and of course beyond the customary goals,

### Traits of women entrepreneurs

The entrepreneur's traits to identify traits that have impact on business performance. Personality traits such as internal locus of control and the business process indirectly. [https://www.researchgate.net/publication/273445209\\_Traits\\_of\\_Successful\\_Entrepreneurs](https://www.researchgate.net/publication/273445209_Traits_of_Successful_Entrepreneurs) Table 2 presents the traits of women entrepreneurs by the selected samples

**TABLE 2. TRAITS OF WOMEN ENTREPRENEURS BY THE SELECTED SAMPLES**

Traits	N-250	Percentage
Creative problem solver	184	73.6
Risk taking propensity	175	70
Self-efficacy	163	65.2
Innovativeness	157	62.8
Sincerity and commitment	142	56.8
Ability to make decision	133	53.2
Dedication and hard work	121	48.4
Liner thinkers	73	29.2

\*Multiple responses

From the above table 3 reveals that the creative problem solver ( 73.6 per cent) of a women entrepreneur in traits (70 per cent) are responded risk taking propensity ( 65.2 per cent) self-efficacy , (62.8 per cent) innovativeness,(56.8 per cent) are sincerity and commitment ,followed by ability to make decision, dedication and hard work, liner thinkers. Hence the majority of the respondents are creative problem solver.

### CONCLUSION

Women today are more willing to take up activities that were once considered as men centered .Women entrepreneurs should be moulded with entrepreneurial traits and skills to meet the challenges of the global markets and also be competent to sustain and strive for excellence in the entrepreneurial arena.

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## PROSPECTS AND TRENDS IN INTERIOR

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### ABSTRACT

*The basic job of an interior designer is to make optimal utilization of available space. Measurement of the furniture should match with the size and proportion of the room and at it should have a good blend with lighting done in interiors .More than aesthetic beauty design should impart comfort to the inmate. The photovoltaic solar panels that gather light energy from the sun and convert it into electricity that can power your home and office .These panel consist of a collection of solar cells. In implementation stage the designer should have the knowledge about the products For eg; Difference between a Marine grade plywood(710 grade) or a normal plywood ,flooring material, paints and how color scheme can be made into the room etc. For example; you can excel in business design, residential design or landscape designing. The increasing construction activity in urban areas and small towns has only added to the demand for these professionals. The demand for interior designers has surpassed the supply. Further, you have to make the space more functional and in accordance with the taste and budget of the client. Besides visualizing and conceptualizing the designs for new structures, interior designers also plan the interiors of existing structures that are undergoing renovation or extension.*

**KEYWORDS:** *Implementation, Conceptualizing, Structures, Photovoltaic*

## INTRODUCTION

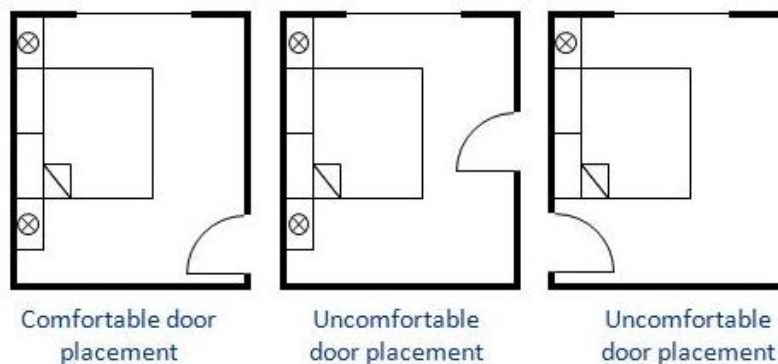
### Scope of Interior Design

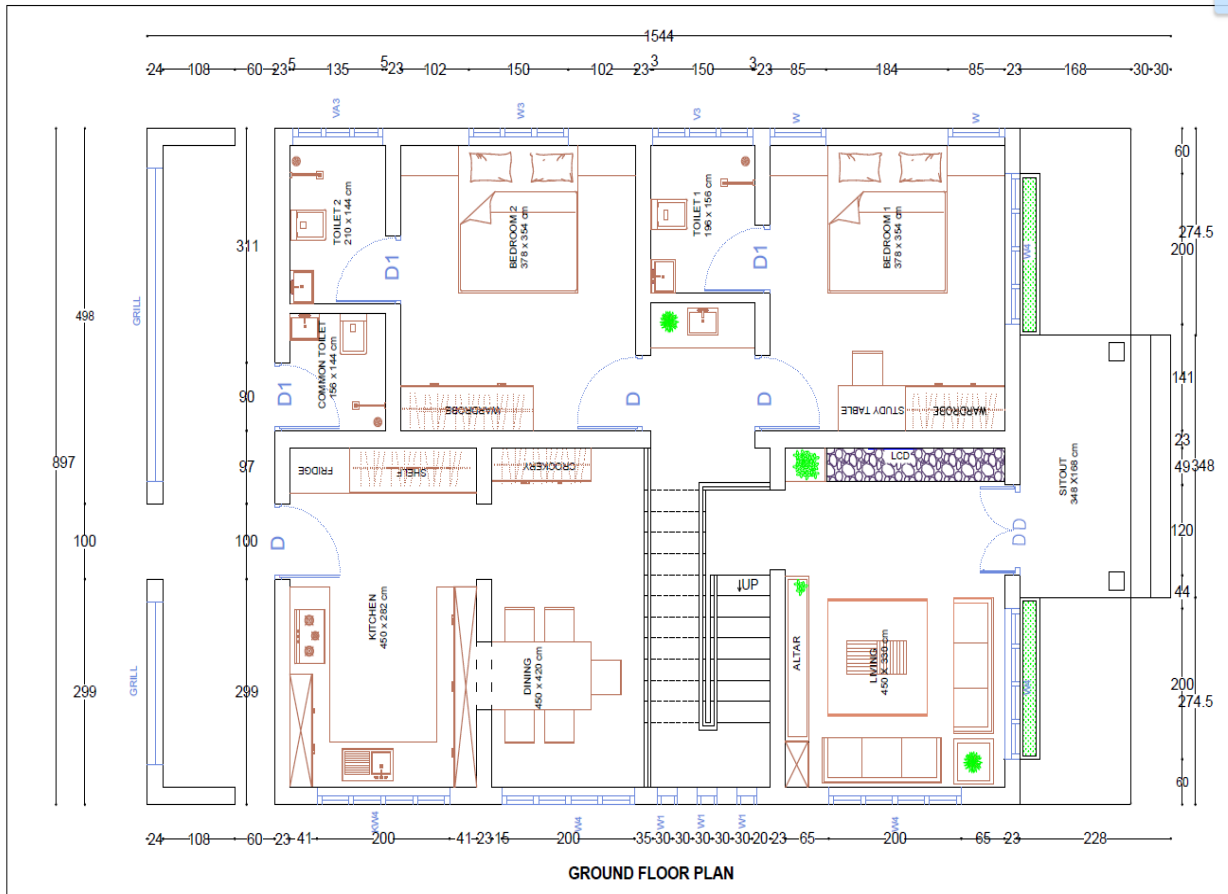
Interior has played a vital part in this developing scenario. Presently, the space is been completely utilized by the interior and it should also serve its purpose so the scope of interior design definitely add value to the building .Space for residential and commercial places is shrinking due to rapid urbanization. This anomalous situation calls for professional help to make the living and working space more comfortable, beautiful and practical. Earlier, it was the task of an architect to do the entire exteriors along with the interiors of a house, office or any other functionally useful edifice. Now-a-days people have become more and more particular about the designs and the layout of the living or working area. This has led to an increasing requirement for professionals in interior designing. The basic job of an interior designer is to make optimal utilization of available space. Further, you have to make the space more functional and in accordance with the taste and budget of the client. Besides visualizing and conceptualizing the designs for new structures, interior designers also plan the interiors of existing structures that are undergoing renovation or extension.

### How to start a project

Designing should starts in the planning stage of the building/residence. The opening (door/window) should be properly positioned so that each nook and corners could be properly utilized. All the interior projects starts with the measurement detail. Designer have to be very particular about the site measurement .It issaid to be the yardstick of the design. Designer should also collect present photographs from the site .All the design and style should merge with the site measurement.

### Positioning of Door in Interior





## FLOOR PLAN

### Furniture

Furniture layout also helps this planning much easier. Furniture layout should be prepared while drawing the plan. Measurement of the furniture should match with the size and proportion of the room and at it should have a good blend with lighting done in interiors .More than aesthetic beauty design should impart comfort to the inmate

Two in one furniture has been more trendy in interiors in order to save space in flat or small apartment .Even though it was old thought but it remain same during ages. In earlier days sofa cum bed was common .But now a day's lift up beds and bed cum storage and four seated dining table which can be converted to six seater is available in the market .Wall bed has become trendy now a days so that the bedroom can be converted to a study room or a home theatre. With the help of design technique a room itself can be made for dual purpose.



### Storage space given under the cot



### LIFT UP COT

### Drawing room can be converted to Bed room



**BEDROOM**



**LIVING ROOM**

### CAD /3D DRAWING

Now a day's computer application helps to minimize the communication between the designer and the client. Three D images plays a key role in design works and it helps to make a lot of changes in the modeling stage itself. All the 3D sketches and cad drawing with all measurements should be completed during the planning stage itself. So that interior work can be easily carried

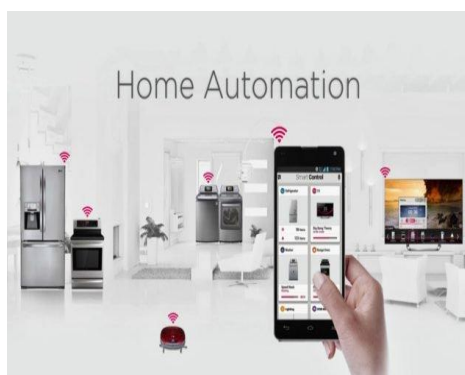


out in the site. The detailed Cad drawing also helps to take the material calculation in a better way.

### Electrical layout

After finalizing the plan and furniture layout, electrical layout should be thoughtfully planned so that depending upon the requirement the wires can be pulled, For Eg: In kitchen, depending upon the shape and provision, electrical points for fridge, hood, microwave oven etc can be given. Power plugs (15A) should also be shown in the diagram .Location of fan, tube, decorative lights all the other points should be comprised in your drawings.

**Automation** A Home Automation System is a Digital Interiors which is custom designed and installed to meet the individual lifestyle needs of our customers. With a simple button press, you can change entire mode of lighting in the house. With help of I phone you can turn of fall lights in the house, lock/unlock the doors, set the temperature where you like it, and arm the alarm system, view cameras. It's incredibly convenient, and since all the equipment is hidden it doesn't disrupt the decor of your home.



### Solar energy

Nowadays everyone wish to have an alternative source of energy so Solar has become one of the best option to generate electricity .The photovoltaic solar panels that gather light energy from the sun and convert it into electricity that can power your home and office .These panel consist of a collection of solar cells . There are two types of system- Off Grid and On grid, In off grid the energy produced is stored in a backup (battery) and on grid system when electricity produced in extra ,it is given to the electricity board extra



**SOLAR PANELS**

## Material Knowledge

In implementation stage the designer should have the knowledge about the products For eg; Difference between a Marine grade plywood(710 grade) or a normal plywood ,flooring material, paints and how color scheme can be made into the room etc. Designer should always update their knowledge and designer should have an idea about new product that arrived in the market Along with Interior design skills like technical drawing, space design, material knowledge, furniture design, and familiarization with interior design tools, you must also have great interpersonal and communication skills, maintain a good network of clients, contractors and suppliers, and of course have the brains to market your interior design services and update them regularly.

## Communication Skill

Once the design are finalized, always give attention to the implementation stage, all the designs are usually made in the minds of the designer, to give wings to these design, the design drawn with measurement should be understood by the worker/ contractor who is carrying out the work can also be able to understand yours drawing and more than that yours client your design should be easily communicated to contractor. Designer must also have great interpersonal and communication skills, maintain a good network of clients, contractors and suppliers, and of course have the brains to market your interior design services and update them regularly.

## Exterior Designs

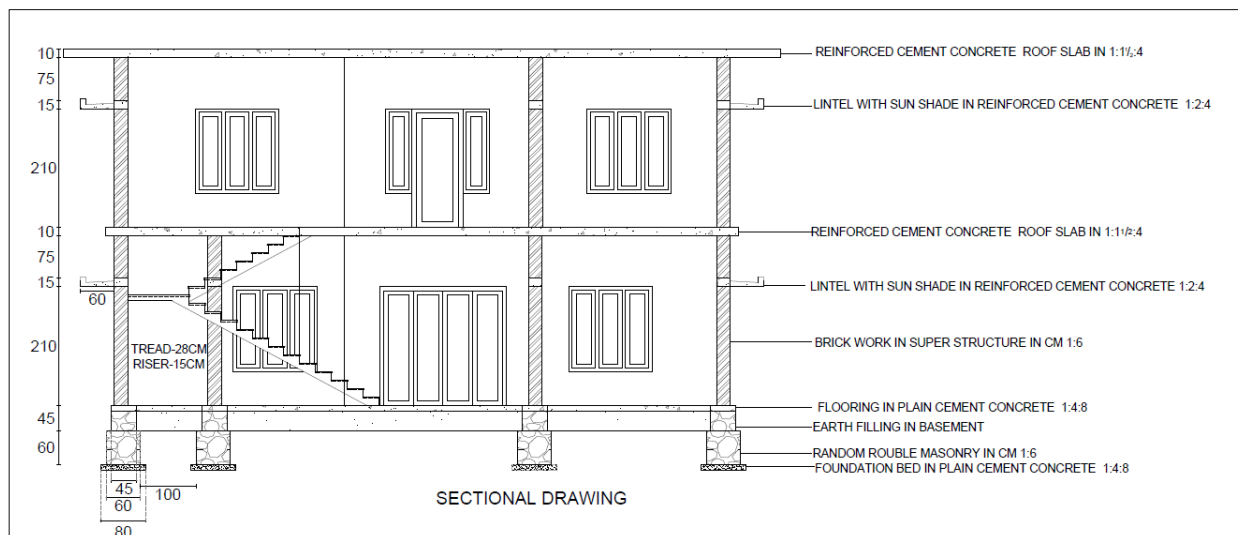
All interior students should have the basic knowledge about exterior structure and parameters of exterior so that you can be able to guide them and also able to give good elevation design. The study of sectional drawing helps them give good guidance and able to contribute more to exterior designs too. Professional interior designers have the education and experience necessary to oversee the complex tasks of designing and managing the construction of interior and exterior environments. Whether designing a private residence, commercial office, retail environment, recreation facility, or public institution, interior designers coordinate with other trades, suppliers, and licensed practitioners to ensure the safe, successful completion of a project







EXTERIOR VIEW



### Knowledge about new and faster Technology

Everyone wants the building to be constructed within months so faster technology has paved way for building. In recent year construction sector has witnessed a number of new trends, technology and advance innovative methods. Eg **Gypsum plastering** used inside furnishing the walls of the building. In conventional method cement plaster requires 28 days for curing and then surface is smoothened with POP (plaster of Paris) which again require time. With gypsum plaster wall can be finished within 3 days and it is also crack free.

### GFRG Technology (Glass Fibre Reinforced Gypsum)

It is one of the latest building technology. GFRG panels are manufactured in molding process from high grade gypsum plaster and glass fiber roving's to a size of 12 meters by 3 meters by

124 mm thick. The hollow sections have 250 mm. Panels are loaded on to collapsible frames called still ages ready for transport to the building site. All hollow parts at the joints are filled with concrete and vertical walls are reinforced. These serve the purpose of conventional reinforced concrete columns. Gaps are provided for plumbing and electric works. The conduits are made before concrete is placed on the roof. Care is also taken to drain rainwater by providing a slope. A multi-storey house can also be built by using gypsum panels as walls in the similar manner done at the ground floor. The joints are filled with concrete.



FILLING CONCRETE BETWEEN PANEL



FIXING PANEL

### Renovation works

Now a day's people also give thrust towards renovation project. Twenty years old house can be thoughtfully converted to a new interior. Even though the wall remains the same, the furnishing, furniture and colours in the interiors can be redesigned and it can be made beautiful.



OLD



NEW





OLD

NEW

### Landscape

Landscape adds breath to the exterior structure. It adds beauty to all structure, there should be definite space for hard landscape and soft landscape (planting material). The activities of a landscape designer can range from the creation of public parks and parkways to site planning for campuses and corporate office parks, from the design of residential estates. Now a day's living wall or green wall are self-sufficient vertical garden are attached to the exterior of the building. Even though trellis and creepers was common in olden days, the potted plants in wall have become a new trend in exterior of building.



VERTICAL GARDEN

### CONCLUSION

The popularity of interior designing as a discipline is not confined to urban cities but it has rapidly spread to small town and cities across the nation. This is largely because of the changing lifestyle of people and they want to customize their residence with the help of an expert who can understand their taste and preference. Specialization in a particular area of interior designing can be done depending on your choice. For example; you can excel in business design, residential design or landscape designing. The increasing construction activity in urban areas and small towns has only added to the demand for these professionals. The demand for interior designers has surpassed the supply.



## ENTREPRENEURIAL AVENUES FOR PRODUCT DESIGNERS

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### ABSTRACT

*The textile industry fascinated my interest in exploring more about this field and hence my new passion towards Fashion, Retail marketing and Merchandising has started budding in me. The course kindled my interest in exploring the history of architecture and history and future of designing. "Fashion show" where the models take up the pride of exhibiting the long term hard work of the designers. They grab the attraction and finally the product gets sold. To do so I had to put myself out of the comfort zone to reach out to my career, to reveal new opportunities that are abundantly available. I had to explore the theory, principles and realities of being into a business operationally, from manufacturing, service, supply chain and project. To be a successful designer it is essential to gel with people(consumers, suppliers, media people, etc) and to understand their psychology, need etc, also to get my work done, to promote my ideas and sales, for this mastering the marketing skills will be helpful to take the design to a final product and to its next level.*

**KEYWORDS:** Operationally, Manufacturing, Fascinated, Merchandising, Mastering



## INTRODUCTION

**‘If you don’t dream big, there’s no use of dreaming. If you don’t have faith,  
There’s nothing worth believing.’**

It is my B.Sc in Interior Design course from Avinashilingam Institute for Home Science and Higher education For Women, Coimbatore that led the foundation to my designing career. My passion for designing and the support from all around that encouraged me to pursue my dream of becoming a designer. The Interior design course helped me learn and explore the basics of Interior designing with innate love and flair on subjects like Colors, Spatial arrangements, Architectural elements, Landscaping, Lighting, and Furnishings along with proper exposure on implementation of all my theoretical knowledge on practical applications. The course kindled my interest in exploring the history of architecture and history and future of designing. With the constant support and motivation of the faculty members, I along with my likeminded friends, we started experimenting our ideas in interior decoration in many of our events. We thereby found a platform to experiment and exhibit our skills inside the campus.

After my bachelor’s degree I have understood that, to become an entrepreneur, along with the Technical skills I had learnt from Interior design course, management skills too are highly essential. To be a successful designer it is essential to gel with people(consumers, suppliers, media people, etc) and to understand their psychology, need etc, also to get my work done, to promote my ideas and sales, for this mastering the marketing skills will be helpful to take the design to a final product and to its next level. Then I took up MBA course specializing in Human resource and Marketing subjects. That paved me a way to understand the ultimate need to frame strategies, understand the global market, handling and studying about customers and consumers which shown a clear idea of what all required to become a designer. With the technical skills of Interior design along with the management skills, I gained the self –confidence to meet the societal demands. The Management course helped me to set and define my career goals. During my MBA, the project that I had done in a Textile Mill helped me gain more knowledge on the textile business functioning ,Purchasing behaviour and buying intentions of consumers from the producer’s perspective in textile field, growing trends in textile industry and its vast demand in the society . The textile industry fascinated my interest in exploring more about this field and hence my new passion towards Fashion, Retail marketing and Merchandising has started budding in me. That passion triggered me to do a Boutique Management course from Indian Institute of fashion Technology, Bangalore. Entering there, the vast subject of fashion attracted me even more into it and the course was much more interesting and understandable because of the strong foundation laid in Interior and management subjects previously. One Fine day I had got an opportunity to assist the Famous Indian Fashion Designer **Mr. Manish Arora** in Paris fashion week, France .The knowledge and experience gained in that fashion week was immense and that gave me a clear picture of how the designer’s thought process reaches the consumer as a final haute couture product. Participating in fashion show I gained the knowledge of that transition of an idea or creativity of a designer, which after so much of hard work, how that creative idea becomes a final product ready to be sold. Taking the final product to its next level was the work of Marketing plans and strategies that helps in taking that product to the Customers through the royal exhibition called “Fashion show” where the models take up the pride of exhibiting the long term hard work of the designers. They grab the attraction and finally the product gets sold.

The trend analysis, which plays a niche role in fashion world helps to meet the future fashion demand successfully. As said that proper predictions are the basic for any future success, a training seminar at the famous Paris Trend union, France, made it even more clear about how to predict future trends, demands and how to research and handle the upcoming and newly arriving trends.

With all the education that I have got, the knowledge, skills and experience gained, they gave me the confidence to enter the fashion society. Unlike the olden days, now the society extends a very warm welcome to all women entrepreneurs as there is a vast demand and unbelievable craze for fashion products in the society. The inner urge to leave a footprint in the society and confidence in stepping towards the success are arguably the most important elements for any entrepreneur. Here in designing industry, it's likely that we already possess passion, creativity and ambition in spades these will by default keep us motivated.

In order to own a fashion venture, resource handling, making strategic decisions about the direction of the business, selecting the right people at our corner to help us achieve the goals, be they team members, suppliers, stakeholders and/or business partners, the great communication and leadership skills will help in achieving it. Also clearly communicating my vision and building positive relationships with the people around are highly important as fashion industry is much a people-centric business, so the need to create and maintain a good reputation, within a wider network of industry associations, such as designers, manufacturers, distributors, media and publicists are essential.

“Waiting for the ‘right’ or ‘perfect’ set of situations for a startup can mean waiting forever. Learning to seize the opportunity that comes to us and making an attempt to analyze our self and societal needs by calculating the risks and favours can help in achieve the dreams.” yes, keeping this in mind and incorporating all the knowledge gained through education and experience and with the proper understandings of how to use the available sources of information, that was the time to make right decisions. As said so, I started my free lancing career in fashion .To do so I had to put myself out of the comfort zone to reach out to my career, to reveal new opportunities that are abundantly available. I had to explore the theory, principles and realities of being into a business operationally, from manufacturing, service, supply chain and project.

Later, I learnt that an element of commercial management is the most effective incentive to keep the business pushing forward. Learning has no end ,every day with new and very different encounters that I go through with people I learn and grow.I believe that this habit will take the lead to a successful entrepreneur.

Motivations that helped me are:

- My love for fashion and owning an independent business
- Self confidence
- Constant encouragement and appreciation of my every single work from faculties and family
- Guidance from the faculties

Challenges faced:

- Financial struggle
- Getting customers and orders

- Raw material purchase
- Time management

With an old but a very strong cliché “Where there is a will there is a way” I found the way to overcome these challenges gradually. Building a reliable and strong network with customers, suppliers and co workers, though this may sound cheesy but the truth is that having people network is one’s net worth. I keep in touch through emails with people, with no agenda but just to keep the relationship and to remind them about my presence. When everything else seems impossible and when we have nothing left the biggest asset within us the Passion and the Education, one can do wonders to bring everything into super success.



## LAYER-BY-LAYER: OPPORTUNITIES IN 3D PRINTING TECHNOLOGY TRENDS, GROWTH DRIVERS AND THE EMERGENCE OF INNOVATIVE APPLICATIONS IN 3D PRINTING

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### ABSTRACT

*The most common, and the most popular currently, is 3D printing. Through secondary research and conversations with business analysts, investors, members of the 3D printing community, experts and entrepreneurs, we investigated some of the potential market opportunities the technology is unveiling. Entrepreneurs are not only focusing on new manufacturing processes, products or verticals but also on other opportunities in the ecosystem, from the recycling of (printed) plastic products, establishment of standards and legal frameworks, to the cataloguing of 3D printing products for consumers. The range of enterprise applications for 3D printing varies depending on the sector, but there are three industries that are already experimenting or applying 3D printing that are expected to experience the biggest gains. These sectors are the Architecture, aerospace, bio medical and consumer markets. Many entrepreneurs and professionals interviewed for this report agreed that mass consumption is not yet part of the equation. Furthermore; makers are creating new business models or conducting the necessary research to bring products to market. Research not only includes 3D printers and its applications, but also the materials. As the materials available and the refinement of the 3D printing process continue to progress, the types of products that can be built are, arguably, unlimited.*

**KEYWORDS:** Manufacturing, Conversations, Refinement, Arguably,

## INTRODUCTION

Additive Manufacturing (AM) is a manufacturing process that deposits materials layer-by-layer to build a tangible product. The most common, and the most popular currently, is 3D printing. AM is claimed to have triggered a third industrial revolution because the technology presents new and expanding technical, economical and social impacts (Economist, 2012). Particularly, the increased accessibility to 3D printing capabilities has allowed mass customization to become more widespread in industries such as healthcare and consumer markets. Since the advent of mass production in the early 20th century, consumers' demands have been met by producing large numbers of goods in significantly less time than ever before. While production time and price decreased, they did so at the expense of customization. AM makes it possible to offer customers options to personalize the products and goods they are purchasing, from custom-made prosthetics to a personalized smart phone case. This report explores the potential impact that this technology may have in various sectors. Through secondary research and conversations with business analysts, investors, members of the 3D printing community, experts and entrepreneurs, we investigated some of the potential market opportunities the technology is unveiling. We also explore sources of capital and nascent business models for those innovators interested in capitalizing on this technology. As part of our investigation, we also profile some organizations involved with 3D printing or related markets. These entrepreneurs are actively and creatively pushing the limits of 3D technology. For the purposes of this document, the terms 3D printing and additive manufacturing will be used interchangeably.

### Industry at a glance

Charles (Chuck) Hull of 3D Systems developed the first working 3D printer in 1984. While 3D printing has been around for almost 30 years, it is still a nascent market with low market share concentration although rapid growth is expected. According to IBIS World (2013), the industry is growing at a rate that consistently surpasses the overall US economy. Falling costs, technology developments and new applications for 3D printing technology have driven growth in the industry.



Recent hype and buyer interest are also giving rise to software, hardware and service providers that are offering easy-to-use tools, a wider range of materials, and improved product quality. Industry revenue in the US is expected to reach \$1.4 billion in the next five years and grow at an annual rate of 12 per cent (IBISWorld, 2013).

### Technology and key players

There are seven different additive manufacturing processes, as defined by ASTM International. Of the seven, material extrusions lead the market growth due to greater consumer adoption (Gartner Forecast, 2013).

Table 1 summarizes the seven process classifications and technologies that comprise the 3D printer market with selected market participants. This research does not constitute an exhaustive list of developers in any given technology area.

Table 1

Classification of additive manufacturing processes, adapted from ASTM International (ASTM International, 2012)

Classification	Technology	Description	Materials	Developers (Country)
Binder Jetting	3D Printing Ink-jetting S-Print M-Print	Creates objects by depositing a binding agent to join powdered material.	Metal, Polymer, Ceramic	ExOne (US) Voxeljet (Germany) 3D Systems (US)
Direct Energy Deposition	Direct Metal Deposition Laser Deposition Laser Consolidation Electron Beam Direct Melting	Builds parts by using focused thermal energy to fuse materials as they are deposited on a substrate.	Metal, powder and wire	DMDD (US) NRC-MI (Canada) Inspec Laser (France) Trumpf (Germany) Soleady (US)
Material Extrusion	Fused Deposition Modeling	Creates objects by dispensing material through a nozzle to build layers.	Polymer	Stratasys (US) Delta Micro Factory (China) 3D Systems (US)
Material Jetting	Polyjet Ink-jetting Thermjet	Builds parts by depositing small droplets of build material, which are then cured by exposure to light.	Photopolymer, Wax	Stratasys (US) LUNAKOR (Netherlands) 3D Systems (US)
Powder Bed Fusion	Direct Metal Laser Sintering Selective Laser Melting Electron Beam Melting Selective Laser Sintering	Creates objects by using thermal energy to fuse regions of a powder bed.	Metal, Polymer, Ceramic	EOS (Germany) Renishaw (UK) Pharos Systems (France) Matsuda Machinery (Japan) ARCAM (Sweden) 3D Systems (US)
Sheet Lamination	Ultrasonic Consolidation Laminated Object Manufacture	Builds parts by trimming sheets of material and bonding them together in layers.	Hybrids, Metallic, Ceramic	Fabrisonic (US) CAM-LAM (US)
VAT Photopolymerisation	Stereolithography Digital Light Processing	Builds parts by using light to selectively cure layers of material in a vat of photopolymer.	Photopolymer, Ceramic	3D Systems (US) EnvisionTEC (Germany) DWS Srl (Italy) Lithoz (Austria)

## New applications

Today, 3D printing accounts for only 28 per cent of the total manufacturing sector, but the market seems destined to explode. Gartner research suggests that 3D printing has already reached an inflection point, and predicts that “the total number of consumer and enterprise 3D printer shipments will grow from 38,002 units in 2012 to 1,083,496 units in 2017, a compound annual growth rate of 95.4 per cent. While the consumer market is expected to be the main driver of the sector growth, there is also room for innovation in the enterprise market. Most analysts expect that more companies, from large organizations to small and medium-sized enterprises (SMEs), will begin to explore the technology and unravel new business cases. Entrepreneurs are not only focusing on new manufacturing processes, products or verticals but also on other opportunities in the ecosystem, from the recycling of (printed) plastic products, establishment of standards and legal frameworks, to the cataloguing of 3D printing products for consumers. Based on conversations conducted with several analysts and investors for this report, there is still a gap between what 3D printing technology can do and what it will end up being used for. Thousands of developers, designers and enthusiasts working with the technology continue to stretch the boundaries of applications. The process is challenging and, in most cases, requires sophisticated skills and training.

## Opportunities at the commercial level

Historically, prototyping has been the most popular application of 3D printing, as part of product development and research and development (R&D) projects. Today, printers and materials have evolved and 3D printers are currently being used to create finished products for niche applications and industries; for example, the latest Boeing 787 Dreamliner has 3D-printed parts. According to Deloitte, most of the revenue generated by the 3D printing sector will come from commercial users, as printer makers experience continued price pressure and 3D printers become more affordable. In the past, only large organizations such as 3M, Ford and Microsoft had the capital necessary to invest in 3D printers and explore new business models or product lifecycles: 3M, for example, has used AM to conduct research on new materials and health-related products; Ford has used it to prototype and build cars components; and Microsoft used 3D printers to develop its Kinect in house to avoid media leaks. Thanks to more affordable prices, smaller organizations are increasingly joining in the exploration of applications. Some are even purchasing 3D printers without a pre-defined use and setting up small labs to explore new business opportunities and efficiencies. Another key driver of 3D printer growth is the expanding set of materials available.



Materials are as important to AM as the printers themselves: build materials account for 40 per cent of revenue for this sector and is expected to increase as 3D printing grows. Even though polymers are the most common, metals, paper and even organic tissue are becoming available. The development of new composites could allow the industry to explore new product development in sectors such as electronics (from simple motherboards to robots). Researchers and professionals in 3D printing say that product design is also being transformed by the rise in popularity of 3D printing. Companies can market test new products, making necessary transformations based on customer feedback. They can also print small batches of a product, test different versions and only send to production the one that proved most successful. Instead of mass producing one product, based on limited feedback from focus group participants, companies can now create five products and sell them directly to consumers, letting the market decide which is successful enough for mass production. Prototyping, customized products and small production runs will keep driving the commercial usage of 3D printers in the short term while new niches develop. The range of enterprise applications for 3D printing varies depending on the sector, but there are three industries that are already experimenting or applying 3D printing that are expected to experience the biggest gains. These sectors are the Architecture, aerospace, bio medical and consumer markets.

### Architecture

Create Your Scale Models Faster Seeing is believing. Stratasys 3D Printing helps architectural firms seize more opportunities by creating complex, durable models in-house, directly from CAD data. Stratasys 3D printing technology produces astonishingly smooth, detailed architectural models in an array of materials, including rigid photopolymers ready for painting and finishing.

### Why 3D Printing for Architectural Design?

Help Clients to Better Visualize your Design. By printing more detailed models, will help your clients to better visualize the final projects, ultimately helping your firm to win more business

Reduce hours spent creating models

With a Stratasys 3D Printer you can significantly reduce the time and expense in producing building models, often requiring highly delicate details. 3D printed models are also stronger than traditional models and won't buckle or break over time.

### Create a Library of Reusable Designs

Using 3D printing allows you to be more innovative with your model making. For instance when you have repetitive pieces, you can print one as a mold, cast it, and then use the cast to injection-mold the required duplicate



## Aerospace

Despite current limitations, particularly with materials and structural integrity, aerospace companies are exploring 3D printing for manufacturing various parts of their products. Boeing has already used the technology to manufacture interior pieces of airplanes while NASA has used it to build rocket engines and parts for satellites. Companies in the sector are actively investing in the technology either by (1) purchasing companies, like GE Aviation did when it acquired Morris Technologies, an engineering firm specializing in advanced fabrication techniques for jet engine production



Aerospace is also one of the most research-intensive sectors using 3D printing. It has used the technology to build demonstration units, used by governments to evaluate functionality and hull design concepts. Research also includes developing complex parts, such as satellites parts or components of NASA's rovers, including flame-retardant vents and housings, camera mounts and large pod doors (Stratasys, 2013). In 2013, Airbus, a leading aircraft manufacturer, announced plans for an airplane that will include 3D-printed components that are significantly lighter but as strong as traditional machined parts (PricewaterhouseCoopers, 2013).

## Health

Researchers and business analysts interviewed for this report identified the medical and healthcare vertical as one of the key industries for new developments, as 3D printing can replicate the human form more accurately than traditional manufacturing techniques. Hearing aids, orthopedics and dental implants are the most common medical uses of the technology. IBISWorld (2013) estimates that there are already more than half a million 3D-printed dental implants in patients worldwide. New research in other applications is rapidly expanding in this sector. For example, various organizations are researching the possibility of bioprinting live cells and tissue, such as the University of Toronto's Bio Printer project which is exploring the use of 3D-printed tissue for the treatment of burned patients.

3D printing also allows the production of complex shapes (such as hollow figures) and lightweight parts that can be used to create implants—a growing demand in countries with aging populations. Bone replacements and support structures for growing body parts made by 3D printers are at different stages of research. Another possible application in the medical industry is to use 3D printers to create models of human parts from CT scans or MRI images to assist surgeons during complex surgeries. Designers and engineers are also exploring the development of new and specialized surgical tools made by 3D printers.

## Consumers

Various reports predict that 3D printing will experience the biggest growth in the consumer market, even outpacing the enterprise market in the short term. However, the definitive consolidation of the consumer



sector depends, among other things, on the irruption of a compelling application that would prompt consumers to embrace the technology, a “killer app” that, prices, will finally bring the era of self-production into consumer homes. This application (or applications) is expected to likely emerge from the thousands of projects, labs and experiments currently being conducted by makers, hobbyists and enthusiasts who are pushing the limits of the technology. These experiments range from new lower-cost printers like a 3D printer that costs \$100 (CBC News, 2013), catalogues of 3D models, computer-aided design (CAD) software, and customized design services (see Hot Pop profile). Many entrepreneurs and professionals interviewed for this report agreed that mass consumption is not yet part of the equation. Even though it is possible to download and print a 3D model, it is not yet clear what types of applications would compel consumers to purchase their own 3D printers. Currently, 3D printers cannot compete with economies of scale or the mass production of some goods. In this context, it is still unclear how 3D printing will affect consumer goods manufacturing.



### It's a maker's world

The makers culture is fostered by tinkers, craftsmen and enthusiasts that engage with technology as part of the do-it-yourself (DIY) culture. Highly motivated, makers are a very eclectic group that includes designers, engineers, developers and graphic artists. In the case of 3D printing, makers are one of the most energized groups of technology adopters and creators. Their work includes printers, like the RepRap community, and 3D artifacts that are distributed through platforms such as Shapeways and Thingiverse among others. 3D printing is not as accessible as it seems, as the technology has not reached a “plug and play” or a “push and print” stage. Printing a 3D object requires data preparation, file modification, setting of the device, pre-heating, build, cooling, support removal and finishing. As a result, “extreme users”—people with the skills and knowledge to understand the nuances of the process—are largely conducting the exploration of new products, business models and verticals. Makers are exploring the design, production and consumerization of complex forms that were previously unthinkable due to the limitations of traditional manufacturing (complex forms are expensive to build and therefore avoided; conventionally, an efficiently designed object is one that can also be easily manufactured). Furthermore, makers are creating new business models or conducting the necessary research to bring products to market. Research not only includes 3D printers and its applications, but also the materials. As the materials available and the refinement of the 3D printing process continue to progress, the types of products that can be built are, arguably, unlimited. In reality, however, there are still restrictions. Materials are complex, thus restricting the type of products that can be printed (for example, electronics that combine plastics and metals). Printing also involves a lengthy process that is prone to errors and often requires the user to print several versions of a product. The lack of simple CAD software also makes the technology only accessible to more advanced users, such as architects and designers familiar with 3D modeling. 3D printing may change how things are manufactured in the future but cannot replace mass manufacturing, at least not yet. Only usage will determine its evolution. In this sense, 3D printing may undergo an evolution similar to the Internet, a tool originally created to share academic knowledge. The discussion is still open. Some experts view 3D printing as a tool that could change manufacturing to its core while others say it is complementary to traditional manufacturing.

## Prototyping

Prototyping has long been part of the manufacturing process as there has been no substitute to physically having a product in one's hands and testing it before mass production. Traditionally, prototypes have been designed and molded by hand and the process was commonly outsourced overseas. It is a time consuming process, particularly if numerous prototypes are required before the right one is found. The advent of 3D printing has brought the rise of a new form of prototyping known as rapid prototyping. Three-dimensional printers allow manufacturers to quickly make and alter prototypes on their own or through a company that specializes in rapid prototyping. The ability to design, produce and test products five or 10 times faster enables designers and entrepreneurs much more creative freedom (Lipson & Kurman, 2013). In fact, prototyping has become the leading use of 3D printers globally, with the automobile and aerospace industries leading the way. It is estimated that prototyping is used in 70 per cent of the 3D printing market and earns approximately \$2.2 billion annually (Morgan Stanley, 2013).

## Mass customization

Mass customization combines aspects of mass production with the ability to personally customize the product. 3D printing technology has had a large impact on mass customization; for example, a customer renovating his or her bathroom could use a 3D printer to completely customize the cupboard handles on a vanity, down to the size, colour and placement. The handles can then be printed off and installed in a matter of hours. While this process is still in its infancy, it may soon become general practice and expected by consumers. Hamid Mughal of Rolls-Royce, an engine company that has experimented with 3D printing, has stated, "product technology is the key to survival, and manufacturing excellence provides one of the biggest opportunities in the future" (as cited in The Economist, 2012). However, it is also important to forecast and predict how consumers are going to react to different forms of customization. Some consumers may feel overwhelmed when customizing goods or products such as clothing. By anticipating and suggesting popular combinations or clothing designs, the consumer can have a better experience with the customization process. These combinations can be determined through stylistic reasoning or by looking at past consumer purchases. Further predictions can be made based on the knowledge of certain customer demographics. There may be similarities amongst consumers in similar age groups or levels of income. The idea of collaborative customization are closely related to mass customization. Collaborative customization occurs when a customer articulates precisely what he or she wants from a product to a particular manufacturer. This collaboration allows the manufacturer to customize a product to suit the customers' needs and expectations (HBR, 1997). The increased use of 3D printing has resulted in an increase in collaborative customization because some levels of personalization would be unfeasible without the technology. The ability to use digital environments to manipulate goods before they are physically produced increases the chances that the customer can receive exactly what they want.

## 3D printing and the cloud

The combination of 3D printing and the cloud are two major game changers in terms of manufacturing as a service. Manufacturing as a service refers to the ability to deliver on-demand products through a virtual environment. This process allows individual consumers access to untold numbers of products that could otherwise be difficult to obtain. An article on the increasing use of 3D printing from Cloud Times, an international group of experts on cloud computing, sums up the process well: "Imagine if instead of companies manufacturing parts or



products in their factories in bulk and selling it to consumers, consumers can instead just buy said parts of products per piece through a company that will create a single one through 3D printing..." (2012).

In the future, it may not make financial sense for companies to keep large inventories of their products. Instead, their entire inventory can be made available on the cloud and printed off when selected by customers. These items can be kept on a digital file until they are needed. This also eliminates the worry of overstock. Currently, this practice has proved especially useful for hard-to-get items or items that are no longer manufactured such as parts for classic cars or motorcycles. Business models that involve 3D printing are changing the landscape of manufacturing around the world. Countries in which manufacturing is faltering could embrace these models to potentially revive their industry.

### **Last words**

The excitement about 3D printing today is centred on the potential new applications for the technology. The technology is expected to grow exponentially and become a new source of productivity and innovation. Architecture Aerospace, biomedical and consumer applications are already being developed, with other verticals quickly joining the exploration. Extreme users are constantly pushing the limits of the technology, searching for new products, applications and business models that could transform the technology into a feature of everyday life. This push is filled with challenges and uncertainties; viability of new applications, legal constraints and environmental impact are already being debated. The initial intention of this report was to introduce the technology to entrepreneurs and to illustrate how a disruptive technology can transform an industry. After extensive research, discussions with experts and interviews with entrepreneurs, two main points emerged: first, there is a big difference between a technology's potential and its actual usage; and second, the utmost impact of 3D printing technology may not happen in a vertical but rather in the process of developing and selling new products.

Although some participants interviewed for this report consider 3D printing a technology with the potential to replace traditional manufacturing in the production of consumer goods, this substitution seems highly unlikely. As with previous technologies, 3D printing would mature in those verticals where there is an advantage to be gained (either by reducing costs or producing highly customized goods). 3D printing can be a great complement for the local manufacturing industry, which is today in search of higher levels of customization and competitiveness. Furthermore, 3D printing provides designers and tinkers with a new tool and process to solve problems and create new products. Traditionally, limitations of the manufacturing process (such as the construction of some geometrical figures or hollow structures) have constrained designers. In some cases, a well-designed artifact was one that solved a problem effectively and was easy to mass-produce for a competitive price. 3D printing allows the construction of imaginative solutions and artifacts that may not exist otherwise, solving problems in a novel way. This technology can be the answer to problems for which we do not have a solution yet. Historically, design can be understood as a continuous copy and refinement process—the same way that Apple's iPod resembles Braun's portable radios from the sixties. Thanks to 3D printing, that process can be accelerated or transformed into a collaborative process. Product design can become an open process, where the usage of products can easily inform new iterations of always changing artifacts based on frequent and fast-paced user feedback. 3D printing is a fascinating and exciting technology that requires skill, knowledge and patience. It is not a simplified process

or a democratization of manufacturing. It is a new playground for innovators and only the increased use of the technology will determine its evolution and final adoption

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