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Design for All

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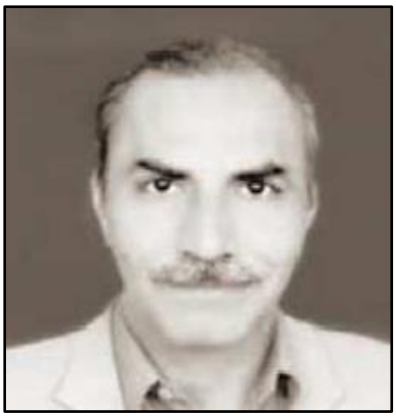

Letter from the Chairman's Desk

By Sunil Bhatia PhD

I was cleaning the dirty vessels after the dinner by placing them in sink where tap for cold and hot water was designed in such a way it should not have spoiled my clothes and there was liquid soap and scrubber were placed close to it for applying for removing strains as well oil dirt from the cooking utensils. As I realized there was some dirt still remained in the vessels I thought for proper cleaning with hot water. It struck to me as to why do we clean the vessels with water or wash our hands as we feel these are dirty or take bath and the common factor in these activities is water. Water is acting as our neutral cleaning agent and detergent or scrubber is supporting the cleaning process. Water is natural gift to us and we procure with little efforts by designing wells, ponds, rivers and other water reservoirs but it was all not sufficient for better cleaning, man devised for use of detergent and scrubber and it was right combination of efforts of natural with manmade products that help in proper cleaning. Sometime we create pressure by designing water jet for cleaning with force, that idea came to their minds from the water filled mouth act as jet for throwing water not to spoil their dress or placing vessels under natural water falls that cleans with force or close to geysers that clean with forced by hot water strike on surface of vessels . Is water a cleaning agent that has no adverse effects on us? Why do we clean is it not to allow the germs grow on vessels that has harmful effects on our health and we prefer

that soap should have turned ingredient to make it cleaning germs free or removal of earlier leftover of cooked food struck to vessels triggers in spoiling the food taste as well its content of current cooking foods as we witnessed with left over turmeric or salt or acidic elements may split the boiling milk or there was possibility that cooking temperature of earlier cooked food that struck with vessels might have cooked at low flame and current foods needed high flame and preparation time is also more that might help in burning the earlier attached particles into carbon that triggers in spoiling the cooking food . This theory of cleanliness led to the peeling of vegetables or removing skin of the hunted animals because it cooked in high temperature with high flames but meat or peeled vegetables required low flames with lesser temperature. Another problem is minor but plays significant role and we enjoy the taste of cooked flat bread because it is burnt at some places as effects of overheat of dangling flames and majority of surface of bread remain not over cooked and combination of both gives proper unique taste . Some carbon particles are struck with surface of tawa (is a large flat, concave or convex disc-shaped frying pan or dripping pan) it has quickly burnt with overheat from high flames and next bread do not get proper taste because of struck carbon with tawa leaving more carbon spots on surface of flat bread and before placing next bread it should be clean by wiping with cloth.

I admire the wisdom of primitive people who were struggling for survival and other side they had been continuously developing to make their lives safe by exploring the concept of cleanliness and living in uncertainties by controlling the adverse effects of dirts. Cleanliness helped in more survival instincts and associated with light mind set where dirtiness was extra burden , consumed more energy and had character of dampening spirit, lethargy and

indifferent toward life . Ancient peoples' prime focus was struggle for longer life and in inventing and devising new techniques of survival and concept of cleanliness which helped in achieving their supposed goal and other side with all possible means deflected dirtiness. Every human was equipped with natural phenomena of sneezing to clear the blockade of nostril or cough from throat that phenomena was also with animals but human beings used in optimum for safe and longer living by concept of cleaning and animals used till survival and nothing more . Some outside element in food could prove dangerous and they learnt the art of peeling of banana and did not allow the hands should touch the fruit while eating because hands could be dirty and germs might go inside the stomach through food and turn dangerous. Even they avoided food left in open by that time idea of cleanliness was established in their minds and forced to think it might have attracted some bad elements that might harm their bodies. Clean human body interestingly works better compared to dirty and idea of cleaning the body for removal of dust by slapping that area allowed it to fall but with water help in better cleanliness . They realized sitting on ground attracts the some foreign elements easily attack the body that might have proved harmful or life changing injuries, designed raised platform for safe clean sitting from the dist and later it took the shape of bed for sleeping. That helped in avoiding possible attacks by harmful creatures. All living beings enjoy cleaning with water. Human beings enjoy water, animals clean their bodies in water reservoir or standing in rain and plants looked fresh in rainy season. Only one incidence humans are afraid of water for keeping himself clean when someone is mentally unsound or suffering with hydrophobia .The moment human beings thought for segregating the dirt from the water by using hands or tongue or blowing the air from the mouth to keep away the floating dirt and the way designed by joining the

palm as cusp for lifting and holding clean water was the first step for cleanliness. Later on designed with earthen pots having tiny holes at the bottom for slow dripping filled with sand, charcoal and other neutral agents arranged one above another for cleaning the dirty water without adding its features for turning filter germ free , odorless and sediments free potable water .

When dust storm was striking their eyes and mouth and it was natural gush carried germs, harmful particles along with dust that might entered through open mouth and it was effecting visibility and their involuntary action was closing the eyes as well mouth for protection and it was one step toward cleanliness. This natural concept was with animals but humans moved beyond and devised new method when storm was strong and could not be safe by closing eyes, learnt not to allow foreign elements entered by covering with their hands . Animals confined to survival but failure of keeping eyes clean in dust storm helped humans for devising the trick of hiding behind the trunk of tree to protect from dust. Later that idea turned in making the concept of walls for protection from dust. Rain drenched and that slowed down their actions of survival compared to when were dried, that forced them to design standing under tree or hide in cave or erect roof from protection of snow or rains or falling dust not to spoil their performances of survival. Too much moisture stays in body for longer time invites skin infections like itching or rashes and to protect from it , designed towel for soaking and cleaning by drying extra water after the bath. Our mind is tuned in such a way that if we do not rub our bodies with towel we do not feel properly clean. Reason may be it removes the dead skin that softens with bath that if not properly removed responsible for itching. In an occasion I faced the situation where there were no clothes close to me for soaking and rubbing after bath and I stand in open for

let my body dried and that moment psychologically realized my bath was incomplete and felt improperly cleaned. Diapers are not designed for cleanliness rather there are for controlling and absorbing the human waste for time being but constant and long use of diapers invites various skin related diseases. Natural disturbances had occurred at times or say for a while but generally they were with usual time to get proper clean air they designed doors, windows and ventilators within the walls. Even I realized raised platform in my kitchen that for comfortable working but it helps me to keep away from the waste that could spoil my dress and for extra caution wearing apron. Even industrial workers' job demand where chances of spoiling the dress are high they cover by wearing boiler suits to keeping themselves clean.

Raw eatables were unsafe for consumption and they discovered fire they started roosting the dead hunted animals for cleaning from not required elements and that unknowingly helped in killing bacteria and other harmful ingredients that might have adverse effects on humans. They realized by avoiding the corpses as foods fearing that it would harm their bodies because of unknown foreign elements might have entered that. Progressive agriculture stabilized their lives and it worked as dynamo for clean concept. They learnt the art of separating the husk or paddy and stored in clean environments where it should be out of reach from rodents or other insects and animals. When they cut the trees with axe for making their clean paths or for agriculture fields were marvellous concept. Later they used fire as means for cleaning the unwanted plants that could harm the standing crops by burning. Even used Neem (Azadirachta indica) of the mahogany family that disrupts reproduction of insects, used as an

insecticide to keep the plants clean and that protected from further harm.

This cleaning concept is an ancient practice and I believed the day child was born, mother cleaned her nipple for breastfeeding thinking no foreign elements gets into the child's mouth and might prove fatal and keep the body of child's private areas cleaned for better survival. Even after delivery of child women were advised to take the foods that helps in keeping her body warm for taking out the human waste related with uterus. Even for abortion or termination of pregnancy they used food items made with special seeds those had character of raising the blood flow for cleaning the ovulation by untimely menstruation cycle. It is natural that when child enjoys the breast feeding mother releases the hormones from the vagina that help in cleaning her from the inner, more feeding more cleaning of her body from inside.

I have observed in rural areas where women soaked the dirty vessels overnight on earthen pots where cow's food were placed with mixture of ingredients as staple diet for better production of milk. It is my theory that owners do not clean the pot on regular basis and once in a while washed with water and in due course of time it develops large number of amoeba. As they soaked the vessels container's amoeba came to action for eating leftover food contents attached with vessels as their food and by product was it cleaned the vessels. Earlier generations were soaking the vessels in pond's water for cleaning where abundant amoeba were living and with times as ponds vanished they switched to cow's earthen pots for serving foods. They were not aware about friction but rural women were using coir of coconut or small stone for rubbing against the tough strains for removal of it. I have observed when we placed the dirty vessel under flowing water for cleaning we

invariably use hands for keep rubbing the surface till satisfy for good cleaning. Proper cleaning of vessels needs good amount of water and women preferred taking it for best cleaning sitting on by placing a stone slab at the bank of the river. It is my belief that first detergent was discovered in the soil of river bank that was alkaline in nature and they even used for cleaning and washing the clothes or cleaning the head hairs.

Some natural products like soap nut has nature of releasing foam of soap if we soak overnight in water and it can clean the clothes as well can be use for vessels. Gradually they avoided cleaning with soap nuts because it was not neutral as water but alkaline in nature and soar taste and bad smell stayed on vessels and spoiling original taste of the serving foods. Knowledge of fire added new dimensions and hot water gave better result of cleaning and by product of ashes used for rubbing hard over the vessels for cleaning and modern time it took the shape of sand paper for removal of dirt. As metals came into their lives they used soaked tamarind for cleaning the brass for good results. Later they found lime juices or vinegar were stronger in effects and result was better in cleaning. Some vessels were cleaned but uneasy smell remains with it and to remove it they found menthol of mint plants which has character to remove the foul smell. Some tribes used the home made liquor from rice or sugarcane for removal of strains without knowing it had alcohol in its content.

Different parts of human body need different kinds of products for cleaning like removal of dirt from hair that is delicate needs petroleum based shampoos, nail polish removal need paraffin liquid, body cream based bathing soap, unwanted hairs by hair removal cream or with shaving or cutting tools , face wash with high moisture contents and scrubber for removal of ankle dried dead skin. Surprisingly people learnt the art of using powder to

keep the body fresh and clean for long time by sprinkling perfumed telecom powder over possible perspiring parts. Even designed deodorant for using under armpits for keep it away foul smell of sweat for long time .It was the humans they wished to get rid of hairs that was declared unwanted by either plucking or rubbing hard with soil or ash on that areas for removal or shave with different designed tools for cleaning. Initially mouth was cleaned by filling water and allowed to storm and use fingers for rubbing against teeth that led shaping tooth brush and paste and as knowledge advanced we designed mouth washed liquids.

Clothes need such detergents that should not harm the threads and colour and help in gentle cleaning. Cotton clothes need different handling against those is woollen and silk. Better results of cleaning are noticed with time of soaking, temperature of water and quality of detergent. This knowledge helped us in designing washing and dishwasher machines for best cleaning of clothes and spoiled vessels. Latest design of the washing machine where focusing on water conservation and devised the cleaning without using water but air is dispelled in such a way it cleaned the clothes as it appeared we have washed in water. Some scientists are experimenting with some chemical treatment of clothes that should dispel the dirt and as we jerk the clothes it should leave and clean the clothes.

Why do women apply oil for their head hair? It helps in cleaning them by removing oil by applying the soap that takes away the dirt with foam in a quick manner without damaging hairs and oiled hairs help in for better management. The concept of using the foundation before applying for smooth makeup and it helps in easy cleaning the face for removal of makeup. How came idea of design of broom for cleaning struck to them? Journey of broom to vacuum cleaners is interesting for cleaning.

Cleaning of glass needs special application of products those cleaning articles without leaving scratching marks on the surface. Better cleaning of Machine's lubricated parts were cleaned by applying petrol or kerosene or rub with sand paper or hard rubbing with dried clothes. Some parts need air pressure for cleaning or even we use fire for burning carbon stuck in silencers for better result for removal of blockade that reduces the performances of vehicle. One day my home appliance was troubling and I called the service man and he opened the small chip for cleaning of deposited carbon by using aerosol.

In medicines cleansing agents are designed for solutions and these are applied for cleaning the wounds before applying medicines for better result. Pimples or black heads are unwanted in face and there are creams for cleaning. To clear the pregnancy marks or scar there are special creams are designed for cleaning. Medical professional's biggest fear is bedsore attacks because of not keeping proper cleanliness and hygiene standards for bed ridden patients. Cleaning of specs needs special liquid. Our biggest organ is skin and once it is affected with some disease right way to clean by burning that local skin with chemical and it is ancient practice of applying vinegar and new skin comes free from disease. Vomiting is natural gift for humans for cleaning by vomiting out foreign elements out of the body that might harm by intake. Some time medical practitioners artificially induced vomiting for cleaning the stomach to take out harmful elements. What did make them to clean their teeth with tender twig of the tree and later with neem or babul tree twig or chewing ginger or mint? How did the idea of cleaning with common salt and later by adding mustard oil strike to them for cleaning the teeth. Toothbrushes and pastes are designed in present days. Wax gets harder in ear and it blocks the sound. How did idea of removing

the ear wax by using drop of oil come in their minds? In modern times women are staying most of the time out of the house and itching in private parts creates embarrassment in public and to avoid they wished to keep clean and use chemical that has Ph level that neutralizes the effects of contents of releasing hormones and does not allow for the growth of infections.

Ancient people used the clean water parameter by taste as well as smell and drum stick plants were neutral and used for cleaning of water and later chemical knowledge of camphor or alum now reverse osmosis. Design of vessel for carrying water has come in to the existence because of concept of cleanliness. Even water supply through pipe lines has come to the human minds because of transportation of clean potable water and design of drainage for keeping house and nearby areas of habitat clean. Biggest fear of potable water storage tanks is managed by all means not to allow algae to grow. Once it grows, it spreads like wild fire and whatever possible known treatment make it free from it for clean water proves futile exercise. Design of chimney for exhaust of smoke for clean air was amazing. Later we designed ionizer for clean air. Benefits were known of fresh and clean air for peoples and did all efforts in this direction without compromising with safety and designed of doors with latches or windows with iron grill were thought. Even local Hakeem or vaidya (a physician using traditional remedies) used to advise their patients who were suffering with incurable diseases for stay in hills for clean air for cure.

Mud guard in the moving vehicles were designed not to spread mud because of moving wheels and wipers for cleaning the windshield during rains for better visibility for driver and helps in keeping the vehicle clean also.

This special issue Guest Editor Prof Sushma of Lady Irwin college of Delhi University focussed on sustainability and it is deviation from our track of focusing on universal Design. It is new experiment for us and let the readers should provide us true genuine feedback what they feel for our experiment and future course will depends on your feedback.

With regards

Dr. Sunil Bhatia

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Forthcoming Issues

December 2017 Vol-12 No-12

Manja Unger---Büttner, Technical University Dresden, Faculty of Arts, Humanities and Social Science, Associate at the Professorship for Philosophy of Technology. She is an Industrial designer & philosopher of technology, literary and cultural scientist. She is a lecturer for ethics and philosophy of design and technology for designers, engineers, design--students and students of philosophy in Dresden and Berlin.

January 2018 Vol-13 No-1

North Carolina State University Department of Industrial Design Prof Sharon Joines will be the Guest Editor for our inaugural issue. Sharon Joines, PhD Professor of Industrial Design, Director of the Research in Ergonomics & Design Laboratory, Director of Industrial Design Graduate Programs.

February 2018 Vol-13 No-2

Colleen Kelly Starkloff is the Founder and Co-Director of the Starkloff Disability Institute in St. Louis. She is also the Founder of the Universal Design Summit series of conferences focused on home and community design. She remains the Conference Organizer of these summits. These conferences, 5 of them already, have brought best practices in Universal Design together into one national/international conference since 2002. Ms. Starkloff did not want an "academic" focus on Universal Design for these conferences. Rather a focus on what works, what doesn't, what's the difference between Universal Design and Accessible Design and how the use of universal features in home and community design best integrates all people in communities and improves housing choice for all.

March 2018 Vol-13 No-3

Christian Guellerin has been the Executive Director of L'École de design Nantes Atlantique since 1997, an institution of higher education in design, which has campuses in Nantes (France), Shanghai (China), São Paulo (Brazil) and (Dehli) India. The institution has developed significantly, striving towards the professionalization of design studies and establishing relationships with businesses.

He was President of Cumulus, the International Association of Universities and Colleges of Art, Design & Media from 2007 and

2013 (250 members from 46 countries). He is also President of the France Design Education and Honorary Consul of the Republic of Estonia for the West of France since 2009.

He has regularly taught courses and given academic lectures on design and innovation.

He was a consultant for various institutions and worked on a frequent basis as an expert to set up design centers.

In 2015 and 2016, he was elected by L'Usine Nouvelle magazine in the "50 people who made innovation in France".

Chevalier de l'Ordre National du Merite since 2016.

April 2018 Vol-13 No-4

Dr.Lee Christopher is the Director of eLearning at Arapahoe Community College and also an ACC instructor. Lee has a BA in Philosophy, an M.Ed, and a M.F.A in Writing and Poetics. Dr.Lee is currently in the dissertation phase pursuing a Doctorate in Education from Capella University. Her dissertation title is Universal Design for Learning: Implementation and Challenges of Community Colleges. Lee's publications include: "Digital Storytelling" in *Handbook of Research on Transformative Online Education and Liberation: Models for Social Equality*, Kurubacak and Yuzer, Eds., IGI Global, 2011, "Hype versus Reality on Campus: Why eLearning Isn't Likely to Replace a Professor Any Time Soon" with Brent Wilson, *The E-Learning Handbook,* Carliner and Shank, eds. Pfeiffer, 2008 , and "What video games have to teach us about learning and literacy," located at http://edrev.asu.edu/reviews/rev591.htm, Lee is on the Colorado Community College System Task Force for Web-IT Accessibility. She has a passion for Universal Design for Learning.

May2016 Vol-13 No-5

Dr. Antika Sawadsri" ,She is an Assistant Professor and the Director of Inclusive Designed Environment and Research (IDEaR Unit) at School of Architecture, KMITL, Thailand. As both professional and academic interested in Inclusive City, her contribution ranges from home modification to urban public space development for users with all life's spectrum."

June 2018 Vol-13 No-6 (150th milestone issue)

Prof Ricardo Gomes will be the Guest Editor for our 150th special issue. Professor Ricardo Gomes has been a faculty member in the School of Design (formerly the Design and Industry (DAI) Department) at San Francisco State University for nearly 25 years. He was the Chair of the DAI Department from 2002-2012. Prof. Gomes coordinates the Design Center for Global Needs and the Shapira Design Archive Project in the School of Design (DES). This non-profit international research and development center is dedicated to promoting responsive design solutions to local, regional and global issues such as: inclusive/universal design, health care, the aging, community development, social innovation and sustainability of the built environment.

Prof. Gomes is on the Board of Directors of the Institute for Human Centered Design in Boston. He is also a member of the Industrial Designers Society of America; and Epsilon Pi Tau International Honor Society for Technology.

Prof. Gomes received his MFA in Industrial Design for Low-Income Economies from the University of California, Los Angeles *(Design of a Container System for Mobile Health Care Delivery in East Africa).*

***Dr. Sushma Goel**, Associate Professor at department of Resource Management and Design Application, Lady Irwin College, Delhi University has been teaching from past more than three decades. She has authored subject manuals, modules for distance education, text book, etc. She has several publications in national and international journals to her credit. She has been supervisor for 60 masters' dissertations and 9 doctoral researches (some ongoing). She had been principal coordinator for projects with DDA slum wing, DST, Ministry of health and family welfare, Ministry of social Justice and empowerment and Delhi University Innovation projects.*

Editorial

At Community Resource Management & Design Application now known as Resource Management & Design Application, my initial interaction with design started as a student (in early 80s) learning the nuances of interior design while also interacting with rural and economically disadvantaged communities who were looking for solutions to make their homes organized for efficient work practices. Got involved in ways of redesigning (using participatory design process with local residents as co-designers) rural and slum houses (areas for cooking and washing; storage of clothes, shoes, farm produce, fodder for animals / pets, etc.; surroundings of household well or hand pump, animal house and feeding troughs for animals; drainage system referred to as *soak-pit* for indigenous discharge of household waste water, recharge of ground water by rain water harvesting, and so on. Similarly in slum settlements, managing a living in a small space is quite a challenge. Such social design exposures acted as effective ways to sensitize towards design needs of different communities (rural, semi-urban or urban). In the words of Miettinen (2006) aim of social design is to improve and contribute to human well-being particularly the needs of underserved or marginalized populations as stated by Margolin (2002). In other words these were communities of practice, understanding that design issues are different for diverse communities.

These exposures to community labs delineate cultural differences, for example the social gaps in technology access. It is extremely desirable that future design encompasses aspects of diversity and social sustainability. Application of the concept of social engineering is meaningful to use centralized planning to regulate social change for development and behaviour of a society in times to come. Designers are social engineers who use scientific

methods to analyze and understand social systems, design appropriate methods to achieve desired results among users and enhance acceptability. Society cannot operate successfully if using outmoded methods therefore to achieve best outcomes, advanced techniques are indispensible.

With the onset of global warming and resultant climate change, we are once again compelled to adopt eco-consciousness reflected in contemporary design. It is always better to adopt designs that are congenial ecologically as they are long lasting and sustainable. Ecological compliance refers to co-existence by remaining within the boundaries of each living species on this earth and not intruding onto each others' spaces. Lighting designers installed sky-scraper lighting to light up the urban cities and the result was light pollution inhibiting astronomy, scientific discovery and explorations. Urban sky glow is responsible for disappearance of milky-way from our night skies. These lights also interfered in the privacy of birds who took shelter on trees. Bright light intimidated them and they flew away from the urban sky glow. Excessive concreting pushed frogs away from city gardens. Such self-centered designs have led to degradation and photo-pollution of habitats. Inclusion of bird bath, bird feeders, minimal use of resources, water curtains to minimize use of water, etc. are some measures adopted, to enable coexistence of different forms of life on earth.

Therefore it is important for any creation or design to remain rooted to preserving the resources in the natural environment to ensure sustainability at the core of its design. A design enduring sustainability concepts is long lasting and hence delayed disposal that protects the environment.

Designers are silent and effective communicators. They communicate to the users through their designs. If focus of design

is optimal use of resources or durable structure, it is well displayed in the conception of the designers. Designers have very effectively driven users to save water by designing dual cistern settings, taps with in-built resistance to prevent excessive water flow from the taps. Similarly using sensors in lamps to vary light intensity, integrating daylight with electric lamps, street light system switching on & off via dash board (Internet of Things i.e., IoT), sensors in taps, and the list is long. Space saving designs like collapsible, foldable, convertible, portable furniture are some of the solutions to small space interiors.

Integrating renewable energy resources in daily lifestyle products is the cutting edge technology for future living. Solar engineered furniture designed in the department by students for their projects could be an essential requirement in future design. Designs supporting resource efficiency must take the center-stage. Modern customers are showing preference for resource efficient products, systems, services and also the stores (resource efficient), which sell products. They prefer to frequent those stores which use more daylight (for a better ambience and psychological impact), natural systems for cooling and heating spaces (for greater comfort), local materials and construction techniques (like brick *jalis*, hollow walls – rat trap bond, etc.) simple designs and décor, focus on plants, shrubs and trees in the surroundings for better quality of air, natural ventilation and reduced pollution in the environment leading to higher feeling of well-being. Some customers show interest in visiting those stores or places of recreation where there is emphasis on reuse and recycling, selection of recycled paper, plastics, refurbished inherited furniture, etc. are gaining popularity.

Government policies and regulations also support such concerns by giving specifications to adopt green practices, create green

products, construct energy-efficient buildings, ensuring EPR for manufacturers' responsibility for disposal of their merchandize, mandatory practice for management of solid waste and waste water at the source of its formation.

The bottom line of planning spaces and infrastructure is that it should be inclusive (functional and accessible for all) while being sustainable. Therefore a futuristic design must be sustainable, inclusive, and acceptable to the masses to make its due impact. The articles in this issue of newsletter focus on sustainability and design.

Dr. Sushma Goel

***Vaishali Gupta** is a Post-Graduate from Lady Irwin College, University of Delhi. She started with her PhD in 2013 on waste management in India. Currently she is working as an Assistant Professor in the department of Resource Management & Design Application, Lady Irwin College.*

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Dr. Sushma Goel, ***Associate Professor at department of Resource Management and Design Application, Lady Irwin College, Delhi University has been teaching from past more than three decades. She has authored subject manuals, modules for distance education, text book, etc. She has several publications in national and international journals to her credit. She has been supervisor for 60 masters' dissertations and 9 doctoral researches (some ongoing). She had been principal coordinator for projects with DDA slum wing, DST, Ministry of health and family welfare, Ministry of social Justice and empowerment and Delhi University Innovation projects.***

***T. G. Rupa**, Assistant Professor, M. Sc. Ph. D (Community Resource Management & Extension), University of Delhi. Her areas of interest include Resource Management, Housing and Space Design, Ergonomics, Product Design, Facilities Management, Sustainable buildings, Waste management and Renewable energy. She has successfully completed DU Innovation projects on Solar engineered products for rural population and Developing sustainable products using garden waste. Email: tgrupa70@gmail.com*

GREEN WASTE - THE ECO-FRIENDLY WAY

Vaishali Gupta, Dr. Sushma Goel & Dr. T.G. Rupa

ABSTRACT

Management of solid waste is becoming a serious problem in most of the countries around the world. With increase in waste volumes, there is a rise in environmental risks and loss of resources. Landfills and open dumping are the two most common methods adopted for waste disposal which can lead ecological risks through loss of resources. More than 40% of waste generated in India is organic / green and composting is the most beneficial way that can help in convertingone-forth waste into nutrient rich soil amendment. Composting provides a means to recycle green waste back into soil for improving its fertility and structure. This paper reviews information on addressing solid waste problems through the process of composting for treating solid waste.

KEYWORDS

Green waste, bio-degradable, composting, waste management

Introduction

During the last few decades, the increased use of petroleum products has forced countries around the world to use various possible energy products for carrying out human activities which has led to degradation of environment (Atalia, et.al., 2015). Waste is the consequence of human activities in society. With modern growth and development, population in urban cities is increasing at a fast rate and generation of solid waste has a very high magnitude. To bring it under control, collection and disposal is

necessary for maintaining healthy and hygienic conditions (Kumar, 2004).

India is the third largest producer of solid waste in the country. According to a survey conducted by ENVIS Centre in renewable Energy and Environment for the year 2009-12, India alone produces1,27,458.107 metric tonnes of waste per day (ENVIS, 2011). Only 31% of Indian population resides in urban areas accounts for 1,43,499 metric tonnes of waste per day. The per capita generation of waste in major cities in the country ranges from 0.20Kg to 0.6 Kg (MoUD, 2016). The government also claims to have a collection efficiency of 70-90% in most of the metro cities but the results of the same are far visible.

With the increasing concern for environment and ecology, management of solid waste has become most critical for survival. Though many solutions have been worked out for handling waste efficiently but there is no single one solution to the problem of solid waste (Brewer, 2001). The most appropriate way of handling the situation is to make use of multiple techniques instead of an integrated approach.

The composition of Municipal Solid Waste (MSW) in India as given my Ministry of Urban Development (2016) states that 40-60% of waste generated in the country is organic waste. Other materials found include ash and fine earth (30-40%), paper and paper products (3-6%) and plastic, metal and glass (3-4%).

Green waste

Green waste, also known as organic waste is the result of human habitation. The three main forms of organic waste are household waste, agricultural waste and human and animal waste. The amount of green waste generated by countries especially developing nations like India is increasing drastically every year.

According to the Cambridge Business English Dictionary, Green waste has been defined as 'The waste that decays naturally and in a way thatit is not harmful to the environment as well as human health'(www.dictionary.cambridge.org, 2017). Waste arising from various human activities like landscaping, gardening and agriculture generally consists of materials which are bio-degradable and can be broken down by the natural processes (Sorathaiya, 2014) as shown in Figure 1.

Figure No.1: Classification of Green Waste

Reducing, Reusing and Recycling Green Waste

With the world changing over, it is imperative to recognize and realize the sustainable growth potential and interest in the solid waste management hierarchy – Reduce, Reuse and Recycle. It is most essential to first reduce waste, then reuse and the last resort is to recycle waste (loadingdock, 2017)

***Reducing Green Waste*: Source reduction is a very efficient method of reducing growing organic waste problem. It involves activities which separate organic material from other waste at the point of generation. This waste can then be treated by various**

methods like bio-digestion, bio-gas plant and composting (Department of the Environment and Energy, 2017).

It helps in cutting costs and improving productivity by targeting wasteful processes of segregation, collection, transportation and disposal. It also helps in promoting efficient use of available natural resources and decrease the pollution generated (EPA, 1999).

***Reusing Green Waste*: Reusing is the first step of reducing waste. Reusing vegetables peels for cooking another dish, plant trimmings as natural mulch, brush piles as habitat for insects, big branches as showpieces / utility products is a great way of selecting right kind of green waste in the right place for reducing tonnes of organic waste ending up in landfill sites (www.stopwaste.com, 2017).**

***Recycling Green Waste*: Green waste has a lot of potential for recycling to form new materials which are good for environment. The largest component of municipal solid waste of any city is organic waste (Kumar, 2004). According to study conducted by Central Pollution Control Board (CPCB,2015), of the total waste generated in India, only 10-20% material is recyclable and about 40-60% is green waste. These figures indicate a clear potential for waste minimization through recycling and recovery of materials. Other recyclable materials like Glass, aluminium, plastic and other metals can be easily retrieved through segregation.**

Various benefits of recycling organic waste has been discussed under the following heads:

For the Urban Local Bodies (ULB):

a. ***Recycling organic waste helps ULBs by reducing the total amount / quantity of waste that has to be collected, sorted,***

transported and disposed off thus helping in saving cost as well as time and energy required.

b. ***Longer life for Landfills – The lifespan of a landfill is directly proportionate to the amount of waste disposed off daily. Recycling of organic waste at individual or government level.***
c. ***Reduced environmental management efforts.***

For the economy:

- ***Reduction in expenditure*** **– Organic recycling at source has the potential to reduce the expenditure on trash services like collecting, sorting, transportation and disposal. It also helps in reducing the cost of fuel and manpower requirement (Hennepin, 2015).**
- ***Market for recycled organic products*** **- Recyclable organic materials have a decent market. While prices of these materials may fluctuate but the sale of these materials can help generators earn revenue from the same (Waste Wise, 2015).**
- ***Avoidance of alternative disposal methods*** **– Organic waste is recycled helps avoid introduction of an alternative disposal method which may be damaging to environment but also very expensive. It may also be limited to a space/ area (Schulz & Romheld, 2017).**
- ***Livelihood opportunities*** **– Recycling of goods is the need of the hour and has a bright future in the country. It also provides people with an opportunity to work in recycling industry.**

Benefits to the Environment

- ***Recycling of Organic components can significantly reduce the production of methane gas which is the result of green waste decomposing in the landfills and help alleviate climate change (Hennepin, 2015).***

- ***Recycling is a healthy way of conserving natural resources. It also limits the supplies of natural resources (Schulz & Romheld, 2017) which in turn reduce the requirement of the land for storage sites.***
- ***Reduced Environment Impact – Organic material when recycled is beneficial both the environment as well as mankind. Reduction in activities like pollution, deforestation and waste pile can help in lowering the overall environmental impact on climate change*.**

The most environmental friendly way of recycling organic waste is Composting. Composting is an age old practice based on the conversion of biological organic waste into humus like substance which can be used to enhance soil properties physically, biologically and chemically. It is an environment-friendly, sustainable and an appropriate treatment for handling green waste (Kumar, 2004). It has the potential to reduce a significant fraction of solid waste generated in the country from going into landfills. This not only helps in preventing use of scarce resources but also reduces the environmental impact on human health and natural world.

According to Solid Waste (Management & Handling) Rules, 2016; Recycling of solid waste has been defined as "*the process of transforming segregated waste into a new product or raw material for producing new products*" (MoUD, 2016). After source

reduction, recycling is the most preferred option in the Integrated Solid Waste Management (ISWM) hierarchy. It is an ideal system of managing waste before choosing any waste processes or treatments.

COMPOSTING

Composting is a method of diverting green waste from ending in landfills into creating a useful product at a reasonable cost (Eriksen, et. al., 1999). It is also beneficial for decreasing germination of weed, killing pathogens and destroying malodorous compounds (Figure 1.2). Organic waste though comprises of a large part in India's waste, provides an opportunity to handle about 60% of countries waste with ease (MoUD, 2016).

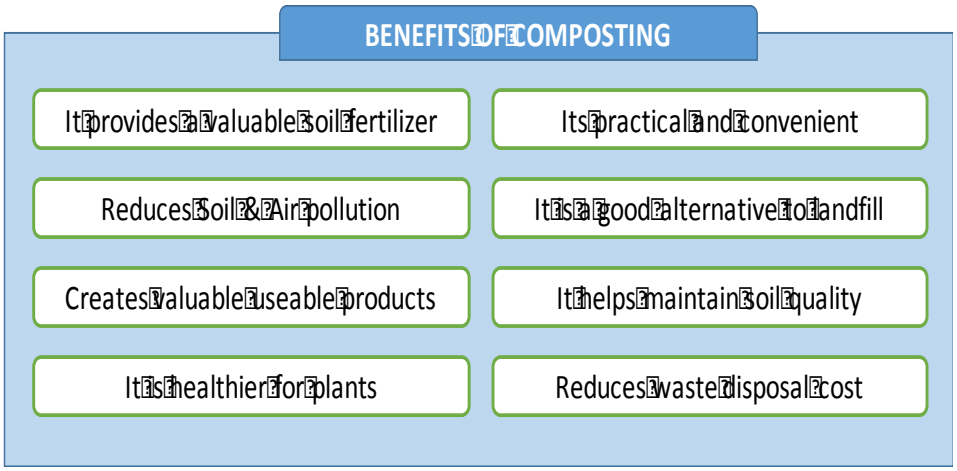

Figure No. 2: Benefits of Composting

Composting can be done through the following three methods:

a) **Aerobic composting** - **It is a biological process where organic matter is decomposed under controlled conditions of moisture, ventilation, heat, temperature and organisms present in the waste itself (Sathish kumar et.al., 2002).The resultant product is a human like material (Sludge) which has high**

nutritional value and can be used as fertilizers for fields. As explained by Ramchandra, et.al there are various methods of composting in India:

- ✓ ***Indore Method*** **– Similar to Bangalore methods, Indore methods ensures regular shifting / turning of material in the pits at regular intervals. The compost is prepared in 2-4 weeks.**
- ✓ ***Windrow Method*** **– The windrow method of composting involves long, narrow piles of green wastein heaps of about 3m height, which are allowed to sit for a period of 6 months with regular (weekly) shifting of matter for accelerating the composting process. The end matter is then sieved to obtain compost (Ramchandra, et.al, n.d.).**

b) **Vermi composting – It is a comparatively newer method of composting where earthworms are used for preparing compost from farm and livestock waste. The simple technique used in this process involves earthworms eating organic matter and producing casts. The casts is very rick is nutrients and excellent manure for plants (Government of Madhya Pradesh, 2016).**

c) **Anaerobic composting – It is process of composting that works without oxygen. Thus most of the anaerobic composting is either underground or in pits and trenches. It is comparatively a slower process and the only way to observe the progress is to dig and check (Cromell, 2016). Two basic types of anaerobic composting are:**

- ✓ ***Bangalore Method*** **– It is the conventional method of composting that is carried out in pits. Alternative layers of waste and soil is laid with a final solid layer to prevent bad odour, flies and waste seepage. A period of 4-6 months is given for the matter to decompose, after which stabilized material / compost is produced (Ramchandra, et.al, n.d.).**

- ✓ ***Passive composting*** **– It involves the simple procedure of stacking materials in piles and allowing them to decompose over a long period of time. It is mainly used for decomposition of animal waste (Mishra.et.al, n.d.).**

Factors affecting Composting

Composting is a process driven by microbial activity. Just like any other living organism, microbes also require the right environment to thrive and survive. For composting to be successful there are various factors that should be considered (Chen, et. al., 2011).

a. ***Oxygen demand*** **– Aerobic composting is more efficient than anaerobic composting which is a very slow process. A minimum oxygen concentration of 5% and optimal level of 10% is required for the compost piles. The composts can be aerated either passively (turning the material over) and actively (keeping aerobic organisms active) (Pace, 1995).**

b. ***Suitable Moisture*** **– The preferred level of moisture content is when it appears**

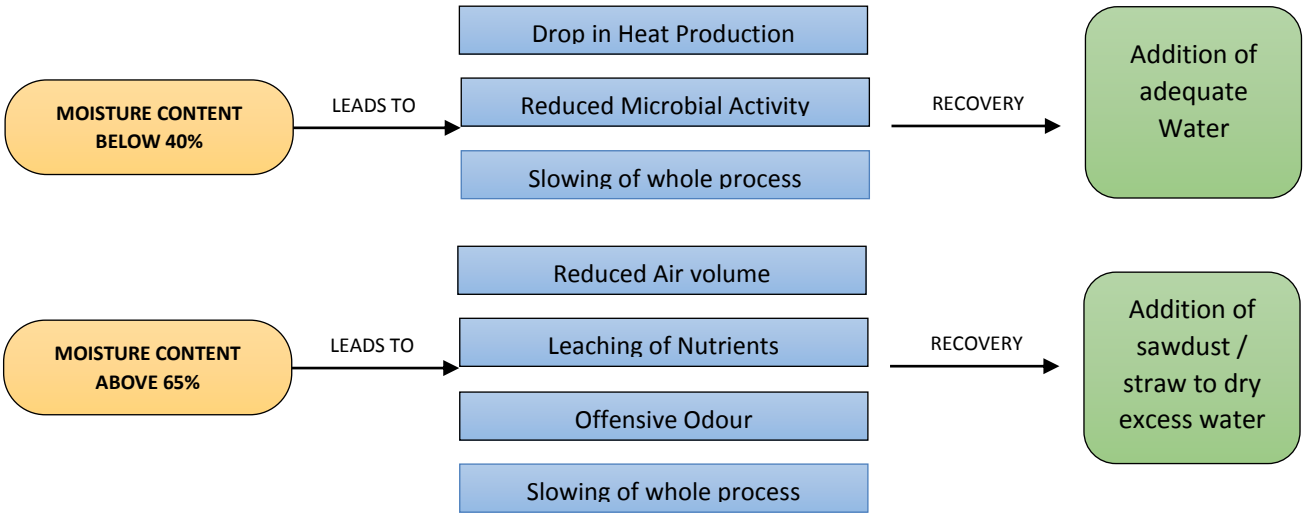

Figure No. 3: Appropriate moisture content for composting

Adapted from: www.fsaconsulting.com, 2003

wet yet no water can be squeezed out by hands. The ideal level moisture content ranges from 40-65 w.b which allows compost organisms to access sufficient water from the matter without inhibiting aerating (www.fsaconsulting.net, 2003). Moisture levels below 40% and above 65% are not considered suitable for a nutrient rich compost (Figure 1).

***c. pH balance*–pH Balance significantly affects the process of composting as it used to follow the process of decomposition. Neutral to acidic conditions are considered best for most microorganisms. The time proceeds, the organic acids in the compost neutralizes and a pH of 6 to 8 most suitable (Zorpas, et.al., 2000).**

***d. Particle Size*–The process of composting is affected by its particle size as it influences the continuation of interstitial air spaces and aeration. A large surface area is required for ensuring maximum microbial activity. It can be achieved through shredding and chipping of waste into small pieces which makes it easy for microorganisms to act and decompose. Particle size too large can lead to air pockets and heat loss while particle size too small can inhibit the circulation of air in the compost (Fares et. al., 2011).**

***e. Nutrition food* – Composting involves break down of micro-organisms for obtaining energy and acquiring nutrients like Carbon, Potassium, Phosphorous and Nitrogen for sustaining their population. Carbon (for energy and growth) and Nitrogen (for protein production and reproduction) are the two most critical nutrients found microbial decomposing. Materials that are moist and green are usually high on N, whereas materials that are brown and dry are high on C. Obtaining the ideal C: N ratio of 30:1 is essential for good composting results (Chen, et. al., 2011).**

f. Temperature **– Temperature at any point during composting depends on the amount of heat generated by the micro-organisms and the lost through aeration and surface cooling. The ideal time taken by organic waste to turn into compost is between 120 and 150^{o}F which allows microbes involved in the process to perform at their best capacity to keep the process moving (Otto, 2013).**

CONCLUSION

Despite the developments in the management of solid waste over the last the years, the pace of improvements needs to be accelerated. Green represents Nature and sustainable recycling of green waste concerns environment both natural and working environment. Composting is an environment friendly method of managing green waste compared to landfill. The resulting compost can be used for various purposes like agriculture and horticulture, as well as for remediation of adulterated sites and sustainable landscaping.

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***T. G. Rupa**, Assistant Professor*

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He has guided four PhDs, published research papers in International Journals, mentored B.Tech and M. Tech. students including young aspiring entrepreneurs. He is member of Academic Council of GB Pant Engineering College PauriGarhwal, Uttarakhand and Advisory Council of DeenDayalUpadhyay Kaushal Vikas Kendra JamiiaMilia besides being guest faculty in a number of educational institutions.

ADOPTION OF RENEWABLE ENERGY TECHNOLOGIES BY RURAL HOUSEHOLDS

Dr. Sushma Goel, Ms. Supriya & Dr. Pradeep Chandra Pant

Abstract

The world is undergoing a transformational change and adjustment necessitated by a paradigm shift due to increase in use and fast depleting fossil fuels. More than 40 percent of population does not have access to energy resources. In this context, the role of energy efficiency and renewable energy is vital. Continuous efforts are being made to upgrade functionality of conventional as well as renewable energy resources so that their adoption becomes effective. Several government programmes have been initiated to provide the off-grid electricity and alternative energy resources to meet the growing energy demands. Despite such efforts, in rural areas limited awareness about the importance and types of renewable energy technologies available, the reach of renewable energy is limited and inadequate.

There is a need to enhance the coherence between energy access and availability, observe existing energy practices and develop methodologies to promote consciousness towards effective clean energy. The research focused on adoption of renewable energy technologies available to enhance quality of life of people in rural areas.

Rural residents prefer to use locally available resources for fuel, etc. as they are within their vicinity and available free of cost. Due to such a practice there is depletion of natural resources leading to environmental degradation. There are several reasons why rural energy deserves special attention distinct from energy in general. The research focuses on various aspects relevant in any

energy programme to make an impact on the lives of rural residents.

KEYWORDS: ***Energy resources, Energy practices, Awareness, Energy Consciousness, Renewable Energy Technologies.***

Introduction

Energy has been universally recognized as one of the most important inputs for economic growth and human development. Growth of an economy is assessed on the basis of the availability of cost-effective and environmentally benign energy sources and the energy demand (EIA, 2006). India's energy crisis is defined by the fact that the major share of its rural population is energy poor. Rural areas in developing countries are severely deprived of dependable energy, which they need primarily for household use (mainly cooking), water pumping for agriculture and domestic use (such as lighting, etc.) and cottage or small scale industry.

Recognizing the critical role that energy plays in the development of rural areas, the Government of India has taken several initiatives in the past to promote a fuel switch from the use of fossil-based fuels, such as kerosene, to renewable energy resources. There has been a strong attempt in improving the supply of bio-fuels and introducing new and renewable sources of energy as alternative fuels, to meet the demands of the rural population.

According to IEA (2009) worldwide 1.456 billion people do not have access to electricity, of which 83% live in rural areas. More than 60% (400 million) Indians have no access to electricity. India has a population of 1,028.61 million out of which 72.20% live in rural areas as compared to 27.80% in urban areas (as reported by Census 2001, Office of the Registrar General India).

In accordance with the Census 2001, about 1.2 lakh rural areas were un-electrified in the country and about 7.8crore rural households had no electricity. Around half the country's population does not have access to electricity. Even though 85 percent of villages are considered electrified, around 57 percent of the rural households and 12 percent of the urban households i.e. 84 million households (over 44.2% of the total) in the country did not have electricity in 2000. According to a Planning Commission report (2006), improvement in human development is strongly associated with access to electricity. The International Energy Agency publication (2009), emphasizes the need to support renewable energy initiatives in the face of expected increase in world-wide electricity demand (by 2.2% per year between 2008 and 2035, with 80% of the increase from non-OECD countries). The role of emerging economies, China and India, is highlighted with regard to increasing future global energy demand. Furthermore, Asia has an electrification rate of 78.1%, and 68.8% rural electrification rate. The overall rate given for electrification in India is 66.3%. The electrification can mean a connection of electricity to a village, rather than reticulation within a village.

In a study conducted by NCAER (1985) on domestic fuels, to look into the issues of availability and affordability of kerosene in both rural and urban areas, it was observed that the relative share of fuels in overall energy consumption had changed. The share of firewood logs in rural houses went up dramatically (35% to 56%) from 1978-79 to 1992-93, while the other forms of biomass, such as firewood twigs and crop residues, remained the same or declined marginally. The share of dung increased marginally. The survey also revealed that a greater percentage of households were dependent on their own farms than on forested lands grown especially for fuel-wood. A rural energy survey, on *Energy strategy for rural India: evidence from six states* in Andhra

Pradesh, West Bengal, Punjab, Haryana, Rajasthan and Maharashtra emphasized on various issues such as rural energy consumption patterns, estimates for energy needs in rural regions, factors underlying fuel preferences, review of existing policy initiatives, opinions and attitude of the rural population regarding available forms of energy and potential alternatives. The survey findings reported significant shift in rural energy use as 80% of rural families expressed concern about the shortage of fuel wood in their surrounding woodlands. In Andhra Pradesh, Punjab and West Bengal, the percentage of households using fuel-wood declined from 30% to 40%. Since the living patterns have witnessed a sea change in rural areas, there is a need to relook at use of energy resources along with the more promising alternatives available.

Renewable energy has been defined as -

Renewable energy is energy that is derived from natural methods that are restored steadily. In its different kinds it derives indirectly or directly from sun or from heat produced deep within the earth. Similarly IEA categorizes renewable energy produced from wind, solar, geothermal, biomass, ocean and hydropower resources and hydrogen and bio-fuels derived from renewable resources as renewable energies (The International Energy Agency, 2005).

Solar energy: Solar energy is the source of energy that sustains earth life on all people, plants and animals. It offers a compelling solution for entire societies to meet their requirements for abundant and clear energy sources in future. The solar energy source is the nuclear communication at core of sun where energy exists from conversion of hydrogen to helium (Foster, Ghassemi and Cota, 2009).

Renewable energy devices

Renewable energy devices make use of non-conventional energy resources in their usable forms. Following are the renewable energy devices.

Biomass gasification: Far reaching accessibility of horticulture wastage, fuel wood, creature waste also biomass gasification representation of biofuel and biomass based vitality engaging, with biomass gasification to a standout amongst the most guaranteeing small scale power producing advances. The utilization of biomass gasification innovation for country jolt still stays restricted, however with huge potential crosswise over India.

Wind hybrid: When considered piece of a hybrid framework, nearby diesel, biomass or sunlight based era, wind turbines could be financially engaging. Diminishing capital expenses and also government impetuses reinforce the suitability of wind-mixture frameworks. However troubles in sitting of turbines, joined with frequently undocumented neighborhood wind-speed varieties, make viable organization time and data serious, diminishing its suitability even in various design for small scale applications.

Solar based photovoltaic: The Ministry of New and Renewable Energy (MNRE) under its PV program has disseminated around 610,000 frameworks, totaling around 20mw of limit. This incorporates sun based lights, home lighting frameworks, road lighting frameworks, water pumping frameworks, and a total limit of about 1.2 MW of stand-alone power plants.

Why renewable energy?

The development of various renewable energy systems began as early as in 1953. In 1981, the Government of India established a Commission for Additional Sources of Energy (CASE) in the Department of Science and Technology, on the lines of the Space

and Atomic Commissions. In 1982, a new department, i.e, Department of Non-conventional Energy Sources (DNES), that incorporated CASE, was created in the then Ministry of Energy. In 1992, DNES became the Ministry of Non-conventional Energy Sources. In October 2006, the Ministry was rechristened as Ministry of New and Renewable Energy (MNRE).

Growing demand of energy has necessitated the need for finding alternative means for meeting the demand of urban and rural areas as well. With the change in rural scenario, agricultural practices, advent of gadgets, i.e, television, mobile phones, computers, etc. the demand of energy has also increased manifolds.

Rural population prefers to use locally available resources for fuel, etc. as they are within their vicinity and available free of cost. Due to such a practice there is depletion of natural resources which is leading to ecological issues of concern. There are several reasons why rural energy deserves special attention distinct from energy in general. First and foremost, if rural energy is not treated separately, it is bound to be deprived of appropriate and deserved emphasis because it 'would fall between the cracks'. Second, the demography of rural areas differs fundamentally from that of urban towns, cities and metropolises. Rural areas consist of dispersed populations in contrast to the population concentrations of urban conglomerations. This fundamental distinction leads to a third reason for treating rural energy differently.

Centralized generation of energy may be a feasible option for urban areas but not for rural as it may be costly and inefficient for the dispersed population in areas that are remote, scattered and require low loads leading inevitably to greater transmission and distribution losses. Beyond certain break-even distances from the grids/transport systems associated with centralized generation, it

may be more cost-effective to implement decentralized village-scale generation coupled to mini-grids.

Barriers to energy access for rural masses

The barriers or constraints to Energy Access to Rural Masses have their origins in economic, social, technological and financial limitations coupled with inadequate focus by the planners, Governments and national and international development organizations on the issues involved. Some of the major barriers to Energy Access for Rural Masses are:

Geographically dispersed villages: Long distances and widely disbursed village populations have made it extremely difficult and expensive to provide access to grid electricity for the Rural Masses.

Inadequate focus on local resources: There is need for increased focus to explore the local energy resources due to perceived inhibitions of cost, suitability of available technologies and appropriate organization to optimize use of such local resources.

Inadequate financing structures: While the investments involved were perceived to be too huge to be met by the Government resources, appropriate financial models need to be developed to tap these resources through innovative private sector investment and PPP models.

Inadequate interest of private sector: Viability of private sector investment needs to be facilitated by the Government though an appropriate mix of:

- ***Subsidies & Grants***
- ***Incentives***
- ***Policy of Tariffs and Risk Sharing***

Unsustainable initiatives: In some cases, the initiatives for decentralized energy systems have not sustained due to various reasons and this has created mistrust in the planners, policy and

decision makers to pursue these and other initiatives for decentralized energy systems.

Impact of energy programs

Provision of energy to rural areas impacts poverty in a number of ways.

At the macro level, energy consumption indirectly ameliorates poverty through trickledown effects of growth. Expanding employment and income at various tiers take place through backward and forward linkages of agricultural and industrial expansion facilitated by energy consumption. The corresponding economic growth widens the tax base, which supports investment in rural schools, hospitals and other basic infrastructure.

At the micro level, energy consumption in households, agriculture and industry sectors directly contribute to improvement of quality of lives of project beneficiaries, especially poor. It also depends on the energy and conversion technology.

Centralized generation of energy may be a feasible option for urban areas but not for rural as it may be costly and inefficient for the dispersed population in areas that are remote, scattered and require lower loads leading inevitably to greater transmission and distribution losses. Beyond certain break-even distances from the grids/transport systems associated with centralized generation, it may be more cost-effective to implement decentralized village-scale generation coupled to mini-grids.

The project focuses on adoption of clean and modern/sustainable energy technologies available to enhance quality of life of people in rural areas and protect the environment. The aim of the project is to enhance the coherence between energy access and usage with sustainable livelihoods, evaluate existing energy development, and develop methodologies to promote consciousness towards effective clean energy. There is dearth of intensive information concerning rural energy demand, supply,

and consumption therefore, it is necessary to focus in a synergetic manner. Unless the households have good knowledge of alternative options available for energy use in their areas it would be difficult for them to appreciate and use them effectively.

If energy systems in rural have to be instruments of sustainable rural development, the energy usage and distribution of the benefits of rural energy technologies have to be scrutinized. This project will help to understand the energy use patterns in the present energy scenario, scope and implementation of renewable energy and technologies leading to socio-economic development of resident population.

Methodology

Rural households were selected from Haryana and Uttar Pradesh villages. Visits were made to two villages namely, Bhagwanpur (Panchkula, Haryana) and Rabupura (Ghaziabad, Uttar Pradesh). The selected villages are located 16-23kms from the district headquarter Panchkula and 20-30kms from district headquarter Ghaziabad. In both the villages the occupation was primarily agriculture.

The sample was drawn from the two villages. In order to have an equal representation same number of households was selected from both villages, i.e, 40 households from Bhagwanpur (Panchkula) and 40 households from Rabupura (Ghaziabad). One respondent from each household was interviewed.

Multiple tools were used in the research were interview schedule (to study socio-economic profile, energy use practices, adoption of renewable energy resources by rural residents), observation of energy use practices and focused group discussions.

Discussion

Energy use practices

Crop residue was used in areas of intensive agriculture, such as those from corn, cotton, wheat. In some respect crop residue might be considered the least satisfactory form of energy, as they burn quickly and are the most difficult to control and hence they are mostly used along with fuel wood. It was observed that in both the states, the percentage of households using crop wastes for cooking was observed among large farmers, who had supplies readily available from their own farmlands.

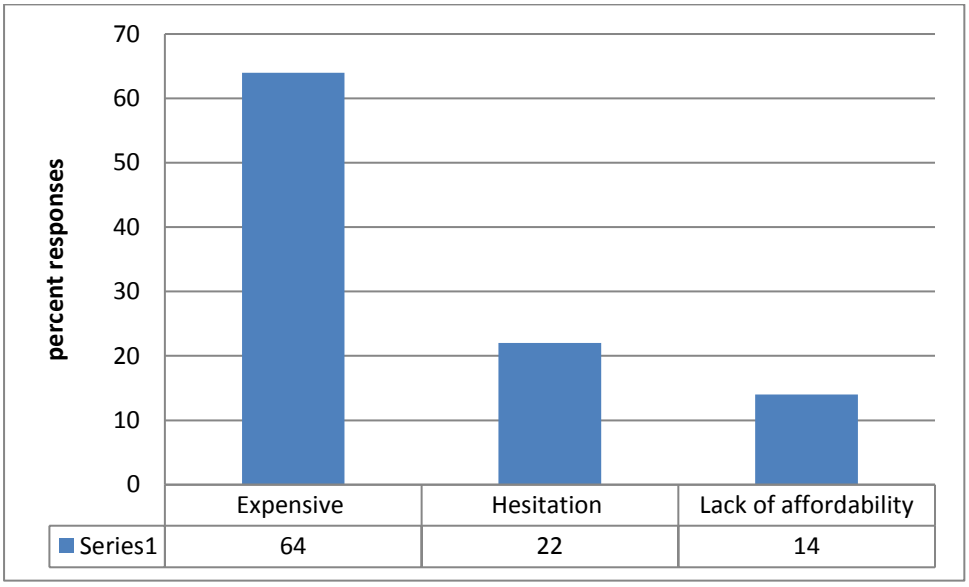

Figure No. 1: Reasons for not using RETs

Dependence on traditional resources

The most common stove used for cooking in India still happened to be the traditional *chulha*. A traditional *chulha* typically consisted of a stone plastered with mud to form a rough cube that is around one-foot square, with one side open to feed fuel. It had no chimney hence the smoke from the burning of fuel remained in the room. Primarily fuel wood was used though dung cakes and crop residue was found to be used in some areas. Most of the households surveyed often owned more than one *chulha* and LPG stove along with it which was used for cooking. The focused group

discussions pointed towards the popularity of traditional *chulha* as the one preferred by women since they used it earlier and hence found greater comfort in using the *chulha* over the LPG stove. The low efficiency yet popularity of traditional *chulhas* had responsible for extensive efforts and programs undertaken by several experts to improve the efficiency of traditional stove and disseminate improved models (NABARD and TERI). Although such programs have met with some success, the traditional *chulha* still predominates in rural India. Studies have shown that indoor air pollution, caused mainly by the burning of traditional fuels in unventilated stoves, is a significant problem in India. The effects on human health may be as high as 4, 00,000- 5, 50,000 premature deaths per year (Smith 2000). The main problem associated with traditional *chulha* is its inability to vent smoke out of a room, which causes significant levels of indoor air pollution, and its low efficiency (Parikh and Laxmi, 2001).

In Rabupura village (U.P) the energy needs were predominantly met by women (who were at times assisted by young children) for collecting wood, biomass or dung and making dung cakes for cooking and other purposes (such as heating water, warming room in winters, etc.). Apart from the above mentioned sources of energy LPG was also used by high income group households. The fuel wood and other biomass are burnt in inefficient traditional mud stoves with less than 20% efficiency compounded with poorly ventilated kitchens.

Petroleum products like LPG and kerosene were used in less than two per cent of the total energy resources consumed in rural areas in Bhagwanpur (Haryana). Besides petroleum based energy resources, they were also using dung cakes and firewood is used for cooking. Petrol and diesel is used for transport and agricultural purposes. Two families were found to be possessing

biogas plant in Bhagwanpur that they used for cooking while its residue was used as fertilizer in their farms.

Energy resources used for different activities

In both the villages, electric supply was erratic as there was heavy load shedding and power was available only for 6 hours either in the morning or in the night. Households depended on kerosene-based lighting devices. The kerosene devices used in rural areas have low luminous efficiency and high fuel consumption. In a study of the usage of kerosene-based lighting devices in the rural areas of Uttar Pradesh (TERI 1999b); of the electrified households surveyed, 85% households were using home-made wick lamps for more than four hours a day (average) and the remaining were found to be using hurricane lanterns. Another interesting pattern of usage was that a majority of electrified households used incandescent lamps or compact fluorescent lamps for lighting in their living rooms and outer verandahs but continued to use kerosene based lighting devices in the kitchen and for other miscellaneous activities. The residents of Rabupura informed about 8-12 hours power cuts and the same was observed by the investigators as well. At this time, the only source of lighting for the people is the solar street lights and solar lanterns, which can work for 8-10 hours and 4-5 hours respectively.

Rabupura had higher energy needs in comparison to Bhagwanpur. The key activities which needed energy were, lighting, cooking, lifestyle needs (fans and coolers) and transportation.

The availability of clean fuel was high in the project area. The kerosene public distribution system (PDS) was quite good. Clean fuel use was greater (55%) among higher income groups, i.e., greater than 30,000/- per month, whereas only 8% of households with annual household incomes (AHIs) below Rs. 6000 used clean fuels. Thus the kerosene subsidy was benefitting the higher

income families instead of poor or low income group. Sixty-six percent of multiple fuel user families (users of both clean fuel and biomass) were drawing kerosene against their quota. Only 4% of households were buying kerosene from the open market, which was on an average 0.7 liters per month for cooking.

Cost of energy resources

Cost of usage of conventional resources was quite high, resulting in financial burden on the villagers. Table 1 provides detail of average costs of conventional energy resources.

Table No. 1: Average cost of different energy resources used by the rural residents

Energy resources	Quantity used	Expenditure (in Rs.)
Wood	60-70kgs	250-350
Crop residue	--	Available free from farms
Dung Cakes	35-40kgs	Available free from household cattle
Kerosene	4--5 liters	60-70
Coal	Insignificant quantity	--
LPG	1 cylinder	450-750
Biogas	Dung from two to four cows	Initial cost based on capacity of biogas plant (subsidized)
Diesel	2.3-2.5ltr	150
Electricity	30-50 units	250-300

Cost of renewable energy resources primarily comprised of initial cost of ownership of RETs and their routine maintenance. The table below describes the cost of most commonly used renewable energy equipment in Rabupura and Bhagwanpur. Table 2 gives details of subsidy provided by the Government to facilitate use of solar RETs by the residents.

Table No. 2: Subsidy provided the Government for different solar devices

Devices used	Actual rate	Subsidy	% subsidy
Solar lantern 10 W	2350	1000	42.5
Solar lantern *shikshadeep* 10W	2350	2350	Free for girls
Solar cooker (dish type)	5710	3213	56.2
Solar cooker (box type)	3150	1945	61.7
Home domestic light LED based 12 W	6500	2000	30.7
Home domestic light 37 W module	9700	5000	51.5
Solar street light (for panchayat)	16000	4000	25
Solar water heating system	36000	12000 cash (per month electricity rebate)	33.33
Solar water heating system	70% subsidy of total cost for NGOs		70
Solar tube well	2.85 lakh	1.14 Akh	60

Awareness of Renewable Energy Technologies

In both Rabupura, Uttar Pradesh and Bhagwanpur, Haryana there were similarities concerning sources generating awareness about RETs. A detailed breakup of the sources is given in table no. -- for each district of Uttar Pradesh and Haryana.

In Haryana, *Akshay Urja Shops* were the key source of awareness (42%) followed by solar fairs which accounts for 22%. One of the reasons as observed during the research is the presence and involvement of State Nodal Agency (SNA) personnel in the community. As informed by the residents of Bhagwanpur personnel visit the community, as and when complaint is there. The occasional delay was mainly due to the lack of trained personnel in the hilly terrain. The residents appreciate and respect the work of the Haryana Renewable Energy Development Agency. Electronic media and non-government organizations have very less presence.

In Uttar Pradesh, Print Media and *Akshay Urja* Shops played a key role in creating awareness about RETs, contributing 38% and 32% respectively. It took more than an hour to reach the nearest *Akshay Urja* shop in Ghaziabad and hence, for better penetration of RETs and easy access, the need for more such shops was felt by the residents.

Training programs designed by MNRE and implemented by State Nodal Agencies also trained local technicians to open up shops and become entrepreneurs. Rural areas covered in the study had universal need of trained personnel in the area. Solar Fairs and Electronic media shared the same percentage for effective awareness generation in their respective states. It was observed that the households in the lower hills of Haryana got newspaper and have subscribed to magazines and journals. Therefore they were better aware of RETs as compared to residents living in the interior part of the village. Awareness of RETs seemed to be improving. This can be attributed to the frequent training and awareness workshops organized by Ministry of New and Renewable Energy (MNRE) through the State Nodal Agencies (SNAs). The typical frequency of a workshop was once in a quarter. These workshops targeted both potential and existing

users of RETs. The comparison of awareness about RETs in Rabupura, Ghaziabad and Bhagwanpur, Panchkula are provided in the figure 2.

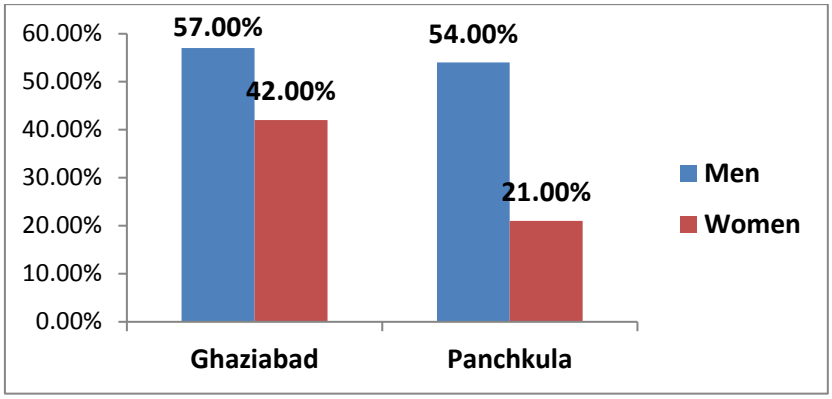

Figure No.2: Awareness of renewable energy resources among residents (men and women) of Rabupura, Ghaziabad and Bhagwanpur, Panchkula

Availability of RETs in rural areas

Availability of RETs has been increasing in both Ghaziabad and Panchkula. This can be attributed to the increasing efforts of Government agencies to promote RETs in the respective areas. The residents of both the villages were satisfied with the availability of RE devices at the Akshay Urja Shops (MNRE shops) which were 15-20kms away from the village and took approximately half to one hour to reach. RETs ranging from solar cooker (box and parabolic type), solar lanterns, solar home lighting systems (LED and CFL), solar torch were readily available at these shops.

Availability of training, repair and renovation services in RETs

The repair and maintenance contract for the power plants in few villages located at higher altitudes particularly, in Panchkula district was available for 5 years. For rural residents who have not seen power since a long time, solar energy devices have been a ray of hope and has changed their lives for good. The service personnel usually employed by the State Nodal Agency, namely,

HAREDA in Haryana and UPNEDA in Uttar Pradesh were trained and capable of resolving various problems related to RET devices. The response time for repair is usually one to two days. In the hilly terrain though, due to weather conditions and difficult topography sometimes there was delay. Due to far off location of service centers, most residents visited *Urja Shops* located in ts to he village premises, where most facilities for repair and maintenance were poorly available. One can find most of non-functional used RETs lying in the display shelves in unrepaired condition. Such events discouraged the rural residents to adopt more RETs and use the ones acquired by them more intently. Such situations compelled residents to revert back to their conventional equipment leading to inefficiency. There is a need for more shops for repair and maintenance along with more trained engineers, as observed as well as reported by the residents.

Share of energy resources by rural residents

Villages under study used both conventional and renewable energy resources for meeting their energy needs. The key conventional sources of energy were electricity from grid, wood, LPG, diesel, kerosene and dung cakes. The renewable energy sources used in Rabupura and Bhagwanpur were solar light, solar cooker and solar fans. The usage of renewable energy equipment was improving with time as awareness campaigns organized by agencies were highlighting the advantages of RETs. Solar lights were the most commonly used RE equipment. Nearly 20% and 35% of households in Rabupura and Bhagwanpur were using solar lights respectively.

It was found that maximum share of energy was of dung cake (45.79%) followed by fuel wood (17.78%) in the selected villages. Solar energy did not occupy significant share as informed by the rural residents and also observed in their practices. Reason for poor usage of RETs was ineffective method used for the

installation of solar devices, i.e., poor involvement of rural residents during planning, installation and after care (maintenance). Therefore many of them due to lack of knowledge, did not choose to use the improved energy sources despite the fact that they had purchased them.

Only about 20% of the families showed interest to use the solar equipment. In Haryana villages, solar energy equipments installed were 5kw power plants, solar home lighting systems, solar lanterns (*kissan* torch) and solar street lights. In Rabupura, Ghaziabad, solar street lights and solar lanterns were provided. These were quite popular and the residents found them quite useful.

In Rabupura village, some families had installed Emu hatching by using solar energy wherein the eggs of Emu (a bird) were sold to pharmaceuticals companies to make medicines for treating cancer patients. This unit was running quite successfully.

Residents seemed interested to use the RETs as they felt these provided them safety from theft and wild animals as they could light up the premises and protect the residence surroundings. Also they felt comfortable while having to visit farmlands for various activities such as supervision of irrigation, etc. during night time, performing household chores, study of children, etc. Overall the residents were happy with illuminated residential premises as it improved their performance in work and also made them safe by providing adequate protection.

Among various RETs installed, solar lanterns seemed to be a favorite option among hawkers as they were able to sell effectively even late in the evening when it became dark. About 150 hawkers benefitted under the Urja Unlimited Solar Lanterns project.

Problems experienced in the adoption of conventional and renewable energy resources

In the survey area, 27% of the households surveyed were not using clean fuels. Of these, only 22% were unwilling to switch from their current fuel. Various reasons for not using clean fuels are summarized in Table no. 2. Approximately 64% of households were of the view that clean fuels were very expensive, 22 % were scared / hesitant to use them, while 14% felt that fuels were not always available. Of the many options offered, only two reasons predominated, namely the lack of affordability and the hesitance in using newer energy resources. Other conjectures, often found in the literature, such as cooking with kerosene were that they changed the taste of food as wood smoke acts as an insect repellent, received virtually no evidence in the study findings. Both Rabupura and Bhagwanpur villages faced problems with conventional and renewable energy sources.

Constraints in using conventional energy resources

The main problems with conventional sources were poor availability of conventional energy resources and poor access. This limited the usage of conventional energy resources by the residents. The villagers usually experienced power shortages for long duration. Some houses were not electrified, therefore did not have access to energy resources, particularly lighting and had to live in darkness or inadequate kerosene lamp lit area.

Constraints in using renewable energy resources

Awareness and affordability were the major challenges with renewable energy resources. The villagers due the lack of monetary resources were sometimes not able to afford renewable energy equipment despite Government subsidies. Those who acquired RETs were not able to maintain them when there were some problems related to its operation. Battery change was one

such aspect for which rural residents were unaware and therefore did not know about this additional expenditure. Most of the times after 2-3 years, when battery was due for change, these expenses had not been budgeted by them when acquiring the RETs. Probably, while purchasing RETs, they were not informed about the maintenance of these devices.

The resistance to change was one of the major barriers towards better penetration of renewable energy technologies into the rural areas. Some residents who had purchased RETs, but did not use them efficiently for daily activities due to being habitual in using conventional energy resources and equipment.

However, the system to repair and charging of batteries was not in place due to which most of the solar RETs were not functional. The residents were neither informed nor was there any provision for additional cost (by the residents) due to battery replacement every 3-5 years.

Challenges in use and operation of RETs

The workshops for training were highly significant for use and operation of RETs. However, these training workshops were only attended by the selected family members of the villages. This limited their knowledge concerning the use and operation of RETs by users. Lack of operational and maintenance knowledge usually resulted in improper and inadequate use of renewable equipment. This in-turn decreases the operational life of the equipment. In many cases we observed that solar battery was not maintained properly (serviced as per requirement) resulting in lower life of the same.

Road blocks in adoption of RETs

Several constraints in the adoption of RETs were reported by rural residents, which were later shared with the MNRE officials during the project meetings.

1. ***Inadequate knowledge about RETs and their benefits. This resulted in improper and inadequate use of RETs, leading to dissatisfaction among residents.***
2. ***Inadequate training to use, operate and repair leading to inefficient, un-sustained and improper use.***
3. ***Inadequate financial assistance/loan available for purchase. Grameen Banks were not too keen to provide loan for solar products due to high risk perceived by them.***
4. ***Inefficient functioning of repair shops and changing of batteries. Replacement and repair of products took time.***
5. ***Theft of solar panels, batteries and poles, etc.***
6. ***Due to quota benefit powerful people and certain castes like SC, ST and OBC got the benefits i.e., higher subsidy amount. Common people got neglected.***
7. ***High initial cost of RETs.***
8. ***Lack of community participation and ownership particularly the women.***
9. ***Spurious RETs provided by some private companies led to misbelieve of rural residents in RETs.***
10. ***Lack of product standardization and certification due to which quality control of RETs was not possible.***

Suggestions to improve adoption of RETs

To ensure energy security in rural areas, a decentralized strategy is perhaps needed with emphasis on the following:

- ***Technological empowerment of the rural communities and institutions to deal with maintenance, management and distribution functions.***
- ***R&D must be an on-going activity for appropriate choice of technologies and should not be influenced by failures.***
- ***Bio-fuels, bio-diesel must be a plank of rural energy security as GOI has allowed 100% use of bio-diesel to run state facilities like pump sets.***

- ***Improvement in planning and implementation of energy consciousness programme***

The rural residents seemed to be inclined towards individual ownership of renewable energy devices rather than the community bound products like solar street lights, solar power grid, etc. The primary motivating force was saving in individual electricity bills.

Based on survey results, the energy consciousness programme was designed focusing on Solar and Biomass RETs covering the following aspects –

- ***Importance of RETs based on the constraints and problems experienced***
- ***Information about the technology involved in RETs, its repair and maintenance.***
- ***Comparative analysis of saving in electricity bills with conventional energy resources***
- ***Applications of RETs in rural households.***
- ***Understanding the construction of RETs by working models. This method proved highly effective in information sharing.***
- ***Games (such as, match the energy equipment with energy source, wheel of renewable energy resources) were usedto reinforce the understanding of RETs*.**

Participation of residents in the programme was encouraging as they wanted more information concerning repairs, subsidy and financial assistance.

Conclusion

The project dealt with the rural families of the two selected villages where Government had already installed some RETs but were not being used to their optimum by the residents for their own benefit. Since the families did not gain enough knowledge about the new technology by Government installations, the

project team was able to reinforce the existing programme by providing relevant information concerning functioning of RETs.

Thus interventions during the project helped in not only addressing the barriers in adoption but also befriending the new technology and bringing it to practice as part of day to day life. There was a perceptible change in their way of living and immense power saving in the households therefore electricity was available for other operations and most importantly as a substitute, as reported by the residents.

The project findings also revealed certain critical factors that should be looked into, when any such programme takes place in future for introducing RETs in a rural area. The benefit of the awareness progamme has been highlighted below:

- **Awareness generation: The understanding of the use and operation of renewable energy technologies was increased with the help of working models of the RETs.**
- **Availability of RE services: The repair and maintenance service was a matter of concern of many households using renewable energy technologies. The participation of service engineers from the SNAs answered many of such queries and the presence of the representative of the state renewable energy representatives was a boost for the participants from the villages.**
- **Improving adoption and usage: Better services, awareness about the importance of using RETs motivated many of the non-users to purchase RE devices and benefit from the same.**
- **Changes felt in their functioning / use: An understanding of management of RE equipment has shown visible improvement in the functioning of devices. This could be seen as users of solar heaters and solar cookers now make sure that the solar panels are cleaned periodically. Village**

representatives appointed by the *Panchayat* are dually checked of fulfilling their duties, for instance, cleaning the panels of solar street light, informing about battery or lamp/luminaire change or any theft of product or part of the solar street lights.

Key learning from the energy consciousness programme

Programmes aimed at the deployment of RETs in rural areas should be integrated into wider rural development programmes to ensure suitability and harmonization.

- ***Enabling Government policy is essential to stimulate uptake of RETs in rural areas, both on the supply and demand sides. Government support may take many forms: regulation, subsidization, import duties, public awareness campaigns, or more likely a combination of these.***
- ***Better funding for RE programs: Given limited national budgets in most developing countries and competing sector demands, donor support is likely to be necessary to deploy RETs and to bring down costs. In order to mitigate against a dependency on donor funds, donor support must be closely in line with government policy and phase-out plans need to be clearly articulated. Mechanisms such as the CDM have potential to promote RETs in rural areas, especially if numerous small projects are bundled together.***
- ***Knowledge sharing and innovation to improve products and reduce costs: In order to leave a sustainable local market for RETs after subsidies and donor support is phased out, it is imperative that local supply and demand are developed and fully connected with each other. While regulation can play a role here, especially in maintaining quality control and managing competition, it should be carefully targeted so that it does not prevent sustainable markets for RETs from being***

established. Opportunities for knowledge sharing, innovation and learning by suppliers and users can also help to improve products and reduce costs.

- ***RE development through awareness and training programs: Deployment of RETs requires hardware and "software" elements. Adequate training in areas such as installation, operation and maintenance – as well as learning and awareness- raising activities - are key to developing the local knowledge required for effective and sustainable RET use. If rural development through the use of RETs is to be sustainable and low-carbon, it is essential to build local capacity among both technology suppliers and users.***

List of Abbreviations

IEA- International Energy Agency

RE-Renewable Energy

RETs-Renewable Energy Technologies

CASE-Commission for Additional Sources of Energy

DNES-Department of Non-conventional Energy Sources

MNRE- Ministry of New and Renewable Energy

LPG-Liquefied Petroleum Gas

SNA- State Nodal Agency

NGO- Non Government Organization

CDM- Clean Development Mechanism

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Eco-Friendly Materials in Home Accessories for Green Living

Dr. T.G. Rupa[1]and Ms. Nancy Bhatia[2]

ABSTRACT

Home accessories are an important part of interior decoration and help make a house a home. They express the personal style of the occupant of the spaces as well as enhance the feel of any living or work space. They are used for more than just their practical functions in the home. India has a great history of beautiful hand made products often used as home accessories to add vibrant and exciting colours to the home interiors. The production of these items take place in cottage industries which require nominal amounts of land, lower inputs of power and energy making it is environmentally friendly to some extent. However, many artisans have now started experimenting with new materials, finishes and techniques to improve saleability of their products. These changes are taking place without adequate assessment of the impact on environment. Among the consumers, need for sustainable interior design is increasing day-by-day as people are becoming more conscious and aware about the alarming situation of environment vis-à-vis global warming, leading to a concern towards buying green home accessories and use of materials that are readily available in nature and less energy intensive. An eco-friendly environment requires a certain commitment and social involvement and green home accessories is a part of that consciousness. There are obvious benefits accruing from sustainable home accessories, yet it provides better design process to determine which of several designs may leave a smaller "footprint on the environment". Conducting life cycle sustainable assessment often results in recommendations for

minimizing resource use and emissions. This paper discusses the various aspects related to materials used in home accessories and their impact on people, planet and people through Life Cycle Sustainability Assessment (LCSA).

Keywords – Home accessories; Life Cycle Sustainability Assessment; Green Living

Introduction

Accessorizing a home is vital in many aspects on many levels to make the house a home. Adding those little touches to the décor of a home makes it interesting and offers a lot by way of comfort (Examiner.com, 2013). House decorating activity has evolved through the years to become an art form of sorts. While the objective before in setting up a house was to provide basic home comforts, it has now turned into a multi-dimensional affair that includes satisfying both aesthetics and function (Urban-ecos.org, 2013).

With the power to transform a house into a home, there is no easier way to express personal style and enhance the feel of any living or work space than through carefully chosen home accessories. However, with the emphasis shifting from "just aesthetics" to "green living" and environmentally friendly products these days, there is a need for making products which are green throughout their life cycle. There is a renewed interest towards re-living an eco-life in simple living spaces without compromising on well-being and environmental resource conservation (Cohen, 2014).

From the general notion of sustainability, an idea gaining traction in all industries is the notion of a "sustainability index" for products. It is clear that the world is moving forward aggressively to achieve sustainable design, and manufacturing with lifecycle

considerations. Designers are confronted with the challenges of designing sustainable products, processes and services. Achieving sustainability is no more an option during product development; it has become a part of the design requirement. For the development and improvement of humankind, it is imperative to renew a commitment to living as part of the earth by understanding development and growth as processes which can be sustained, not exploited to impractical limits. To achieve sustainability, products, processes and services should meet the challenges not only related to their functions and performance but also to environment, economy and social issues.

This paper focuses on Life Cycle Sustainability Assessment (LCSA) of materials used for construction of popular accessories used in the interiors and their impact on people, planet and profit.

To select the materials for LCSA, buying behaviour of users of home accessories was first ascertained in terms of reasons for selection and their life span as well as disposal. People generally picked those accessories which either offered a new design concept or served some functional purpose, were made of long lasting material, easy to maintain and low cost; modern style of home accessories which reflected their urban lifestyle was preferred by the users. The top four accessories identified were clocks, mirrors, wall hangings and decorative accents which help to highlight a room. The preferred accessories were available in various materials ranging from metal, wood, plastic, paper, terracotta, frames, papier mache, leather, coir, bamboo, fabric to glass, paper/cardboard, stone, ceramic, blue pottery and earthenware.

Factors affecting selection of materials and finishes for home accessories by manufacturers included location of manufacturing

unit, native place/area of residence of the manufacturers, their education and their financial condition, demand for accessories made from specific materials, etc. Majority of the manufacturers (77%) preferred using locally available raw materials to save on transportation cost. The finishes applied to the products to increase the aesthetic beauty of the accessories included both traditional organic material as well as the ones easily available even if they contained high levels of VOC. For them, more than renewable and non-renewable energy, it was the human energy that was consumed the most in the production of the accessories as manufacturing of hand made products is a labour intensive industry.

The products were mostly packed in paper and cartons as handcrafted items were mainly sold in *haats* and local markets. About 43% also used plastic packaging. Very few used willow baskets for packaging of big sized accessories mainly for export to other countries. Most of the users optimized the life of accessories by cleaning them on a regular basis; some also repaired the products to increase their life and reused them due to feelings they associated with the products. Some creative users tried to restore a product or parts of it by making something new out of it.

When a product is manufactured, some wastage occurs; the same applies when the product reaches its end stage. Nearly half of the manufacturers reported that they tried to minimize wastage to a large extent by using the left over raw material in some form or the other at the manufacturing stage itself though much of the waste generated during manufacturing of products went to the landfills. The users however facilitated reuse of the products either by giving away the home accessories to their maids or to friends, relatives and neighbours based on its utility to them. But

many of these products found their way to the dustbins once their utility was over as the users did not know what to do with them.

Life Cycle Sustainability Assessment (LCSA)

To understand the impact of various materials on people, planet and profit (3Ps), materials used for the construction of the four most popular accessories were selected and their LCSA conducted. The top four accessories were *clocks, mirrors, wall and door hangings, and decorative accents*; materials used for construction of at least more than one of the selected accessories included wood, brass, plastic, terracotta, blue pottery, handmade paper, papier mache, coir, bamboo and fabric.

The LCSA for the selected materials included the process of manufacturing, life cycle stages/ system approach and radar diagrams to show the impact on the 3Ps. The analysis of the selected materials revealed that all of them had some impact, both positive and negative on the 3Ps.

The methods developed to conduct LCSA of selected materials were shown to experts for authentication. Based on the reviews obtained, an outline for Life Cycle Sustainability Assessment was developed which is as follows:

- ***Process of manufacturing from raw material stage to the end use and disposal/recycling stage.***
- ***Life cycle stages were studied by investigating the inputs that go into the system and evaluating the outputs during the entire life cycle using the system boundary approach (EPA,1993).***
- ***Impact on society (Social Life Cycle Assessment), where the social sustainability activities focus on maintaining mutually beneficial relationships with customers and the community.***
- ***Impact on environment (Environmental Life Cycle Assessment), where environmental sustainability activities focus on the***

impact of resource usage, hazardous substances, waste and emissions on the physical environment.

- ***Impact on economy (Life Cycle Costing assessment) to understand how economic sustainability activities focus on business efficiency, productivity and profit.***

RADAR diagrams were developed to show the impact on society, environment and economy (people, planet, profit) for different materials as shown in Figure 2.

Comparison was done for LCSA of ten materials of which the best four as per research are discussed in detail here.

Coir is an important material which is not only eco-friendly but also cheap and very useful for many purposes. It is obtained from coconut husk. Kerala the 'land of coconuts' is the largest producer of coir and accounts for about 75 per cent of the total coir production from India. It is a natural fibre used for making variety of products like floorings, mats, carpets, bags, wall hangings and decorative accents.

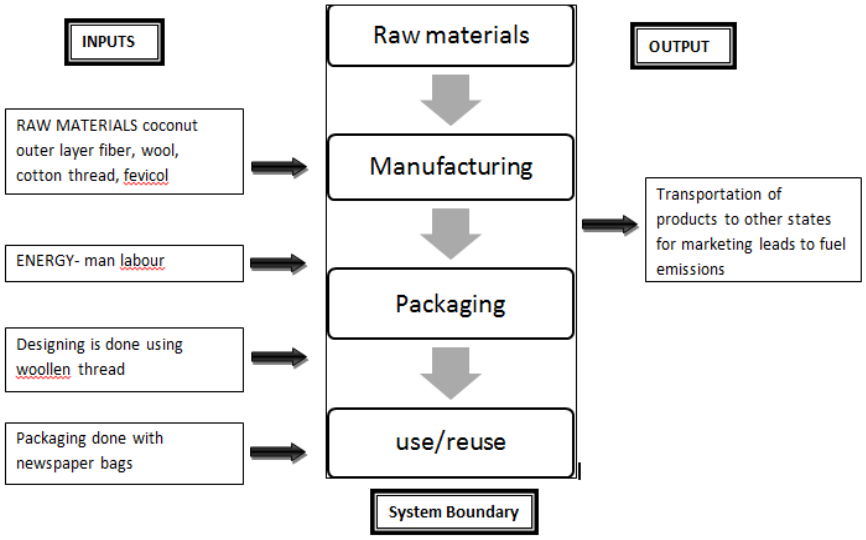

Fig. 1. Life cycle stages of coir

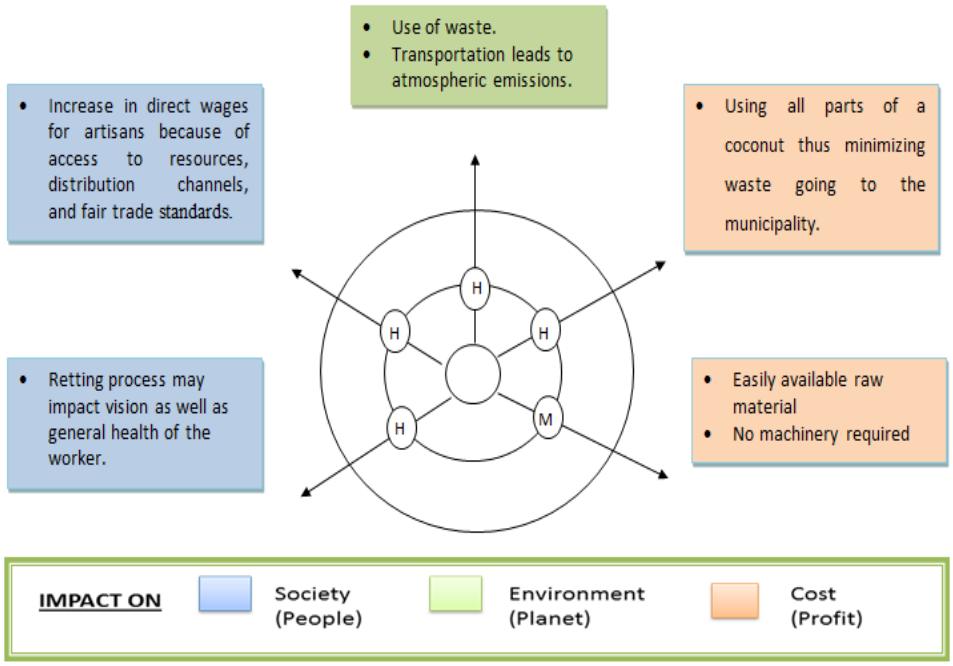

Fig. 2.Impact of coir products on 3Ps

Coir was found to be the best material. It uses waste part of the coconut to make it usable in the form of fibre by simple process of retting which does not have any environmental impact. The use of coir as a fibre gives employment to many people and leads to increased levels of income. Thus, it has very beneficial impact on society, environment and economy.

Papier-mâché was the second best material since it uses traditional practices which did not have any negative impact on the 3Ps. It is a wet craft commonly used in cases where the ease of construction is important, such as in arts and crafts. It is also used in modern art and sold in galleries, online, and even displayed in museums. Use of papier mache has regenerated an emphasis on recycling everyday items to create one-of-a-kind masterpieces. The manufacturing of papier mache is totally done in traditional form without using any machinery.

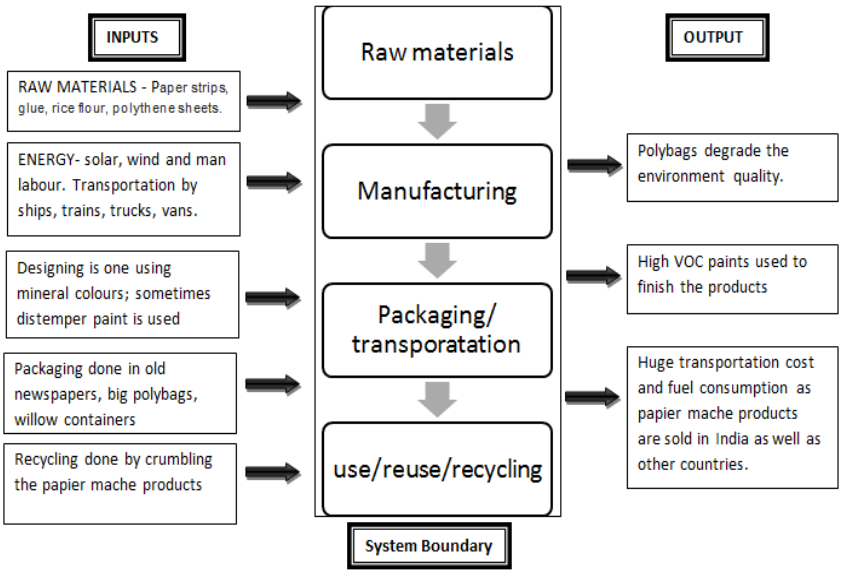

Fig. 3.Life cycle stages of papier mache

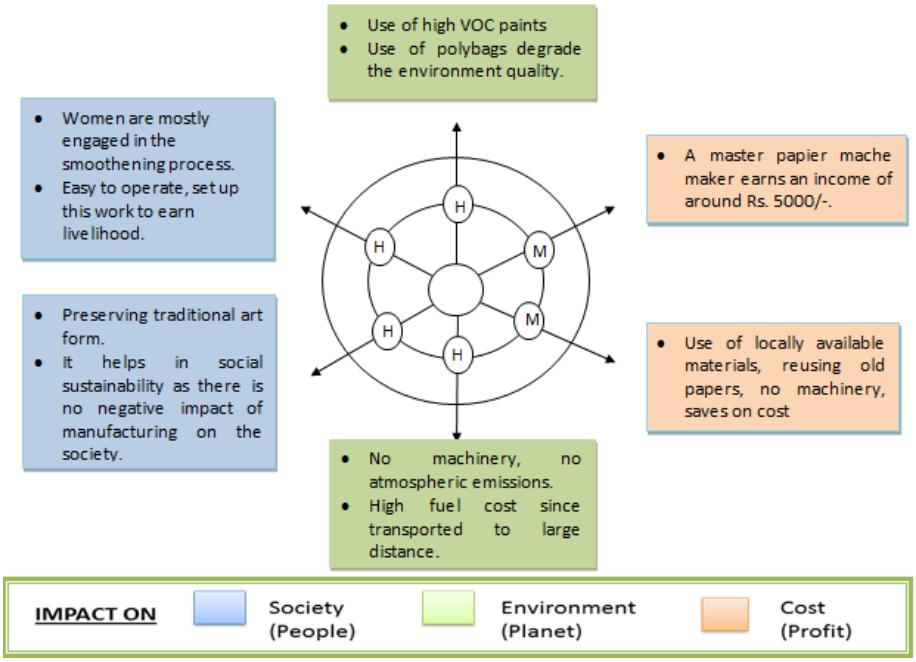

Fig. 4.Impact of papier mache products on 3Ps

Papier-mâché increases in direct wages for artisans because of access to resources, distribution channels, and fair trade standards. It is one of the most important craft which increases women employment. The main use of mineral colours makes it eco-friendly. Work of *nakkashi* is appreciated by almost everyone and results in good sales.

Reusing of fabric for making decorative art, wall hangings, etc. makes it the best material in terms of recyclability which decreases the impact of producing new cloth fabrics for making accessories and home furnishings and leads to promotion of women employment as fabric are mainly stitched and decorated by them.

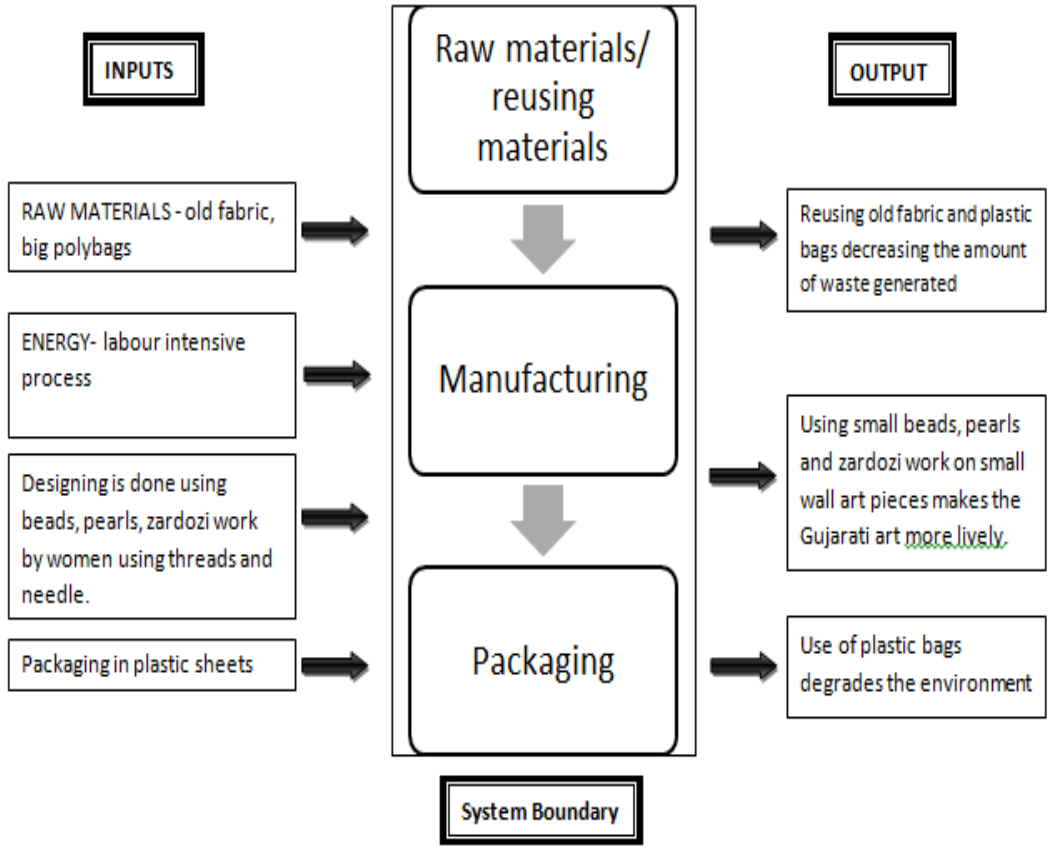

Fig. 5.Life cycle stages of product made up by reusing fabrics

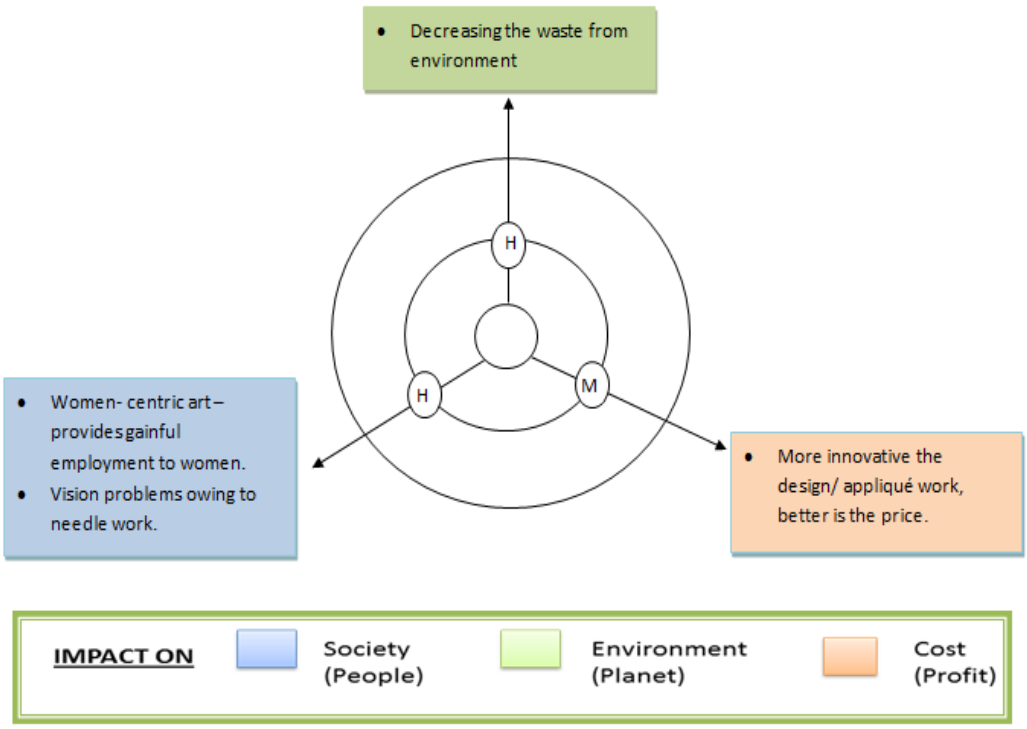

Fig. 6.Impact of products made up by reusing fabrics on 3Ps

The village women in India manufacture wall hangings, mats, center table pieces for decoration. Beautiful appliqué is one of the oldest and finest crafts of Gujarat. By using different patches of fabric, beautiful forms of floral and animal designs are prepared. Puppets, wall hangings, mats, cushion covers are some of the popular items they sell. Decreasing the fabric reusing it for decoration purpose is a process of making products in an eco-friendly way. It decreases the amount of waste from environment.

Handmade Paper is traditionally made using various vegetable fibres or cotton rags. Another method is to use recycled paper. These fibres are obtained from variety of plant species. Each fibre has its own physical properties and lends a peculiar characteristic to the paper. Handmade paper can be classified primarily by the sheet making process.

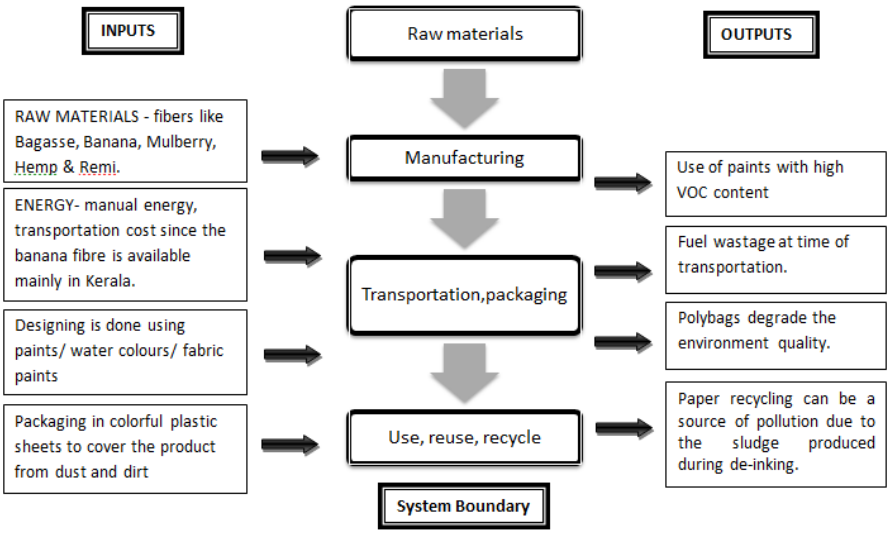

Fig. 7.Life cycle stages of handmade paper

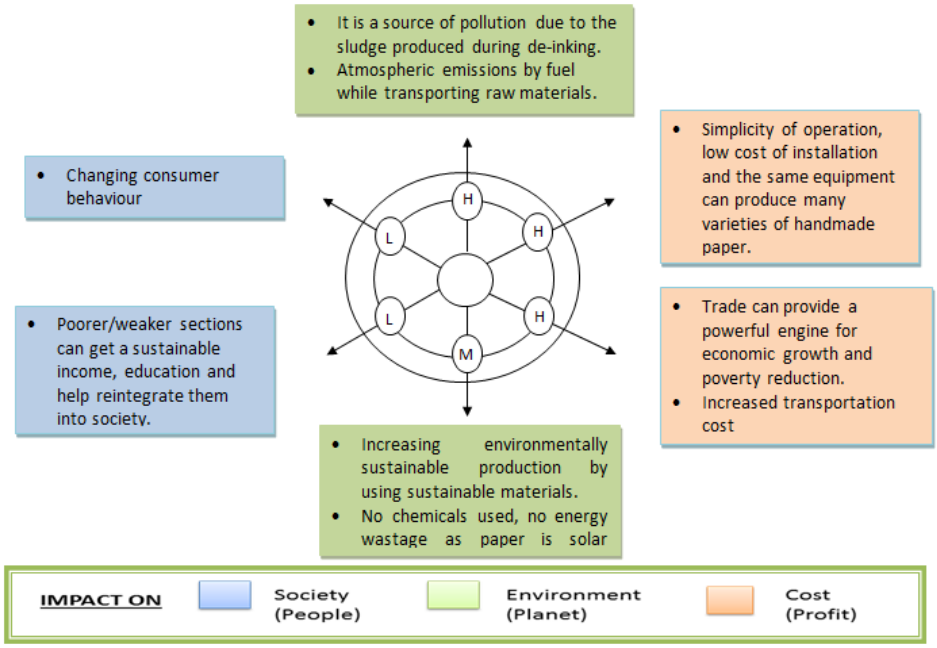

Fig. 8.Impact of handmade paper products on 3Ps

The manufacturing of hand-made paper encourages reusing the old paper and fabric which has many positive impacts on society, environment and economy. Concerns about the disappearance of forests, coupled with renewed interest in the quality of papers, have generated new ideas of paper making materials, especially the pulps and fibres. There are no chemicals used in the manufacture of handmade paper. The paper is solar dried, and hence no energy wastage. But demand for new hand-made papers

such as banana paper requires processing using the new plant hence it increases cost on transport and new methods of manufacture.

The following table gives the comparative analysis of impact on the 3Ps of various materials including the ones discussed above.

Table. 1. Comparative analysis of impact assessment for various materials

S. No.	Materials	Impacts of material		
		On society (people)	On environment (planet)	On economy (profit)
1.	**Coir**	Positive (generates employment)	Positive (using waste part of the coconut to make it usable by simple process of retting which does not have any environmental impact)	Positive (locally available raw material)
2.	**Papier mache**	Positive (traditional form of art, preserves indigenous technology of making papier mache products)	Positive (use of organic paints, mineral colors)	Positive (*nakkashi* work is appreciated providing better sale opportunities)
3.	**Fabric**	Positive (generates employment for women)	Positive (reusing old fabric and old plastic bags decreases impact of producing new fabrics for making accessories and home furnishings)	Positive (raw material is easily available at less price, designing and appliqué work by women is appreciated by users thus improving sale)
4.	**Handmade paper**	Positive (requires man labour effort thus generating employment)	Positive (minimizes waste by recycling)	Positive (uses less or very minimal raw material, reusing the old paper, fabric, etc.)
5.	**Bamboo**	Positive (processing of bamboo is easy and can generate more income for the community, state having bamboo plantations)	Negative (processing requires use of chemicals, lot of water; sometimes paints are used for embellishments)	Positive (locally available raw material, is light in weight, can be used in place of metal, plastic or hardwood)
6.	**Wood**	**Positive** (Increases employment, wages, using the most in-demand material)	**Negative** (deforestation, use of varnishes)	**Positive** (locally available material)
7.	**Brass**	**Positive** (Increased employment opportunities & opportunity to innovate new products)	**Negative** (use of fuel, energy, machines for processing brass)	**Positive** (reusing the same brass for different purposes by recycling it)
8.	**Terracotta**	**Positive** (preserves old craft)	**Negative** (use of kiln emits smoke and increases the emissions in atmosphere, use of high VOC paints)	**Positive** (colorful objects, variable shapes, tend to sell more)
9.	**Blue pottery**	Positive (preserves the traditional art form, funds are provided to the society to keep the traditional art form in existence)	Negative (use of quartz, chemicals and baking in the kiln releases harmful chemicals in the atmosphere)	Positive (traditional art sells well, particularly among those who appreciate the hard work involved in making the intricate designs)
10.	**Plastic**	**Negative** (machine based processing)	**Negative** (harmful impact on living beings, water, air; use of inorganic colors)	**Positive** (light weight, can be moulded in any shape, makes it the most saleable material)

Thus, coir, papier mache, reused fabric and hand-made paper were the top four materials that had the least negative impact on people, planet and environment. Other materials if processed in an environment friendly manner to substituted with components

that are less harmful, would be more beneficial to the world at large.

The decorations and accessories available to the person are always evolving and changing because of new materials in the market, while many strong and undying accessories remain precious items for years. One of the biggest factors to consider when choosing a home product is its lifespan. If a user chooses a product that only lasts a few years, he will end up replacing it more often. Also, it is important to note that the artisan sector generates income, creates jobs, fosters community development, sustains ancient techniques, and safeguards culture that is an essential component of healthy and sustainable development. It also increases environmentally sustainable production by using locally available materials.

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MULTI-CRITERIA FRAMEWORK FOR SUSTAINABILITY AUDIT OF ELECTRONIC PRODUCTS IN PLANNING MODERN INDIA

Dr. Sushma Goel & Prof. Lalit Das

ABSTRACT

In present scenario major thrust lies with making the entire globe sustainable, therefore, it is indispensible for every product to conform to these specifications, such as long life of the product, its maintenance and how and to whom to dispose these products at its end of life? And why discard if we can refurbish and give it another lease of life. There is a need for a legislation/regulation and compliance of all electronic products to bear such vital information to inform the users prior to purchase. There is an urgent need for the innovators as well as manufacturers to make a paradigm shift in innovating new designs, perhaps by integrating with sustainability features rather than design engineering, efficiency or aesthetics alone. Focus on layer technology, modular or retrofit of new technology will help to improve longevity of the electronics.

From sustainability view point, there is a conceptual shift from current industrial system designs, which generate toxic, one-way, cradle-to-grave material flows to cradle-to-cradle system to enunciate a positive and long-term goal to create products which are commercially productive, socially beneficial, and ecologically intelligent. Sustainability is not only doing more with less or reducing the human footprint to minimize the symptoms of environmental decline but also retrofitting them with incrementally cleaner, more efficient systems for longer life of electronics.

INTRODUCTION

Today every product used on this globe needs to be sustainable in order to prevent adverse climatic impacts, resource crunch, reduce environmental degradation and pollution. Every user prefers to acquire a product that is sustainable in the modern era of high level of environment consciousness. They are inquisitive to know the basis of evaluation of products on the sustainability parameters. For buildings there is enough work done by LEED and GRIHA but for electronic products, issues concerning their sustainability have yet to be integrated.

E-waste is growing very fast in the world due to increasing "market penetration" in developing countries, "replacement market" and "high obsolescence rate" in developed countries (Borthakur & Sinha, 2013). India generates $1.5 billion worth of domestic E-waste annually with the booming IT sector contributing maximum to the pool, as much as 30% of its machines reach obsolescence. Bangalore alone generates 8,000 tons of electronic waste in a year (Toxic Links, 2013).

Many companies manufacturing electronic goods including multi-national companies have failed to fulfil their basic responsibility which the E-waste management rules, 2011 defines as extended producer responsibility (EPR) for all the manufacturers which clearly requires manufacturers to take responsibility for the end-of-life recycling of their products. As per a very recent report titled "Time to Reboot" by Toxic links (2014) approximately 50 well-known electronic brands manufacturing mobile phone, laptop, camera etc. have no system in place with respect to taking back their products after 'end of life' or after they turn into E-waste. Furthermore, there are not enough collection centres for same. The menace is also increasing as there is no system in place by Government for inventorization of E-waste manufacturing units,

storage facilities for e-waste, authorizing E-waste recycling plants and no action plan for storage of E-waste (Times of India, 2014).

METHODOLOGY

Formulation of the criteria for sustainability audit of electronic gadgets (so that consumers can select sustainable electronics) is much needed. The criteria will act as a checklist while selecting electronics that are sustainable too. Care has been taken to draw the criteria that would be applicable to a wide range of electronics.

Multiple tools were used to gather information from all the stakeholders, i.e., the users, manufacturers, recyclers, and civic authorities concerning electronic gadgets and to formulate the criteria for sustainability audit of electronic products.

- ***A cross-section of consumers using a variety of household and lifestyle electronics were interviewed to investigate their practices, problems encountered while using, repair and disposal of these.***
- ***Complaints received by service centre officials by the users and also their frequency.***
- ***Informal discussions were held with the stakeholders in the sustainability chain of electronic products to understand the practices by each one.***
- ***Lifecycle assessment of electronic products was done to identify the gaps to be included in the formulation of the sustainability audit criteria.***

DISCUSSION

Interview with households revealed that a typical family used more than 30 electronic products. List of these products was rather long. Some of them were -

Mobile phone, air conditioner, refrigerator, television, iron, toaster, microwave oven, chopper, washing machine, cooler,

juicer mixer, fan, laptop/PC, DVD player, digital camera, IPAD, calculator, play station, hair straightener, wax heater, electronic accessories, etc.

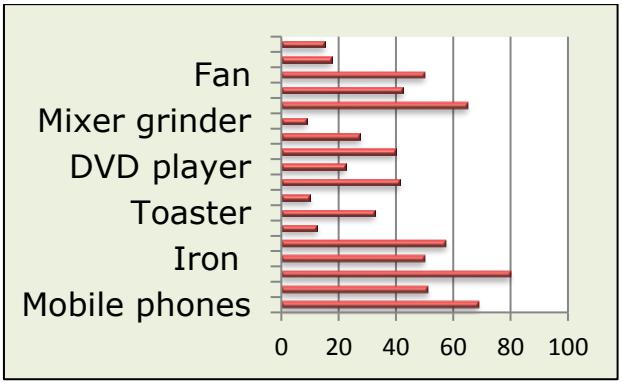

Figure No. 1: Frequency distribution of electronic gadgets used by consumers

Considerations while selecting an electronic product

Consumers selected electronics based on the brand name/company reputation, style, latest technology, cost, efficient operation, energy efficiency, after sale service / AMC available and warranty. None of them care about the following factors while selecting electronic gadgets -

- ***Life of the product***
- ***Serviceability***
- ***Environment compatibility***
- ***Hazardous components not used***
- ***Buy back policy of the company***
- ***Detailed information about materials and components used on the label***

Consumers sought the information on label of electronic gadgets such as use and operation instructions, energy efficiency, maintenance, and after sale service but not the contents or hazardous materials used. Hazardous materials used in electronics are presented in table 1. Most electronics have more than one of the above materials therefore their disposal has to be under controlled conditions.

Table No. 1: Hazardous materials used in electronics

Material	Toxins	Hazards
Mercury	Mercury	Affects the central nervous system effects (CNS) as well as the kidney Toxic by inhalation
Lead	Lead compounds such as lead oxide	Causes respiratory disorders Harmful by inhalation/harmful if swallowed
LCD Films	Polyethene	Contributes to elevated ground-level ozone levels which may damage vegetation. Irritates the respiratory system, aggravate asthma and lung diseases, cause permanent lung damage, and impacts the immune system
LCD	Mixtures of 10-20 substances, like substituted phenyl-cyclohexanes, alkyl benzenes & cyclohexylbenzens.	
Plastic	Phthalate plasticizers, Polyvinyl chloride (PVC)	Phthalate plasticizers in environment result in toxic reactions involving inflammation and Carcinogenicity In case of uncontrolled burning it liberates HCL gas.
Copper	Copper beryllium, alloys	Toxic by inhalation
Antimony	Antimony, trioxide	Limited evidence of a carcinogenic effect
PCB's	Level ‹50mg/kg (0.005%) is hazardous	Water gets contaminated with PCB & may cause long term effects in the aquatic environment
BFR	Contains poly-brominated di-phenyl ethers, highly persistent & bio-accumulative	BFR can give rise to dioxins & furans during incineration
Refrigerant	R-22	Results in ozone depletion and emits powerful greenhouse gases - a global warming potential
Cadmium		Cause lung and prostate cancer Toxic to GIT, kidneys, respiratory, cardiovascular and hormonal systems
Lead		A known hormone disruptor, can damage almost every organ and system in the human body, particularly the nervous system.
Lithium		The metal can burn creating underground fires difficult to extinguish

Problems experienced by users of electronic products

Survey of users indicated that most users experienced problems with electronic products soon within six months to one year of

purchase. The scenario also dwells on the fact that life of different parts of the electronic gadget varies, therefore when one part fails the entire product enters the disposal cycle prematurely. Survey of users revealed that the life of a laptop is about 2-3 years and with repair and maintenance, another 2-3 years. Most users are indifferent to this fact. Figure 2 represents different life of components of a laptop. This may result in poor / non-functioning of the product and finally its disposal.

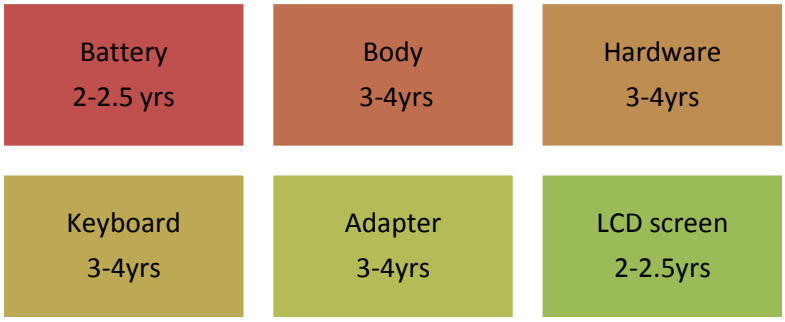

Figure No. 2: Estimated life of components of a Laptop

We need to evaluate the design of products and its consequences. Consumers are confronted with a wide array of products along with wide range of choices for models, sizes, and variety. There is no framework available for the wise selection of products available in the market for the users. Users do not have any idea about the life of these products or the service cost they have to incur. They purchase them for a certain expected life span however the product does not last that long. As per the claim by manufacturers for electronic goods, there is a warrantee specified for certain part/s and not for the entire product. Problems experienced with mobile phones and action taken by consumers to resolve them are shown in figure 3.

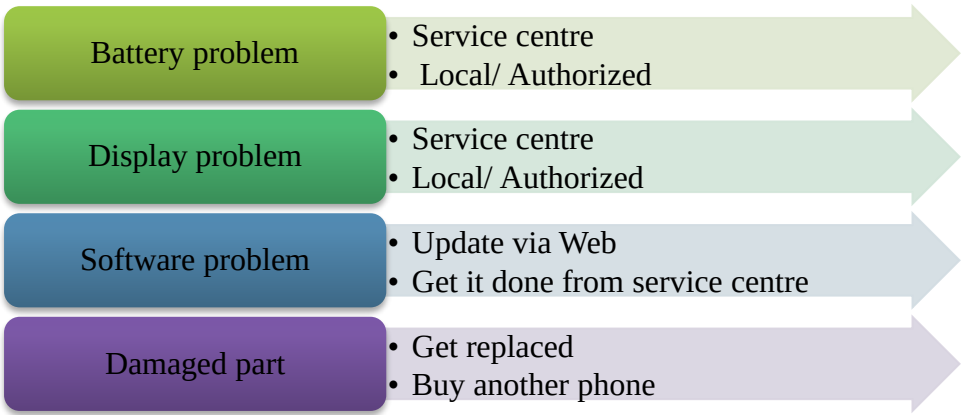

Figure No. 3: Problems experienced with Mobile Phones and action taken by consumers to resolve them

Composition of e-products

The average consumer in India uses a cell phone for about 18 months before they discard it. The designed life of a mobile phone is 3-5 years as claimed by the manufacturer. However, the warranty is only for 1 year. There are several factors that contribute to such a short usage. These are:

- ***Changing Technology (every 3 months)***
- ***Planned Obsolescence***
- ***Style statement***

A mobile phone comprises of most materials which are recyclable and long lasting, like plastic, copper and metals whereas non metals like PCB, lead, lithium, cadmium, etc. in batteries which are not so durable and have to be discarded. There is a need to consider design aspects of electronics which could be retrofitted if outdated so that the rest could be used as such. Designers need to also consider value addition of these products to offset monotony.

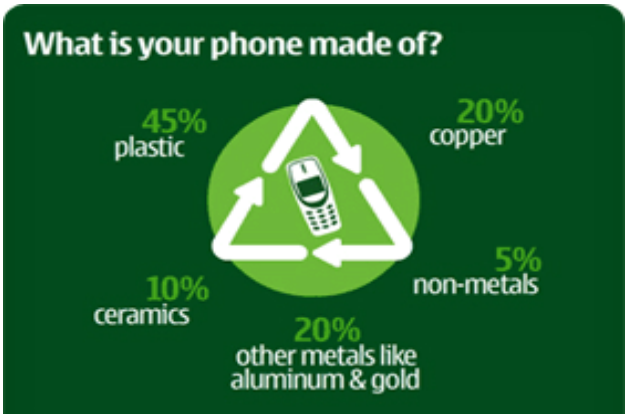

Figure No. 4: Composition of mobile phone

The findings indicated that their purchases were influenced by social and technological factors rather than environmental. Survey findings exhibited that –

- ***The life of the most electronic gadgets was rather short compared to the promise made by the manufacturer***
- ***Further enhancement of products with newer and advanced technology led to frequent change of these products.***
- ***Poor after sales service led to frequent change of old products with new, thus the issue of premature waste accumulation.***
- ***Manufacturers have shown very little or no concern towards method of disposal of the electronics safely.***

Frequency of problems experienced: One or the other problems were experienced by most of the users and these were evident soon after purchase i.e., within a year for household electronic products. For example, Laptops, which are an important companion of many who are constantly on the move. The issues confronted by the consumers while using laptops included frequent deadlocks, processor failure, poor visual or audio quality, boot errors, security threats, poor battery backup, loss of valuable data, operating system errors, non-availability of technical help,

the operating system errors, etc. Some of the problems generally encountered are listed below –

- ***Batteries needed to be changed after six months (in some e-goods) to three years of purchase. User was not prepared to incur expenditure for replacement of battery. Cost of battery was not an integral part of the cost of the electronic product.***
- ***There was problem with the display system.***
- ***New technology could not be upgraded therefore change of electronic product was indispensible.***
- ***Problems were frequent with the circuit system and operating system (software) of electronics.***
- ***Outer plastic body cracking / breakage, paint scraping and discoloring of the gadget.***
- ***Failure of motor / pump probably due to the voltage fluctuation.***
- ***There were frequent problems with switches and non-availability of spare parts.***
- ***The responses with users of electronic products highlighted the weak aspects of these products which were generally not part of the warranty.***

Problems experienced while repairing of e-products

Interview of service centre officials indicated that majority of customers came with some problems in their gadgets, among which there were minor as well as major issues. Customers did not feel satisfied with the intervention by service centres as they had to make repeated and frequent visits and also paid heavily for the services of these centres.

The service centre officials reported that problems were wide and varied – ranging from technical to minor ones. Sometimes due to improper use the problem occurred in the appliances. As regards resolving the problems, most of the service centres reported that

they were able to resolve within the same day of complaint. The payment for the visit and the part was the responsibility of the customer, whether post paid (without AMC) and prepaid (with AMC). Charges for each visit to review the product varied from Rs.150/- to Rs.600/-. Cost of the part ranged from Rs.200/- to Rs.5000/-. Some of the customers felt highly dissatisfied by the services provided by the service centres. They felt that service centres tried to make maximum profit out of the service sought by customers. Often working parts were changed. Some of them also felt that service centres had a shortfall of expert technicians / engineers therefore semi-trained representatives were not able to identify the problem and also solve them. They made repeated visits to investigate the fault and then the part was ordered from the warehouse, which took minimum one week to ten days. Customers reported of the use of duplicate parts which were promised with only one to three months guarantee. They reported that generally after three to four months the part (duplicate) would cease to function and had to be changed again. This made them highly dissatisfied with the kind of service provided. Most customers preferred to change to a new appliance rather than paying enormous amount in the repair. So, repairs were not done sincerely and in the interest of the customers probably interest of the manufacturer was to indicate change of appliance which is against sustainability.

As regards the problems encountered before the warrantee period most of the companies believed in repairing the piece bought by the customer unless there was some major defect in the appliance. Most companies tried to introduce buy back schemes probably to replenish the old one by upgrading the technology, appearance, etc.

Disposal of electronic products

Recycling is a hope because we are not aware where the product is gone. We give our discarded products to '*kabadiwalas*' without knowing where it is supplied further. Most consumers kept used e-goods in the cupboards for years as there was lack of buy back options. Some users resold them or gave to scrap dealers or got them repaired or exchanged for new, some threw it in the household bin or gave to housemaids / servants.

What happens to electronic products when thrown in the bin?

Waste pickers engaged in the free collection of waste from municipal garbage bins, streets and dumps. Scrap buyers purchased small quantities of waste (plastic, paper, glass, metals, etc.) from households. Between the waste collectors and the re-processors were various levels of traders. The trade gets more specialised as it moves up the pyramid to processors. At every successive level, waste is sorted more specifically; the better the segregation, the more value is added. In this chain, some of the players may be missing or combined at times.

Figure No. 5: Pyramid of E-Waste Collection and Processing

Recycling issues and process concerning e-waste are represented in figure 6.

Figure No. 6: Recycling of E-Waste

Some extractions that are possible from e-products for reuse or recycling are presented in figure 7.

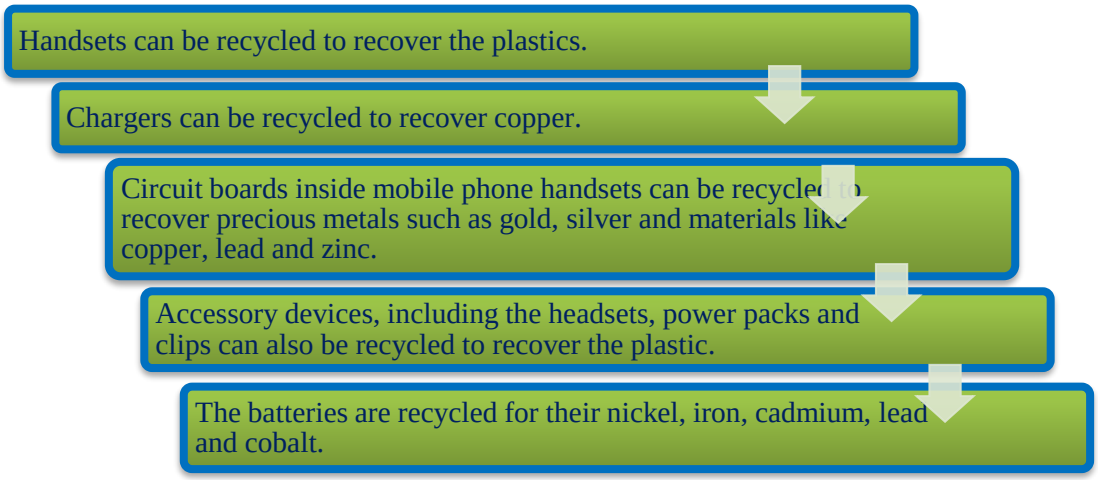

Figure no. 7: Extractions from Mobile Phones for reuse or recycling

In order to study the impact of electronic products on environment, a lifecycle assessment of the selected electronic products was done. The LCA revealed that –

- ***There were many hazardous substances used in the construction of electronic products and none of them were disclosed on their label.***
- ***The e-products except for lighting products did not state their life span. Though the e-products had slated warranty for certain parts ranging from one year to 10 years.***
- ***Some products mentioned their performance on energy efficiency but not on environmental sustainability and impacts.***
- ***There was no mention of disposal method on any of the selected electronic products, neither the buy-back option from the manufacturers end.***
- ***Hazards from the use and disposal of the products were also not mentioned anywhere in the booklet.***
- ***There was no mention of authorized recyclers of the electronic products to whom these should be given at the end-of-life.***

Divers of industrial electronic waste

The analysis revealed that following were the drivers of industrial waste -

- ***High obsolescence of product***
- ***Designed short life of product***
- ***Technology advancement***
- ***Closed product architecture***
- ***Absence of scope for upgradability***
- ***Inadequate support & Service***
- ***Poor description of material content of product and lack of knowledge of recycling advise***
- ***Lack of Industry commitment towards sustainability***

Commercial feasibility of designing electronic goods for lower obsolescence

The project findings and analysis point out the fact that since it is inevitable that hazardous substances can be totally avoided, therefore the option that will go a long way in favour of electronic products is to ensure that they do not become obsolete early. They should be upgradable so that premature disposal of electronic products could be avoided. Following are some suggestions to delay obsolescence of electronic goods.

- ***Design strategies exist for designing products with longer life.***
- ***Growing second hand market (for example, cars, medical equipment, Home Electronics, OLX, Suzuki, Hyundai)***
- ***Modular & layers approach to designing.***
- ***Digital proto typing of component spares***

Why sustainability audit criteria for electronic products?

- ***There is a need to design e-products to serve for a long time.***
- ***E-Products become obsolete fast either due to new technology or improved design.***

- ***There is an impact on the environment as e-products are discarded much before their end life.***
- ***There is a need to specify duration of the e-products i.e., its serviceable life.***
- ***For e-product quality, encourage use of open architecture for design- provision of technical component retrofits for renewed products.***
- ***There is a need to benefit from technological advancement without damaging the environment.***
- ***There is a need to offer choices to the users to select a product by its sustainability credentials specified as for buildings (green).***

Benefits of sustainability audit criteria for electronic goods

Users have to be either knowledgeable about the sustainability of e-products or they make mistakes which damage the environment. There is a need to offer choices to the users to select a product by its sustainability credentials specified on its label, like the life of a product, contents used for manufacturing, process of manufacturing, end of life of the product, disposal practice to be adopted, its performance on social, economic, political and environmental aspects. By this framework it would be possible to develop certification guidelines for products on the basis of their sustainability aspects and also grade it.

Users have very little information available to choose a sustainable product. The sustainability audit criteria developed will help users to find out how an electronic gadget performs on sustainability parameters and accordingly choose the product. When any such system of evaluation will be shared among users, there will be a demand by them to follow sustainability guidelines

and improve performance of electronic gadgets (based on their long life and problem free operation).

The criteria developed will help the users, policy makers and manufacturers to ensure product sustainability.

Sustainability Audit Criteria

A sustainability audit criteria for electronic products was formulated. The sustainability audit criteria were worked out in consultation with the experts, and manufacturers based on the information obtained from users regarding their practices for use of electronic gadgets, and the regulations for handling and maintenance of electronic gadgets.

Proposed sustainability audit criteria for e-products

Six domains have been included in the sustainability audit criteria for e-products

- **Life of a product**
    - ***Designed life of product: This is the period during which the product is expected to function within its parameters. The life expectancy of the product should be as mentioned by the designer / manufacturer.***
    - ***Serviceable life of product should be mentioned so that user is aware of the duration for which the product is expected to be 'serviceable' or supported by its manufacturer.***
    - ***Easy upgradability of the parts, technology, software, components of the product by retrofit method.***
    - ***Use of advanced / upcoming technology at the time of manufacture. If the manufacturer uses the latest or the upcoming technology for those requiring high precision and accuracy, likelihood of product becoming obsolete could be delayed by controlling the frequency of change of the gadget.***

- ***Use of hierarchical technology that is well supported downstream appropriate technology, for those who have limited functional applications or economic resources, re-conditioned or older technology could be made available at comparatively lower cost.***

- **Material used**
  - ***The material used for construction of the electronic gadget should be sustainable i.e., non-degradable, inert with low emissions, long lasting, possibility of reusing the materials (particularly the outer body using metals, rubber and plastic).***
  - ***Disclosure of all materials used in construction of electronic gadget including hazardous substances along with their concentrations.***
  - ***Harmful effects of all hazardous substances used in construction of e-gadget.***
- **Energy efficiency**
  - ***Use of energy saving technology for design of the product.***
  - ***Compliance to energy star rating - innovative power savvy designs.***
  - ***Low embodied energy, i.e., the energy necessary during different stages of its life cycle (i.e., processes used for manufacturing) should be minimal as far as possible.***
- **Health & environment**
  - ***Eco-labeling - life cycle follow up from inception to end life.***
  - ***Use of eco-technology with low carbon footprints during manufacturing, use and disposal.***
  - ***Less polluting substances that generate/emit low toxins and no health hazard from waste.***

- **End-of-life**
  - ***Addresses of registered service & recycling centers on product label.***
  - ***Correct method of disposal of product emphasizing hazardous consequences of improper disposal.***
  - ***Authorized collection centers (for discarded electronics) and recycling centers.***
- **Manufacturer responsibility**
  - ***Socially sustainable and safe work environment (with due focus on work, leisure, health and hygiene).***
  - ***Post-purchase information, after-service schedule with complete contact details of service centers. Self-instructional user manual (in different languages with pictographs).***
  - ***Compliance to legislations like CSR, CSE – follow cradle to cradle cycle - during selection of raw materials, pre-processing, processing, operation, maintenance, disposal and reuse / recycle.***

Each of the six domains has sub-domains and each sub-domain was subsequently rated on a scale. A sustainability audit criteria for electronic gadgets with total of 100 scores have been worked out. To be sustainable an electronic gadget must obtain a minimum of 60 scores.

>60 scores – not sustainable

60-70 scores – one star

70-80 scores – two star

80-90 scores – three star

90-100 scores – four star

This is a checklist for consumers to find out if the electronic product selected by them fulfils the required parameters of

sustainability or not. Total scores obtained by an electronic product will judge its performance on sustainability credentials.

(For detailed tool contact the author)

Interest to adopt the sustainability audit by manufacturers of electronic products, carbon foot-printing could be reduced and environment could be protected along with health of human life, flora and fauna. The discussions of adopting the sustainability audit criteria (whether completely or partially) is a noteworthy breakthrough. The criteria will also provide a framework for evaluation of electronic gadgets by the concerned regulatory authorities so that regulations for best practices could be imposed.

By this we could ensure sustainability certification for electronic products to offer choices to the users to select a product by its credentials, like the life of a product, contents used for manufacturing it, resource efficiency of the product, process of manufacturing used, end use of the product, disposal practice to be adopted, its performance on social, economic, political and environmental aspects.

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Sustainable Practices in Event Management

Sakshi Wadhwa

Abstract

Event management is an extensive industry encompassing enormous logistics and serving multiple functions. It is growing at a fast pace and building considerable global presence. With such progress and diversity, the events sectorcan have a considerable impact on the environment in terms of generating carbon emissions and producing humungous amounts of waste. This requires a comprehensive understanding of the functioning of the entire industry and consequently, building a sustainable framework for all event management operations. This paper therefore aims at providing a structured outline for organizing green events. It also focuses on educating and creating awareness among masses about the necessity of event greening in current times.

Index terms: **Sustainable event management, Event greening, Indicators, Sustainable Development, Sustainable Practices, Awareness**

INTRODUCTION

A. Event Management: A Theoretical Background

"Events are staged occurrences that communicate messages to target audiences". Philip Kotler

Events form an integral part of everyone's life and include certain logistics, goals and objectives. They vary in their purpose, scale and functionality and can take up multiple forms. According to Rutherford Silvers, "hosting an event embodies a wide range of activities from assessment, acquisition, allocation, direction and control to an analysis of time, finances, people, products, services

and utilization of many other resources" (Silvers, 2003). Irrespective of the scale, events can have significantnegative consequences for the environment and thus, it has become necessary to study event management operations and incorporate sustainable practices in them.

B. Event Industry in India: Present Scenario

According to an EY (Ernst and Young) – EEMA (Event and Entertainment Management Association) report titled 'Making experiences in India: The events and activations industry'(2015), the events industry has grown at 15% annually from INR 2,800 crore in 2011-12 to INR 4,258 crore in 2014-15. The industry is expected to grow at 16%-17% to reach INR 5779 crore in 2016-17. The size of the organized events industry is estimated at around INR 4258 crore and accounts for 47% of the total industry. The unorganized sector is also estimated to be large since there is no entry barrier to initiating operations as an event management service provider. Lately, bulkof Indian event companies have managed to build global presence contributing to an additional transportation cost apart from a considerable increase in the use of resources.

C. Sustainable Event Management (Event Greening)

The Bruntland Commission Report for the World Commission on Environment & Development has defined sustainability as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'(Raj & Musgrave, 2009).Additionally, United Nations Environment Programme(2012) has defined a sustainable event as 'one designed, organized and implemented in a way that minimizes potential negative impacts and leaves a beneficial legacy for the host community and all involved'. Sustainable event management focuses on limiting negative impacts on global

climate through adecrease inconsumption of non-renewable resources and reduction in quantity of waste generated.Protecting biodiversity and human health also form important aspects of event greening goals (EThekwini Municipality Environment Planning and Climate Protection Department, 2011).

a) Benefits

Event managers all across the world work in resource-intensive economies and hence, every domain of event management offers enormous scope for incorporating sustainable event practices. Event greening should begin at the inception of the project and all stakeholders should participate in its successful implementation. Steadfast Greening (2010) & United Nations Environment Programme (2012) have enumerated the following benefits of sustainable event management:

- ***Financial Benefits:*** ***Adopting resource conservation and waste management policies results in lowered costs and an increase in return on investment.***
- ***Positive status in the market:*** ***Event greening contributes to a noticeable validation of an event management company's commitment to sustainability. This tends to create a progressive image of the company in the market.***
- ***Environmental innovation opportunities:*** ***Sustainable event management offers large prospects to use innovative technologies and techniques in the field of event greening.***
- ***Public sensitization:*** ***Use of sustainable event practices creates awareness among the stakeholders as well as the community regarding its positive contribution in keeping the environment clean.***
- ***Community benefits:*** ***Event greening offers immense scope in its implementation and in doing so, can benefit the***

local community by providing job opportunities, expanding supply and use of locally available materials and promoting overall social improvement.

- ***Industry revolution:*** ***Integrating sustainable event practices in the existing event operations will eventually pave way for a sustainable event model comprising event greening standards. It will also introduce environmentally responsible behavioral changes in the working system of all event management companies across the world.***

b) Need for Event Greening

From times immemorial, 'efficiency' has been understood in the context of labor input and financial costs. Few attempts have been made to incorporate the 'way' goods and services are used and delivered under 'efficiency'. However, the imbalance in resource use and resulting output has created a need for evaluating efficiency of existing systems (Department for Environment, 2007).

Every event involves an assembly of a number of participants who contribute deleteriously to the environment through the inconsiderate use of materials, energy, water and generation of waste. Such impacts when projected ahead are a cause of local air and water pollution and have a significant role to play in climate change through greenhouse gas emissions. By consolidating sustainable practices into an event's blueprint and final implementation, event organizers have the opportunity to curtail potential negative impacts and inspire a positive change towards building a sustainable industry (United Nations Environment Programme, 2012). Keeping in mind the current trends of growth in the revenue and consequently in inputs of event management companies across India, event greening has become the need of the hour.

DISCUSSION

The genesis of sustainable design in event management is a result of a shift in the mindsets of people towards building an ecologically stable world. However, it remains to be a major challenge in India. The first step in event greening is to validate the need for an event before its planning and execution. It is important to look for alternative designs that can obtain the same result. For instance, a college may hold two events consecutively in order to share its resources or may even plan two small events on the same day to reduce the need for travel and other resources. In case an alternative design is impractical and an event needs to be organized, a number of factors can be kept in mind to ensure green event implementation (Fig 1).

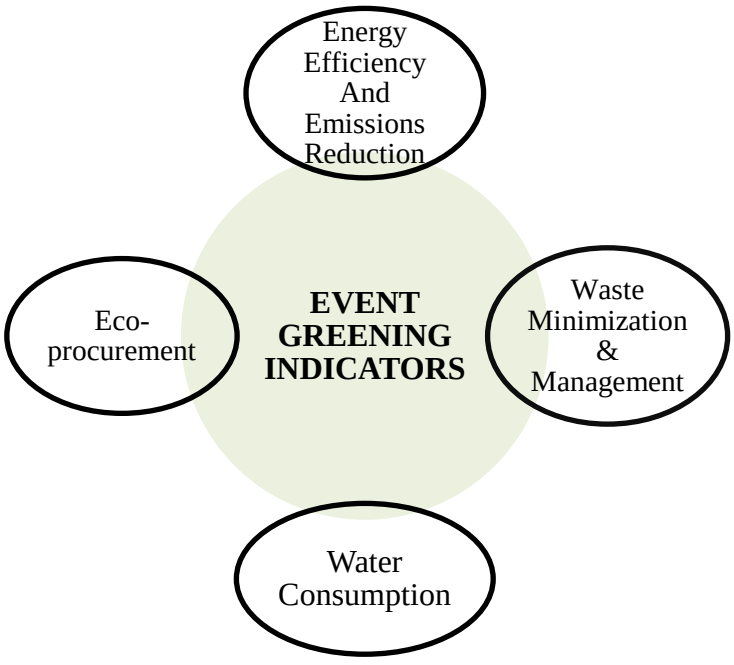

Fig 1: Event Greening Indicators

As seen above, event greening encompasses four major indicators namely energy efficiency and emissions reduction, waste minimization and management, water consumption and eco-

procurement. However, the success of green event management is governed by the link between its indicators and the level of awareness amongst its stakeholders as well as the society which shall eventually contribute to sustainable development. Keeping this view in mind, the following structure (Fig 2) gives a true representation of sustainable event management:

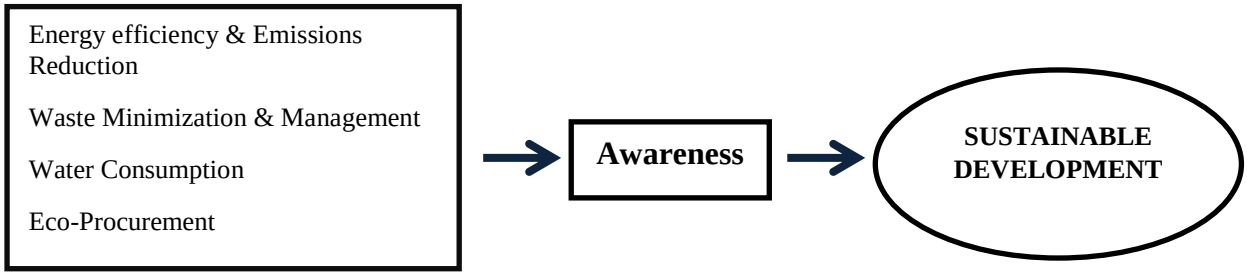

Fig 2: Proposed conceptual framework

A. Indicators of event greening

a) Energy Efficiency& Emissions Reduction

Energy is a fundamental resource for which demand is growing rapidly. Rampant urbanization has led to dwindling of natural resources. Since energy is difficult to quantify, the amount of energy consumption is not evident straightaway. Besides this, it is treated as an inevitable expense during event organization(Ahmad, Rashid, & et al, 2013). Global energy use has increased by 70% since 1900's and most of the energy needs are met through use of non-renewable resources. This in turn has led to an increase in the levels of air-polluting emissions, particularly greenhouse gases and become a primary cause for climate change.To bring about a change in the current system of resource use, the two main aspects that need to be encouraged during event greening are *promotion of energy efficiency* and *use of renewable energy*(Steadfast Greening, 2010).

The following section (Fig 3) provides a framework for integrating energy efficiency and decreasing harmful emissions while planning for various events.

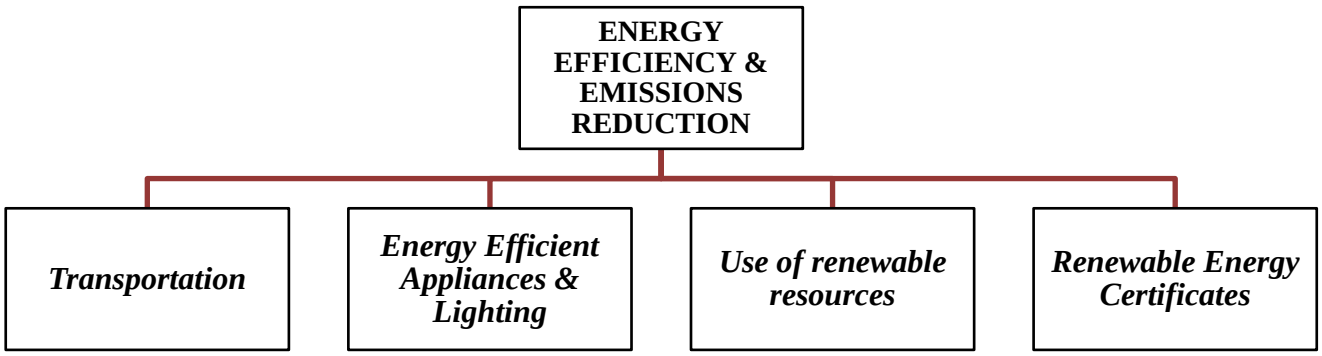

Fig 3: Conceptual framework for energy efficiency and emissions reduction in event management

An event'sprimaryenergy usage comes from using energy to run lighting, heating and/or cooling at venue locations andusing fuel to transport goods, services and people to and from the event (Ministry for the Environment, 2010).

- **Transportation**

Numerous measures can be undertaken to promote green transportation during events as follows:

Choose venue locations that minimize local and long-distance travel **for participants by constructing an inventory of the distances of the participants (United Nations Environment Programme, 2012).In scenarios where this is not possible and a considerable extent of travel is involved, promote use of *green transport modes* such as buses, trains, shuttles, carpooling etc. Encouraging such choices requires collaboration between event management companies, transport companies and venue owners. Event management companies may also provide the participants with relevant information about the availability of green transport modes near the event location through their websites (Ministry for the Environment, 2010). Furthermore, energy expenditure and**

pollution can be mitigated by *selecting transport service providers that offer vehicles with alternative fuels and technologies*(Steadfast Greening, 2010).

***Offsetting greenhouse gas (GHG) emissions*allows event management companies to neutralise the adverse effect of transportation on the environment. This may be done by investing in clean energy projects or planting more trees.**

Transportation of food and other materials to the event can be minimised by *favoring local organic food and using locally available materials.*

A suitable alternative to transportation is to conduct *virtual meetings* wherever possible. Contemporary technologies offer many viable options such as video or tele-conferencing at reasonable costs and can contribute massively to running a sustainable event (McDonough, 1992).

***Disincentives* could be provided to participants travelling by private vehicles by charging high parking fees or prohibiting parking near the venue (Ministry for the Environment, 2010). Alternatively, incentives could be provided to participants using green transport modes. For instance, not charging any parking fee from people opting for car pooling (Steadfast Greening, 2010).**

- ## Energy efficient appliances and lighting

As mentioned before, much of the country's electricity is still generated using non-renewables. Using *star-rated and energy efficient appliances* can help in reducing overall carbon footprint.

It is equally important to make use of *energy-efficient lighting* wherever possible. A number of options (CFL's, LED's etc.) are available in market which could be customized by event management companies according to the type of event being organized.

Wherever possible, make use of *natural light and ventilation* to reduce use of artificial lighting, air-conditioning and heating at venues (Steadfast Greening, 2010).

- **Use of renewable resources**

Event management companies can opt for renewable sources of energy to meet some part of their energy demand since such resources are still largely untapped. Using *biodiesel* as a fuel substitute for generators or using *solar energy* to power electric equipment, small refrigerators, tent lighting, projectors, PA systems etc.are some examples that can go a long way in making an event sustainable.

- **Renewable energy certificates**

Event management companies can purchase renewable energy certificates (RECs) to sponsor the generation of renewable energy corresponding to the amount of energy required for their events. It is a beneficial method of procuring green energy for events without investing in setups such as solar panels or wind farms (Steadfast Greening, 2010).

Besides the aforesaid framework, inculcating energy efficient practices (switching off lights when not necessary etc.) at all levels of an event can contribute considerably in promoting sustainability within this industry.

b)Waste Minimization &Management

All events generate a tremendous amount of waste which, in the absence of proper management, harms the environment severely.In general, a crucial element of sustainable event management is to promote awareness about all aspects of waste management as part of event organization and consequently bring about conscious behavior changes in all stakeholders of an event (Steadfast Greening, 2010).

The key components in waste organization are *waste minimizationthrough prevention and reduction and waste management through reuse, recycle and disposal.*

Waste minimization deals with reducing the amount of waste generated at source either by opting for alternative methods in manufacturing, processing, storage and consumption processes that prevent waste generation altogether (waste prevention) or by decreasing the amount of resource and energy used during such processes in order to limit the amount of waste generated (waste reduction). Waste reduction can also be done by using eco-friendly resources and energy. An example of waste prevention is switching to electronic media and eliminating the need for paper altogether. Alternatively, using eco-friendly paper instead of regular paper can reduce the amount of waste generated.

Waste management focuses on processing waste after its creation through effective techniques of reuse, recycle and disposal. Waste disposal plays a major role in event greening since waste generation is an inevitable part of event management. It is important to segregate waste at source before looking at effective disposal options. Event management companies can collaborate with numerous organizations working in the area of waste management to ensure proper waste disposal.

- **Food Waste**

Food waste can be prevented and minimized in a number of ways as follows:

Reduce: Serving food and condiments in bulk instead of single servings and establishing exact number of participants to avoid wastage can help in reducing overall food waste (City of Vancouver, n.d.)

Recycle:Composting of food and other organic waste can help divert such waste from the landfill and contribute to a nutrient rich soil (stopwaste, n.d.)

Disposal: Donating leftover food to organizations specializing in distributing edible leftovers to people in need is a good option for optimum food disposal. This will not only help in contributing to a social cause, but also prevent release of additional GHG emissions through decay of food waste at landfills (Steadfast Greening, 2010)

- **Material Waste**

Material waste can be prevented and minimized in a number of ways as follows:

Reduce

Reducing unnecessary packaging of materials by buying in bulk or buying only what is required, switchingto electronic media, avoiding use of disposable items by using reusable items during the event and using eco-friendly and other materials are some viable options for waste minimization(Tufts University, n.d.). Canvassing of events through registration and communication with participants has immense potential to reduce negative impacts and generate awareness. As mentioned above, print material used for creating awareness about the event can be substituted with electronic communication. If some amount of printing is required, opt for sustainable ways to get it done like reducing the text and number of pages, choosing fewer colors, using recycled paper, sustainable ink and so on(United Nations Environment Programme, 2012)

Reuse: Materials like banners, stands etc. can be reused in future events having the same purpose. Otherwise, old materials can be refurbished to produce new materials for other events. For

instance, old banners can be converted to bags or badges for participants (United Nations Environment Programme, 2012). Other useful items can be donated to different organizations for reuse (Steadfast Greening, 2010).

Recycle: The range of recycling options may vary between regions and in costs, however, some amount of recycling is manageable at every level of an event (Ministry for the Environment, 2010). A number of materials used at an event can be recycled effectively such as paper, wood, cardboard, plastics & cloth (stopwaste, n.d.).

Disposal: After adopting fair practices of reduce, reuse and recycle, event management companies should dispose the leftover waste after proper segregation and through appropriate channels.

c) Water Consumption

Water is fast becoming a scarce resource with only 0.007% available for drinking purposes (Ahmad et al., 2013). Owing to its scarcity, it has become an expensive commodity for industrial, commercial and domestic users alike (Steadfast Greening, 2010).

The following measures (United Nations Environment Programme, 2012 and Steadfast Greening, 2010)can be undertaken to ensure judicious use of water during events:

- ***Select venues that implement water conservation practices and use water-efficient appliances***
- ***Provide a water dispenser with reusable glasses instead of serving bottled water***
- ***Encourage participants to bring their own water***

d) Eco-procurement

Purchasing goods and services is a fundamental activity in event planning. Eco-procurement refers to choosing products and services that are eco-friendly(Ahmad et al., 2013). In addition to this, it supports economic development and reduces

transportation costs by promoting use of locally available materials and services (Steadfast Greening, 2010). Other benefits include reducing the amount of waste sent to landfills, mitigating GHG emissions and overall non-renewable resource use (Ministry for the Environment, 2010). Eco-procurement can be done through the following methods:

Giving preference to local caterers who use seasonal and organic products will be beneficial for the environment as well as the community (Steadfast Greening, 2010). Similarly, using sustainable materials for the production of event related products such as gifts, bags, banners, decorative items, signage etc. will have a positive impact on the environment(Environment Planning and Climate Protection Department, 2011).

B. Awareness

Creating a green culture often involves encouraging and motivating people to adopt sustainable practices in all spheres of their lives. Many times, this involves generating awareness about such practices as well as delineating their need and benefits. Event management companies network with numerous people (participants, sponsors, vendors, venue owners etc.)in order to manage their events and this serves as a grand opportunity to inspire a positive change and create a legacy that will last long after the culmination of an event. Repeated efforts of event management companies to host sustainable events and generate cognizance about sustainable practices will eventually facilitate permanent behavior changes in people and lead to sustainable development.

CONCLUSION

The events industry is expanding rapidly and increasing its contribution to the GDP annually. In such a scenario, it has

become imperative to organize events responsibly and sustainably in order to minimize potential negative impacts on the environment. Sustainable event management (event greening) can be accomplished by incorporating sustainable design and methods in the areas of energy utilization, waste management, procurement of goods and services and water consumption. That being said, generating awareness among the masses about the need and significance of event greening plays an even larger role in ensuring a permanent shift in the mind-sets and behaviors of the society towards leading a sustainable lifestyle.

The status of event management as an industry is largely informal and inconsistent owing to lack of a structured academic front and absence of mandates such as certification and licensing for practicing in this sector. Furthermore, the concept of sustainability is relatively new and although some event management companies are making conscious efforts to modify their business models in view of sustainable practices, majority are still struggling to stabilize themselves in the marketplace. Also, this industry is heavily dependent on client and participant satisfaction and there exists a dire need to build business models that integrate sustainable practices with client requisites. Largely, this involves creating awareness and acceptance about green event practices.

Thus, the best way forward is to establish a formal body that defines the scope of competencies necessary to practice in this industry, incorporates event greening practices in the existing framework of event management operations and linksthis sustainable business model across all companies and the community.

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EMOTIONAL DESIGN AND SUSTAINABILITY

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Abstract

There is a paradigm shift in design from an emphasis on form and function to the emotional, social and cultural contexts and what they mean to the users. Functionality is taken for granted in products, and users are looking for fulfilment at an altogether different level of appreciation. Design directed by emotional content is regarded as the heart of current design practices, research, and education. This paper discusses the different levels of emotion processing given by Norman (2004) and their relation to design for sustainability. Everything we do has both a cognitive and an emotional component – cognitive to assign meaning, emotional to assign value. Without emotions, our decision-making abilities are impaired. Emotions make us smart and make us make value judgments to design for and choose products relevant for a sustainable lifestyle.

Keywords: ***Emotional Design, Emotional Attachment, Sustainable Design, Sustainability.***

INTRODUCTION

There is a paradigm shift in design from an emphasis on form and function to the emotional, social and cultural contexts and what they mean to the users (Krippendorff, 2006; Boztepe, 2007). Product design is being rapidly transformed through materials technology, production technology, information-processing technology and other processes. Functionality, attractiveness, ease-in-use, affordability, recyclability, and safety are all attributes that are expected to already exist in a product. Users are expecting more from everyday products. There is an

inclination towards objects that inspire users, enhance their lives, and help in triggering emotions or even in evoking dreams. Functionality is taken for granted in products, and users are looking for fulfilment at an altogether different level of appreciation. Design directed by emotional content can be regarded as the heart of current design practices, research, and education (Demirbilek & Sener, 2003).

According to Damazio et al. (2010), "Emotional Design is an approach that extends beyond form, function, performance and usability to the emotional responses, experiences, effects, and social transformations that design actions may produce". Emotional interaction improves user interaction in product design. Products can be more closely associated with the users and support better user experience with provision of emotionally rich product-user interaction (Nam, et al., 2007). A key element in sustainable design is designing products that connect deeply with the users. The implications of emotional design are important for sustainability since products with attributes of emotional design have longer lifespan.

IMPORTANCE OF INCREASING LIFESPAN OF PRODUCTS FOR PRODUCT SUSTAINABILITY

The longevity or lifespan of a product is essential to sustainable design. However, physical lifespan of a product alone is irrelevant to sustainability, if the user is not prepared to keep it for the duration of the product's life (Barr, 2012). A more meaningful user-product relationship is therefore necessary for the user to want to keep the product for its lifespan and even beyond. According to Eternally Yours, there are three dimensions in the lifespan of products: *the technical, the economical,* and *the psychological lifespan*. The technical lifespan is the physical life

of the product and relates to longevity of product forms and materials. The economical lifespan concerns with the economic viability of products in the market before they are outdated with introduction of better or newer models. The psychological lifespan relates to the psychological time the user renders to the product. Psychological lifespan of products may be cut short because the products do not fit our preferences or lifestyle anymore. Products are often discarded because their psychological lifespan is over before the expiration of the technical or the economical lifespan. Therefore, increasing the psychological lifespan of products becomes very important in bringing about product sustainability (Verbeek & Kockelkoren, 1998).

Schifferstein and Pelgrim (2008) cited that a product's life can be lengthened by increasing the user's emotional attachment towards the product, as the person will handle the product with care, repair it when it breaks down and postpone its replacement as long as possible when he becomes emotionally attached to it. Mugge et al. (2005a) cites that product attachment and product lifetime are connected and that product lifetime is a direct consequence of the experience of emotional attachment to a product. A high product turnover is undesirable from the view point of sustainability because it produces wastes and uses more resources. Therefore it is worthwhile to lengthen the life span of products. A possible strategy to slow down product life cycles is by increasing the emotional attachment users have towards the products they own and use.

LEVELS OF EMOTIONAL DESIGN AND ITS APPLICATION TO SUSTAINABLE DESIGN

Donald Norman (2004) proposed a framework in which he distinguishes three levels of information processing for product

emotions. These levels of information processing can be applied in emotional design for sustainability. These levels of information processing are involved in emotional product experience and each level involves a distinct type of product emotion and a corresponding design focus. The design requirement for each level differs widely.

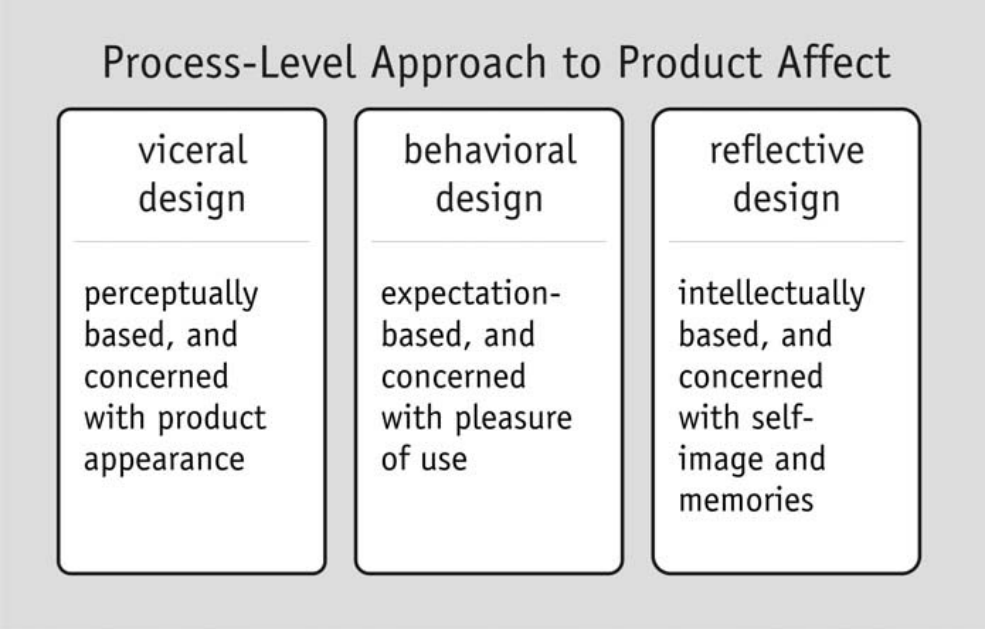

Figure No. 1: Process-level based framework of product affect as proposed by Norman (2004) (cited in Desmet, 2011)

a. **The reactive level: This level of processing is fast, making rapid judgments of what is good or bad, safe or dangerous. The reactive level of processing is the start of emotional processing and is biologically determined. This level is pre-conscious and pre-thought. Emotions experienced at this level are usually outside of our control and directly related to our senses. We make rapid judgments that are largely biologically determined while experiencing visceral emotions. This level is dominated by our sense where we react to the senses in our environment.**

The reactive emotion is perceptually based and corresponds with 'visceral design' which is concerned with product appearance. Visceral design is about the initial impact of a product and it is at this level that first impressions are formed. Physical features of products dominate visceral design. Product appearance is the physical composition of a product, how the product *looks*, *feels, smells* and *sounds* to the users, relating only to the exteriors of the product (Creusen & Schoormans, 2005; Veyisoglu, 2010; Garvin 1984). According to Garvin (1984), appearance of a product is clearly a matter of personal judgment and reflection of individual preference. Product appearances influence the user preferences wherein a user may prefer an "attractive" but "unreliable" product over the one that is "unattractive" but highly "reliable" (Grawal, 1997 in Veyisoglu, 2010). Product appearance also has lasting influences on the user. Pye, (1978 in Veyisoglu, 2010) views that although many products are quickly discarded or consumed, the appearance of a more durable product can create emotional bonds with users as products become part of their environment. The choice of a specific product conveys the kind of person you are or want to be and users use products to express their self-image. A product's appearance communicates messages as it may look 'cheerful', 'boring', 'friendly', 'expensive', 'rude', or 'childish'. Also a certain style of appearance can evoke associations with a certain time or place (Creusen & Schoormans 2005). To fully use the potential of product appearance in product selection, the appearance should communicate the central product advantage to users. The value that is most important to users in obtaining or purchasing a product should be the starting point in the design of the product appearance (Bruce & Whitehead 1988, in Veyisoglu, 2010).

b. **The routine level: This level is the site of most human behaviour. The routine level is about use and experience with a product. This level has many facets: *function, performance* and *usability* of the product. A product's function specifies what activities it supports, what it is meant to do. The product value is decided by if the product function is adequate or inadequate. Performance is about how well the product does the desired functions wherein it determines the success or failure of the product. Usability of a product describes the ease with which the user understands how the product works and how to get it to perform. The routine level is the information processing of acquired behaviours and skills. This well-learned behaviours and skills can be quickly corrected for deviations from the routine expectations.**

The 'routine emotion' is expectation based and concerned with pleasure and effectiveness of use and thus concerned with 'behavioural design'. Usability and functionality are very important attributes of products but are not sufficient on their own to convey pleasure and happiness to users. Positive emotions play an important role in user behaviour relating to decision making, motivation and social interaction (Demirbilek & Sener, 2003). Satisfaction in product use is an attribute relating to how pleasant the product is to use. Pleasure is the agreeable emotion accompanying the expectation, acquisition, or possession of something good or desirable. Pleasure has been distinguished as a reason to consider a product as special, cherished and treasured, indicating the presence of an emotional bond. Pleasure can be experienced during usage as a result of superior functionality, aesthetic pleasure derived from the product's appearance or pleasure from product benefits like

entertainment and relaxation. For example, the pleasure a person experiences by the great sound a high-quality stereo because it provides (Mugge et al., 2006b). A designer's task in behavioural design is to understand how people will use the product they design. A product becomes acceptable in the real world when it has become both socially and practically acceptable (Nunnes, 2006). It is through the knowledge of product use and understanding of its features, practicality and acceptability that the user is able form a meaning of the product. Understanding products involves connecting experiences relating to the context of their use and practice in our environment. It involves the affective value of products acquired from a product's capacity to arouse feelings and emotions (Kidd, 2001; Krippendorff, 1989; Lai, 1995). To understand emotional responses to consumer products, it is important to understand the users' concerns in which the product is or will be used (Desmet, 2003).

c. **The reflective level: It is at this level that consciousness and the highest levels of feelings, emotions and cognition reside. It is only here that the full impact of both thought and emotions are experienced. The reflective level is the most sophisticated involving all higher-level cognitive processes like consciousness, ability to form generalizations, to make plans, and to solve problems. At the lower reactive and behavioural levels, there is only emotion, but without interpretation and consciousness. Interpretation, understanding and reasoning come from the reflective level. The reflective level is the most vulnerable to variability through culture, experience, education, and individual differences.**

The reflective emotion is intellectually based and corresponds with 'reflective design' that concerns with self image, personal satisfaction and memories. People are motivated to establish and communicate a personal identity, distinct from that of others and the use of products is one way to symbolically display one's individuality to oneself and to others (Mugge et al., 2006b). Products serve as symbols of who we are, who we have been, and who we are attempting to become. People make a comparison between their own self-concept and the product image and prefer those products that have an image congruent to their self. A vehicle for self-expression is for designers to offer consumer with the ability to customize products to reflect their self-concept and identity (Tlhabano et al., 2013). People need to maintain a consistent and positive view of one's self and the use of products is one way through which a person can symbolically define and express his unique self and therefore, people prefer products that are congruent to their self-concept. Products can remind a person of people, events or places that are important to him and help him maintain a sense of the past, which is essential to define and maintain one's identity. Part of who we are today is a result of who we were in the past. For example, a souvenir from a place you visited, photographs of past events (Mugge et al., 2006b). Damazio et al., (2010) cited that memorable products are the tangible remains of our most valuable experiences which shape our future decisions and choices. People are more likely to become attached to possessions that are associated with pleasant memories, because they want to preserve the happy moments of life (Tlhabano, 2010).

CONCLUSION

Desmet (2011) notes that this framework is "an important contribution to the design and emotion discourse, because it clarifies and illustrates the role of cognition in the process of product emotion, and provides us with a basis for explaining why and how products elicits emotional responses". Norman (2004) remarks that emotion makes us smart. Without emotions, our decision-making abilities are impaired. Emotion is always passing judgements, presenting us with immediate information about the world, about potential dangers or comfort, about things nice or bad. Emotion makes us make value judgements. Everything we do has both a cognitive and an emotional component – cognitive to assign meaning, emotional to assign value.

Sustainability of people's consumption patterns can be stimulated by incorporating the users' needs and preferences to designs of products, leading to increased chances of the user's approach to product. The users' approach to products can result in increased users-product emotional attachment, thereby leading to increased life of the product. As Barr (2012) remarks, longevity of products is not the physical lifespan of the product but the length of the user's emotional attachment to the product. Designers can increase the sustainability of user's consumption patterns through the retention of products by stimulating the degree of user-product emotional attachment. Similarity in personality between a person and a product is relevant in the development of an emotional relationship between the user and the product. People become more attached to products with a personality that is congruent to their own (Mugge et al., 2006a) and as such, designers should design products that encourage the user's self-expression, useful and enjoyable products that evoke sensory and aesthetic pleasure, and products that can stimulate an engaging

user-product interaction to increase the opportunity for memorable events to occur.

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Greentailing: Sustainability in retail

Ms. Ishita Sacheva Kumar, Dr. Sushma Goel & Prof. Lalit Das

Abstract

According to Pine and Gilmore (1998, p12), a successful experience is one that "*a customer finds unique, memorable and sustainable over time*". *The measurement of performance of retail companies has moved from the traditional measure of Economic Profitability to a combination of Social and Ecological performance added to it. Aptly called the 'Triple Bottom line' (TBL) it is based on three pillars of performance – People, Planet and Profit which are incidentally the goals of Sustainability.*

Green-tailing works on the principle of triple bottom line with the exception of impacting the people who are directly and indirectly involved with the retail store (stakeholders) rather than shareholders by remitting exceptional brand experience.

Introduction

With the increase in global warming, need for sustainable living has come to light. Sustainably designed buildings not only cater to people for all ages alike (universal design) but also care for generations to come. The retailers are choosing the green way because of a lot of reasons- main being the heightened awareness amongst customers for eco-friendly and organic products. The retailers are offering eco-friendly products as there is an increased demand for such products by the customers and it also positions the retailers differently from their fellow retailers.

Also, amidst the race for profitability, some retailers want to stand out of the crowd by committing to reduce carbon footprint using path breaking 'Sustainable Green-tail Design' strategies with inspiring world class execution to attain not just cost

efficiency but great differentiated brand experience. (Gnanaolivu, 2015)

Developing greener assets from scratch is an easier prospect. New build allows developers and retailers to "design in" efficiencies, and use materials and technologies that can greatly reduce operational costs over the asset's life (Morrell, 2012). Like, designers all over the world are putting their best effort to lessen the retail store's environment impact by including sustainable strategies such as waste and water management, recycling, energy efficiency, conserving resources and utilizing materials and using natural finishes in order to increase the life span of buildings and reduce the embodied energy.

Designers have an ethical responsibility to understand the impact their designs have on the environment and eventually on the users (Taylor, Nielson). Ecologically safe shopping environment is comfortable and soothing for the customers to shop in. Retailers are considering the benefits of green and ethically designed shopping environment such as improved profitability, raising productivity, low carbon taxes and cost-savings.

Also, sustainable design attracts the customers- According to a study performed in 2003 by the Heschong Mahone Group, Inc, contracted by the California Energy Commission, an anonymous global big box retail chain was studied to determine the impact of installing methods of daylight (such as skylights) in its stores. The study found out that there was a noticeable positive impact on sales in the stores with new skylights, as well as significant increase in employee satisfaction with the store's additional lighting.

Day lighting may increase customer loyalty. Although the customers were not aware of skylights, they may be enticed

towards the cleaner or brighter area. The customers may feel relaxed which boosts them to stay longer and eventually spend more. The longer a consumer spends in a retail environment, the more he is likely to spend (Donovan, Rossiter, Marcoolyn and Nesdale, 1994; Wakefield and Baker, 1998).

With increased daylight customers are able to view the products with clarity and discriminate between choices. The visual quality makes the products more appealing and attracts the customer. It may also improve employee morale. (Houston Business Journal, September 22, 2000)

Amongst other benefits of sustainable design, one that's supreme includes saving money. Retailers are getting a note of significant cost- savings during the operation of sustainable buildings, while realizing that energy efficient design and construction is no longer exceedingly expensive. Many big box retailers are finding that the monthly cost – savings provided by sustainable design can make a big difference to their economic bottom line.

Another positive aspect of sustainable buildings is the innovation itself. New mobile apps and sustainable technological advancements are created by the designers especially due to presence of Omni-channel retailing as the retailers want the customers to remain connected always. As online shopping is on the rise and customers prefer to shop from the convenience of their homes, it will help reduce the burden on the environment. Fewer trips to the retail store would mean small-sized stores, less energy and water consumption and eventually low waste production. The consumers will make informed and sustainable choices through seamless and ecologically efficient shopping experience.

By embracing the sustainable initiatives and technologies, the retailers are not only achieving operation efficiency but also providing unprecedented customer shopping experience leading

to customer satisfaction and retention. Appropriately lit, ventilated, spacious retail store creates a pleasing and inviting shopping experience for the customers. Retailers are known to design store environments in a manner that will enhance customer positive feelings, assuming this would lead to desired consumer behavior such as higher willingness to purchase or longer stays (Mano 1999).

Green-tail design concept involves application of sustainable design measures at every stage of retailing such as selling organic and green products basically which pose no harm to the environment and also design the retail stores using natural and resource efficient measures in order to reduce operation costs and carbon footprint. An anonymous retail store uses recycled grey water and low energy lighting to lessen the store's environmental impact. It fully takes advantage of natural daylight. It has been fitted with a monitoring system that automatically adjusts the temperature, humidity and light levels based on environmental conditions. Additionally, motion detectors turn the lights off when the shop floor is quiet. The store consumes 30% less energy than the average for conventional shops, it saves up to 50% in water usage and reduces CO2 emissions by more than 150 tons each year.

The following sustainable practices are adopted by the retailers in their retail stores thereby creating a positive impact on their customers.

1. **Store design approach- The stores are designed according to the orientation towards sun, wind and daylight.**
2. **Store built on a green space- The stores are built on greyfield or brownfield plot or are constructed by reusing the old space.**

3. Conserving water by installing water efficient fixtures such as waterless urinals and water saving closet and faucet. Water is recycled and rainwater is harvested wherever feasible.

4. Conserving energy-Installation of green technologies such as solar, wind, geo-thermal. Green HVAC systems which are free of CFC's and HCFC are installed. Natural ventilation and lighting systems are incorporated to reduce energy costs. LED lighting, motion sensors and automatic control are installed to control temperature settings thereby conserving energy. Some grocery stores use highly efficient refrigeration systems with self-closing doors and motion-activated lighting and are do not emit refrigerants.

5. Store interior materials- Application of locally available and eco-friendly materials like flyash for floor tiling, rapidly renewable materials and finishes for decoration and display like reclaimed wooden tables for displaying items in the store.

6. Indoor environment- Installation of natural ventilation strategies and monitoring systems to control air quality to ensure well-being of users. Use of materials with low VOC's emissions, chemical free finishes, dyes and paints.

7. Waste minimization at store- Minimizing waste by reducing material consumption and reusing the materials and items like hangars and display shelves in order to reduce the waste going to landfill. Plastic, aluminum and cardboard materials are recycled. E.g. store uses recycled cardboard cartons. Many retailers also offer incentives to its customers for using paper or recycled shopping bags.

8. Active design- Installation of bike racks and reserve parking space for hybrid and electric vehicles to promote the use of green transportation. Wide spaced stairways are created to encourage physical activity.

9. Inclusive design- Store space is designed to suit the needs of elderly, people with disabilities, different religious groups, kids etc. e.g. store has a provision for kids play area while parents shop.

10. Presence of high performance attributes- Such as escalators, elevators, carts, trolleys and convenient parking.

11. Outdoor views- Providing connectivity between interior and exterior spaces. Store interiors have access to sky, flora and fauna.

12. Sustainability messages in store through social networking sites, emails, campaigns, fairs and events.

13. Packaging- Avoiding packaging materials that contain hazardous materials and reducing the volume of packaging.

14. Engaging customers- through in-store displays, offering eco-friendly products, recycling stations, donation for social causes, community programs.

Conclusion

The retail industry can make a significant difference in conserving the environment due to its connectedness with numerous customers and employees. With the adoption of greentailing approach, retailers are saving money, reducing energy costs minimizing the carbon-footprint and creating a remarkable shopping experience for their customers. The customers are informed about the sustainable practices through information provided by the retailer about the manufacturing process, use and disposal of the products, signage; sustainable messages, on-site recycling stations, buy back programs and trade-ins. Retailers are collaborating and working with non-profit organizations and government in order to reduce environment impact. The integration of greentailing concept impacts the triple bottom line

and is a win-win situation for the retailers, customers, community, stakeholders, government and for generations to come.

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Traditional Sustainable Architectural Marvels

Ms. Anju Kakkar

Introduction

India is a land of traditional architectural marvels built centuries ago in various parts. All these architectural beauties stand perfect on the concept of sustainability being practiced worldwide by modern architects. Our old age concepts have always evolved around nature.Traditional architecture has evolved from the vernacular architecture with the use of skilled workforce . It's an architectural style that is designed based on local needs, availability of construction materials and reflecting local traditions. An indigenous architectural style evolved within a specific time or place and not imported or copied from elsewhere. It is most often related to material , Climate and needs of local people. It's a climate responsive architecture which is highly sustainable and continues throughout the building's life span to create an environment for sustaining human well-being and activities

The traditional architecture evolves and represents some cultural ethos and built forms. Traditional architecture is based on the community's requirements, cultural background, local materials, climatic factors also considering the environmental disasters the region face. Buildings are built as per local standards and traditions. Its scale can be large to small.

The building knowledge in traditional architecture is often carried by local traditions and artisans who are skilled in their profession and is thus more systematic and meticulous.

It is based on knowledge achieved by trial and error and often handed down through the generations rather than calculated on knowledge of geometry and physics.

Artisans and craftsman often hand their knowledge and skill at site to younger generations. This *parampara* is often passed to their disciples called as "*Guru Shishya Parampara.*" Indian architectural beauties are all built in this traditional *parampara*. They reflect our socio – cultural ethics and tradition of handing skills through the generations.

Traditional architecture takes into considerations the locally available material, climate of an area and their needs. It takes into account the rainfall, snow, precipitation, wind direction and speed, ambient temperature ,humidity and solar radiation. Based on this built structures are designed with sloping roofs or flat roof,various types of ceiling designs ,doors and windows shape and size.

Traditional architecture takes into account various considerations like :

i) Built Form - it represents how the building will look from outside and inside , what type of façade it will have ,height of a building , form , shape of building and surrounding environment. Form and shape have always been influenced by functionalism in Indian traditional context.

ii) Social & Cultural needs – understanding the full spectrum of social needs and cultural impact on human needs.Culture and social diversity greatly influences the architecture of a particular area. Age old traditions of a particular community,tribe or a region have greatly influenced the architectural style. Local craftsman have been known to have traditional knowledge about the needs

and wants of a community influencing the design pattern of the area.

iii) Responsive to local climate – India is divided into six climatic zones hot and dry, warm and humid, temperate ,composite ,cold and sunny, cold and cloudy. Based on this traditional buildings are designed for their architectural features such as flat or sloping roof, big or small windows, courtyard or verandah, arches or lintels, leveled or machan houses.

iv) Use of available resources and materials. – Locally grown building material is a way of nature telling us about the usefulness and growth pattern of natural resources as per the flora and fauna of an area. Our knowledge about indigenous materials is based on the survival rate of building components that can with stand the climate, natural environmental hazards like dust storm, tsunami, earthquakes occurring in a particular area and disaster pattern associated with that area.

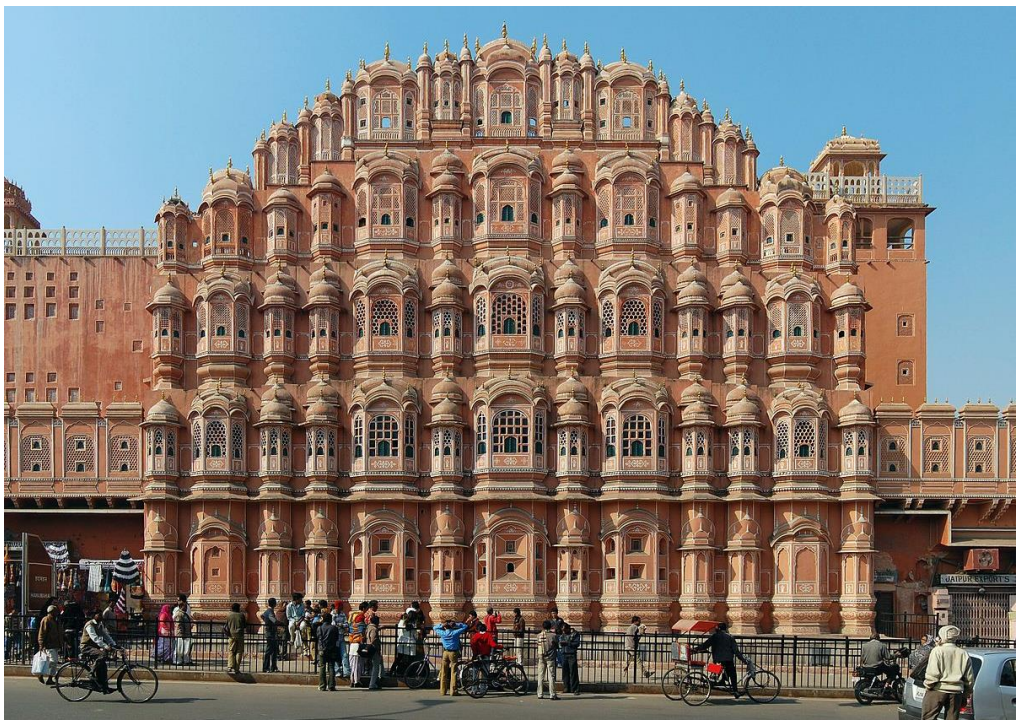
Modern concept of sustainable built form takes into consideration resource efficiency and conservation, energy management, water and waste management and indoor air quality as it's main features. Indian traditional historical buildings are perfect examples of sustainable built form as they have evolved to be in synchronization with nature and not against it.

In India we have always worshipped nature and have tried to love nature in all it's form .Our songs, folk stories, festivals, traditions have all revolved around nature. We worship rain god, sun god and pray to nature. To protect us. Before undertaking any construction activity we always do Bhoomi puja, asking forgiveness from mother earth to build a structure on her. This is

our way of showing gratitude to nature who sustains the entire humanity and works to balance the ecosystem.

This paper takes into account hot and dry climatic zone of India with Rajasthan as an example and how the traditional architectural marvels have been built aligned with the nature making them highly sustainable and respecting our traditional culture.

In this context Jaipur has been taken as it is considered to be the first planned city of India located in the semi-desert of Rajasthan. *Hawa Mahal* an architectural marvel of Jaipur capital of Rajasthan has been taken as an example of traditional sustainable building .Rajasthan lies in hot and dry climatic zone of India.



***Hawa Mahal* is also known as palace of winds, built in 1799 A.D by Maharaja Sawai Pratap Singh. *Hawa Mahal* is a unique combination of Mughal and Rajput architectural style, carved out of red and pink sandstone. It's a pyramidical structure which rises**

to five storeys almost fifty feet above ground. It's famous for it's beehive design elevation built with small portholes .Each porthole has miniature open windows called jharokhas and has carved sandstone grills, finials and domes.There are no staircase only slopes and passages that leads to top of the building. It was designed by Lal Chand Ustad in 1799 by the order of king of Jaipur Maharaja Sawai Pratap Singh.

Hawa mahal **is a masterpiece of Rajput and Mughal architecture. The entrance is through the City Palace where doors open into an open spacious courtyard with buildings on three sides. There are amazing 953 open windows in *Hawa mahal*. Another marvelous feature of Hawa Mahal is that it's built without any foundation. In fact, it is considered to be the tallest building in the world without a foundation. The five-storey building managed to maintain upright because of it is curved shaped. Curved shape has given it a dual advantage of stability and orientation. The word "Hawa" means wind or breeze and "Mahal" is palace. So Hawa Mahal is the palace of breeze.**

It was designed by Lal Chand Ustad in 1799 by the order of king of jaipur Maharaja Sawai Pratap Singh.He was an ardent devotee of lord Krishna, There is an ancient legend associated with Hawa mahal as an abode of hindu god. It is said that The palace is devoted to lord Krishna and thus in the shape of Lord Krishna's crown.

Purdah system was prevalent in Rajput families ,so the royal ladies were unable to interact with the outsiders. The purpose of building Hawa Mahal was to give a space to royal ladies as they were not to be seen by public. The palace was built such that the ladies can watch festival celebrations and all other activities on the street without being seen. When the sun light enters, the entire chamber fills with the spectrum of various colours. There is

a big courtyard in the centre and many rooms where royal queens can live freely and from top floors they can see great view of Jaipur city, jantar-mantar, city palace and street market. There is a secret tunnel from this queens can easily come from the city palace to the hawa mahal and not seen by anyone

There are so many windows that people often marvel at the construction skill of craftsmen. There seems mainly two purpose for the seemingly excessive number of windows. First, when there are windows everywhere, the royal ladies can look out to the street anywhere they want. Secondly, the windows allow breeze to flow through and help to keep the palace cool. It thus makes it an ideal summer palace .Cool breeze flows out of the tiny windows called *Jharokhas*. Latticed grills allow cool air to enter through the latticework ,thereby creating an air conditioning effect in the whole area . This is particularly beneficial in summers considering the hot and dry climate of Jaipur .The small holes in jharokhas increase the velocity of air and filters dust as it passes through them. Hawa mahal is surrounded by Jantar mantar ,Ram niwas bagh ,Govindji Temple .

A marvel in desert area constructed about more than two hundred years ago is a perfect example of Indian traditional architecture that is highly sustainable and a beautiful blend of art and architecture. Hawa mahal is truly a sustainable building providing cool air in the desert area built with local material representing the local traditions of the community and without any carving or any embellishments.

Ar. Anju kakkar

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Is an Assistant Professor at the Department of Resource Management and Design Application, Lady Irwin College, University of Delhi. She has ten years of rich experience in both industry and academia. Ph.D. in the area of quality of life, elderly and inclusive design of old age homes. Management of shared resources, facilities management, accessible public spaces, etc. have been areas of her research.

***Dr. Sushma Goel**, Associate Professor at department of Resource Management and Design Application, Lady Irwin College, Delhi University has been teaching from past more than three decades. She has authored subject manuals, modules for distance education, text book, etc. She has several publications in national and international journals to her credit. She has been supervisor for 60 masters' dissertations and 9 doctoral researches (some ongoing). She had been principal coordinator for projects with DDA slum wing, DST, Ministry of health and family welfare, Ministry of social Justice and empowerment and Delhi University Innovation projects.*

Towards an Inclusive Design of Old Age Homes

Dr.Mayanka Gupta and Dr.SushmaGoel***

Abstract

The approach of the paper is to emphasise on the need for inclusive design features for OAH (OAHs) based on literature review and personal observations. The features suggested could be adopted as standards while designing OAHs with optimum living conditions. These guidelines can be used for accreditation of homes meant for elderly and also support a home seeker's decisions for an appropriate infrastructure for congenial living.

Keywords: OAH, elderly, inclusive design, sustainability.

With increased life expectancy, it is projected that the proportion of elderly in the population is going to enhance globally. With the advent of the twenty first century, there is a growing need for the alternative living for elderly. Thus in the recent past number of OAH have splurged in urban cities in India. Elderly persons and their guardians demand better facilities and services, comfortable and spacious interiors, suitable infrastructure and a clean, safe and well maintained physical environment. Hence, the uphill task for OAHs to meet the expectations of the users.

The concept of inclusive design was first used in 1970. Inclusive design suggests that everything within a structure should be designed in a way that is readily accessible to all persons regardless of age, size, or physical ability (Hall, 2015). The definitive goal of inclusive design is to encourage the design of products and environments that are usable by all people, to the greatest extent possible (Centre for Universal Design, 1997). The inclusive design has gained so much importance in the recent

times as the designing of OAH (OAHs) can become a grave risk for elderly, especially the ones who are mobility impaired. For example, a narrow passageway can become a serious hazard for a wheelchair bound elderly. Similarly, for a sensory impaired elderly traversing safely in a home can be dangerous. The increase in the number of institutionalised homes in India has opened up an opportunity for inclusive space design approach. These homes have scope to make them inclusive. Elderly spend most of their time indoors therefore, it is important for designers to take into consideration the impact of building design on its users (Boluda, 2011). Housing that does not match functional abilities (for those with impairments) exposes elderly to environmental stresses (Lawton &Nahemow, 1973). Incorporating the design features of inclusive design initially during the construction phase is more cost effective and sustainable. As such, inclusive design can be considered as contributing to sustainability. Vice versa, sustainability seems to be an important component of universal or inclusive design process (Heylighen, 2008). The Universal Design Handbook, (Walsh, 2001) introduced a broad person centered view of sustainable development that he believed can be a more appropriate and powerful context for inclusive design. A revolutionary change is needed in the way we look at sustainableand inclusive designing of these homes. Moreover, everyone working in the built environment needs to be mindful of the needs of elderly and the importance of inclusive design (Housing Learning and Improvement Network, 2009).

The elderly in general consume more resources indoors as they spend more time in their house. It is important to make their housing energy efficient (Barker, 2010). While water consumption and energy consumption are key aspects of sustainable design, so should be an integral part of the structural design (Bhatt, 2015).

Important components of inclusive design must include a balanced sense of well-being, user experience and comfortable living space to cater to the requirements of the elderly.

Researchers and Government agencies have understood that rating systems are the best method to demonstrate level of sustainability in all construction initiatives (Haapio and Viitaniemi, 2008). At present, construction activities highlight only the energy and water usage as part of sustainable design but there is much more to it (Forsberg and Von Malmbrog, 2004).

Design criteria for an inclusive Old Age Home design

Site Planning: The OAH should be situated near to the residential community so that it is surrounded by shopping centre, public transport, etc. as it is important for the resident elderly to be connected to local community.

- ***Various facilities like market, bank, grocery, hospital and parks should be in close vicinity to these care institutions.***
- ***Care should be taken not to build an OAH on the arterial roads as the traffic movement will be heavy. Considering the declining physical capabilities of elderly, it is not appropriate to have the major entrance on the main road with heavy traffic movement. The speed limit of the vehicles should be restricted to 20 kph within the residential campus.***
- ***Environment safety in the surroundings that there should be no pot holes, open sewers, dug up pits, open drains at least a few meters from the care institution. Gupta (2014) in her study of OAHs reported that twelve homes were unsafe as there were pot holes, dug up area, vehicular traffic, etc. in the vicinity due to which precautions had to be taken by elderly while moving out of the OAH and crossing the road.***

- ***The building should support affordable independent living for elderly. Erbas (2006), in his study of analysis of living arrangements of elderly in Ankara found out that the caring complexes in Narlidere , Izmir, were easily accessible by public transportation, but, the sloping character of the site was compelling for the elderly.***
- ***The OAH design should have minimal maintenance cost so that it has less burden on elderly.***
- ***All the care institutions should be located at a place where outside environmental noise is non-interfering.***
- ***Appropriate signages outside the home for no-honking zone and placement of speed-breakers will slow down vehicles.***
- ***A warm south facing garden will encourage elderly residents to venture out in lawns (www.rbkc.gov.uk).***

Accessibility: The rooms, toilets, lawns, activity areas, facilities should be easily accessible to the resident elderly by creating spaces that are accessible and frequented by everyone.

- ***Gupta (2014) in her study of OAH in Delhi reported that out of 14 selected OAHs, 8 were very far away from the main access roads so were not easily accessible.***
- ***The building should be fully equipped with facilities for physically challenged like the availability of ramps for movement by the wheelchair, availability of lifts wherever required, etc. According to Helpage India report, 2007, out of 30 OAHs surveyed, only six had lift installed in their OAHs.***
- ***A lift for 13 persons, or a stretcher lift should be provided. The controls in the lift should be visible, audible and at a height so that they are accessible to physically challenged elderly.***
- ***Controls of windows like handles, vents should be located at an appropriate height so that they are within reach of elderly users.***

- ***The homes should be designed with detailed planning to reduce the corridors length and reduce the travel distance from one unit to other.***

Unit design: Spacious rooms at OAHs should be planned in more than 9 square meter which is considered adequate for movement of the elderly as per Neufert norms (2006). Positioning of the rooms should provide benefit of natural sunlight and ventilation and minimise the energy requirement for heating and cooling. In a study by Langdon eds. (2007), 32 elderly reported spatial problems caused by narrow hallways interfering with the manoeuvring space and stair problems such as open risers, narrow treads and landings.

Some of the considerations for space design will be useful.

- ***Central location of the recreation centre is convenient to all elderly as it is the social interaction place.***
- ***An open layout plan with privacy for bedrooms is better.***
- ***A bed-cum-sitting room is more functional for elderly.***
- ***Rooms should be large enough to provide a sense of living independently as in a house or an apartment.***
- ***Wide doorway access, free swing door closers are safe for elderly. In a study by Langdon eds. (2007), five out of sixteen elderly respondents pointed out the importance of door handles that are operable besides swinging.***
- ***Barrier free movement space is accessible for wheel-chair bound elderly.***
- ***Elderly rooms with properly located switches at an appropriate height are convenient.***
- ***Large windows to allow maximum natural sunlight and ventilation are comfortable.***

- ***Chairs with arm support, beds with arm support and bed rail provide independent access.***
- ***Balanced and rounded edges of furniture arranged with minimum 800 mm space across to allow free movement path for wheelchair users.***
- ***Sharp color contrast at points where wall and floor meets prevents accidents.***
- ***Well lit areas prevent accidents and improve sense of security among elderly.***

The units can be designed and furnished as per the individual and personalized needs. Similarly for ventilation, heating and safety requirements (Beyer, & Nierstrasz, 1967).

Safety and security of facility design: Safety and a sense of security are important indicators of design sustainability. Certain concerns in designing care institutions for elderly due to their declining visual, auditory, and kinaesthetic senses. Important safety features to be included in designing OAHs such as adequate outdoor lighting; ramps with shallow slope and rail grabs for easy movement in corridors; non-slippery floors; etc.

- ***Fire extinguishers, smoke detectors, equipped with fire safety devices to meet any emergency related to fires or short circuiting, and the like. Out of the 14 OAHs surveyed by Gupta (2014) in her study only one had a smoke detector.***
- ***OAHs should make adequate security arrangements at their respective homes to prevent any intrusion. This can be implemented by employing 24/7 security guards and CCTV cameras.***
- ***Provision of proper safety equipment such as walkers, adjustable beds, medical tools, etc***

- ***Small resting and seating areas should be provided at least every 40 metres for intermittent seating and prevent fall due to fatigue.***
- ***Windows with simple locks and latches for security***
- ***Straight staircase and not spiral with handrails on both sides to reduce accidents on stairs. Short flight of stairs with six to seven steps in each flight.***
- ***Signages should be bold and legible from a distance in fluorescent colours as they are useful for elderly with dementia.***

Toilets and bath: The problems reported by the resident elderly in OAHs are long queues, waiting for their turn to use the common toilets and bathrooms (Gupta, 2015). As it is well known that after a certain age, elderly have difficulty in holding urine (especially during night time) as they take time to reach the toilets. This is further compounded with mobility problems as most elderly suffer from arthritis which restricts their movement. Due to these concerns, there should be provision of attached toilets to their rooms so that there is no time spent to walk up to the toilet or wait for their turn to use the facility.She further reported that with the exception of 2 \ OAHs, rest of them did not have the provision of call buttons in the toilets which is considered utmost important as elderly are prone to falls and most of them occur in toilets/washrooms. Seventy percent elderly felt the need for the provision of call buttons in the bathroom. None of the OAHs have grab bars in the toilets. Further there was also no contrast between the floor and wall colour to prevent elderly from dashing onto the wall. Thus, all these factors are very important while designing. The toilets and bath should have one window and ventilator.

Hygiene: Institutions with hygienic surroundings and absence of garbage dumps, stagnant water, overflowing drains, foul smell or open defecating areas.

Construction materials: Preference for construction materials with eco-labelling for minimum impact on the environment. Selected materials that need minimum maintenance should be selected (Bhatt, 2015).

Several different types of wall constructions can be considered for building. However, going with the traditional double brick is considered best for outer walls due to its qualities of being warmer in winter and cooler in summer. Moreover, they are termite resistant.Timber products contribute to good indoor quality. The paints used should have low VOC. Flooring materials that can contribute to good indoor quality are ceramic tiles, coir or jute flooring, linoleum, etc. The materials used should be easy to clean and non-slip. Glossy finishes tend to create confusion for those with visual impairment.

Water saving methods

The traditional toilets flush system which uses 13 litres could be replaced with water saving flushes which use 3 litres of water. Rooftop rainwater harvesting can be used for gardening, toilets, laundry, etc. The taps in bathrooms, kitchen could have sensors or in-built resistance to use water according to the need.

Energy efficiency

For hot water system avoid use of long pipes to minimise energy use. Solar water heating system is highly energy efficient for providing water in kitchens and bathrooms. LED lights are highly energy saving (for artificial lighting) as they save upto 60% energy usage.

Innovation in design

Presence of water body evokes a positive emotional response (Terrapin Bright Green, 2014). Variation in lighting pattern can be used to avoid monotony. The dynamic lighting impacts circadian system and increases visual comfort (Terrapin Bright Green, 2014). Smart housing principles could be deployed for use of assistive technology. Smart rooms could cater to the needs of bed-ridden and physically challenged elderly. Remote operations for handling window controls, curtains and blinds, heating and cooling equipment are beneficial for physically challenged elderly. Tracking sensors can be used for elderly with dementia. Informal seating spaces could enhance social interaction among the residents. Erbas (2006), found out that lack of intimate conversation spaces and poor landscaping created poor outdoor space in elderly caring homes of retired organisation in Ankara.

Flexibile facility design and adaptability to future needs

Adaptable home is one where features can be added and removed and is considered very essential for sustainability. The windows, walls, roof and doors can be flexible and movable for adaptive design. Different circumstances and reasons can lead to need for more or less enclosed space and/or rooms. Dividing a single room using movable wall products can become a space for three to four elderly in a room. The space should be augmented so that it accommodates different aspects of ageing. Snyder (2002), in her study of OAHs in Philadelphia found out that many homes that began as single family structures, in order to modernise and meet the increasing demand, needed to expand. When these homes decided to build entirely new complex, most created floor plans similar to residences in which they started. Hence, every home should be designed in a manner that it can be expanded in future.

Conclusion

There is an urgent need to formalise a team comprising of administrators, resident elderly, academicians, specialists, social workers, designers, architects to review, rate the existing criteria in terms of their appropriateness, adequacy (Johnson et al, 2006) adaptability so as to convert the expectations into reality and measurable performance standards. It is essential to take into consideration the opinion of elderly residents as it is vital to make measurable practical standards. It is important to consider sustainability and inclusivity into account while building OAH. Considerations during the planning, designing and construction provide a platform to the developers - what needs to be included and may be used as a selling point for them. The OAH serve as buildings that enable independence and good quality of life.

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SHERYL E. BURGSTAHLER is an affiliate professor in the College of Education at the University of Washington in Seattle, and founder and director of the university's Disabilities, Opportunities, Internetworking, and Technology (DO-IT) and Access Technology Centers.

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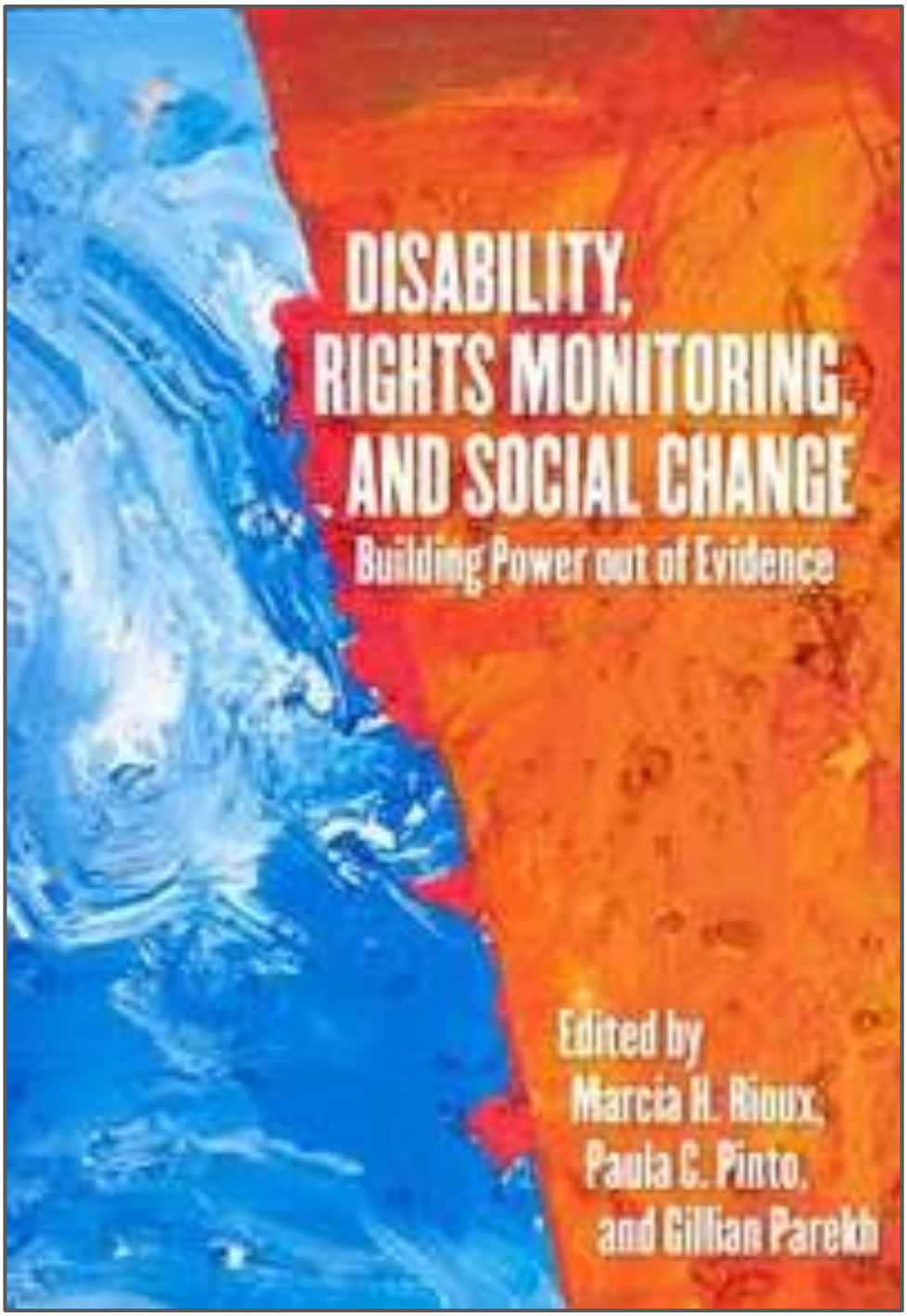

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In this book, Elivio Bonollo takes us on a 'learning journey' about design including a scholarly explanation of the characteristics and power of the design process. It provides valuable insights into the attitudes, knowledge and skills that underpin the design discipline at an introductory level of expertise, and has been developed to meet the needs of aspiring designers in many areas including industrial design, design and technology, art and design and architecture. Elivio uses an operational model of the design process - along with related educational strategies, learning outcomes and an ordered set of design briefs - to develop a systematic, problem-based method for learning design from a first principles viewpoint. The beauty of this approach is that it brings structured learning to aspiring designers whilst being mindful of diverse cultures and backgrounds. Each part of this book encourages self-expression, self-confidence and exploration: it is has been carefully designed to take the reader on a highly motivating journey of design thinking and creativity, supported by excellent sample solutions to design problems, lucid discussions and extensive references. These solutions, developed by design students, serve as novel examples of how to solve real problems through innovative design without restraining creative freedom and individual personality. The design learning method and strategies in this book will greatly assist design and technology teachers, students of design, aspiring designers and any individual with an interest in professional design practice.

I cannot recommend this book highly enough, it was a complete lifesaver throughout my undergraduate studies and honours degree and now continues to serve me well as I move into industry practice. The content is easy to understand and follow, providing a practical guide to understanding design principles and every aspect of the design process. It includes great project examples and reflects the wealth of knowledge and experience possessed by this accomplished educator. I have purchased multiple copies of this book for peers and would suggest any student who is studying a design discipline to pick up their own copy as this has quickly become the most useful book in my design collection.

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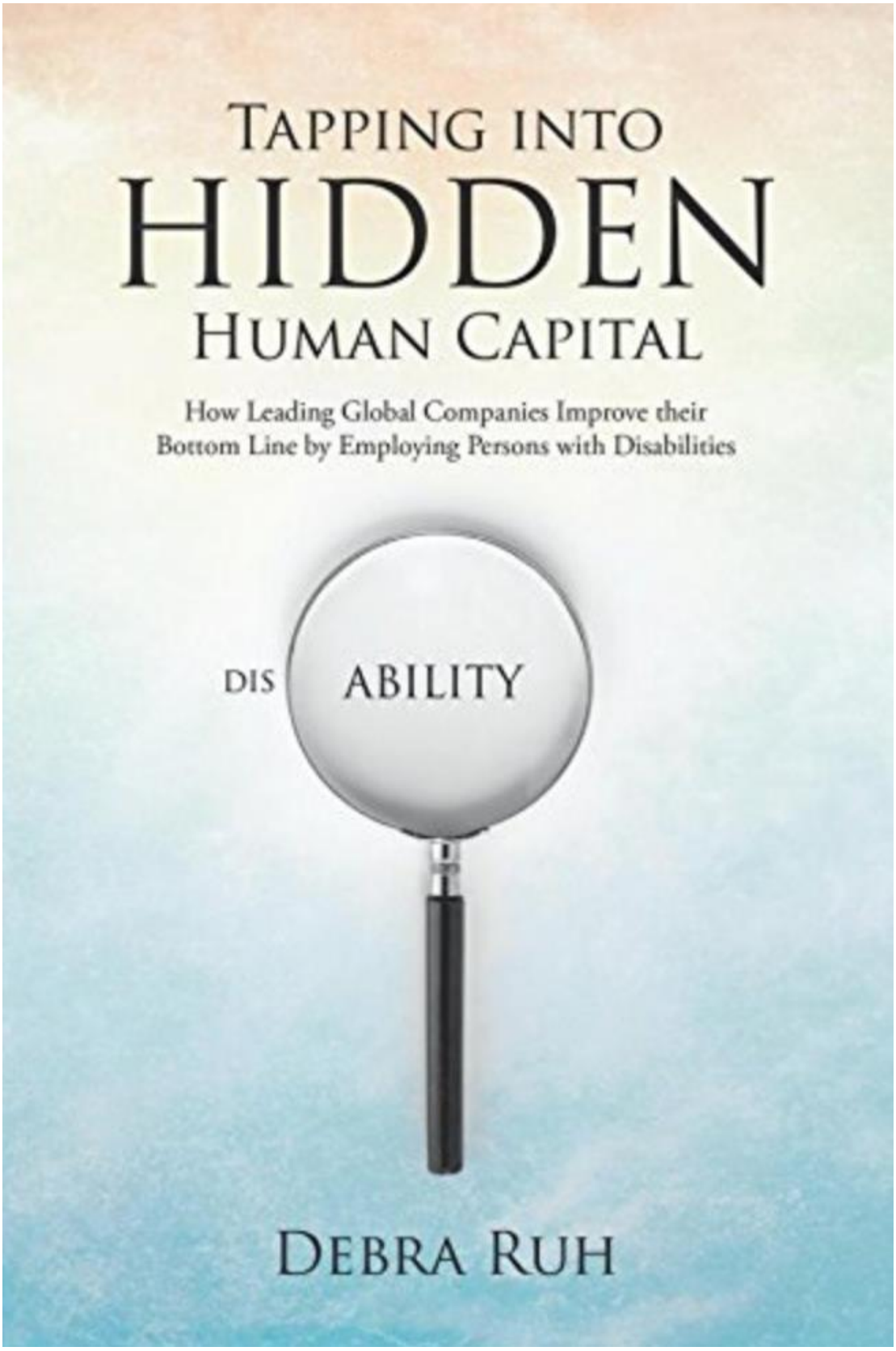
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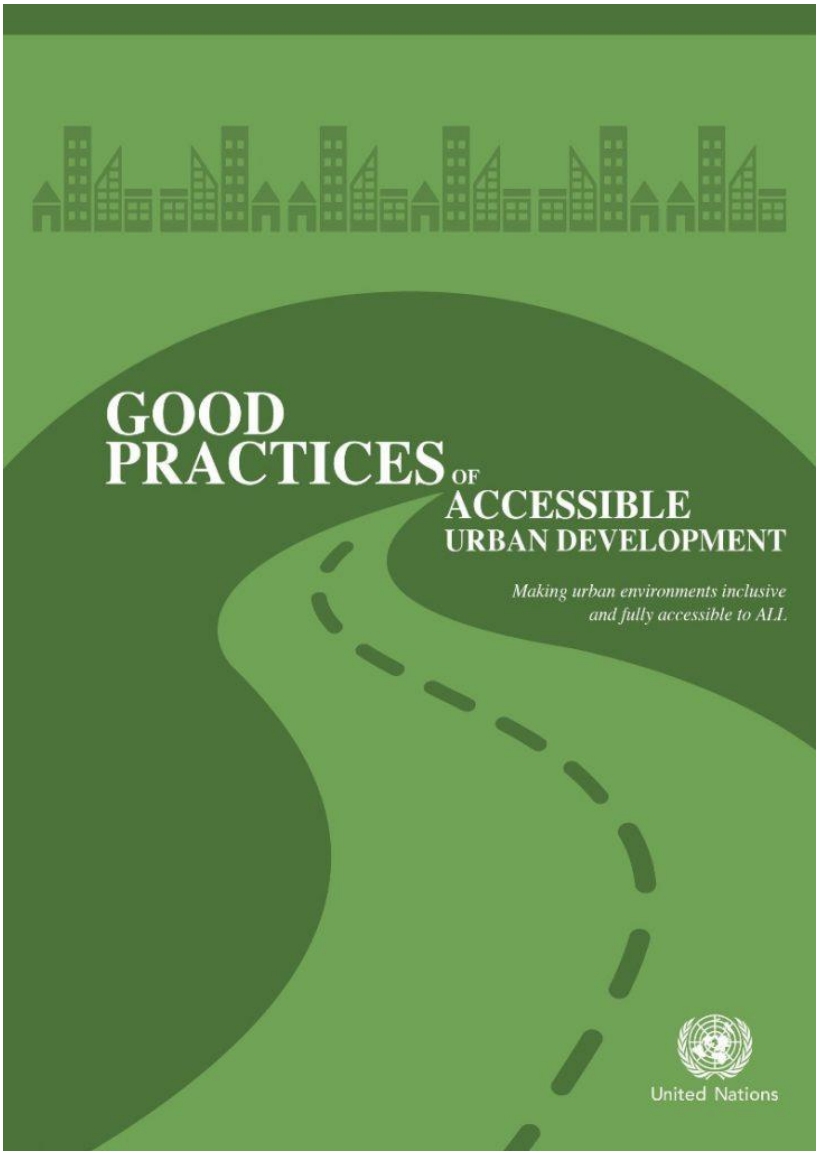
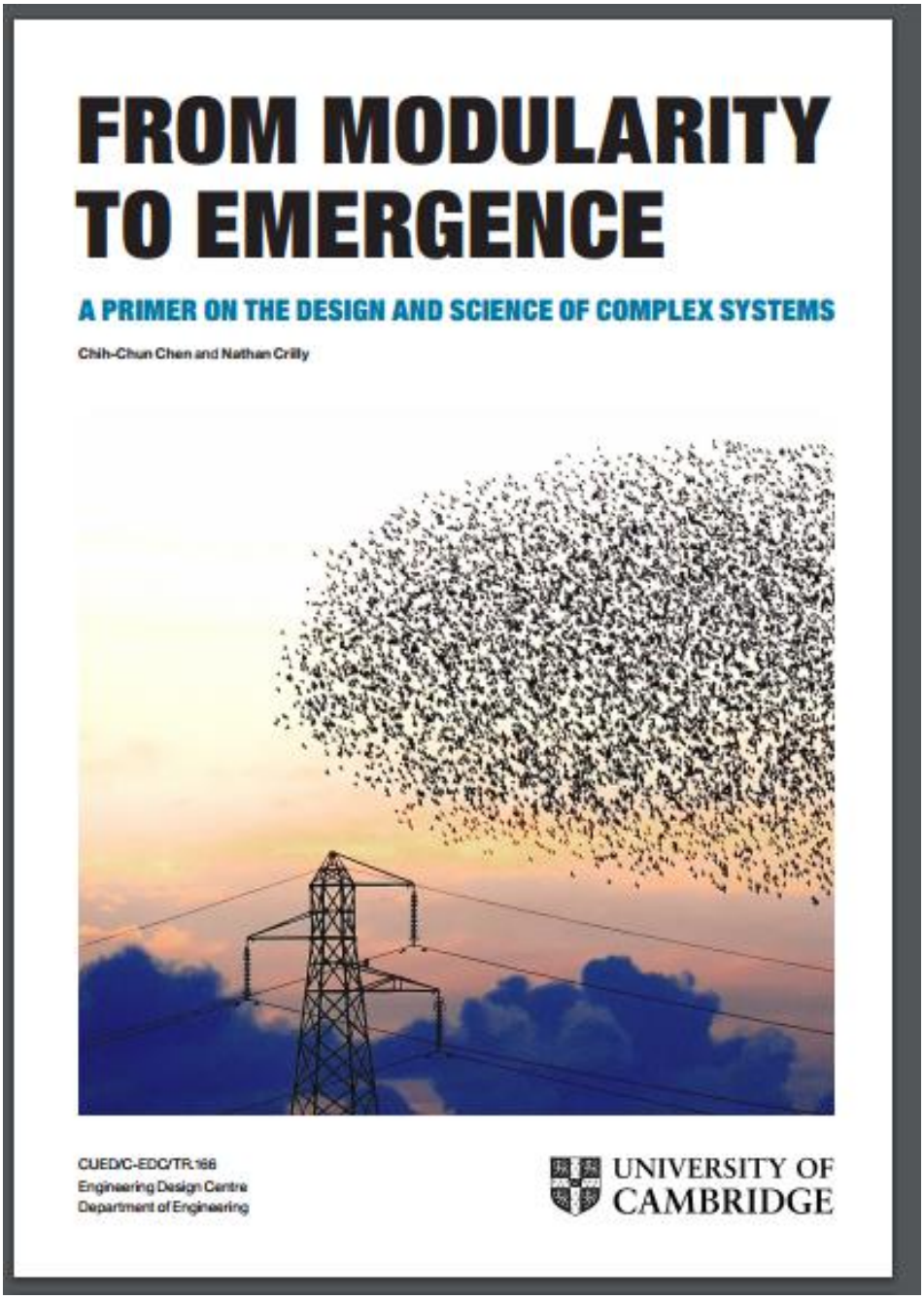


In light of the forthcoming United Nations Conference on Housing and Sustainable Urban Development (HABITAT III) and the imminent launch of the New Urban Agenda, DESA in collaboration with the Essl Foundation (Zero Project) and others have prepared a new publication entitled: “Good practices of accessible urban development”.

The publication provides case studies of innovative practices and policies in housing and built environments, as well as transportation, public spaces and public services, including information and communication technology (ICT) based services.

The publication concludes with strategies and innovations for promoting accessible urban development.

The advance unedited text is available at:http://www.un.org/disabilities/documents/desa/good_practices_urban_dev.pdf



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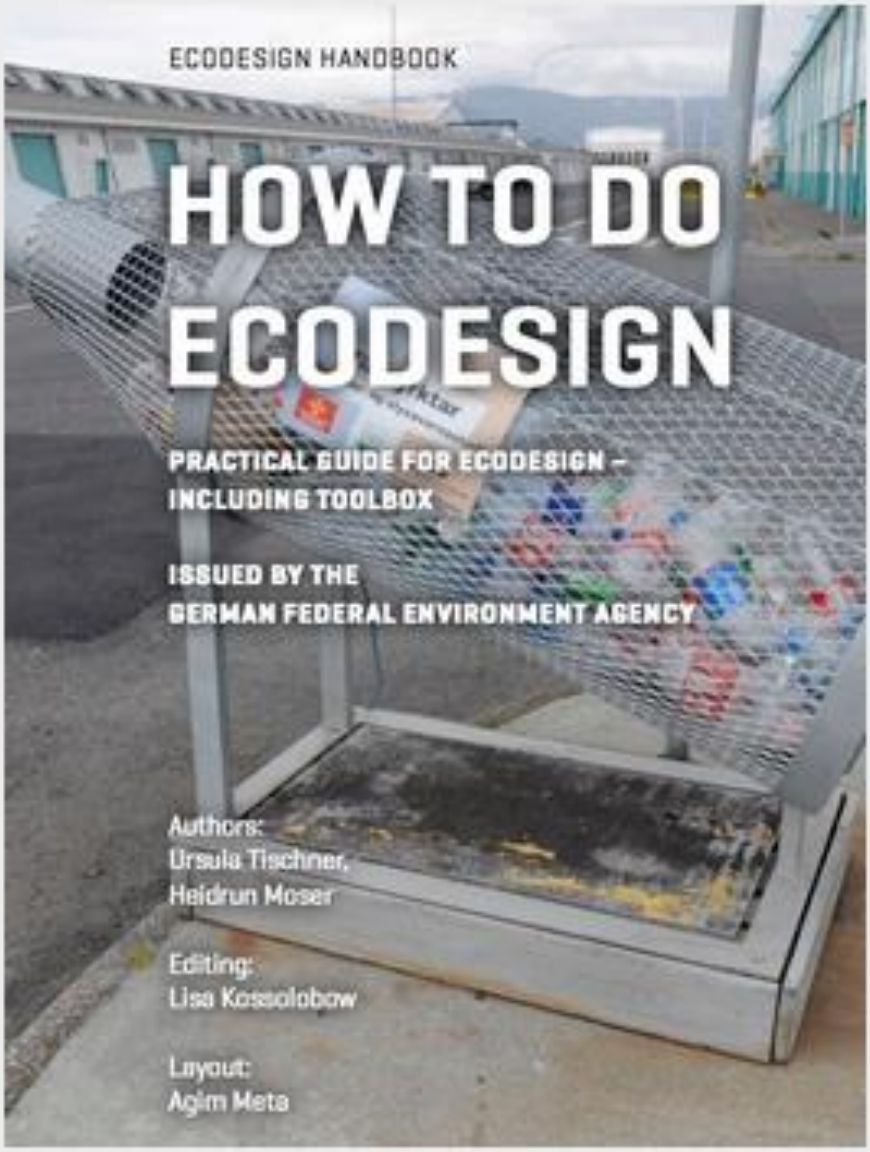

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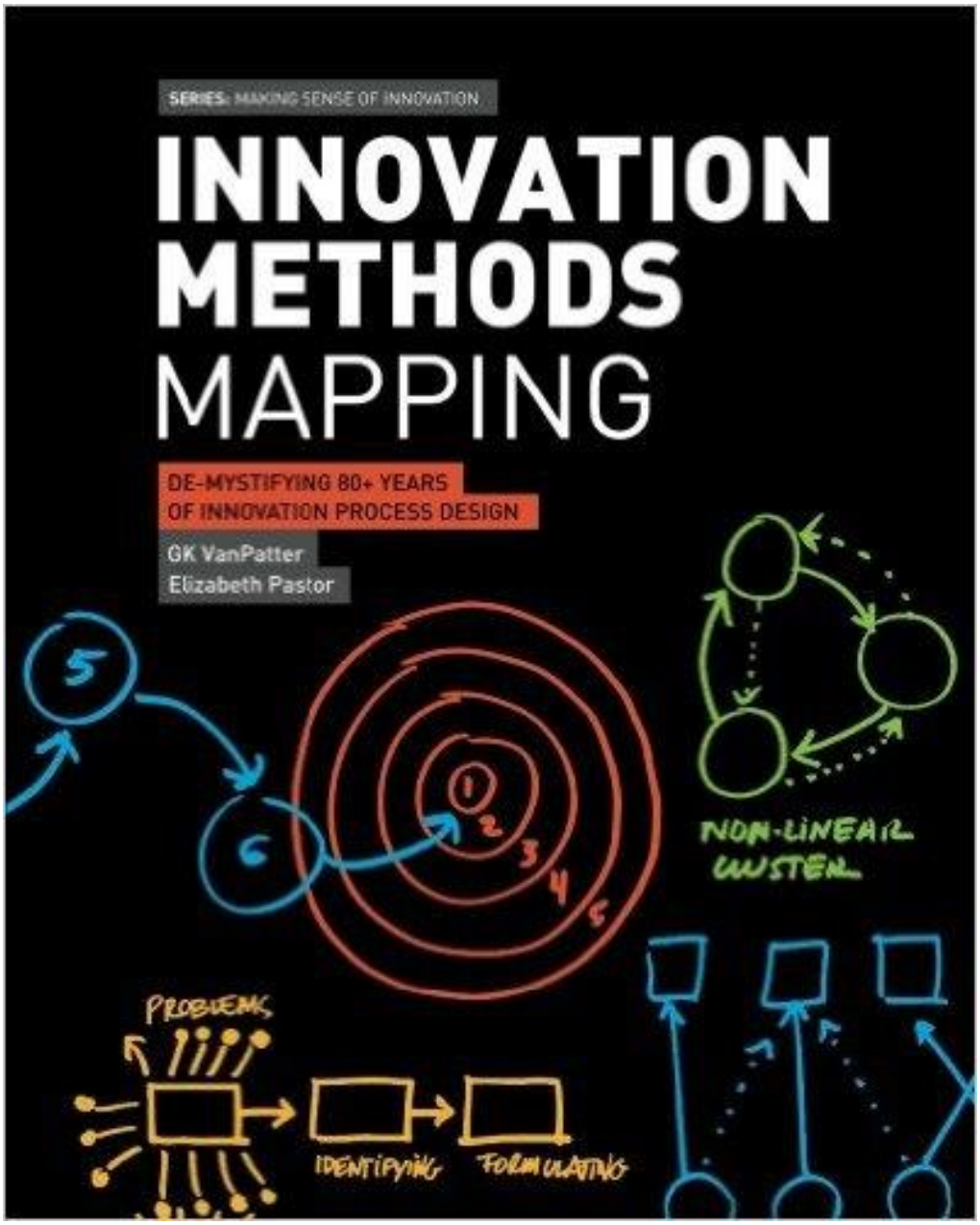

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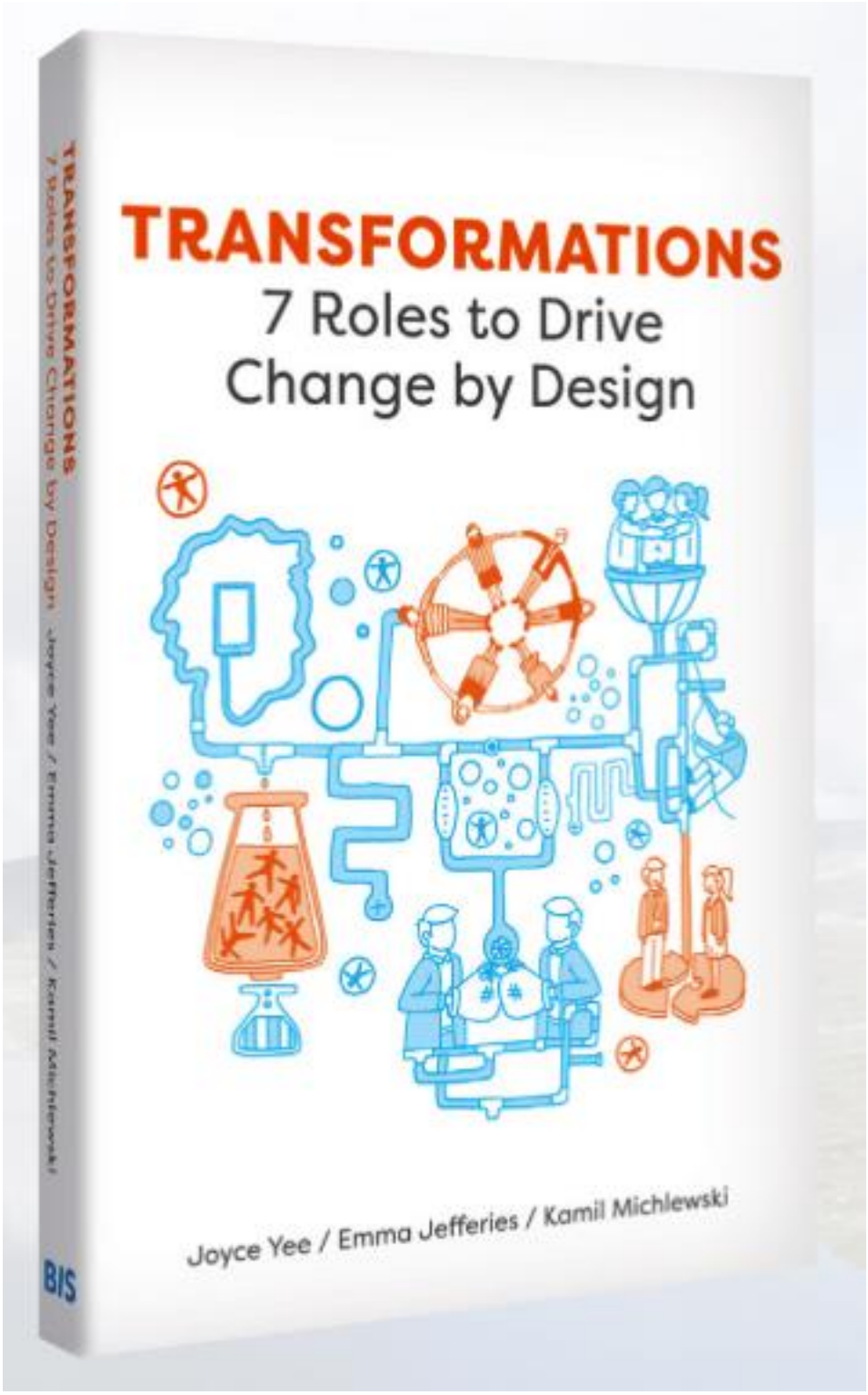
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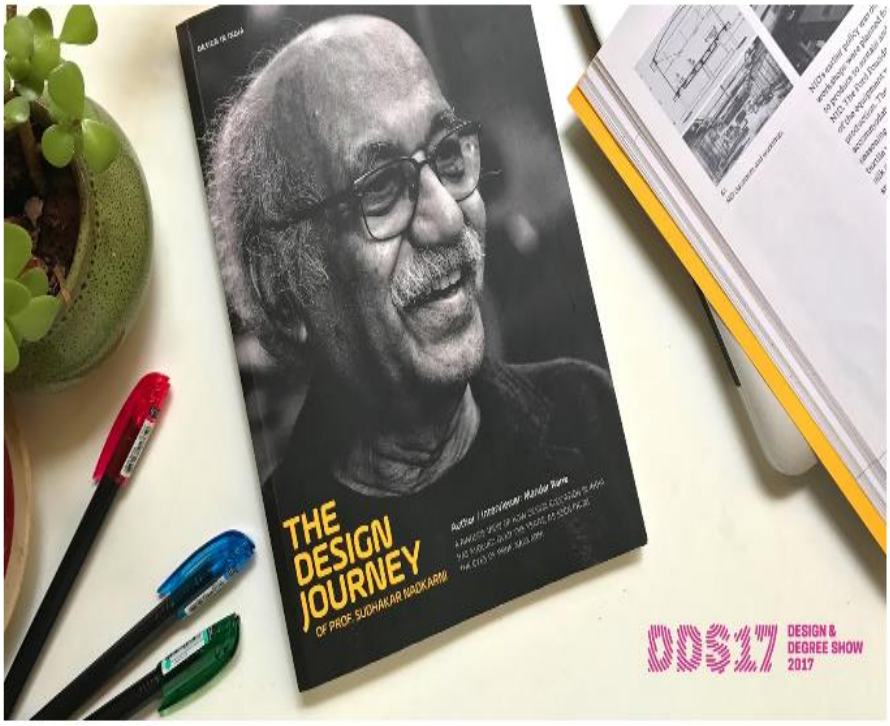

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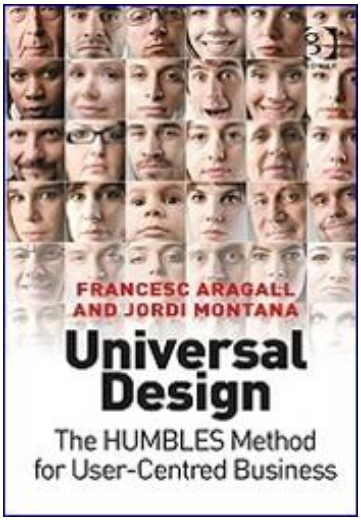
Universal Design: The HUMBLES Method for User-Centred Business

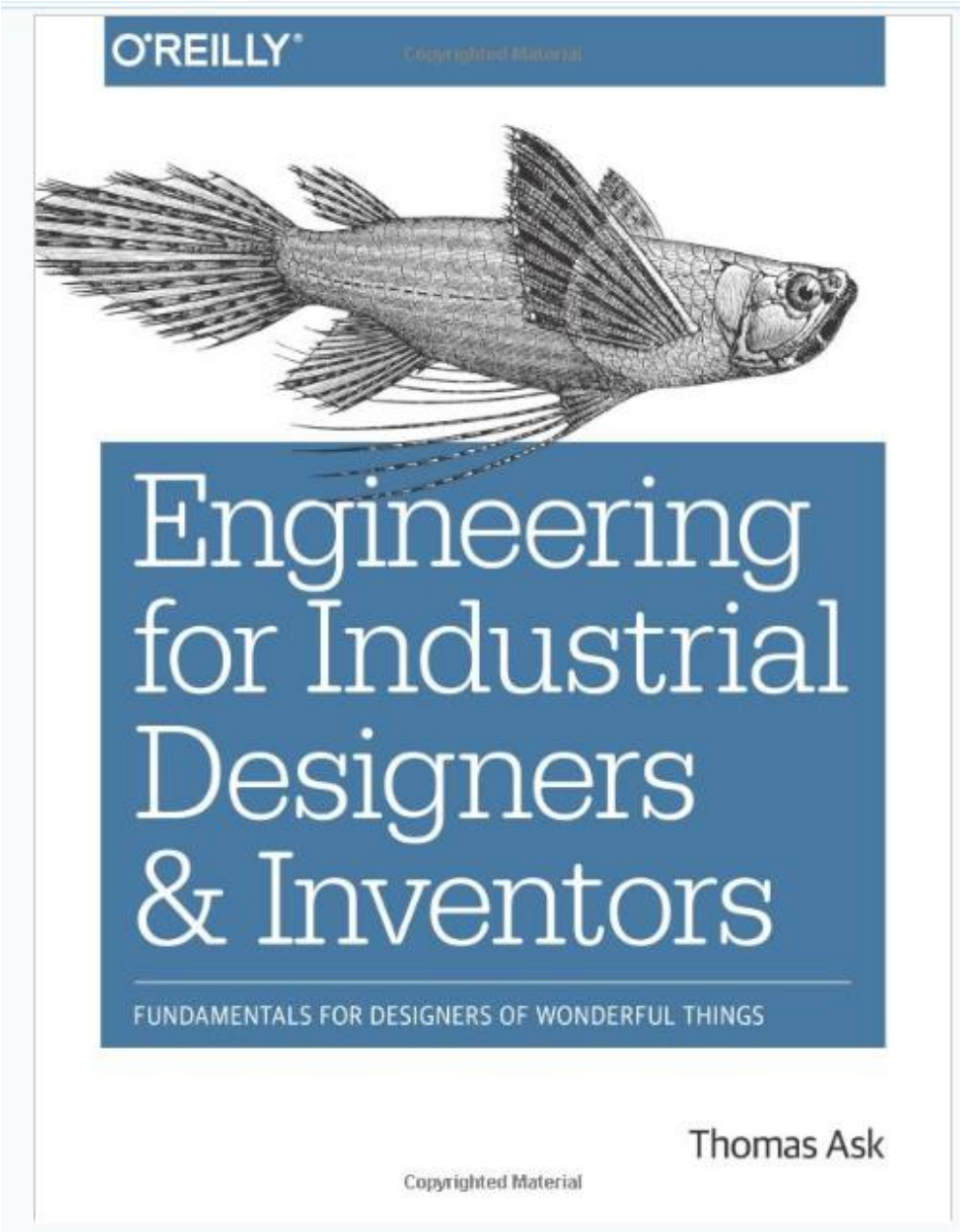


"Universal Design: The HUMBLES Method for User-Centred Business", writtenby Francesc Aragall and Jordi Montaña andpublishedbyGower, providesaninnovativemethod to supportbusinesseswishing to increase the number of satisfiedusersand clients andenhancetheirreputationbyadaptingtheirproductsandservices to the diversity of their actual andpotentialcustomers, takingintoaccounttheirneeds, wishesandexpectations.

The HUMBLES method (© Aragall) consists of a progressive, seven-phaseapproach for implementing Design for All within a business. Byincorporating the user'spoint of view, itenablescompanies to evaluatetheirbusinessstrategies in order to improveprovideanimproved, morecustomer-orientedexperience, andtherebygain a competitiveadvantage in the marketplace. As well as a comprehensiveguide to the method, the bookprovidescasestudies of multinationalbusinesswhichhavesuccessfullyincorporated Design for All intotheirworkingpractices.

According to Sandro Rossell, President of FC Barcelona, who in company withotherleadingbusiness professionals endorsed the publication, it is "requiredreading for thosewhowish to understandhow universal design is the onlyway to connect a brand to the widest possible public, increasing client loyaltyandenhancing company prestige".

To purchase the book, visiteither the Design for All Foundation website



I have a new book that presents fundamental engineering concepts to industrial designers that might be of interest to you. This is the
link:
https://www.amazon.com/Engineering-Industrial-Designers-Inventors-Fundamentals/dp/1491932619/ref=sr_1_1?ie=UTF8&qid=1506958137&sr=8-1&keywords=engineering+for+industrial+designers+and+inventors

Appeals

1.

MDes at NID: Apply by October 31 ...

Read more at:
http://english.mathrubhumi.com/education/news/admissions/mdes-at-nid-apply-by-october-31

Ahmedabad: National Institute of Design has invited applications for admission to the two-and-a-half year long Master of Design (M.Des.)

More details can be had from http://admissions.nid.edu/ and the Admission Hand book that can be downloaded from there.....

News

1. Religious events in Canton, Holbrook, Randolph & Stoughton

St. Joseph School, 143 S. Franklin St., Holbrook will hold open houses from noon to 1:30 p.m. Sunday, Oct. 15 and from 6-7 p.m. Tuesday, Oct. 24. School tours will be offered. The school offers early childhood programs for flexible half-day and full-day Pre-K students ages 2.9 - 4 years, and full-day kindergarten as well as grades 1 - 8. Other programs include a Learning Center for Special Education, Universal Design for Learning, Wilson and Guided Reading Programs and the Collins Writing Program and Before/After Care. The school requires a copy of baptismal and birth certificate, recent report cards, school testing results and nursery school evaluations. If your child is currently in a pre-school program, also provide a copy of a progress report. For information, contact Cox@Stjosephholbrook.com.

Reformation focus of church series

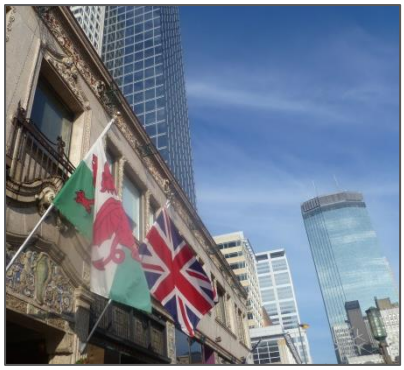
The Protestant Reformation, which began 500 years ago, will be the focus of an Adult Bible Study at the First Congregational Church in Norwood at 8:15 a.m. Sundays, through Nov. 5. Participants will discuss the causes for the Reformation, the people and events surrounding it, and the results of the Reformation. Almost 500 years ago, on Oct. 31, 1517, Martin Luther posted his 95 theses on the door of the church at Wittenberg, Germany. This date has traditionally marked the beginning of the Reformation. Each class will begin with a time of fellowship including coffee, bagels and muffins. For information, call 781-762-3320, find it on Facebook or visit www.firstcongregational-norwood.com. org.

Church schedule

First Congregational Church, 29 N. Main St., Sharon will hold the following:

Oct. 27: Worship at 10 a.m. Sacrament of Holy Baptism. Jeanne Lucas, choir director; Margaret Clark, organist; Deacon of the Month: Cathy Reed; interim pastor, Lay Leader: Carolyn Appleman; Carol Steinbrecker, preaching. Friendship Hour following in the Parish Hall. Spaghetti dinner 6 p.m. Saturday, Oct. 21. For information: 781-784-2631.

(Courtesy: Wicked Local)



Programme and Events

Photo: Delfino Sisto Legnani. Graphic Design: Groupa Ee

FARAWAY, SO CLOSE

25th Biennial of Design
Ljubljana, Slovenia
25. 5.–29. 10. 2017

The 25th edition of the Biennial of Design in Ljubljana is set to strengthen its role as an interdisciplinary collaborative platform where design is employed as a catalyst for change.

BIO 25, under the title *Faraway, So Close*, will be curated by **Angela Rui**, a Milan- and Rotterdam-based design critic and curator, and **Maja Vardjan**, curator of Museum of Architecture and Design (MAO).

In line with their focus on the humanistic side and expression of design, they will use the Biennial **to decode through design the effects** of environmental changes, asset migration, and reactions to the systemic crises.

In the face of the total failure of the theory of Positivism, we are now forced t**o confront the crucial and still largely hidden meaning** of the consequences of “post-modernization”, for which the city seems to have lost its authority as the territory where we look to find the source of quality existence.

Small changes are already taking place and gaining ground, and new inputs are slowly modifying our urban and rural environments. New frictions emerge out of the co-habitation of remote meanings and contemporary habits, as we look for new territories to signify, places to re-inhabit, ancient relations to re-enact, basic coexistences to re-imagine. **Can this friction between distant conditions produce new scenarios for a different present time?**

Along with the main subject-themes of the biennial, BIO 25 will de-centralize and will be interpreted as **a shift towards new territories** to be seduced by research and discourse, as well as by the idea of an event with which to produce knowledge. In the age of super information consumed in real time, the challenge of a biennial becomes increasingly closer to real conditions of everyday systems; **to provoke and challenge the paradigms** related to design and architecture through their pragmatic

application, acting as a “permanent work in progress”.

Slovenia, in accordance with its geographical conditions, will perform as a paradigm to stimulate, discuss and test the status of this global shift.

SAVE THE DATE FOR THE 25TH BIENNIAL OF DESIGN

Open Call 12 May - 5 July 2016
Kick-off event 15 September 2016
Process Autumn 2016 – Spring 2017
Exhibition 25 May – 29 October 2017

INTERACT 2017 MUMBAI

6th IFIP TC.13 International Conference on Human-Computer Interaction - INTERACT 2017

Theme: Global Thoughts, Local Designs

at IDC, IIT Bombay25-29 September, 2017http://interact2017.org/

The 2018 NKBA Design Competition Is Open

NKBA DESIGN COMPETITION

The 2018 NKBA Design Competition is open and accepting submissions. The annual competition provides the opportunity to recognize the association's designer members for their outstanding kitchen and bath projects completed between Jan. 1, 2016, and Aug. 4, 2017.

T18

Typoday 2018

International Conference, workshop, exhibition:

Typography Day 2018

1st to 3rd March 2018 at Sir J J Institute of Applied Arts, Mumbai, India

http://www.typoday.in

18 - 20 OCTOBER 2017, BRISBANE

Universal Design Summit 6

Inclusive Communities: Housing & Public Spaces

November 13 – 14, 2017 in St. Louis, Missouri

A leading conference in North America that proudly provides exceptional content on Universal Design in home and community

Join us at the Summit!

Registration is now open!

$190.00 – Early bird by September 1st at 5:00 PM CDT
$225.00 – Regular price after September 1st

Join us for the **2018 EDRA49 Annual Conference** in the **Oklahoma City, Oklahoma!** Walk along the streets of Oklahoma City, home to an attractive variety of historic buildings. Eye-catching religious buildings, and magnificent structures of great architectural and historic significance. **Stay tuned for registration to open in late Fall.** Check out what OKC has to offer, click here.

iphiGenia

Design Award

iphiGenia Gender Design Award 2017:
Preisverleihung – Save the Date

12. Oktober 2017, 19:00 Uhr
Museum für Angewandte Kunst Köln/MAKK
An der Rechtschule, 50667 Köln

Aktuelle Informationen:
iphigenia.genderdesign.org

Für Fragen eine Mail an:
iphigenia@genderdesign.org

Prof. Dr. Uta Brandes
(Vorsitzende IGDN)
+49 (0) 221-25 12 07

In diesem Jahr vergibt das „International Gender Design Network/IGDN" erstmals die neue, ebenso wichtige wie einzigartige Auszeichnung: den „iphiGenia Gender Design Award".

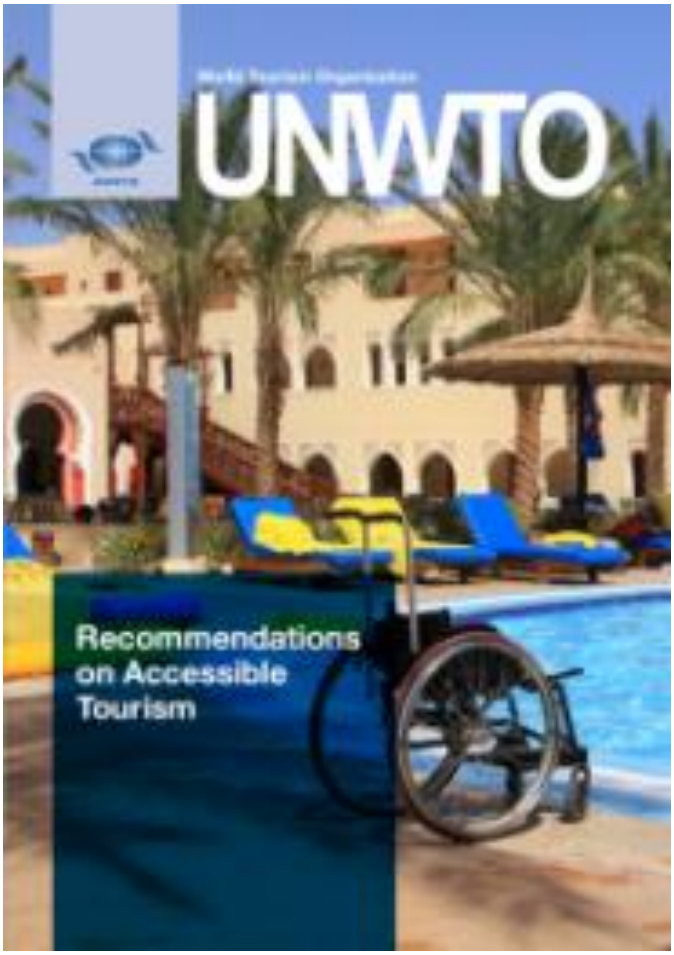
Eine kompetente Jury hat aus den vielen Vorschlägen zwei Preisträgerinnen ausgewählt. Am 12. Oktober 2017 werden im MAKK gewürdigt:

- mit dem „IGDA Evolution" wird ein junges, erfolgreiches Unternehmen aus New York ausgezeichnet, das äußerst innovative, nachhaltige und attraktive Produkte für Frauen gestaltet, produziert, vertreibt und diese auch vorzüglich kommuniziert – und zusätzlich eine Stiftung zur Aufklärung von Mädchen und jungen Frauen insbesondere in Afrika gegründet hat
- mit dem „IGDA Revolution" wird eine dänische Design-Agentur gewürdigt, die radikal, erfindungsreich und provokativ die internationalen Bilddatenbanken gendersensibel verwirrt und bereichert.

Repräsentant_Innen des Unternehmens und der Agentur werden bei der Preisverleihung am 12. Oktober anwesend sein.
Sehr gern laden wir Sie zu der Preisverleihung ein.

Uta Brandes
(Vorsitzende des IGDN)

international
Gender
Design
Network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1, 2, 3 & 4 November 2017
Marriott Whitefield, Bangalore
www.2017.ux-india.org
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4 days of inspiration, education and skills development for user experience designers, UX leaders, program managers, user researchers, startup founders and design students
Be a part of India's
Biggest UX Conference

Job Openings

1.Job Opening

Isha Foundation, Coimbatore needs a visual designer, with at least 5 years of work experience, to work on 1 months' assignment, for a website

If anyone interested please send your resume to
jayaram.r@ishafoundation.com

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