

A Review on Sustainable Product Design, Marketing Strategies and Conscious Consumption of Bamboo Lifestyle Products

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Abstract

Conscious consumption is a trend that is here to stay since consumers are becoming more aware of their purchasing decision and its impact on their health & environment. To sustain in the market on the move towards sustainability and meet the demands, companies need to re-examine their footprints and incorporate green practices in their products and organization. Using eco-friendly material & processes is one of the remedies to come up with this, and bamboo is one of the most versatile, green and renewable natural resources on planet earth. Traditionally bamboo has been exploited to a large extent but cutting-edge options available for bamboo are still limited and have a scope of indulging fully in the lifestyle of people in India. The global market size of bamboo was valued at UED 53.28 billion in 2020, and it is expected to grow at compound annual growth rate of 5.7% from 2022 to 2028. There is increasing demand for sustainable construction, and furniture and handicraft products also have considerable weightage. Many brands and craft clusters of bamboo are realizing and promoting this green quotient of bamboo to the market to attract the eco-conscious audience and trying to cope up with the advancement of sustainability, like certifications of being a green organisation. Despite the exceptional qualities of bamboo, it is considered as a marginalized material due to low production rate, high competition with the non-eco-friendly or cheaper alternatives, aesthetics and marketing gaps. There is a gap between willingness to purchase and an actual purchase when it comes to the sustainable products and marketing plays a major role in conversions. The main purpose of the research is to study and understand the product, craft, design, production processes and marketing practices of bamboo lifestyle products and how conscious consumption patterns influence the bamboo products and the industry in relevance to the sustainability.

Exploratory research method was applied with the literature survey and reviewing of the research papers from the peer reviewed journals. They were classified and reviewed based on the areas relevant to the bamboo products. The research outcome revealed the research gaps and the results were discussed and presented with the perspectives of product design, conscious consumption and marketing strategies in relevant to the sustainability of bamboo lifestyle products.

Keywords

Bamboo, Branding, Conscious Consumption, Home Furnishing, Interior Design, Lifestyle Products, Marketing, Product Design, Sustainability

1. Introduction

India, the second largest producer of bamboo in the world has bamboo craft as one of the oldest cottage industries and handicraft is the second largest contributor to the economy after agriculture. Almost 11.4 million hectares of land are under bamboo plantation. The craft has been an integral part of the society traditionally and bamboo products with contemporary skills and modern technology make a way towards day-to-day lifestyle usage of urban consumer. North-East region of India holds 28% of the total area for bamboo, which sustain about 70% of the rural population. They produce vast range of products that reveal many techniques, structure and forms. Although craft market is declining in India as the market system has expanded. Women continued to engage in that at greater extent than men as men seek alternatives of decreasingly remunerative craft, women are tended to bound by traditional patterns of rights and obligations.

Bamboo

Bamboo is the most diversified group of plants in the grass family. It belongs to the subfamily Bambusoideae of the grass family Poaceae. They are distinguished by complex branching, woody culms, infrequent flowering, and robust rhizome system. Bamboo is one of the most important resources of nature which is highly renewable, versatile, strong and one among the fastest growing plants on earth with highest growth rate in moist deciduous, semievergreen, temperate, tropical and subtropical areas of forest. Apart from these other ecological factors such as altitude, latitude, soil also effects the growth of bamboo. The altitudinal distribution of bamboo from sea level is 4,300 meters, while the latitudinal distribution ranges from 47°S to 50°N. High temperatures have positive impact on growth of bamboo while low temperatures inhibit the growth rate. Bamboo significantly impacts millions of people in Africa, America and Asia where it provides social, environmental and economical benefits. Approximately 123 genera and more than 1500 species of bamboo plant have been identified worldwide. Around 32 million hectares of forestland is covered by bamboo, it covers more than 0.8% of the forest area in the world and more than 60% of it is located in

China, India and Brazil. Almost, 80% of the forests of bamboo are in Asia, 10% in Latin America, and 10% in Africa. Among all countries China is the leading producer of bamboo with more than 500 species in 39 genera, where bamboo covers more than 6.01 million hectares of the country's forest (Salil Tewari 2019, Abolghassem Emamverdian *et al.* 2020; Zishan Ahmad *et al.* 2021). Bamboo has more than 1500 applications in various industries like construction, food, handi-craft, pulp, fuel, medicine, textile and more. Bamboo is a renewable bioresource with a high CO₂ fixation rate, it can absorb approximately 3.73 cubic meter of CO₂ which is equivalent of carbon dioxide emission from approximately 2 cars in one day and 1.83 kg carbon in less than a month, so it can be a great option for coping up with climate change and reducing global warming.

Fashion and Lifestyle Products from Bamboo

Sustainability and innovation often go hand in hand in the fashion and lifestyle sector. The development of products with natural material has been booming in recent years. Bamboo products are turning out to be incredibly mainstream due to its condition of well-disposed highlights. They are lightweight and polished, which give it a luxurious look. Bamboo utensils are exceptionally tough, and they are stain and smell resistant. These are modest and can be managed in a strict spending plan. It also has exceptional natural resistances, extending the life of any product it is applied to. It also has a higher compression strength than concrete. Bamboo's carbonization finishing procedure makes it water resistant and limits microbial growth. As a result, the item is both antibacterial and biodegradable.

Figure 1 shows the classification of fashion and lifestyle products made out of bamboo, like fashion apparels, non-woven articles, medical supplies and

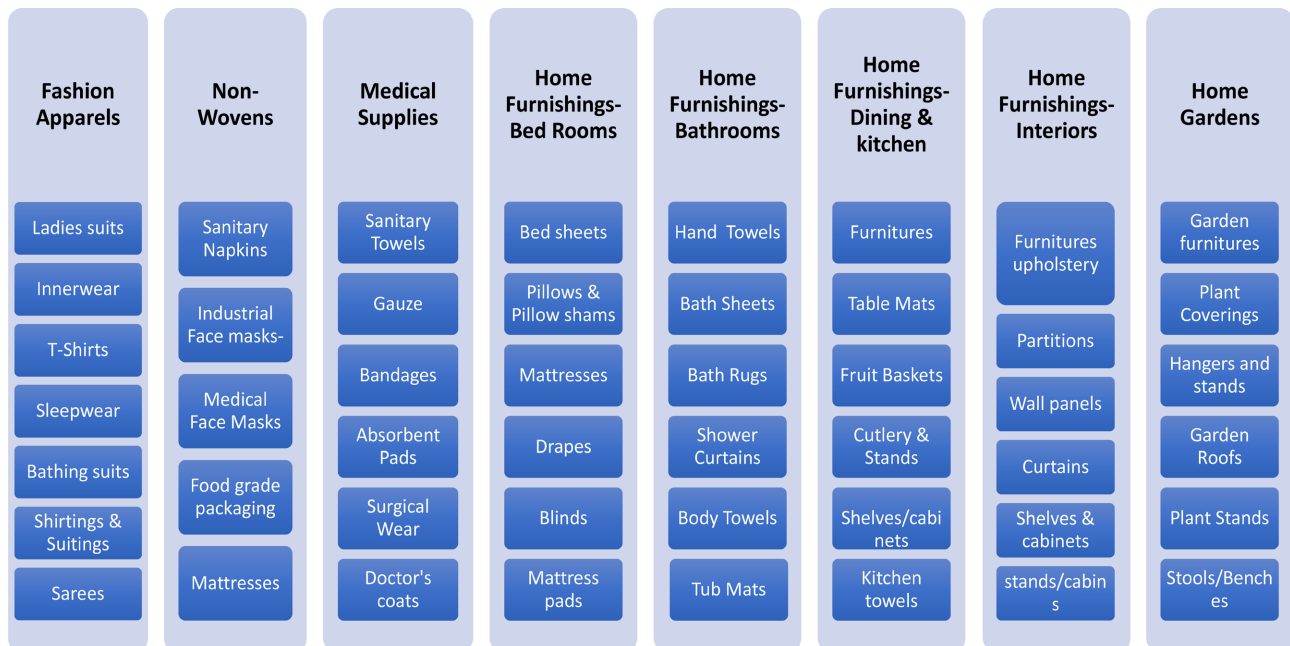


Figure 1. Classification of bamboo lifestyle products.

majorly home furnishings which are the area of this research.

In this context, this research paper focuses on the understanding of the product, craft, design, production processes and marketing practices of bamboo lifestyle products and how conscious consumption patterns influence the bamboo products and the industry in relevance to the sustainability. With a detailed literature review, the paper presents elaborately the classification of research reviews done on the bamboo products with the application of exploratory research method. The research gaps identified are listed at the end followed by the discussions on the scope for further research and future directions with respect to the product design, marketing strategies and conscious consumption in relevance to the sustainability perspectives, for developing the bamboo lifestyle product sector.

2. Research Objectives and Methodology

Objectives:

- To study the crafts, materials & characteristics, design, product development & production and lifestyle products of bamboo.
- To study the influences of conscious consumption and marketing of bamboo lifestyle products with sustainability perspectives.
- To identify and present the gaps in terms of product design & development, materials, production process, marketing and sustainability.

Methodology:

An Exploratory research method with a detailed study of the area in focus was employed. A literature review was performed by researching, analysing, reading, summarizing, and reviewing academic literature, mainly the research papers from the peer reviewed international journals and articles on the subject. The result of the literature review is a complete report that helped in learning more about the detailed nature, various concerns and issues of the research area, identify the research gaps and problems.

3. Literature Review

The authors conducted the secondary research by referring to various magazines, books and peer reviewed journals through offline and online to study and understand the researchers and developments made in the yester years. After surveying through all, a focussed literature reviews was carried out by collecting the research papers relevant to the research area, published in the peer reviewed journals for the past 20 years. The literature collected are classified under eight categories as presented in **Figure 2** and are determined based on the relevant researches done by the previous researchers in the areas closely associated with the bamboo products. The literature thus classified are then reviewed, and presented in this section, with a summary of research gaps at the end.



Figure 2. Classification of literature review on bamboo products.

3.1. Bamboo Crafts in India

A high level of structural and aesthetic sophistication can be seen in the region of North-east of India, in their vast range of products made and used by tribes living in the region. Study on these products reveals many techniques, structures and forms. There is a potential exist for the bamboo products in developed western countries but it will require the development of marketing and production infrastructure at the same time enhancement in Indian market. This will be executed with evolution in research & development in technical, management, marketing, design and economic details related to the craft [1]. There is an immense potential for bamboo resources in increasing the productivity, use of advance techniques and technologies does value addition and enhance the product identifications. According to the Planning Commission of India (2003), the potential exists for economic activities worth INR 26000 crore, based of value-based products in manufacturing, construction, utility and craft products and more. Some of the wood substitutes and composite materials are bamboo mat board, bamboo mat corrugated sheets, flattened bamboo boards and bamboo flooring. Bamboo is a raw material for the manufacturing of incense stick and the biggest advantage of this industry is that capital start-up cost is very less with no or small machinery usage. Bamboo dust and waste of adequate size with the help of a binding agent reinforced into acrylic mat which gives value addition to the waste and provides a link between industry units and mat weaving units [2].

Bamboo is a material with high but latent potential for application in plethora of products, wide varieties of bamboo products are available globally but research in the area shows the development of bamboo products for the western

market have limited growth possibilities because of various reasons like low quality, low production capacity, aesthetics and more. India has a tradition of bamboo craftsmanship, it is a challenge to find innovative ways of making bamboo materials and products for urban global market that can benefit the local craft producers in India [3]. Industrial application of bamboo and modern construction design both have demonstrated bamboo's huge potential with the management of resources and technical advancements. But, there are many loop holes present in this sector, like having no standard classification as usually bamboo is classified by its structure or the end use and due to its multifunctionality, product classification of bamboo is even more complicated [4]. Bamboo is one of the most important non timber plant, played a major role traditionally, it is integrally linked to livelihoods of millions of people. It has numerous essential environmental services among prominent usages in furniture, handicrafts, utensils, housing and more. In India, roughly 8.6 million people are dependent on bamboo for their livelihood. Over the past years higher technology value added products of bamboo have increased compared to traditional products in export. Top importers are EU, USA and Japan, also Canada, Singapore, Australia, Russia and Korea are significant importers in the world. There is potential for new product development, can be foreseen in the future [5].

India is rich in terms of producing crafts, artisans with traditional skills and contemporary techniques have always found impulsive expression in the forms of handwork. Bamboo industry helped in poverty alienation and income generation for the artisans. The raw material is locally available in many parts of the country which helps in reducing the production cost [6], researched on the entrepreneurship potential of Bamboo artisans of Dindigul district in Tamil Nadu for their upliftment. They applied survey method for studying and understanding the demography, socio economic status of the bamboo artisans in the region and also study the impact of the various developmental and welfare schemes implemented by the government. The study aims to know the socio-economic status and demographics of the bamboo handicraft workers at Vishamangalam, Tamil Nadu. They have applied survey method for the study and collected the relevant data for quantitative from the respondents. Also, direct personal interviews were conducted for the descriptive study design [7]. For the socio-economic development of India, segment of bamboo plays an important role but the industry is much inorganized one. The study attempts to know the Importance of bamboo industry in the state of Kerala. The structured questionnaire tool is used for the conduct of the research in the state. Random sampling method is used in the process, also secondary data is used extensively for the conceptual framing of the work [8]. There are 3 large genera (Bambusa, Dendrocalamus, and Ochlandra) of bamboos in India with more than 10 species each. Together, these three genera represent about 45% of the total bamboo species found in India. The research attempts to study the status of bamboo in India, focusing on value of bamboo, essential attempts are required to gather enough information for man-

artisans, employment, consumptions, natural resources, trends have weak connections and less occurrences. The maps also show the new areas of research like globalization, innovations, climate change etc. Bamboo handicrafts are significant part of the culture and tradition of India. They contribute to the economic development of the country, thus the cause of employment generation specifically for rural population. But the craft is lagging behind owing to the gaps in raw material sourcing, sustainable design and marketing. India is the second largest producer of bamboo after China, and globalization is helping India in becoming competent.

3.2. Bamboo Products and Processes

Despite being the potential fast-growing natural resource, bamboo product market is relatively small in the west. Some of the key factors crucial in the commercialization of bamboo products from consumers' perspective are products' image & development, increasing popularity of sustainable certified materials, promotion, market choice, production capacity, transport, trends and market knowledge [13]. Bamboo is a fast-growing, cheap and green resource, with superior mechanical and physical properties, it offers great potential as an alternative to wood, plastic and other materials for structural and product applications through improvements in product innovation with application of engineering and scientific skills and processing technologies [14].

The potential of bamboo for eco-restoration of degraded lands is studied and it is found that bamboo plantation can impact the behaviour towards soil erosion control, increasing capacity and biodiversity conservation in restoration of degraded lands [15]. Durability of bamboo depends upon many factors such as design, treatment with boron, selecting mature bamboo, keeping bamboo dry and more [16]. Bamboo is naturally very vulnerable to insect and rot attack, more than timber. In order to use bamboo sustainably it has to be treated to increase its life span with processes like incorporating durability by design, selecting mature bamboo, keeping it dry and boron and alternative to boron treatment [17].

A study is attempted to explore sustainable design principles for using bamboo stems, the researcher has used survey method and follow-up interviews to reveal the gap between user needs and the competence of the manufacturers [18]. Through problem analysis and assessment, research on utilization and development of bamboo is done in this study which depicts that the current consumption of resource of bamboo is unsustainable, but there are a few strategies suggested by the researcher to enhance the situation are following the scientific guidelines while collecting and harvesting resources, multiple usage of the resource, eco-friendly development of the industry and maintenance of genetic diversity and high production of bamboo resource [19]. Properties of bamboo like strength, flexibility, high tensile in craft, furniture, construction, lifestyle and more are much better comparatively. The researcher have used field survey as a

methodology for the collection, identification and preservation of different species of bamboo. Results of the study explained the usage of six species of bamboo roots, stem, leaves, culms and branches [20].

Bibliometric Analysis:

The analysis in **Figure 4** shows that 4 clusters with major occurrence of bamboo connected to the main keyword's china, paper and pulp, cellulose, mechanical properties, moisture content, physical properties and environmental studies. There are weaker connections to cellulose, hemicellulose and lignin. There are also connections can be seen for compressive strength, charcoal and decomposition. Mechanical and physical properties of bamboo are comparable to steel, wood and plastic, so bamboo can be used as an alternative biodegradable material. Paper and pulp industry are considered to be one of the oldest and mechanised bamboo-based industry in India. Bamboo has moisture content which makes it prone to insect attack, that effects on its durability.

3.3. Product Design and Development

Bamboo is been called poor man's timber to poor man's gold over a period of

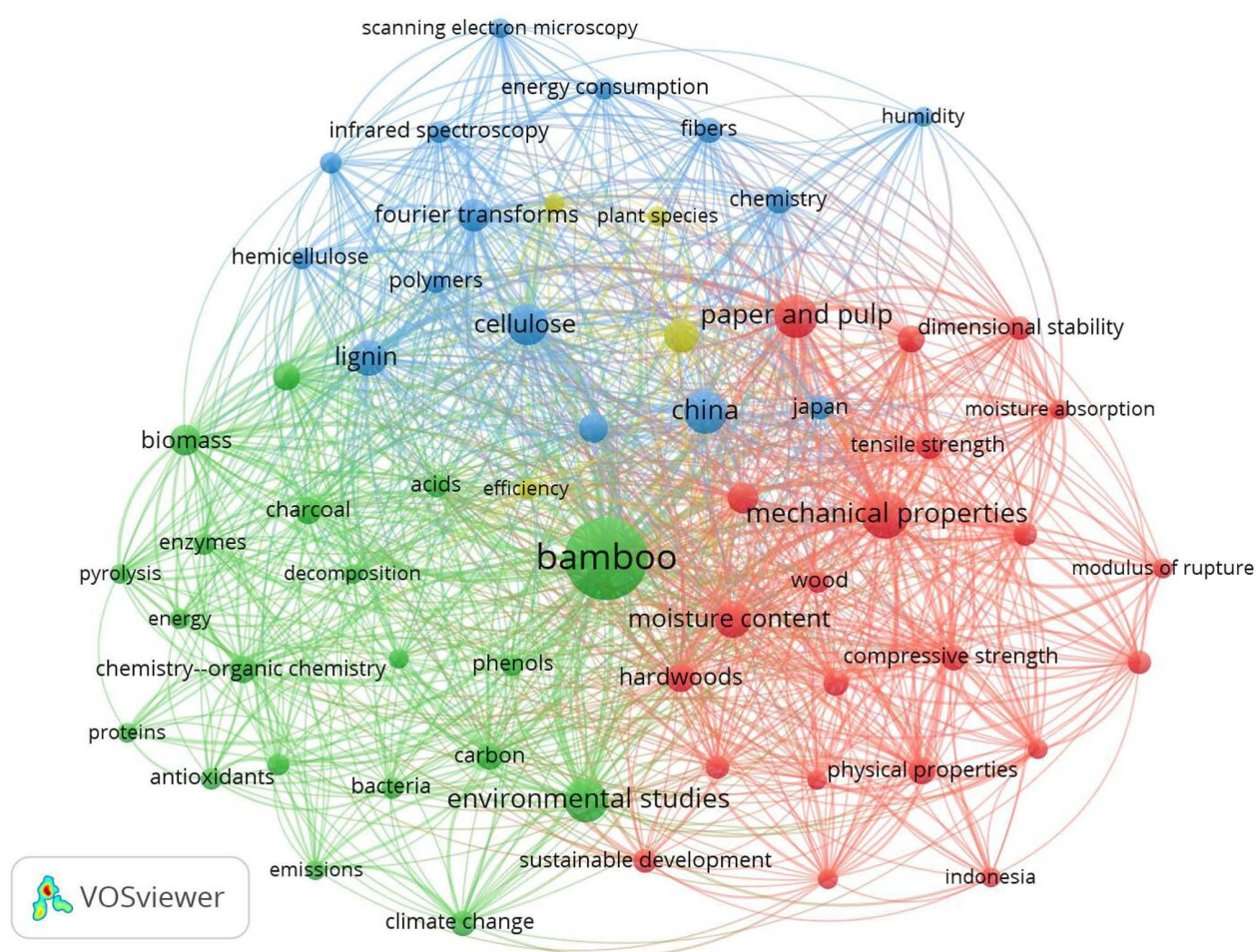


Figure 4. Network visualization of keywords-bamboo products & processes.

time. It's a versatile grass found mainly in Asia and Africa has undergone many changes. Only recently it has been considered not only useful for traditional subsistence economy but even the modern industrial one given to its functional yet sustainable characteristics [21]. The market for bamboo products is on the rise, owing to the ever-growing demand for eco-friendly products. The growing contemporary and innovative applications of bamboo range from Bamboo Eco book computer and the iPod bamboo shuffle case to bamboo textile products to bamboo houses, home furnishings and lifestyle accessories [22]. The sustainability and human story have at least two parts, the first is upgrading building infrastructures to improve energy efficiency, and the second is changing the behaviour of building occupants through interior design, green behaviour changes can be seen in the occupants of the healthy and environment friendly interiors, products, materials, stories and all. It all has an impact on the building residents that can also be reflected in their consumption which in turn causing the demand for green production and development [23]. The study reveals that well-engineered bamboo designs have significant potential as a sustainable, cheap, seismically-resistant, appropriate and durable form of low-cost housing [24].

The application of smart materials in designing the interiors of smart houses and with the environmental benefit of decreasing demands on non-renewable materials, bamboo has the great potential to be used as solid wood substitute materials, especially in the manufacturing, design, and construction usage Bamboo as an example of the kinds of agricultural materials used in interior design and the possibility to develop these types of bio composite and hybrid bamboo-glass fibres composites. The benefits of smart materials which are considered are minimized air conditioners size additional to other natural benefits [25]. The people's behaviour towards the use of eco-friendly products is studied as its one of the remedies of many environmental problems. Random sampling method is used for the survey with the help of questionnaire and personal interview. The results of the study reveals that respondents do not purchase eco-friendly products because they are not aware, they believe prices are high and products are not available in the market [26]. The application of bamboo modular system in a design minimizes the cost and energy used, produces a variety of systems and paves the way to commercialize bamboo as a contemporary building design material [27]. The dimension of interior design is analysed in terms of sustainability. The study reveals that three factors can affect sustainable interior design: the interior designer himself, the clients and the rating systems. Obstacles that are present in the way of a good sustainable design are limited materials, clients reluctant to pay higher initial prices and lack of education of interior designers [28]. This research proposed a set of criteria for interior design sustainability based on literature review. The outcomes of the study depict the recommendation of eco-friendly & healthy materials by designers, integration of sustainable practices through design process, they proposed five criteria

covering manufacturer selection, health, reduced consumption, sustainable design components, and efficient design resource management. all the five recommended criteria in sustainable lifestyle product design are an attribute towards green development [29].

Bamboo has many applications as a building material such as, floor, foundation, walls, ceiling, door, trusses, scaffoldings and roofing. Bamboo is versatile and considered one of the most important non-timber forest resources due to its unimaginable socio-economic benefits derived from bamboo-based products [30]. The physical, ecological, emotional, and cultural characteristics of bamboo were explained. Bamboo product samples were collected and then divided into groups using card classification. Groupings were collected and analysed using software tools, and dendrograms were created to visualize the cluster analysis results. These techniques can be used independently or in combination to provide new ideas for designing innovative bamboo products. In addition, shape grammars can be used to refine them as design rules and combined with smart computing to generate new patterns and promote smart bamboo product design [31]. Green furniture is one of the most discussed development and design topics currently. Recyclability, reusability, easy maintenance, etc., are some of the environmental attributes of a product essential to green furniture design. The existing bamboo furniture is simple in shape and lacks innovation in design. But there is a scope of improvement in many categories of furniture in bamboo, experiments and researches are undergoing in terms of finishes, durability, texture, shades, shapes, structure, usability, sustainability, comfort and more [32]. Owing to the abundance and versatility of bamboo products, bamboos are used for wide range of indoor & outdoor applications. To evaluate marketing and manufacturing problem of bamboo products in Tamil Nadu, descriptive research design is used as methodology and proportionate stratified sampling method is used for sample selection. The study concludes that bamboo development viewed as a tool for poverty elevation and employment generation through eco-rehabilitation purposes [33]. This study focuses of concept of ergo-aesthetics coupled in design process to come up with the better outcome of bamboo furniture design among manufacturers of bamboo in Malaysia considering the behavioural, cultural, ergonomics and aesthetics aspects of consumers as fundamental components throughout the design process [34]. There is a need for the development of furniture design with the use of bamboo to raise competitiveness among handicrafts and furniture of bamboo the local products of SMEs. The study is based on development of bamboo furniture design with the used newspaper as an eco-friendly material in Sleman Regency, Indonesia. Design of bamboo chair is developed with the material exploration based of experimental design and iterative processes. Results of the experiment inspire new movements in the bamboo furniture design also bamboo as a craft product and furniture can be combined with other sustainable material for innovation [35]. Bamboo has high nutrient content and its hydrophilicity makes it prone to mould attacks, so, to increase

bamboo's hydrophobicity, mould resistance and surface functionalization with silver-reduced graphene oxide nanosheets as nanocomposite is a well-organized antimicrobial material. It enhanced antifungal property and hydrophobicity of the bamboo material. This quality can help the bamboo material last for longer period of time, beating one of the major constraints in the product quality or longevity [36]. In this work, they review the mechanism of bamboo photodegradation, in which the behaviour of lignin is key. The changes in bamboo's microstructure, surface colour, and chemical composition during photodegradation are described in detail. This review provides new insights into the scientific application and protection of bamboo in the outdoor field [37].

Design and developments in bamboo product categories in home furnishing and interiors are emerging at a good pace, which is a welcoming trend towards sustainable consumption. Incorporating bamboo with other eco-friendly materials, structural and chemical changes for enhancement of original form, characteristics and experiments with the surface finishes are a few of the examples leading the way for sustainability in product design and development of bamboo lifestyle products.

Bibliometric Analysis:

The analysis in **Figure 5** shows that 4 clusters with major occurrences of bamboo and sustainable development connecting with climate change, environmental studies, sustainable design and agriculture. It can also be seen that mechanical properties, composite materials, biodegradability, natural resources, statistical analysis, constructions, hardwood etc. have weak links. Bamboo can store and sequester carbon; this high yield makes bamboo a surprisingly effective carbon sink and important nature-based approach to mitigating global warming. Compared to hardwoods bamboo finished materials and composite material have shown equal or even better results physically and mechanically in the bamboo product development.

3.4. Conscious Consumption of Lifestyle Products

There is a need to change consumption standards, considering the immense waste of resources caused by unchecked consumption of material. Conscious consumption is gaining strength as an alternative to the consequence of growing wastefulness mediates between society and nature. It involves converting consumption into a "conscious act" [38]. A study was conducted to determine product sustainability features in the selection of electronic products and furniture. The work evaluates the significance of fashion trends in the selection of interior design products. Survey method was used by distributing a questionnaire at the university in Istanbul. The students and designers of interiors and architectures were questioned about the role of sustainability in choosing the materials. The result revealed that the materials used for furniture and interior products shall be recyclable and renewable. The materials selected shall be in compliance with the prevailing fashion trends. Conclusion of the study reveals that

non-probability sampling technique is used [41]. Contemporary consumers, in their constant search for innovation and improvement in quality of life, have transformed consumption into a form of representation and social status. The paper presents the study of reliability and validity in terms of conscious consumer scale, population of the study is the residents of a locality in Ankara, Turkey having different socio-economic background. Stratified random sampling is done for the sample size, survey method is used [42]. Consumers are now more prone to information regarding products and their companies owing to increased communication tools & networks. They demand information about products, brand and relationship with the environment [43]. India being the second largest bamboo producing countries only after China, house the extremely diverse bamboo varieties having around 140 species. Considering the utility function and tradition bamboo mat making is one among the oldest value-added product among various other bamboo products. The potential of value-added bamboo products as commercial eco-friendly product with multiple applications significantly impact in increasing local economy and the upliftment of the rural and tribal communities [44].

The attention towards consumption of eco-friendly products in various sectors such as truism, commerce & clothing has increased in last years. Future research should highlight the less explored areas, looking at the economic & social side of sustainability. At the same time sustainable behaviour of consumers as a whole and its impact from the perspective of people, planet & profit should be kept in consideration for consumer-focused research [45]. Environmental consciousness acts as a catalyst towards approaching conscious consumption behaviours. Consumers are engaging in ways to reduce their consumption and share products with one another, businesses need to be aware of marketing the multifunctionality of their products. Brands should work to increase functionality, present multiple ways to style/restyle products, and encourage sharing and repurposing of their products to appeal to these consumers. The study attempts to examine environmentally conscious consumption, survey method is used [46]. This descriptive quantitative research aims to investigate the impact of consumers' planned action theory (TPB), conscious consumption intentions, and ethical considerations on slow fashion consumption of clothing. As a result, it was found that the slow consumption of fashion within the LPA (Local Production Scheme) of clothing production in Agreste was influenced by conscious consumption intention, ethical consideration of consumer behaviour, and perceived behavioural control [47].

Bibliometric Analysis:

The analysis in **Figure 6** shows that 5 cluster with major occurrence of consumers, connecting majorly with consumption, consumer behaviours, food, lifestyles, sustainability, environmental studies and pandemics. It can also be seen that health care, education, motivation, fashion, values, green products, influence, natural & organic, brand loyalty, green marketing etc, have weak linkages.

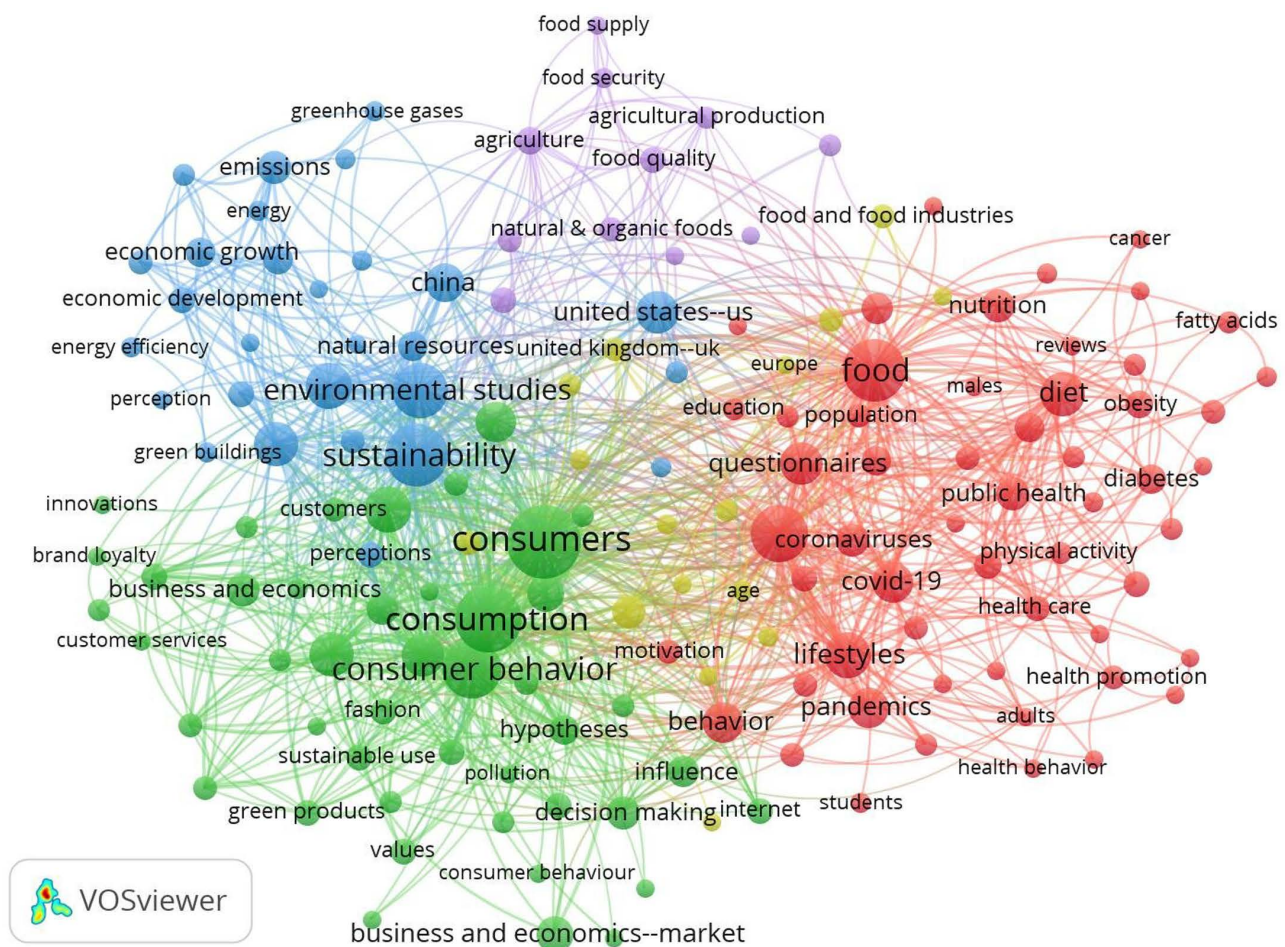


Figure 6. Network visualization of keywords-conscious consumption of bamboo lifestyle products.

Lifestyle products have a direct link to a person's identity, behaviour, perceptions, influence, choices and emotions. Conscious consumption is a consumer behaviour that can be affected by brand loyalty, motivation, education, health-care, decision making, awareness, promotion and fashion. The recent pandemic has also impacted the buying behaviour of the consumers, they have become highly conscious about the nature and image of products that they are purchasing from the brands.

3.5. Branding of Bamboo Products

Bamboo can be used from traditional crafts to contemporary design and architecture as it has wide variety of uses from medicines to building construction products. The combination of new technologies and old skills & techniques evoke the user and the maker with the spirit of innovation and inspiration by the application bamboo's qualities towards the challenge of sustainability. For the creation of sustainable products of social design in an ecologically supportive way designers collaborate with the artisans and create different products, change lifestyles and add new technologies [48]. The study conducts a retail laboratory

choice-based experiment to test predictions related to the effects of brand-level sustainability information on choices, product evaluations, and retailer perceptions. The addition of positive (negative) sustainability information for the brand yields higher (lower) product evaluations and increased (decreased) brand choice [49]. A case study was conducted to learn about the COVID-19 impact on traditional bamboo markets and its effects on indigenous local community in Mysore, Karnataka of India. The methodology involves simple random survey across India. A semi-structured questionnaire is distributed for the data collection related to demographics and marketing. There is a specific section of the market with full agreement towards liking and disliking, mainly when expressed in terms of the service and products that they will buy can be a self-image-based marketing strategy of such group. Social media played an essential role in advertising during the period, and people were able to manage large-scale production of specific products. A direct producer market chain without mediators helped the most to sustain [50].

Bibliometric Analysis:

The analysis in **Figure 7** shows that 5 clusters with major occurrence of environmental studies, sustainable development, China, culture and culture heritage. It can be noticed that occurrence of clothing, trends, ethnography, product development, ecotourism is not very strong and have been introduced in the recent times in the area of research, providing a good scope of further studies where it can be explored with respect to branding of bamboo lifestyle products. Branding of bamboo lifestyle products are majorly done by China as bamboo is more explored and exploited in the country. Apart from that, tourism and clothing sectors are well defined and relevant to bamboo in terms of branding. There is a scope of product development in manufacturing, research, trends, and innovation. Urbanization with ethnography is a key to improve the cultural heritage of bamboo.

3.6. Bamboo for Special Needs

The study to assess the economic feasibility of bamboo plantation and its part as a reinforcement to soil conservation, with implications for reclamation of degraded ravine lands in India suggested that that soil conservation measures of bamboo based were financially and economically viable and effective in similar conditions. The study is based on data collected from a research on mahi ravine system in Gujarat. Experiments were conducted with various bamboo-based interventions. Primary data was recorded regularly of bamboo plantation and different treatments [51]. Structure constructed using cane, timber and mortar, even with lower bound material properties, has some ductility, exceeds the required design capacity both in-plane and out-of-plane and meets life safety performance for high seismicity areas. The technology is also of comparable cost to the alternative blockwork housing yet is considerably more sustainable, is easier to transport to more rural areas, is popular amongst the community, is simple to

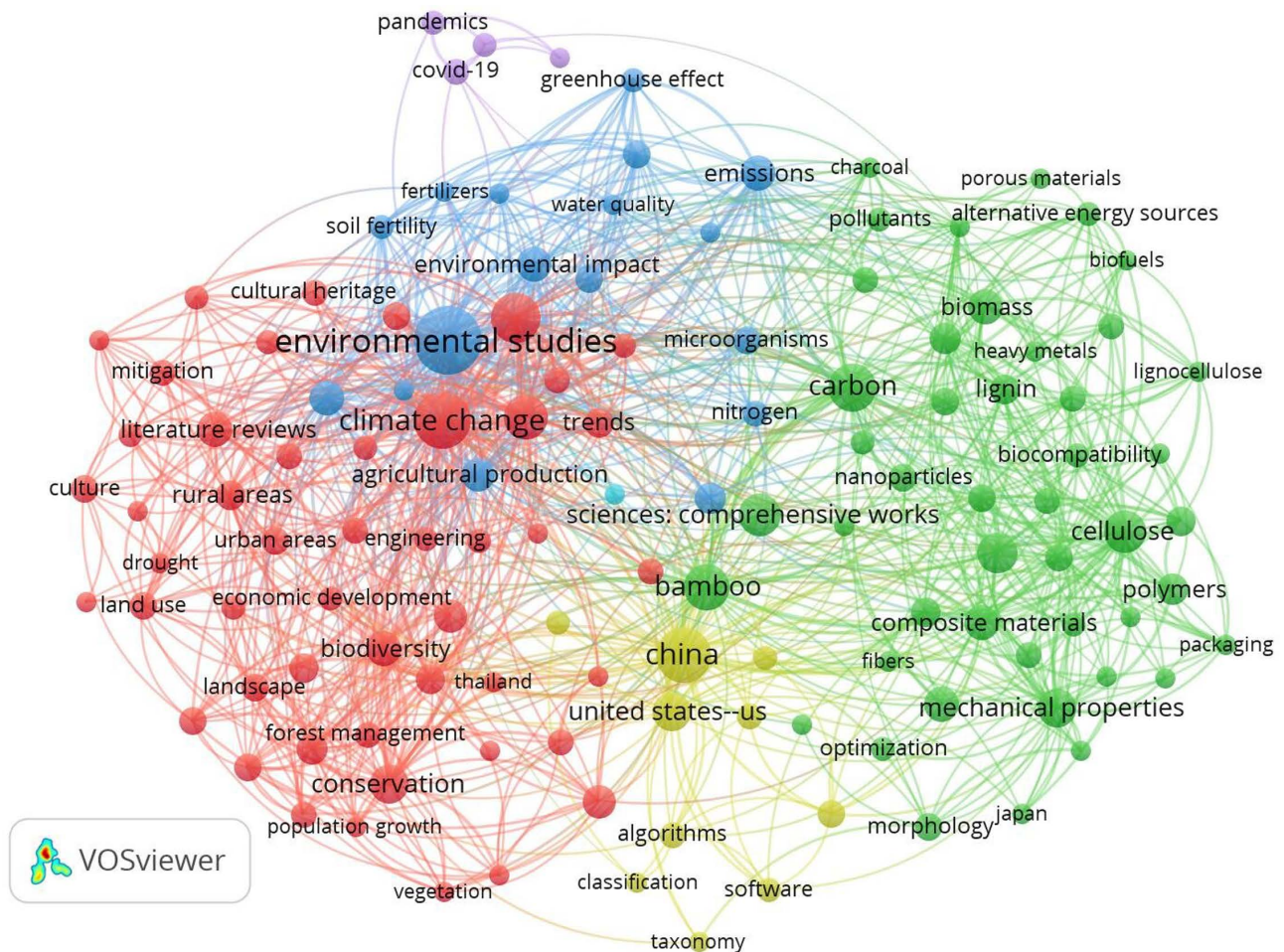


Figure 8. Network visualization of keywords-bamboo for special needs.

vegetation, environmental protection, composite materials, water pollutions, water resources, environmental impact, soil fertility and climate change mitigation have weak linkages. Presence of bamboo has proved to be an aid in climate mitigation, it helps in stopping the processes of soil erosion which helps in land use and keep the land from draught like situations. Biodiversity is again an outcome from the bamboo, it also helps in releasing 35% more oxygen compared to other trees. Bamboo is flexible due to its tensile strength, its porous morphology and its lightweight nature, make it resistant to lateral shocks from earthquakes.

3.7. Marketing of Bamboo Products

Market is the most important aspect in the growth and development of any craft. Bamboo obtained by the craftsmen is processed and made into various products. After the product is finished and is ready for sale, in most villages it is collected at one craftsman's place, which is then sold through different channels in both local and outside markets to consumers directly or through middleman, government and other sources [54].

The potential roles of agroforestry in enhancing domestic bamboo production

and the productivity of different bamboo incorporated agroforestry models are discussed along with potentials for trade in the domestic as well as in international markets. The bamboo products and marketing play multiple roles in the inclusive economic development of the country, especially in the context of the rural populace which dependent heavily on the bamboo resources for their livelihood. The value chain analysis of the bamboo products and consumption also implies that bamboo resources have strong industrial stakes and tremendous potential in pro-poor impact in the development strategies [55]. The study assessed the status of bamboo production in private land, its contribution to socio-economic condition and marketing trend of bamboo culms and bamboo products. No fixed market, no fixed price and no guarantee in sealing the products were found to be the major problems for market development of the bamboo products in the area [56]. The problems in bamboo marketing such as severe fluctuation in daily marketing price, lack of marketing information system, no guarantee of the bamboo crafts, lack of Government policy, lack of institutionalization, strong competition between the craftsmen, surplus availability of plastic-made goods at cheaper price which suppress the use of bamboo crafts mainly in the rural areas due to the lack of institutional development like collection centres or farmers groups and long term vision about marketing networks [57].

The estimated bamboo market is USD 3.6 billion currently. But for the period between 2017 and 2027 the value of the global bamboo market is projected to grow at a compound annual growth rate of 10.6%. With accounted for 65% of all exports China is alone the marked leader with an estimated value of USD 1.2 billion in 2013 [58]. There was a lack of information regarding market of the bamboo products. This paper focuses on economic contribution of bamboo marketing and production in Southern Ethiopia. Survey method is used with the conduct of group decision, multi-stage stratified sampling technique is used to select the sample size and the collected data was analysed by econometric and descriptive statistical method [59]. A survey was conducted to assess the bamboo value chain and explore the market potential of selected bamboo products in Kenya and beyond. The results suggests that despite a lot of economic potential and a larger scope for value addition (employment, income generation and poverty reduction), the bamboo sector, as well as value chains in Kenya, faces a number of constraints. The major constraint in the bamboo value chain is its inability to tap the domestic market. As a result, commercialization of bamboo is confined to limited areas where development agencies are implementing projects [60]. Market analysis of bamboo-based value web in Ethiopia, the largest producer of bamboo in Africa list that producers are restricted by low demand of local products and market for value added goods which are innovative and diverse. Also, dependency on foreign methods and technology has minimal relevance to the environment around [61].

The factual evidence of the study shows that the role of media awareness pro-

grams, price of a product, perceived quality and endorsement of friend's notably influence the decision of buying an eco-friendly product. After buying, there is another behaviour, which is the earlier purchasing experience of the consumer, which affects the consumer decision. This paper discusses about the impact of factors affecting the buying decisions of the consumers while purchasing the environment friendly products. Primary data is collected from the green consumers of Multan by questionnaire and personal interviews [62]. This research work dealt on improving the quality and quantity of bamboo products, increasing the level of comfort of facilities owned-production space, administration space and showroom, increasing marketing networks of partner small and medium enterprise (SME) products for the national level, and improving the function and role of cooperatives in the partner region [63]. This research determined and assessed drivers-barriers to enable the formulation of strategic recommendations aimed at promoting the success of community-based supply of the commodity for the modern bamboo industry in Ngada Regency in Indonesia. The community proceeds from a traditional mindset with regard bamboo resources and utilization but that the community already owned social capital to strengthen and drive modern utilization of bamboo [64].

The global bamboo products market is expected to total US\$ 6.9 Bn in 2022. Growing emphasis on sustainability and plastic waste reduction across the globe is anticipated to drive the market at a healthy 6.1% CAGR, pushing the market size to US\$ 12.4 Bn in 2032. Due to the qualities of bamboo being affordable, easy to harvest and transport bamboo products are emerging as an alternative to timber products in furniture and handicraft. Bamboo being a sustainable product is also preferred in construction of low weight buildings and strong structures [65]. Bamboo craft is destined to benefit the most and to find out how the design principal processes can be exploited for the entrepreneurs in the industry, marketing and sales personnel and the consumer. This research attempts to analyse bamboo product success through I-CAN design process. I-CAN is the acronym for inspiration, conceptualization, adaption and nurture, the four pillars of this design process. Case study has been chosen as research methodology with the combination of participant observation and experimental design [66].

Bibliometric Analysis:

The analysis in **Figure 9** shows that 3 clusters with major occurrence of marketing, bamboo, environmental studies, sustainability connecting with economic development, value chain, culture, product development, supply chain and research development. There are weak links connecting to innovations, consumption, research, small & medium enterprises, forest products and handicrafts. Bamboo sector in India is still majorly unorganized, but a lot of small & medium enterprises are connected with the business of bamboo, so it is run by heavy competition among themselves. Design and Innovation are still lagging behind, there is a need of research & development and supply value chain. Marketing linkages are need to be strategized and well connected in order to enhance the

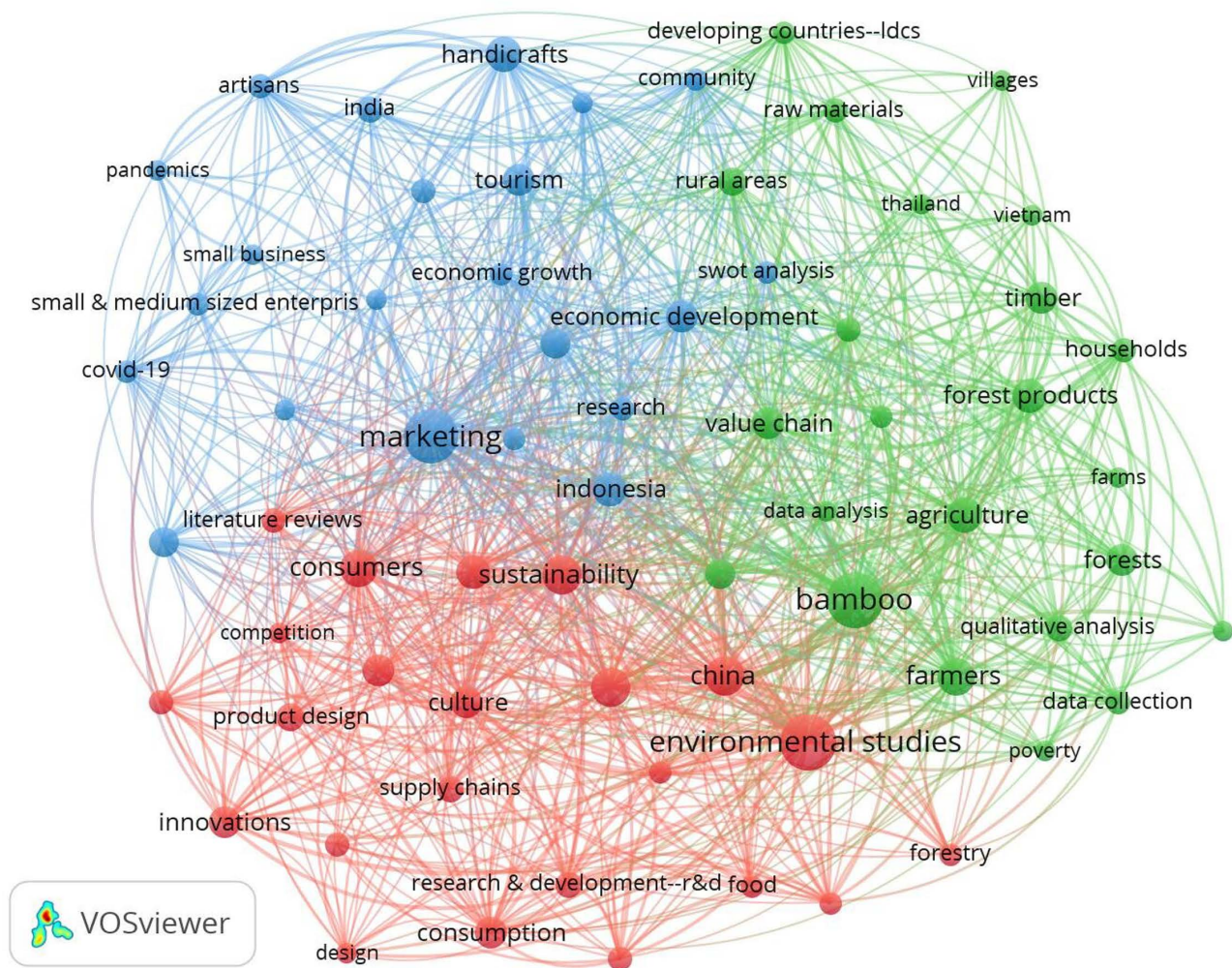


Figure 9. Network visualization of keywords-marketing bamboo products.

current scenario sustainably.

3.8. Bamboo and Sustainability

Bamboo has played an integral role in social, cultural and economic development, especially in Asia. The rural communities adapt this versatile material in order to meet their needs in novel and ingenious ways. Agencies promoting bamboo are of the opinion that with new technical inputs, marketing finesse and a renewed commitment, bamboo could take on the role as the “material of the future” [67]. In order to reduce the harmful impacts of construction on the environment and to achieve sustainability in the industry, three principles emerge: resource efficiency, cost efficiency and design for human adaptation [68]. A sustainable lifestyle requires a change in the social norms, in the design of the infrastructure and goods used in lifestyles [69]. Bamboo has been able to generate revenues to government, develop the communities and it has greatly added to the agricultural economy as this has created an employment and income generation to rural population. The social, economic and environmental study shows

that a scientific, holistic and planned approach to the processing, cultivation and management of bamboo on a sustained basis will make bamboo a sustainable alternative material for infrastructure development [70].

Designing with nature and constructing with bamboo can avoid the waste of non-renewable resources, and it is vital to ensure that the material and the way to use it are sustainable [71]. Environmentally sustainable interior design has become a major issue in practice. There are limited sustainable practices followed in reality especially when choosing materials. Emphasis on bamboo material in interiors, furniture and construction is an aid towards sustainable approach [72]. The concept of sustainability born out of focusing various threats such as global warming, water crisis and so on. Material is one among the most important content in the process of ecological sustainable design and bamboo is one of the best suited sustainable material since ancient times. The current bamboo furniture design field generally lacks of sustainable design consciousness, which also remains in the direct use of traditional bamboo [73]. The consumer awareness towards the use of sustainable products concerning environmental protection is growing and the bamboo market is characterized by intense competition with the presence of several international and local players across different parts of the world [74].

From the perspective of modern design various innovative design processes of bamboo products are suggested including use of advanced manufacturing techniques, current styling and design concepts. So, the environmental value, social and economic value have been re-evaluated in these transformations of ideas and processes. With the depletion of resources, the global world is getting aware of the problems with conventional economic development system and focusing on the direction of sustainable development [75]. Every part of bamboo finds application in various applications, making it appropriate for the development of the circular economy. An overall zero-waste, closed-loop model for bamboo industries can pave the way for sustainable development. There is an immediate need to address the issues of policy implementation or development of bamboo policy regulation on the universal understanding of the industrial perspective of bamboo to boost the country's economy [76]. The study explores woven bamboo wall material production with sustainable architectural principles. The case study method is applied with a qualitative approach [77].

This study identified the ecosystem services offered by bamboo to the local population for their wellbeing. The results showed that bamboo is highly utilized for subsistence purposes in many households in the Western Highlands of Cameroon, with at least 97 bamboo uses and products identified. These uses/products were grouped into 11 sectors/domains making use of bamboo. Agriculture, silviculture, handicrafts, furniture and house construction are the sectors using more bamboo products [78]. The study attempts to explore opportunities for the promotion and development of traditional handicraft of bamboo as tourism products. The methodology involves qualitative and quantitative research with

participant observation and semi-structured interview tools. Results of the study show that there is a demand and potential of the bamboo batik products. There is a need for skill development and marketing strategies for product competitiveness and value addition [79]. Various brands of bamboo are existing in Zhushan Township, Taiwan, China, these brands have explored different types of social innovations through design, management and mechanical knowledge. They are in favour of causes such as preservation of culture, eco-friendly local development, mutually beneficial situations and sustainable lifestyle [80].

A literature review on design for social sustainability for the designers of product-service system discuss about conceptually developing a design for social sustainability in order to highlight the overlooked component, the social sustainability. This concept is specifically focused on designing product-service system. The results suggest disparate knowledge on social design, also operationalizing it by finding gaps and key points [81].

Bibliometric Analysis:

The analysis in **Figure 10** shows that 6 clusters with major occurrence of bamboo, environmental studies, mechanical properties, china, carbon sequestration, biomass, climate change, sustainable development etc. It can also be seen that there are weaker linkages between forests and bio diversities, thermal stability, economic development, sustainable material etc. Bamboo has a very long connection in our life and now sustainability and bamboo can go hand in hand. It helps in carbon sequestration, sustainability management, plantation, soil erosion, water purification, economic development, sustainable development, ecosystem services, wildlife conservation, biodiversity, policies, vegetation, forestation, insulation and more.

Summary of Research Gaps

- 1) India, the second largest producer of bamboo in the world after China, but still import bamboo products and raw materials.
- 2) There are various problems in bamboo products for the urban market, such as varying quality, low production capacity, aesthetics and no standardised classification, structurally and mechanically because of natural difference and variation in stem's form and size marginalised material even with many sustainable attributes.
- 3) Artisans related to the craft are still poor and upliftment of them with the government schemes and initiatives is still at the beginning stage.
- 4) In India bamboo sector is still unorganised, semi-skilled and socio-economically backward, manufacturing process is still heavily relied on experienced workers who can treat and work on bamboo by hand.
- 5) Employment is irregular, social discrimination is there and presence of meaningful wages is lacking.
- 6) Among various remedies of environmental problems, green consumerism is still emerging, farmers and artisans face major problems in selling the bamboo products due to issues like, long market channels, increasing cost of transportation,

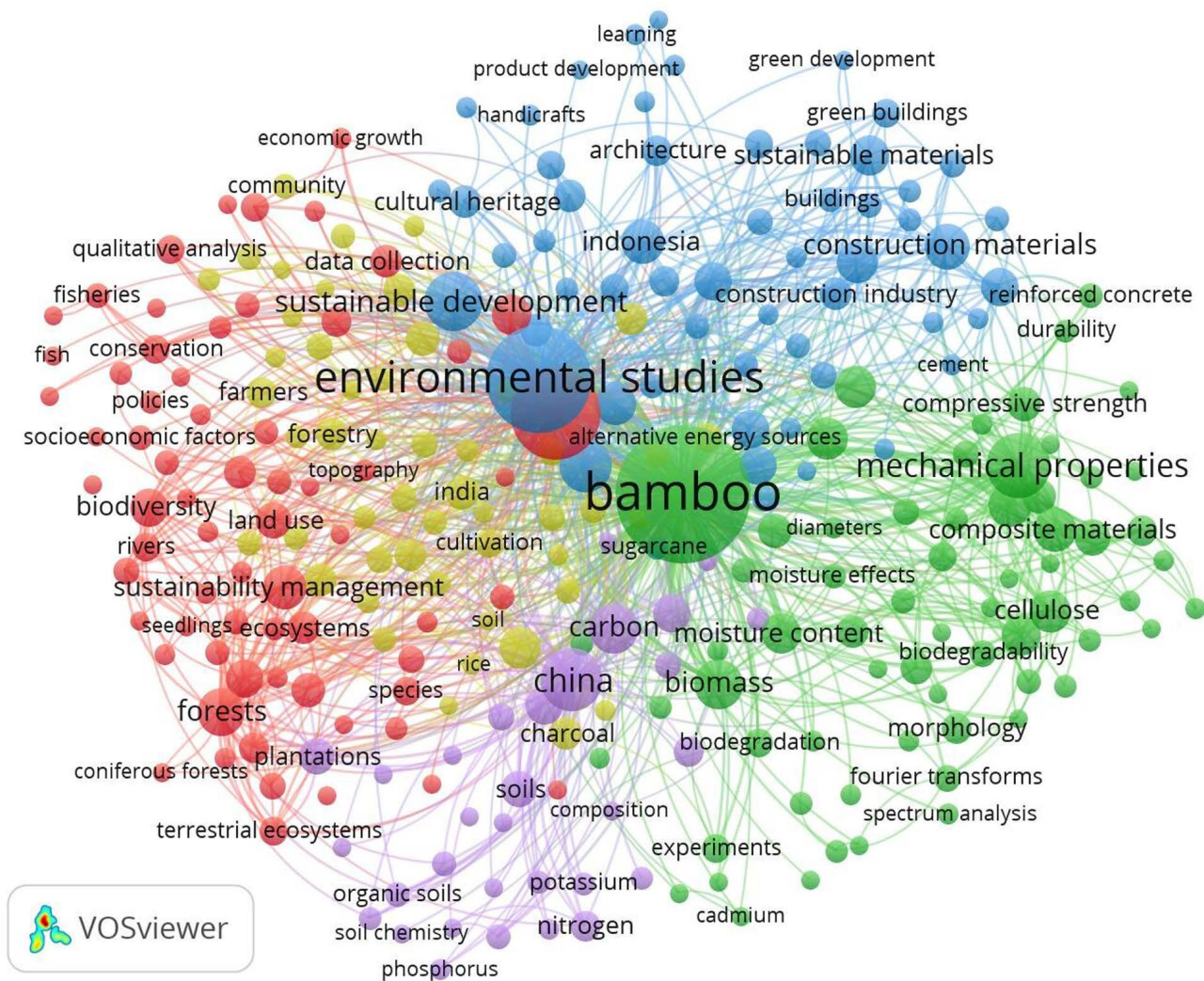


Figure 10. Network visualization of keywords-bamboo & sustainability.

lack of storage facilities and processing units, fluctuation in daily marketing price, lack of marketing information system, no guarantee of bamboo craft, surplus availability of plastic-made goods at cheaper price.

7) At present the original bamboo furniture is simple in shape, single in product category and lack of innovation in design.

8) Environment friendly products are considered high priced, difficult to identify from conventional ones and lacks proper promotions.

9) Bamboos are widely distributed in India but its spread is limited in agro-forestry to home stays, farm boundaries and marginal areas.

10) There is a gap between architects, interior designers and those who want to live in green spaces because of lack of development of sustainable designs. Although sustainability has become a major issue in construction but there are limited practices followed in reality, especially when choosing a material.

11) There is a need to change consumption standards, considering the immense waste of resources caused by unchecked consumption of materials. It in-

volves converting consumption into a conscious act.

4. Research Discussion and Future Directions

4.1. On Sustainable Product Design

There are many species of bamboo available in India, it is the second largest producer of bamboo after China. Bamboo material is natural and biodegradable. Stakeholders have incorporated various green practices from manufacturing to sales to make their products sustainable. There is a lot to learn from the high level of aesthetics and techniques from the bamboo crafts of the Northeast region, which is essential for the future of bamboo design developments. Women artisans are more involved in the bamboo handicraft sector. Millions of rural populations depend upon it, making the bamboo industry an aid towards the uplifting rural economy and gender equality. Waste generation is one of India's biggest problems, and bamboo can help as an alternative biodegradable material. Also, maximum utilization of the material can support the manufacturing process tremendously. Bamboo has various applications, but there is room for development in producing cutting-edge products for urban and western markets. It also has extraordinary qualities that make it a perfect material for serving special needs, such as seismic resistance, UV resistance, and anti-bacterial properties. A few key factors are crucial in the commercialization of the products from consumers' perspective, products' image & development, increasing popularity of certified materials, and production capacity. Companies must implement industrial applications and technology advancements to increase production and address the masses. Durability is one of the significant assets when considering sustainability, maintenance, and seismic resistance. With the upliftment of the sector, brands are also working to improve artisans living conditions by providing development & entrepreneurial training, making them self-sufficient financially and personally. Still, there is a need for initiatives and government policies to enhance their situation.

4.2. On Marketing Strategies

There is a potential for economic development in the bamboo market for value-based products in utility & handicrafts. Also, there is a need to explore the organizational structures to reach their real prospects and Value-chain amplification. The global bamboo products market will be worth US\$ 6.9 billion in 2022. With growing international interest in sustainability and reducing plastic waste, the market is expected to reach a healthy annual growth rate of 6.1%, reaching \$ 12.4 billion by 2032. The IT revolution is impacting the economy globally. The results of it can be seen in this skill-based industry significantly. Stakeholders of bamboo are introducing various green practices in their supply-chain and promoting them to the market. According to INBAR, bamboo is getting global attention from fast developing sectors adopting sustainability, so there is a scope for developing new categories catering exports. For the socio-economic devel-

opment of India, bamboo plays a vital role as the handicraft is among the most significant contributor to the economy, and millions of rural populations depend on the bamboo sector. Still, the industry is much unorganized. Beneficial additions in the value chain and supply chain are crucial. The role of media in awareness programs, perceived quality, and endorsement from friends has a notable impact on purchasing eco-friendly products. There is a need for government policies and norms addressing market support, pricing mechanism, and market intelligence, as marketing knowledge, promotions, and trends are essential to growth. Given its functionality and sustainability, bamboo has been considered helpful for the modern industrial economy. Endorsement of characteristics of bamboo products & spaces as a benefit to health, reduced consumption, sustainable design components, and efficient design is needed.

4.3. On Conscious Consumption

Conscious consumption can only be led by the behavioural changes that defend improving capital and making it more ecological and human-friendly. There is a need to change consumption standards. Considering the harm caused to the environment and society in past years, consumption needs to be converted into “a conscious act”. From satisfying needs to demands, consumption is a social, cultural, and economic activity. Strong connections between interior product consumption and identity or social status influence consumers’ purchasing decisions. Contemporary buyers are affected by the product, brand, and its relationship with the environment and society. Bamboo is a sustainable material with various socio-economic benefits. Strategic leveraging of bamboo can lead to exceptional improvement of rural and tribal livelihoods, empowering women, poverty alleviation, and improving the local environmental conditions & income generation, especially in non-urban areas. The development achieved by the present age will be difficult to maintain in the future. Among various remedies for saving the environment, green consumerism is still at the beginning stage, but green spaces have the potential to alter human behavior apart from energy efficiency. There is a need to re-evaluate the awarded green status of bamboo products. The products, making, their environmental effects linked to the production cycle, and usage needs to be checked for their identification as a green product. Life cycle assessment for end-users in the format of an environmental product declaration, environment labels like LEED, BREEAM, and FSC are gaining practical relevance, and companies are investing in creating value for themselves and their customers.

5. Conclusion

Conscious consumption has impacted the bamboo industry and other sectors in general. Stakeholders are branding their products & company with eco-labels, working for socio-economic and environmental causes, and helping them and their customers to be identified and transparent. The bamboo market is growing,

and lifestyle products can provide the need for sustainable options in handicrafts, utility, and other new categories serving the urban user with the help of suitable marketing strategies. There is a need for specific promotion and branding practices for more conversions, justifying the bamboo products' healthy, cultural and environmental competence.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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