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"ATTAINMENT OF SUSTAINABLE DEVELOPMENT GOALS THROUGH PROMOTION OF BAMBOO BASED INDUSTRIES"

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Abstract :

Bamboo is considered as a low cost raw material which is available in abundance in our country. Bamboo is a renewable source: fastest growing plant as mentioned in the Guinness Book of records which keep on regenerating by itself for more than 75 years even after harvesting. It helps in carbon sequestration by absorbing 5 times more CO2 and oxygenating the environment by producing 35% more oxygen in comparison to other plants**.** Hence Bamboo based industries will be a best substitute for plastic and timber based industries and thus solve the problem of all sorts of pollution i.e. land , air, water as well as deforestation of the forest zones. Commercial Plantation of the recommended bamboo species and better promotion strategies of the bamboo based products will surely lead to the development of various micro, small and medium industries. These labour based industries will create employment opportunities for the major section of the society who are not well educated and are living below the poverty line.
Based on the preliminary results of primary data collection it has been concluded that most of the bamboo based artisans are striving to fulfill their basic livelihood requirements even though bamboo is considered as the best raw materials for producing multiple products. India is the second largest producer of bamboo yet bamboo based sector is underdeveloped in our country.

The research work is based on the literature review and initial primary data collection from respondents who belongs to Gujarat state. Descriptive research design and convenience sampling method has been used.

The objectives of the research work is 1) To study the implementation of sustainable development goals with respect to the role of bamboo plantation and 2) To study social, economic and environmental implications by the promotion of bamboo based industries.

Keywords **- Bamboo, sustainable development goals, eco-friendly, Environment, sustainability.**

1. INTRODUCTION

A sustainable development environment is crucial for the sustainability of the humanity but these days due to all sort of pollution like land, air and water, growing levels of global warming, poverty, hunger, unemployment, deforestation etc the entire biodiversity of our planet has disturbed. The United Nations has framed the set of 17 sustainable goals which are to be strictly attained by the global nations by the end of year 2030. The term "sustainability" has become a necessity to be achieved rather than just choice. The aim of SDGs is to ensure a global world free of hunger, poverty with a conducive environment for survival. These goals also focus on dealing with the climate change issues by adopting green management practices. This research paper tries to answer the attainment of SDGs by highlighting the importance of sustainable bamboo development through an integrated approach to economic and social development by maintaining the natural balance between the biotic and abiotic components of environment.

The United Nations adopted the 2030 agenda for achieving the 17 sustainable development goals for the peace and prosperity of the people around the world. The idea behind these goals is to visualize a future world free of poverty, hunger, gender inequality while protecting the environment through well formulated climate crisis-management strategies.

17 SDGs framed by the United Nation to accomplish by the end of year 2030 are:

- Goal 1. End poverty
- Goal 2. End hunger, achieve food security and promote sustainable agriculture
- Goal 3. Ensure healthy lives and promote well-being
- Goal 4. Ensure quality education and promote lifelong learning opportunities for all
- Goal 5. Achieve gender equality and empower all women and girls
- Goal 6. Ensure sustainable management of water and sanitation for all
- Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
- Goal 8. Promote sustainable economic growth, employment and decent work for all
- Goal 9. Build resilient infrastructure, promote sustainable industrialization and foster innovation
- Goal 10. Reduce inequality within and among countries
- Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
- Goal 12. Ensure sustainable consumption and production patterns
- Goal 13. Take urgent action to combat climate change and its impacts
- Goal 14. Conserve oceans, seas and marine resources for sustainable development
- Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- Goal 16. Promote peace and justice for all
- Goal 17. Strengthen the means of implementation and revitalize the global partnership

How Sustainable Bamboo development will lead to the attainment of most of the SDGs?

This question has been answered by performing the literature review by addressing various problems and challenges faced by the countries and the crucial steps taken up by them in promoting sustainable Bamboo development. According to the INBAR (International Bamboo and Rattan Organisation), bamboo and rattan have unimaginable potentials to combat poverty and environment issues that are the major challenges for most of the global countries. Bamboo plant grows with ease in almost tropical and sub-tropical regions and provides multiple sustainable livelihood options for the poverty stricken communities and maintaining ecological balance. This research paper highlights the important characteristics of bamboo in fulfilling the expectations of these SDGs with respect to socio-economic and environment development of the nations.

2. Review of Literature

This research paper reviews the available literature to come up with the different alternatives to achieve SDGs by harnessing the potentials of Bamboo based applications.

2.1 No Poverty(SDG1), Zero Hunger(SDG2), Good Health and Well Being(SDG3), Quality Education(SDG4), Gender Equality(SDG 5) and Economic Growth(SDG 8):

End poverty in all its forms everywhere: SDG 1 aims at eradication of the poverty of world population living below the currently measure level of $1.90 per day. Poverty is the root cause of hunger (SDG 2) which leads to deteriorated health condition (SDG 3), inaccessibility to basic education (SDG 4) and gender inequality (SDG 4). According to United Nation, Poverty refers to denial of choices and opportunities, a violation of human dignity and lack of basic capacity to participate effectively in society. While according to the World Bank, poverty means deprivation of well being and inability to acquire the basic goods and services necessary for survival with dignity. Some of the remedial measure of Poverty reduction is economic development, population control, better education etc. For economic development various programmes and schemes have been started by the government like SHGs-Bank linkage, NABARD, SIDBI etc and non-government organizations like Microfinance Institutions, NGOs etc to provide financial assistance without deposition of any collateral to these poor people so that they can perform various business activities for income generation. Apart from financial assistance, several technical and skill development courses like PMKVY (Pradhan Mantri Kaushal Vikas Yojana), Skill India Mission, DDU-GKY(Deen Dayal Upadhyay Gram Kaushal Yojana) etc. have been organized by the concerned authorities to improve their entrepreneurial skill and abilities. The development of the Bamboo based MSME sector and encouragement to micro-business activities of poverty-stricken society will help in the accomplishment of the above sustainable goals.

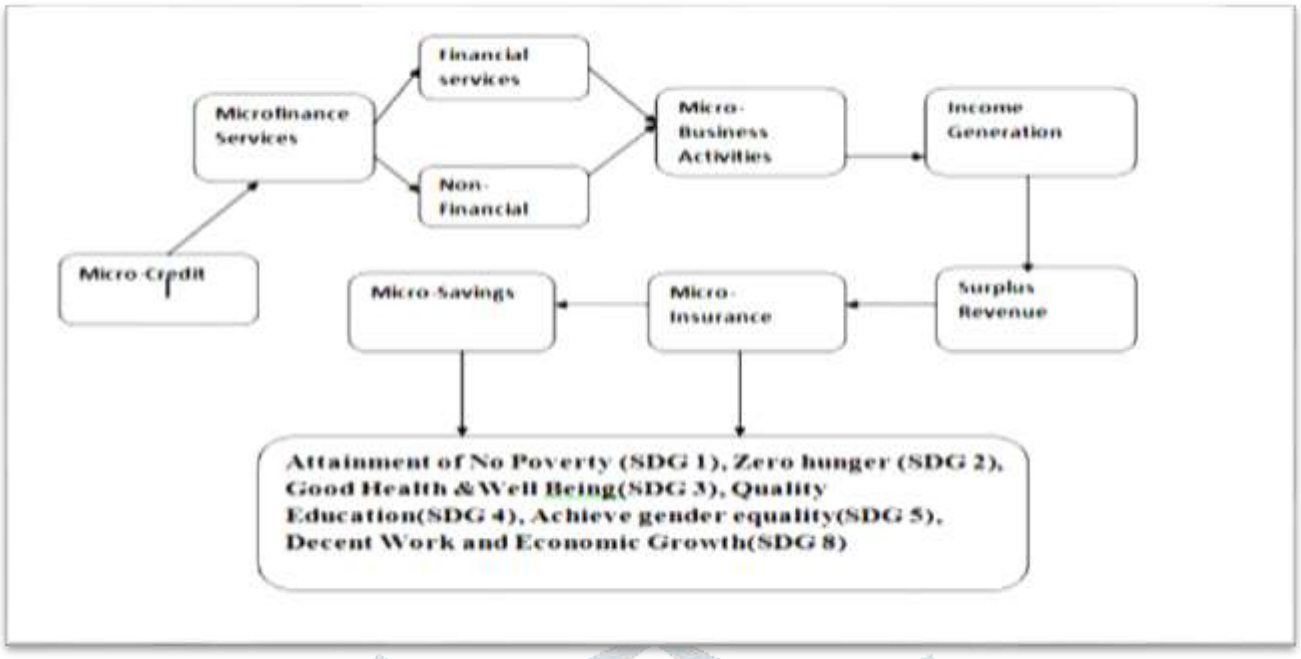

FIGURE 1: (SELF-COMPILED)

(Shekar, Parwez, Patel, & Chandra, 2017) examined the status of microfinance in Gujarat to assess the socio-economic impact of microfinance on local population basically focusing on the SHG members. The finding revealed that there is a significant positive effect of microfinance on the development of sustainable livelihood of the SHGs members. The concept of SHGs movement has created an atmosphere of regular interaction, socialization among members, raised confidence level, active participation in family decision making and improved socio-economic status.

(Panigrahi, 2017)studied the effectiveness of microfinance through Self-Help-Groups (SHGs) for socio-economic development of the rural people particularly in the Boudh district of Odisha. There is a positive relation between microfinance institution and overall economic development of poor people in rural area and it plays an important role for income and savings of people in rural area. It assesses to capacity building support through various social work. It is noticed that all the respondents agreed that micro finance brought courage and self-confidence and improved their skill and self-worthiness. It is found that microfinance improved the literacy level of rural women, raised awareness for children education and consciousness for better environment. Women are economically and socially empowered after joining SHG and getting micro finance as 92 percent of them reported that poverty level reduced by participating in micro finance program.

(Kishore & Jayaram,2018) emphasized on role of microfinance in improving the living Standards of rural poor population of Bangalore rural. The study revealed that there was lack of awareness among the rural population to avail the schemes initiated by the Government. While those who avail the facilities have not utilized the funds optimally for starting new ventures yet they consumed it for their personal use. The collaborative models between banks, NGOs, MFIs and Women's Organizations lead to uplifting the living standard of rural population. Finding showed that there was significant increase in the income of the respondents after they became members of the SHG. There are many challenges faced by the women in doing the business as entrepreneur like lack of capital, networking etc. With the help of micro credit these challenges can be overcome by these people for livelihood support.

(Munish Kapila, 2017) performed the study to assess the contribution of Self-Help Groups to mitigate the poverty through generation of sustainable households' income in rural areas of Ludhiana district, Punjab. In order to cope up with poverty, unemployment and poor progress on various socio economic indicators in India, Government of India has started focusing on the microfinance activities through the formation of SHGs-Bank linkage programmes to promote financial inclusive growth in the rural areas. Different data analysis technique suggests that income of participants of the SHGs, type of occupation, number of earning members in the family and extent of employment has significantly contributed towards the enhancement of households' income of the SHGs members. The study also suggested that capacity building and skill development programmes had led to strengthening of the SHGs.

(Borah, 2015) analyzed the present status of Bamboo based Industries in North East India and examine the future prospects of available Bamboo species in North East India. It was concluded in the study that this "Green Gold" has numerous untapped potentials for the farmers, entrepreneurs, industries and also Government agencies for economic, ecological and social gains. The huge domestic and global demand for bamboo based products will surely going to improve the national income of our country thus increasing the employment opportunities and income generation opportunities.

(Jamatia, 2012) expressed that in India archaic legislation and lack of awareness have inhibited the bamboo based industrialization process. The biggest impediment towards a bamboo based sector from developing has been the irregular and scant supply of bamboo for entrepreneurial use. An efficient regulatory institution is essential for markets to grow in a sustainable manner, especially where environment concerns are coupled with business development. In general, there seemed to be a strong promotional role of a governmental organisation, which would generate awareness on bamboo products, run a nationalized campaign and help develop product market linkage. It has been suggested that National Bamboo Mission should be converted

into a permanent 'Board' for the development of the Bamboo sector in India similar to that of the 'Coffee Board', 'Tea Board' and 'Rubber Board'.

(Wang1, Innes, Dai, & He, 2008) analysed the current state of bamboo forest resources and management and the roles of the bamboo forest industry in social development, economic growth and ecosystem protection in Fujian and Zhejiang Provinces of southern rural areas in China. The study concludes that the Bamboo forest industry has directly or indirectly contributed to more than 20% to their GDP, an increase in the per capita income of farmers generated from bamboo. Thus it suggested that a balanced working-role combination of government, farmer, and local community and NGO support systems is essential for the sustainable management and development of bamboo forests for ecological restoration and rural poverty alleviation. Bamboo forest plays an important role in sustainable forest management and rural development not only in China but also in rest part of the world.

(HOGARTH & BELCHER, 2013) suggested the absolute and relative contributions of bamboo to household income and rural livelihoods for cash generation and subsistence uses. Detailed analysis of the percentage contribution of different income sources to the mean total income for all sample households concluded that bamboo is the single most valuable and important cash income source of the main income categories. This study has therefore suggested that there is much favourable opportunity for a continued and increasing contribution of bamboo resources to rural livelihoods in south china, through an expansion of bamboo plantations and improvements in productivity and utility with continuing favorable management practices, policies and market conditions thus a better solution for poverty reduction efforts.

(Joddar & De, 2019) explained about the sustainability level of women based microenterprises and the effect of such activities on physical and social well being. The study is based on the primary data analysis conducted on 500 households of selected districts of West Bengal in India. In order to measure the sustainability of entrepreneur and enterprises, 6 main attributes have been discussed by the author i.e. (i) entrepreneurial quality, (ii) entrepreneurial ability, (iii) entrepreneurial power,(iv)entrepreneurial trait, (v) capability to start an enterprise and (vi) competency of the enterprise. This study showed a visible change in the women's active involvement in microenterprises that had resulted in increased income for livelihood, better problem solving capabilities, decision making power and physically well being at the household level. Rural microenterprises need to be strengthened by the access to external financial support as well as provision of high quality of non financial services such as management skills, business training for sustainability of entrepreneurship, monitoring and evaluation of enterprise and limit of expansion.

(Jayasree Datta1, 2016) conducted the study in Sepahijala and West Tripura district on 80 respondents in order to understand the intricacies associated with the bamboo handicrafts and to know about entrepreneurial behaviour of rural women of Tripura. The study concluded that to promote women entrepreneurship and improve their socio-economic condition adequate institutional, financial support should be given by the Government for sustainable livelihood besides the development of infrastructure on marketing. They have measured the dependent variable i.e. entrepreneurial behaviour in terms of nine dimensions viz. innovativeness, achievement motivation, decision making ability, risk orientation, co-coordinating ability, planning ability, information seeking behavior and self confidence. The most significant aspect of the findings is that it clearly reflected two important behavioural aspects of enterprise: one is the financial aspect which is considered to be the life and blood of an enterprise and another is the accumulation of knowledge/ information part based upon which the survival of the enterprise largely depends.

(Phimmachanh, Ying, & Beckline, 2015) concluded that Bamboo cultivation, management and marketing have generated a good income and better livelihood for the rural communities. This paper has been divided into three parts with the first part looking at the biophysical and ecological description of bamboo, the second section explores about the probable importance of bamboo as a non-timber forest product (NTFP) with important economic and development potentials and in the third section, it has highlighted the implications of bamboo to the rural agricultural economy and in rural poverty alleviation. They have suggested that still globally there is lack of understanding about the Bamboo value chain and this requires involvement of stakeholders, governments and rural communities to bridge these knowledge gaps which would certainly help us to get out of the poverty trap.

(Selvam, 2016) analysed and tried to find the possible means and ways to improve the socio economic condition of unorganized Bamboo handicraft workers at Vishamangalam. It explained the correlation among social, economical and environmental developmental and welfare status of unorganised Bamboo handicraft workers. It elaborates the social condition such as legal identity, memberships, health problems and their habits; economic condition such as living house, possession of house, irrigative land, facilities, income, work availability, savings and loans and environmental conditions such as experience, working area, working hours and satisfaction of the bamboo handicraft workers. The study also suggests for the NGO and government organizations to come forward for ameliorating the distress conditions of bamboo workers to handle their issues like poor health, unhygienic work environment, lack of education, socio-economic problems and skill upgradation for welfare and developmental activities.

(Chatterjee, DuttaGupta, & Upadhyay, 2017) investigated the impediments of the business sustainability of the microenterprises and they also proposed a framework of social sustainability of women micro entrepreneurs in India. The findings suggested that economic, political, demographic factors along with family contribution are the important factors in determining the sustainability and success of microenterprises. The study concluded that microenterprises run by the self-help groups (SHGs) are contributing towards women empowerment by overall personality development of the rural women.

(Ferdousi, 2015) measured the effectiveness of microenterprise loans on increasing entrepreneurs' incomes and innovation. Findings revealed that a competitor with a existing business model can increase income by about 33% while a competitor with an innovative business model can increase income by about 70%, which is more than double when innovation is present. Further analysis showed that micro entrepreneurs not only face the financial obstacles but also they lack business skills and knowledge regarding market, technologies and other information required for the sustainable development of their businesses.

(Bhusare & Chanda, 2017) highlighted the reach of microfinance institutions and their impact on the customers and the channels used by these firms for the effectiveness of Micro Finance and Microcredit schemes. It can be concluded that the self-help groups contribute substantially by raising the income level as well as improving the living standards of the rural population. Most of the MFI's agree towards the importance of Client savings, low interest rates, group peer pressure, access to future loans, regular monitoring by program members and careful application screening as important factors for loan repayment. Most of the respondents agree that borrowing from MFI's help them to reduce costs by buying in bulk and increase the amount of money they spent on inputs. Most of the respondents agree that they were impacted positively after the MFI's support in the form of business related training, leadership experience and optimal use of money.

(Venkatesh, 2019) studied the performance of self help groups and evaluated the effectiveness of SHGs in socio-economic empowerment of women in Bengaluru District. The result shows that after joining the SHGs the member's income has increased considerably. The main purpose of savings of the members is for the children education and marriage purpose. Socio economic status of the respondents has increased in the form of family recognition, literacy and education on becoming members of SHGs. The study suggested that group activity needs to be encouraged in the interest of building up of strong SHGs. The training for the members is essential to successfully run the SHGs. Skill development of women will enable them to take up the enterprises and thereby contribute more to their family income. The government should make budgetary allocation for training of the SHGs members.

(K.R.Suprabha, 2014) aimed at exploring the relative importance of various determinants of empowerment and then constructing a consolidated empowerment index of SHGs based on the level of institutional and financial performance of the SHGs of different promoters under research. The research suggested that the micro finance can be an effective strategic instrument for poverty alleviation only if it is used for the sole purpose of income generation and microenterprise development. Since the members of SHGs belong to the poor and weaker sections of the society, the prospect and survival of SHGs ultimately depends on their sincere efforts towards microenterprise development for generating income to improve the standard of living of its members. Based on the findings of the field study and interaction with the SHGs, promoting agencies, and other parties concerned, it is recommended that the promoting agencies such as NGOs should be encouraged more to play as facilitators rather than financiers and vertical market integration strategy is required to market-link SHGs products.

2.2 Clean Water and Sanitation(SDG 6), Affordable and Clean Energy(SDG 7), Responsible consumption and production (SDG 12), Life on Land(SDG 15) and Climate Action(SDG 13) :

These goals ensure availability and sustainable water management, access to affordable, reliable energy, sustainable consumption and production patterns for everyone. It laid emphasis on monitoring, controlling and taking urgent preventive remedial actions to combat climate change and its impacts. SDG 15 goal urges for the protection, restoration and promotion of sustainable use of terrestrial ecosystems, forests management, combat deforestation and desertification and reverse land degradation and subside the biodiversity loss. Bamboo plant has numerous astonishing features which prove it to be the best way to accomplish the mentioned SDGs (Sustainable Development Goals). Bamboo belongs to the grass family Poaceae and is considered to be the fastest growing plants in the world which designate it as the perfect solution for deforestation, carbon sequestration and climate change mitigation. Bamboo is a multi-utility fastest growing plant in the world which requires bare minimum one time initial investment for plantation and replenish by itself for more than 70 years even after being harvested again and again until the flowering of the bamboo plant which leads to the ultimate death. Plantation of Bamboo helps in the purification of environment by absorbing 5 times more carbon dioxide and producing about 35% more oxygen than that of the other hardwood trees .Thus it is helpful in the reduction of green house gases, controlling pollution levels and thus monitoring the global warming.

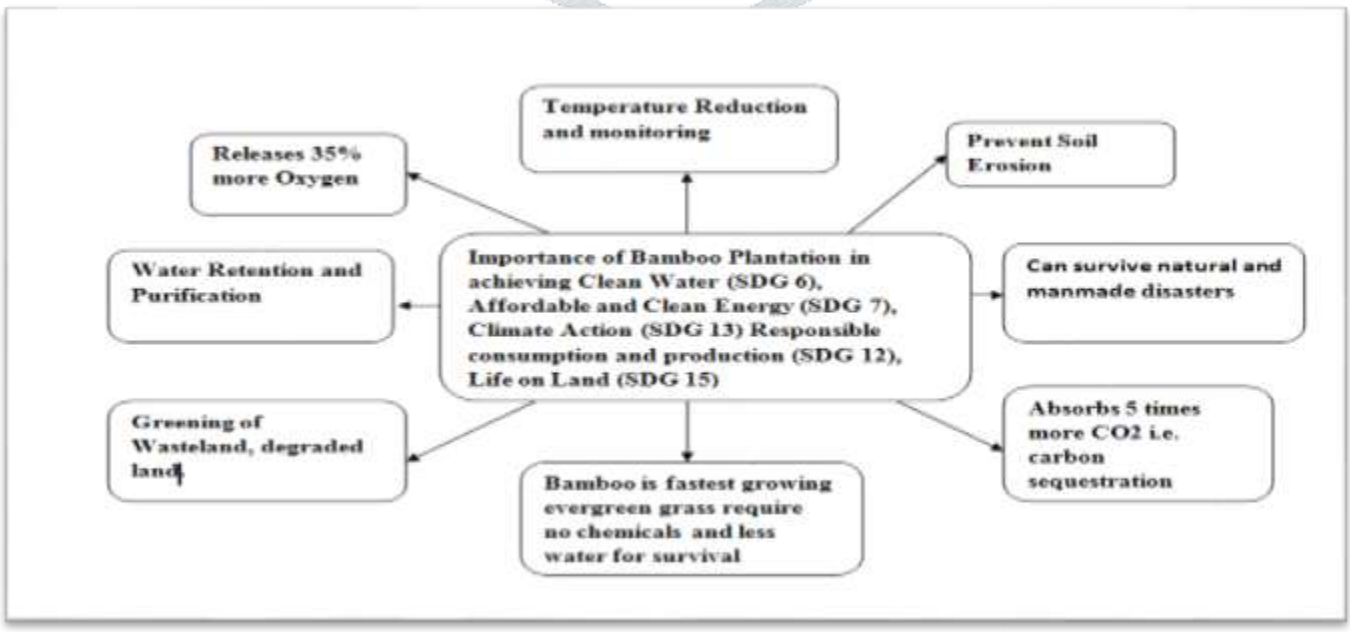

Figure 2: (Self-Compiled)

(Tewari, Negi, & Kaushal, 2019)suggested that the growing demand for timber can be managed by encouraging bamboo plantation because of their unique properties like fast growing, widely present, renewable and versatile resource. The study has suggested that lack of awareness, limited choice of species and non-availability of quality planting stock, lack of database, lack of genetically improved species and transport restrictions are some of the obstacles in the development of bamboo sector. The drawbacks can be taken care by understanding the bamboo value chain, policy framework for leasing degraded ravine lands and liberalization of ceiling limits/restrictions. Capacity building, adequate information base for policy and management decisions for its conservation and cultivation are need of an hour. Current market demand and supply gap accentuates the actions for the active promotion of bamboo cultivation and expansion of area under cultivation by developing promising agroforestry models.

(Dwivedi, Kumar, Baredar, & Prakash, 2019) studied about the 'two fold potential' of Bamboo in improving financial conditions of farmers by utilization of cultivable wasteland and helping in climate change mitigation by afforestation, and carbon sequestration. Bamboo provides fresh opportunities to entrepreneurs due to the unlimited possibilities of new applications of bamboo. More research and industrial investment are required to develop new bamboo products and improve the quality and life of existing products like bamboo laminates and bamboo tiles etc. Concerted efforts by policymakers, agricultural research institutes and nonprofit organizations are required to achieve the true potential of this magical plant. Farmers can earn upto 800 USD per hectare annually by selling raw bamboo from their degraded land. Bamboo cultivation can generate around 10 CERs per hectare annually, which can be traded as carbon credits. Additionally, under-employed farmers can work as skilled workers in bamboo handicraft industry and can earn upto 2700 USD annually at current exchange rates, which is significantly higher than the present average income (1750 USD/annum) of farmers.

(Patel, Gami, & Patel, 2017) suggested that for Indian economic growth, it is required to promote bioenergy projects in linkages with social forestry and bamboo farming through innovative financing mechanisms and developing national carbon sink target enabling India to add its green density. Its ability to grow on nutrient-poor soils, little requirement of silvicultural management, easy and cost-effective harvesting, vegetative propagation, fast growth and a host of other desirable characteristics like(i) high biomass yield (ii) versatile and diverse uses, (iii) not susceptible for common seasonal changes, (iv) does not fall under forest law for harvesting and cultivation at large scale, (v) absorb more carbon dioxide (CO2), (vi) produce more oxygen (O2) and (vii) shallow root structure suitable for soil micro-flora and capable of improving soil ecosystem makes it more suitable candidate for commercial plantation. Large-scale captive bamboo plantation of Bambusa balcooa in 120 acre land was initiated in July 2010 at Rameshwar kampa village, District Aravali, North Gujarat. Within three years, 120 acres of marginal land was converted in man-made forest. Therefore, through bamboo plantation project, several socio-economic and environmental benefits can be achieved by creating job opportunities from farming, micro-business, bioenergy and greenhouse gas emission reduction, reducing import of fossil fuels and bamboo sticks, and thereby raising the GDP figures of the country.

(Anusriti Basumatary, 2015) suggested the biological characteristics of the bamboo which have played a crucial role in improving the future prospects of North East with respect to the food security, economic prosperity and ecological security. Bamboo is an evergreen and versatile fastest growing plant which is a precious gift to the mankind and enriches the socio-economic condition of the North-east dwellers. Bamboo helps in mitigating the erosion of biodiversity, climate change, dietary deficiencies and insecure economy by providing employment opportunities to different sections of the community. Keeping the above points in mind the author recommended for the mass plantation of Bamboo in North-east areas.

(Pandea, et al., 2012) recommended bamboo plantation for productive and protective utilization of degraded wastelands lands. Economic analysis has been carried out using data from three major ravine systems, viz. Mahi, Chambal and Yamuna to examine economic viability of plantation under different soil conditions. The analysis has suggested a cash outflow ranging from Rs 30,550/ha to Rs 48,000/ha from the 7th year onwards to individual stakeholders in the region. The study has suggested that high cost of establishment may be met through financial incentives to the group/ village community through the land base policy schemes of central and state governments like MGNREGA etc. Bamboo plantation for productive and protective utilization of such degraded lands is not only a profitable option for local stakeholders but also an economically viable policy option for funding agencies and government and non-government agencies.

2.3 Sustainable cities and communities(SDG11) and Industry ,Innovation and Infrastructure(SDG9):

SDG 11 refers to construction of sustainable cities and human settlements while SDG 9 refers to building resilient infrastructure, promotion of inclusive and sustainable industrialization and to foster innovation. Due to light weight and high strength -to-weight ratio, Bamboo is recommended to be the best constructing material for making suspension-bridges, cottages etc. It can be used as a building material, for scaffolding purpose, in paper and pulp industries, for making handicrafts, as cookware utensils, have medicinal properties, as an edible food, considered to be a good substitute of wood and plastic products and many more.

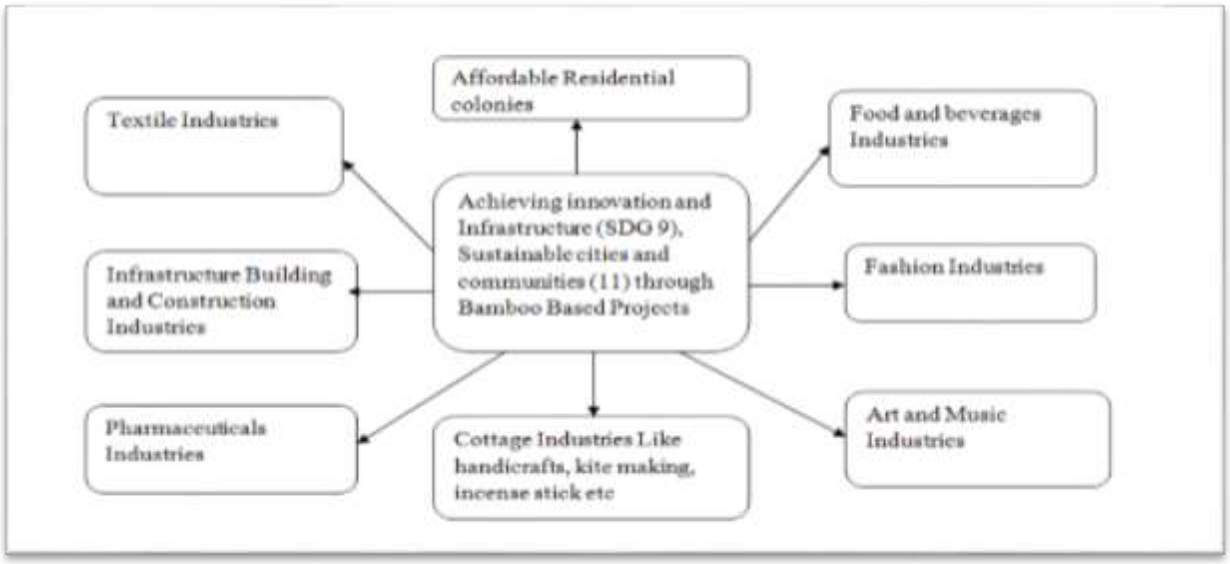

FIGURE 3: (SELF-COMPILED)

(Akwada & Akinlabi, 2016) studied the economic, social and environmental assessment of Bamboo for the infrastructure development in Africa. The study presented the SWOT analysis which presented a planned, scientific and holistic approach to the cultivation, processing and management of bamboo on a sustained basis. This approach will make bamboo a sustainable alternative material for infrastructure development and hence it will play a significant role in the restoration and rejuvenation of rural and national economies. Bamboo is a rapidly growing perennial crop with multiple application which can attain maturity during a short-cycled harvesting of 3 to 5 years, requires only basic tools and techniques, thus making it best alternative for soft and hardwood in the wood and timber industries for community based development. Bamboo groves and forests can provide sustainable source of revenues as well as important ecological services including carbon sequestration.

(Mitra & Agrawal, 2010) conducted a market survey at West Bengal to understand the demand for bamboo artifacts in the local and wider markets and also formulated a sustainable business strategy for marketing of the bamboo based product and services. The study concluded that producers should be more aware of the recent trends, fashions and quality control in functional and financial matters as well as in business culture. They should come up with new initiatives for marketing and advertising products. The study revealed that the involvement of communities other than traditional communities help to diversify the bamboo based sector and will surely attract the young generation towards this profession. Findings suggest that for the survival and growth of the bamboo sector, it is much needed to incorporate modernization, innovative product designs, new technological modifications and marketing efforts.

(Yasin & Priyanto, 2018) analyzed the mechanical properties of bamboo in terms of the mechanical strength and stiffness of bamboo as a wood substitute construction material. Bamboo as a wood substitute material that is environmentally friendly, strength and stiffness needs further research. One hectare of bamboo plant can absorb more than 12 tons of carbon dioxide in free air. Bamboo as an environmentally friendly and renewable material, can influence the effects of global warming, maintain the sustainability of the green environment and make the earth a comfortable and friendly place for human life. Bamboo forests have a big influence in reducing the impact of global warming and climate change. Bamboo can be used as an environmental friendly material and reduce the use of wood as a construction material. Bamboo plants have the ability to cope with natural disasters and their significant ability to absorb carbon in the air gives the future a comfortable and healthy atmosphere.

(Majumdar, ShivaJi, & Banerjee, 2017) designed the research work to understand the perception of the urban consumers, their preferences and buying trends in furniture. It also tries to understand the Bamboo products value chain from manufacturing till the ultimate distribution to the market. The results shows that consumer finds the Bamboo product to be “Beautiful/Aesthetic”, “Eco-Friendly”, “Light-weight”, “Homely” and “Strong” while some of the unfavourable comments includes being “Obsolete”, “Not durable”, “Not strong” and “Prone to Termite Infestation”. The author suggested focusing on conducting proper training and skill development modules and ICT sessions organised by the government authorities for the rural craftsman to understand the changing market scenario and the use of online marketing for global accessibility of their products for higher profitable business.

(Datta K. , 2016) identified and assessed the problems of bamboo handicraft industry in Jalpaiguri Sadar Block, to present a detailed analysis of the socioeconomic profile of the artisans, and finally to suggest strategies to improve the condition of the industry. The findings suggest that though there is sufficient supply of bamboos to the bamboo artisans in Jalpaiguri district, but they need a continuous training so that they can use the new sophisticated tools to improve the quality of the product, and moreover they can learn how the product can be diversified into various essential and decorative items and finally market linkages to sell their bamboo products to the end users.

(Manjunath & Rao, 2015) presented the efforts made by Center for Green Building Materials and Technology, Bangalore to find and establish the link between the Demand and Supply of Bamboo and its products, and ensure Bamboo its rightful and respectful place with other modern materials in its contribution towards an Integrated Sustainable Development of Bamboo based communities and the bamboo sector in the world. Bamboo has immense potential to become the vehicle of Integrated Sustainable Development for most of the marginalized bamboo based communities of the world, who are generally treated as untouchables, through sensitively designed and customized structure for skill development and up gradation programs for various levels. The

opportunity to leverage Bamboo as a cost effective, environment friendly and as an emerging alternate in various industries; offers plausibility to generate interest and propagate involvement right from the state of cultivation to the various desired end products. This sector has concentrated knowledge, initial skills and financing capabilities that needs to be effectively explored which call for immediate profitable and sustainable alliances amongst all stakeholders i.e. government, institutions, organizations, cultivators, artisans, various industries and ultimately the end user. Such support and alliances will bring a Bamboo Revolution - The Green Gold Revolution in the lives of the rural and tribal population and surely the bamboo sector will become one of the key economy drivers of the global economy.

(Kaur, Pant, & Kaushik, 2019) presented the information regarding the basic features and properties highlighting the economical and ecological importance of bamboo species to formulate the strategies for specific utilization of these species making it the best multi-utility profitable raw material. Some of the unique characteristics of Bamboo are faster growth rate, high tensile and compressive strength, and low weight to high height ratio. It is considered to be the "Material of Future" which grows effortlessly with numerous species available across the world and a suitable alternative for wood, metal, steel and plastic etc. with wider applications.

(Yoo, Divita, & Kim, 2013) identified the various factors influencing bamboo textile and apparel purchase intentions. The mechanism of bamboo product purchase decisions in relation to consumer environmental awareness (i.e. perceived consumer effectiveness, environmental concern and clothing environmental attitudes) has been used as the measurement criteria. The results that environmental consumer awareness found out to be the significant factor in determining bamboo textile and apparel purchase intentions. Consumers should be informed that bamboo consumption provides social and economic benefits as well as greater environmental benefits.

3. Need/importance of the study

This research paper highlights the importance of bamboo plantation and promotion of bamboo sector to accomplish 13 out of 17 sustainable development goals enlisted by the United Nation. Bamboo is considered to be a low cost, easily available eco-friendly raw material for manufacturing various durable and biodegradable user-friendly products. The study also mentions the problems and challenges faced by the bamboo artisans of Gujarat for their sustainable livelihood.

4. Objectives

1: To study sustainable development goals with respect to the role of bamboo plantation in attaining these goals.
2. To study the social, economic and environmental implications by the promotion of bamboo based industries.

5. Research Methodology

Sampling Design
It is based on the literature review and initial primary data collection from respondents who belongs to Gujarat state. About 75 respondents belonging to Gujarat state have been interviewed to understand their problems and challenges faced by them in carrying out the bamboo-based micro-business activities. Descriptive research design and convenience sampling method has been used.

Methods of Data Collection
For primary data collection, bamboo based artisans have been contacted through telephonic interview, visiting to exhibitions, field survey etc for filling up the structured questionnaire. Secondary data has been gathered from different authorized websites of United Nations, World Bank, INBAR, National Bamboo mission etc.

Research Tools
Descriptive studies have been performed to understand the problems and challenges faced by the bamboo based artisans for sustainable livelihood.

6. Limitation & Scope of the Study:

The study captures the response of different bamboo based artisans who belongs to Gujarat state only. The research paper tries to find out the ways of attaining sustainable development goals framed by the United Nation by adopting Sustainable Bamboo Development. There are numerous unique features of bamboo which presents wide scope for unexplored research areas in the field of research and development. Thus various organizations of different states of our country can perform similar studies for the efficient and effective utilization of Bamboo based sector.

7. Conclusion

Bamboo is considered as a low cost raw material which is available in abundance in our country. Bamboo is a renewable source: fastest growing plant as mentioned in the Guinness Book of records which keep on regenerating by itself for more than 75 years even after harvesting. It helps in carbon sequestration by absorbing 5 times more CO2 and oxygenating the environment by producing 35% more oxygen in comparison to other plants which caters to the fulfillment of (SDG-13) climate change and (SDG-15) life on land goals**.** Hence Bamboo based industries (SDG -9) will be a best substitute for plastic and timber based industries generating employment opportunities(SDG-8) to combat poverty (SDG-1), hunger (SDG-2), health issues (SDG-3), education (SDG-4), gender inequality (SDG 5) and thus solving the problem of all sorts of pollution i.e. land , air, water (SDG-6) as well as deforestation of the forest zones. Commercial Plantation of the recommended bamboo species and better promotion, innovation and infrastructure (SDG-9) strategies of the bamboo based products will surely lead to the emergence of various micro, small and medium industries. Since ages and even today due to high tensile strength, durability, light in weight, bamboo is used for

constructing magnificent architectural buildings, bridges etc. These labour intensive bamboo-based industries will create employment opportunities for the major section of the society which is not well educated and living below the poverty line.

8. FINDINGS AND SUGGESTIONS

Based on the preliminary results of primary data collection it has been found that most of the bamboo based artisans are striving to fulfill their basic livelihood requirements even though bamboo is considered as the best raw materials for producing multiple products. India is the second largest producer of bamboo yet bamboo based sector is underdeveloped in our country. Due to low demand for bamboo products, high competition with respect to available substitutes, lack of online and offline media involvement and underdeveloped marketing, most of the bamboo based artisans expressed their unwillingness to continue their profession. Lack of skill and technical knowledge, use of traditional tools and unawareness about the recent marketing trends, such people have not upgraded their knowledge and that is why they won't be able to earn expected profit margin for their products in the market. Still they continue to produce traditional bamboo based products from the knowledge what they have inherited from their ancestors. They require financial support, technical and skill development trainings, marketing assistance from the concerned authorities to earn reasonable income which would help them for sustainable livelihood to come out of poverty. There should be well planned strategies formulated by the concerned government as well as non-government organizations for understanding the value chain analysis from producer to the manufacturer level for promoting commercial availability of these high quality bamboo-based products until it reaches to the end-user.

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