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## **Sustainable Development of Cane and Bamboo Industry of Assam: Its Strength, Challenges and Prospects.**

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### **ABSTRACT**

Cane and Bamboo are the “Green Gold of Forest” because of its utilization in almost all important aspects of the rural world. Hence, cane and bamboo are accepted as a material of sustainable development worldwide. Cane and bamboo industry is a very good example of sustainable industries and development. The paper examines the knowledge of Sustainable Development Goals among the entrepreneurs and its implementation in their enterprises. The purpose of the paper is to find out the benefits of adopting sustainable development practices in cane and bamboo industry and support needed to boost sustainable development. The paper also explores the challenges faced by the entrepreneurs and the prospects of mitigation of those challenges.

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### **Introduction: -**

Cane and Bamboo is prevalently known as the “Green Gold” of 21<sup>st</sup> century as it is environment friendly, widely available and sustainable. Since, ancient time’s bamboo played a significant role in human civilization, known for rapid growth, flowering and superior physical and mechanical properties (Hung and Wu, 2010). Cane and bamboo are the fastest growing plants that mature early as compared to other plants. *Phyllostachys Bambusoides* native to China and Japan, *Dendrocalamus Aspernativus* native to



Southeast Asia are bamboo species that grow up to 91 cm per day (Guinness World Records, 2007). Bamboos belong to the family of grass known as Poaceae. It grows in warm to tropical weather around the world. There are 1642 known species, 88 genera and it grows up to 30 cm in diameter and 35 meters tall. Certain species of bamboo have wood like nature which can be used as furniture, building materials, source of paper, packaging and fabric (International Bamboo and Rattan Organization, 2022). Bamboo forest is spread over 35 million hectares worldwide, which is nearly 1% of total forest area in the world (Food and Agriculture Organization, 2021). Around 900 species and 65 genera are found in Asia-Pacific with about 65% of bamboo resources found in Asia (INBAR, 2022). Cane also known as Rattan belongs to the family of Palmae. It grows in wetlands of tropical and sub-tropical rainforest of Australia, India, Southeast Asia, West Africa and the Pacific. There are 631 known species and it grows up to 30 meters tall and has a diameter of 1 to 5 cm. Malaysia with 100 species of cane and Indonesia with 200 species of cane are considered center of cane resources (INBAR, 2022).

### **Review of Literature**

The related literature provided insight into the various aspects of the problem defined for the study. The studies have been undertaken by scholars on aspects like problems and prospects, growth and development, policies and dimensions of sustainable development. As per the nature and scope of these studies, only the major works that have bearing on the entrepreneurship and sustainable development of cane and bamboo industry were reviewed.

Mitra (1998) has conducted a study on environment and sustainable development. It is observed from the study that the knowledge and experience of local people have to be preserved and utilized towards achievement of sustainable development goals. In hilly state like Arunachal Pradesh sustainable development can be achieved by developing tourism industry, handloom industry, food processing industry, cane and bamboo industry rather than developing un-sustainable industries which leads in deforestation and over exploitation of forest resources.

Abrahamsson (2006) has evolved of the term “Sustainopreneurship” by merging entrepreneurship with ecological development. The concept of sustainopreneurship has emerged from sustainability entrepreneurship, ecopreneurship and social entrepreneurship to solve problems related to issues of sustainability. According to him the features of sustainable entrepreneurship are social responsibility, competitiveness, progressiveness, knowledge creation and usage, innovativeness and dynamism.

Gupta and Kumar (2008) proposed that utilization of bamboo in construction industry will contribute in sustainable development and protection of environment. Along with social and cultural



growth bamboo industry has potential of sustainable development. The entrepreneurs in bamboo industry are able to develop themselves with the help of central government and state government schemes and sale their products in other countries.

Handique (2014) has proposed that cane and bamboo industry of Assam can be developed by improving the infrastructure facility and government policies that give financial support and skill development training. In urban areas of Assam cane and bamboo craft is an important sector for income generation which consists of cane and bamboo furniture, decorative items etc.

Shah (2018) conducted a study on sustainable entrepreneurship and ecopreneurship and found that most interviewed entrepreneurs had little formal work experience. Very few of the entrepreneurs are selling their products with the help of intermediaries outside the state. The artisans of Tripura have used new innovative technology to improve their products and maintaining sustainable entrepreneurial practices.

As per the research of Apostolopoulous, et al. (2018) entrepreneurship plays an important role in achievement of sustainable development goals. With the help of entrepreneurship social, economic and environmental challenges can be tackled in local as well as global level. Use of innovative and new technologies to produce new products in developing countries will led towards elimination of unemployment. With the help of this research the policy makers and entrepreneurs can facilitate the use of entrepreneurial activity towards achievement of sustainable development goals.

According to Goh, et al. (2019) the countries where weather is hot and humid the bamboos are attacked by fungi which lead to degradation. Therefore treatment of bamboo is must to improve the durability of bamboo. The treatment generally eliminates the sugar and carbohydrate which attract fungi and insect but the treatment is insufficient for bamboo used in construction.

Sawarkar, et al. (2020) conducted a study on 27 commercial species of bamboo in India. In this study the area of application, turn over, export and support from state and central government were determined. It is found that India has bamboo forest more than China which is of great advantage and can export bamboo product all over the world but the bamboo entrepreneurs have to focus on products that have more demand in international market. Therefore with the help of sustainable development there is enormous opportunity for the bamboo entrepreneurs to expand their market in all over the world.

Therefore, it should be noted that the sustainable use of resources is essential to eliminate further degradation of the environment. The above cited reviews of literature have concentrated in one part or another area of sustainable development and cane & bamboo industry. No comprehensive study



has been carried out in the state of Assam on sustainable development of cane and bamboo entrepreneurs of Assam.

An Overview: -

India is the second major bamboo producing country after China with 1,54,670 sq km which covers 13% of India's total forest area. India covers 75 genera and 136 species spread over an area of 8.9 million hectares. Bamboo grows naturally all over the country except in extremely cold climate like Kashmir and Ladakh and extremely hot climate like western parts of Rajasthan (India State of Forest Report, 2023). About 50 percent of bamboo resources are found in Northeastern part of India followed by Eastern and Western Ghats, remaining bamboo resources are found in Indo-Gangetic plains and Andaman and Nicobar Island (Logu A, 2014). Indian species of bamboo outmatch other Indian trees. It is known to be an essential and superior raw material form durable and sturdy furniture, construction components, ornaments and novelty items. Bamboo seems to suit these needs as wood lumber does not have as much strength and properties as that of bamboo (Langhelle, 1999). In India, due to commercial and environmental importance, the bamboo forest area increased by 3,229 sq.km in 2019 as compared to 2017 but in 2021 there was a decline of 10,594sqkm in bamboo bearing area compared to 2019 and again in 2023 bamboo forest area increased by 5,227 sq km as compared to 2021. It shows a positive growth in area that is 7.07% and in production that is 128.94% of bamboo resources in India (ISFR, 2023).

In the context of North East India, According to India State Forest Resource 2017 of Forest survey of India, The North Eastern states of India are home to approx 90 species of bamboo. 28% of land area is covered by bamboo in India out of which 66% of total bamboo produced in India is from the Northeast region. According to ISFR, 2021 Arunachal Pradesh has the highest bamboo bearing area with 15,739 square kilometer followed by Assam with 10,659 sq. km. and Manipur with 8,377 sq.km. Bamboo bearing forest in Assam is approximately 0.895 million Hector or 5.7% of total bamboo forest. In case of culms the number is 2452 million which is 8.7% of total number of culms of the country making it 14.9 million tones or 8% of the country's total green bamboo weight (ISFR, 2017). Cane and bamboo industry in this region is indulged on generation of employment, empowerment of women and alleviation of poverty in rural areas. The artisans of north eastern region of India are blessed with techniques and designs of cane and bamboo handicraft products. Over the last few years entrepreneurs are performing excellent role in creating opportunities of employment for unemployed youth and training them with skills which enhances their confidence and self dependence (Shah 2018).

Cane and bamboo industry in Assam plays a vital role towards socio-economic development of the state which can contribute employment and employability in the modern society. The government



aims to fully utilize the potential of small, tiny, micro and medium enterprises like cane and bamboo industry for fostering industrialization to end poverty, gender inequality and sustainable source of livelihood (Assam Vision Document, 2016). Bamboo is found in abundance in the districts of Cachar, Karbi Anglong, Kamrup, Nagaon, Lakhimpur and Goalpara. The total number of bamboo species found in Assam is 34 but only few species are used by artisans that are *Bambusa Balcooa* (Bhaluka), *Bambusa Tulda* (Jati), *Bambusa Palida* (Bijuli), *Dendrocalamus Hamiltonii* (Kako), *Melocana bacifera* (Muli) etc (SBDA, 2023). According to the study conducted by the Rain Forest Research Institute (RFRI) Jorhat 2020, artisans sell 68% of their bamboo products directly in markets, 20.48% to middlemen and rest through other means. As per commerce and employment generation department, the bamboo sector in Assam has huge potential but the disadvantage is that the sector is unorganized. The RFRI 2020, Jorhat has identified that the major bamboo markets are in Barpeta, Biswanath Chariali, Bongaigaon, Dhubri, Diphu, Dhemaji, Goalpara, Golaghat, Guwahati, Haflong, Hailakandi, Jorhat, Karimganj, Lakhimpur, Nagoan, Nalbari, Silchar, Tinsukia and Tezpur (RFRI, 2020). The skill development centers such as Bamboo Technology Park, North East Cane and Bamboo Development Council and Rain Forest Research Institute helps to enhance the quality of the products and efficiency of artisans.

Thus, keeping this in view, the study aims to fulfill the following objectives and hypothesis:-

**Objectives:**

1. To review the existing scenario of Cane and Bamboo Industry.
2. To study the challenges and prospects of entrepreneurs in Cane and Bamboo Industry.

**Hypothesis:**

1. There is a gap between performance of Cane and Bamboo Industry and Sustainable development practices of entrepreneurs.

**Research Methodology:**

The research design is descriptive in nature and results are based on primary and secondary data. The study was conducted on entrepreneurs of Cane and Bamboo Industry based in Nalbari and Barpeta Districts of Assam. The study has a sample of 432 respondents. The respondents were selected based on non probability convenience sampling. Primary data were collected with the help of structured schedule. The secondary data were collected from published documents such as thesis, journals, research papers and books related to sustainable development and cane and bamboo industry. The reports of Indian State Forest Resource, Rain Forest Research Institute, NITI Aayog, State bamboo and cane policy, District Industry & Commerce Centre, India vision document of sustainable development, Assam vision document of sustainable development, State bamboo mission, National bamboo mission etc. were



analyzed. The schedule consists of 48 questions based on cane and bamboo industry and sustainable development. Paired t-test and Pearson Correlation is used for meaningful analysis and interpretation of data collected. The study was conducted in Nalbari and Barpeta Districts of Assam only hence the results may vary if the area of study is broadened.

### **Analysis and Discussion:**

In the survey, the respondents are entrepreneurs. 40% of the respondents are in between 30 to 39 years of age. 51% of the respondents have 7 to 10 years of experience whereas 36% fall in the 3-6 years category, while only 11% have above 11 years of experience. The sample represents a male dominated group. This highlights a gender gap in entrepreneurial participations and suggests support programs to encourage women to participate in entrepreneurship. All respondents had participated in training programs offered under District Industry & Commerce Centre or Indian Institute of Entrepreneurship. The findings indicate that all participants considered the training useful with a majority (61%) reporting that it was highly beneficial. None of the respondents indicated dissatisfaction with the training that strongly supports the efficacy of the program. It is observed that 84.5% of the selected enterprises have sole proprietorship as their form of business organisation, while 15.5% have partnership as form of business organisation. None of the respondent has private limited company as form of business organisation. Every respondent depends on their own capital as a primary source of finding, while Public Sector Banks are a significant financing option. Regional Rural Banks play a pivotal role with 92% of respondents availing them indicating strong dependence on localized banking institutions. The finding indicates that entrepreneurs predominantly depend on owners' capital and RRBs. The study indicates that 84% of the enterprises from the Barpeta and Nalbari districts have received government subsidies in schemes under DI&CC, MSME etc. The study reveals that, manufacturing of decorative products (75%) are most popular among the entrepreneurs followed by furniture (52%) and trays/baskets/bags (48%) indicating strong market presence in home décor categories. Jewellery and toys/musical instruments occupy niche segments. 37% of the respondents manufacture straw, incense sticks, mats, toothbrush, curtains etc which comes under the category "others". decorative products are most demanded with 68% followed by furniture with 43%, suggesting a strong market for functional yet stylish products due to its aesthetic appeal. Products which are under "others" category such as Dhara, Straw, Incense sticks, Toothbrush, Curtains etc are in moderate demand with 28%. The data on export reveals of only 26% of the selected enterprise export their products in Nepal, Bhutan, UAE, Thailand etc. During the field visit it was found that some of the products are exported indirectly through agencies. It was observed that entrepreneurs are not aware of the



process of export and are reluctant to go through the documentation procedure of availing export import registration licence.

H<sub>0</sub> – There is no significant difference in sales before and after implementing Sustainable Development Goals.

H<sub>1</sub> - There is significant difference in sales before and after implementing Sustainable Development Goals.

**Table 1: Sales from enterprise before and after implementing SDG**

Paired T-Test									
		Mean	N	Std. Deviation	Std. Error Mean				
Pair 1	Sales from enterprise before implementing SDG	3.54	432	.720	.035				
	Sales from enterprise after implementing SDG	4.04	432	.871	.042				
Paired Samples Correlations									
		N	Correlation	Sig.					
Pair 1	Sales from enterprise before implementing SDG & Sales from enterprise after implementing SDG	432	.493	.000					
Paired Samples Test									
		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Sales from enterprise before implementing SDG - Sales from enterprise after implementing SDG	-.502	.812	.039	-.579	-.426	-12.862	431	.000

Source – Field Survey



The paired t-test result indicates a statistically significant improvement in sales performance after implementing Sustainable Development Goals within the enterprise. The mean sales increased from **3.54** (Standard Deviation 0.720) before SDG implementation to **4.04** (Standard Deviation 0.871) after implementation. The standard errors 0.035 before and 0.042 after indicate precise estimates of the mean values. The test signifies that adaptation of sustainable development goals had a meaningful and uniform impact on sales performance that is 14% increase of sales after implementation of SDGs. The paired sample correlation indicates positive relationship ( $r = 0.493, p < 0.001$ ) between sales performance before and after implementing sustainable development goals in the enterprise. The paired t-test indicates highly significant difference in sales before and after implementing sustainable development goals. The paired t-value of -12.862, degree of freedom 431 and  $p < 0.001$  implies that Null Hypothesis is rejected at 5% level of significance and statistically significant difference in sales before and after implementing sustainable development goals is found. The results, when considered alongside moderate correlation between pre and post SDG sales, signify that increase of 14% of sales represents a practically significant enhancement, likely corresponding to substantial revenue increases.

$H_0$  – There is no significant difference in profit before and after implementing Sustainable Development Goals.

$H_1$  - There is significant difference in profit before and after implementing Sustainable Development Goals.

**Table 2: Profit from the enterprise before and after implementing SDG**

Paired T-Test					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Profit from the enterprise before implementing SDG	2.97	432	.759	.037
	Profit from the enterprise after implementing SDG	3.21	432	.856	.041
Paired Samples Correlations					
		N	Correlation	Sig.	



Pair 1	Profit from the enterprise before implementing SDG & Profit from the enterprise after implementing SDG	432		.463		.000			
<b>Paired Samples Test</b>									
		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Profit from the enterprise before implementing SDG - Profit from the enterprise after implementing SDG	-.241	.841	.040	-.320	-.161	-5.948	431	.000

Source – Field Survey

The paired t-test result indicates a statistically significant rise in profitability after implementing Sustainable Development Goals within the enterprise. The mean profit increased from **2.97** (Standard Deviation 0.759) before SDG implementation to **3.21** (Standard Deviation 0.856) after implementation. The standard errors 0.037 before and 0.041 after indicate precise estimates of the mean values. The test signifies that adaptation of sustainable development goals had a meaningful and uniform impact on profitability that is 8% increase of profit after implementation of SDGs. The paired sample correlation indicates positive relationship ( $r = 0.463$ ,  $p < 0.001$ ) between profitability before and after implementing sustainable development goals in the enterprise. The paired t-test indicates highly significant difference in profit before and after implementing sustainable development goals. The paired t-value of -5.948, degree of freedom 431 and  $p < 0.001$  implies that Null Hypothesis is rejected at 5% level of significance and statistically significant difference in profit before and after implementing sustainable development goals is found. The results, when considered alongside moderate correlation between pre and post SDG profitability, signify that increase of 8% of profit represents a practically significant enhancement, likely corresponding to substantial revenue increases.

$H_0$  – There is no significant correlation between performance of cane and bamboo industry and adopting sustainable development practices.

$H_1$  - There is significant positive correlation between performance of cane and bamboo industry and adopting sustainable development practices.

**Table 3: Performance of the enterprise post implementation of sustainable development goals**

<b>Correlations</b>						
		Growth is good	Profitability is good	Employees attrition rate is high	Prompt payment of suppliers due	Prompt payment from customers
Growth is good	Pearson Correlation	1	.998**	.939**	.929**	.929**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	432	432	432	432	432
Profitability is good	Pearson Correlation	.998**	1	.942**	.931**	.931**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	432	432	432	432	432
Employees attrition rate is high	Pearson Correlation	.939**	.942**	1	.981**	.981**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	432	432	432	432	432
Prompt payment of suppliers due	Pearson Correlation	.929**	.931**	.981**	1	1.000**
	Sig. (2-tailed)	.000	.000	.000		.000

	N	432	432	432	432	432
Prompt payment from customers	Pearson Correlation	.929**	.931**	.981**	1.000**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	432	432	432	432	432
**. Correlation is significant at the 0.01 level (2-tailed).						

Source – Field Survey

The Pearson correlation matrix signifies strong and statistically significant positive relationships among the factors namely growth, profitability, employee attrition rate and prompt payment behaviors within the cane and bamboo industry. Growth and profitability show an almost perfect correlation of 0.998, indicating a close alignment in enterprise expansion and financial gains. The employee attrition rate also correlates strongly with both growth and profitability ( $r = 0.94$ ). Additionally, prompt payment to suppliers and from customers indicates strong positive correlations with growth and profitability ( $r = 0.93$ ), highlighting sound financial practices in sustainable performance. The findings challenge the null hypothesis ( $H_0$ ): *There is no significant correlation between the performance of the cane and bamboo industry and adopting sustainable development practices*. Given the strength and significance of the correlations observed, the null hypothesis is rejected, indicating that sustainable development practices are indeed significantly associated with improved industry performance.

Major Findings and Recommendation: -

1. Cane and Bamboo is an integral part of livelihood for the people of Assam and is an important resource in socio economic context. The eco friendly and sustainable product made of cane and bamboo has a great potential in employment generation, production as well as export opportunities.
2. Sustainable development on the other hand demands that enterprises should reduce all sorts of waste and switch to renewable resources as well as adopt clean and environmentally sound technologies for its operations. According to the survey, the demographic factors such as form of



the business, years of experience and skills acquired by the entrepreneurs and the artisans play an important role in development of the enterprises in a sustainable way.

3. It was found that cane and bamboo furniture and decorative items are most demanded product and a few of these products are exported as well. However, entrepreneurs face problems related to skilled artisans as most of the artisans are not formally trained and face difficulties in operating machinery equipments which are used in manufacturing cane and bamboo products. Most of the entrepreneurs are facing problem in getting subsidized loan due to complex procedure and high requirements.
4. As per the survey, majority of the entrepreneurs have the knowledge about Sustainable Development goals, but they have connected sustainable development only with environmental sustainability. Only few of the entrepreneurs have knowledge about economic and social sustainability. Majority of the entrepreneurs feel that the benefit of adopting sustainable development practices in cane and bamboo industry will increase in use of environmentally sound technology and also generate employment among the youth of Assam. The entrepreneurs believe that methods of production will improve after implementing the goals due to the use of improved technology. They also believe that sustainable development goals will reduce the impact of business on natural resources. The adaptation of energy efficient technology and development of sustainable product and services will help MSMEs of Assam to fulfill the sustainable development goals.
5. However, Cane and bamboo industry require support to boost sustainable development which can be achieved by uniform government policies and financial literacy among entrepreneurs as well as their link with global bodies so that they can sell their product overseas.

**Recommendation:**

1. Waste management is a major concern in cane and bamboo industry as it generates lot of waste. Efforts should be to use resources efficiently and wastage generated should be recycled.
2. The challenges in implementing sustainable development practices in Assam are lack of awareness about opportunities and access available financial resources. Implementation of sustainable development practices requires significant financial investments. Government has to incentivize through subsidies and by mandating quotes or statutory requirements in public procurements. The measures to reduce the challenges are providing knowledge on financial schemes and resources.



3. The government has to incentivize the industry to invest in sustainable development practices, promote development oriented policies for productive activities, decent job creation, entrepreneurship and growth of MSME's, promote inclusive and sustainable industrialization by upgrading basic infrastructure and adoption of clean and environmentally sound technologies.
4. The measures government of Assam should adopt for ensuring sustainable development of cane and bamboo industry are use of cane and bamboo instead of hardwood where possible, use for energy related activities, use of bamboo as alternative construction material. With the help of certification, brand image / marketing and government recognition the entrepreneurs of cane and bamboo industry will be benefited after adopting sustainable development practices.
5. Furthermore, to encourage adaptation of sustainable practices in cane and bamboo industry, financial incentives, capacity building training, certification and branding, policy and regulatory support may be provided.

**Conclusion:**

Thus, to conclude, the sustainable development of the state depends upon the optimum utilization of renewable resources. Cane and bamboo industries are helpful in reduction of poverty through entrepreneurship development. The present study is an attempt to discuss the relationship between sustainable development and cane and bamboo industry. The process of enabling sustainable livelihood through entrepreneurial activities in cane and bamboo industry are helping skilled artisans to find suitable jobs which in return contributes to economic development of the state and generation of employment. However, the problem related to marketing of the product, export of the product and availability of finance are still faced by the entrepreneurs. To overcome these problems proper planning and strategy is required by the government and the non government organizations in the areas with up-gradation of technology, product design and development, marketing strategy, export etc.

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