

Research Article

Bamboo: A Source of Multiple Uses for Adoption as an Alternative Livelihood in Odisha, India

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ABSTRACT

Despite becoming one of the most valuable resources, the role of bamboo in livelihoods and rural development is poorly understood. The present study documents the indigenous utilization pattern of bamboo (*Bambusa vulgaris* Schrad ex Wendl.) and its significance in the social, cultural and religious life of the people of Bhadrak district, Odisha, India. An exploratory assessment was made from 71 informants through field surveys, literature consultations and key informant interviews. Plant parts such as culms are used for various purposes including construction, handicraft, fencing, musical instruments, as well as in rituals and ceremonies. Leaves are mostly used as fodder. This plant has been instrumental for indigenous people by providing them substantial livelihood through their own indigenous wisdom, from collection to the processing of products. Proper training with modern technology, financial assistance to develop infrastructure, as well as proper marketing of products will encourage more earning opportunities among rural people of the said district.

Keywords: *Bambusa vulgaris*, Bhadrak district, indigenous knowledge, phytoresources, rituals.

Introduction

Communities around the world possess knowledge, based on centuries of experience, adapted to their environment and communicated from one generation to another. This knowledge manifests in various forms and is acquiring greater significance in the present-day context. The use of plant resources through indigenous knowledge of local people represents the foundation for human societies (Alcorn, 1995). Since ancient times,

phytoresources have been used to support human existence and development, and the collection and utilization of plant resources have played a key role in promoting human civilization and economic development. Bamboo is one such plant resource that has been linked with mankind for ages and has been an indispensable part of almost every civilization (Atanda, 2015). Bamboos is botanically considered a group of tall arborescent, perennial, evergreen, woody grass in the family Poaceae (Goyal et al., 2013). It is dominant in tropical and subtropical regions, especially in eastern and southern Asia, and South and Central America (Jiang et al., 2007; Lobovikov, 2007). The World Checklist of Bamboos and Rattans describes a total of 1,642 bamboo species belonging to 123 genera worldwide (Vorontsova et al., 2016). India supports about 136 bamboo species under 23 genera, which are found naturally and under cultivation, or both (Hore, 1998; Basumatary et al., 2017; FSI, 2017). Bamboo is extensively grown in diverse geographic, soil and climatic conditions of Madhya Pradesh, Maharashtra, Arunachal Pradesh, Telengana, Andhra Pradesh, Manipur, Karnataka, Assam, Chhattisgarh and Odisha. (Garbyal et al., 2008; Shukla & Joshi, 2000). *Dendrocalamus strictus* (Roxb.) Nees is the most widely distributed species and predominantly found in dry deciduous forests all over India. *D. sikkimensis* Gamble ex Oliv. is abundant in eastern India. *Bambusa bambos* (L.) Voss [Syn. *Bambusa arundinacea* (Retz) Willd.] is pantropical and flourishes in the moist mixed deciduous forests of Odisha, West Bengal, Assam, and in all states of Deccan.

In Odisha, there are 13 bamboo species, among which five are common. *Dendrocalamus stricus* (Salia) and *Bambusa bambos* (L.) Voss [Syn. *Bambusa arundinacea* (Retz) Willd.] (Kantabaunsa) are predominant in forests. *Bambusa vulgaris* Schrad ex Wendl. (Badi baunsa or Golden bamboo), *B. nutans* Wall. ex Murno (Sundar kani), and *B. tulda* Roxb. (Balangi), are mostly encountered in village areas (Bansal, 2016). *Bambusa vulgaris* is the preferred species for planting in homestead lands either in pure stands or mixed with other plants. Although bamboos have played essential roles for both subsistence and emerging economies through commercial products, many of which are profoundly linked in local cultures, scientific studies on this grass species are sporadic in India (Ghosh, 2008; Singh, 2008; Bhandari et al., 2015; Basumatary et al., 2017; Sharma et al., 2018; Chaurasia, 2019; Shukla & Joshi, 2020). In Odisha, it is not properly looked into (Bansal, 2016) and reports from Bhadrak district are still lacking. Hence this study was carried out in Bhadrak district of Odisha, India, to document the multifarious uses of thorn-less bamboo (*Bambusa vulgaris* Schrad ex Wendl.) and attempts to assess its significant role for artisans as a supplement to livelihood support.

Methodology

Study site

Bhadrak district (20° 43'–21° 13' N and 86° 6'–87° E) is located in northeast Odisha and covers an area of 2,505 km², with a population of 1.507 million (2011 Census). It borders the Balasore district in the north, Jajpur in the south, Bay of Bengal and Kendrapara district in the east and Koenjhar in the west (**Figure 1**). The district has 1,311 villages with schedule caste population of 334,896 (22.23%) (Census, 2011). The district accounts for 1.61% of the state's territory and shares 3.62% of the state's population. The climate of the district is warm and humid. The maximum and minimum temperatures range from 37.4°C to 17.7°C, respectively, and the annual average rainfall is approximately 1,428mm (Anonymous, 2019), of which about 71% occurs in the monsoon season. The varying intensities of cyclones, drought and flood are the characteristics of the district.

Data collection

The method employed in this study was designed with the purpose of providing baseline information on the traditional use of *Bambusa vulgaris* in the local system, through literature surveys and field visits to various areas (seven blocks of the district i.e., Basudevpur, Bhadrak, Bhandaripokhari, Bonth, Chandbali, Dhamnagar and Tihidi) from 2018 to 2020 in Bhadrak district, Odisha, India. Several field investigations were conducted using ethnobotanical methods (Martin, 1995). Documentation of the community indigenous knowledge system of bamboo artifacts was done through informant interviews, unstructured questionnaires, and direct observations. Specific questions asked during the field study include a) use of bamboo in day-to-day life, b) traditional craft of bamboo and c) socio-cultural significance of bamboo. A total of 71 artisans (44 male and 27 female) with an age group range of between 35–80 years were interviewed (**Table1**). Detailed information with reference to species used, areas and mode of collection, time spent for collection of the raw material, and general condition (poor, good, better) of the resource at the site were recorded. An inventory of different bamboo products, their local names, and their uses were also noted. The quantity of raw material used for making different products, designs used, time taken for making these items, and mode of selling of the product were also investigated. Discussions were held with the artisans to get their perception and views about possible ways and means for bamboo resource management and conservation, the demand and supply status of the resource, and the community demand for the products. In addition to records, personal observations were made on uses, and social and religious rituals were attended to study the actual uses of bamboo or its products. Visits to local

markets were undertaken to gather information on bamboo and bamboo products sold.

Results and Discussion

The link between plant and human societies has resulted in several uses of plants that were developed through trial and error as well as by the imaginative minds of indigenous people the world over (Albuquerque et al., 2009; Dahlberg & Trygger, 2009). Plant diversity and associated traditional knowledge have been emphasized since the Rio Convention on Biological Diversity (CBD, 1992). The ethnic communities of India produce a wide range of products using available raw materials with indigenous processing methods. Correspondingly, bamboo multifarious products and uses by the people of Bhadrak district are one such typical use of the plant. In the present study, some areas of application of bamboo (*Bambusa vulgaris*) are depicted in **Table 2** and **Figures 2-5**. The culms and leaves were the most used plant part (**Figure 2a**). To harvest bamboo, a thick cast iron knife was used. Then it was split into half, the diaphragm removed, and strips of any width or thickness served to prepare a variety of products, used, and traded by rural artisans. The majority of permanent houses in the region are largely constructed out of bamboo. Bamboo is used to make all parts of the house from structural walls and columns to woven roofs to doors and windows (**Figure 2b and c**). In the studied area, bamboo was used in combination with other natural materials like wood and clay. Various authors affirm that bamboo is a suitable material for use in housing (Basumatary et al., 2015; Nurdiah, 2016; Selvan & Tripathi, 2017; Jose et al., 2021). According to villagers, houses constructed using bamboo as raw material are comfortable in hot and humid climates. This study shows that bamboo is used for building schools, shops, shelters for livestock, poultry farms, foot-bridges, scaffolding, as staircase and winnowing of sand during construction work (**Figure 2d-i**). It is also used for diverse purposes such as transportation, fencing of crop fields and homestead land, support to creeper plants, walking sticks, in afforestation programmes, ladder, incense sticks and many others as represented in **Figure 2j-o and 3a-h**. Bamboo, as a multi-facet substance, is widely used in several parts of the world (Borah, 2008; Liese et al., 2015; Ede et al., 2018; Panda et al. 2018; Chaurasia, 2019; Daramola et al., 2019).

The bamboo artisans at the study site are mostly Scheduled Castes and Scheduled Tribes, and economically backward. A majority are either daily wage labourers or marginal farmers, and making handicraft is their secondary occupation. The matured culms were used by artisans (**Figure 3i and j**) to make

a variety of handicraft products including small-baskets for sowing rice, big-baskets for fodder collection and carrying manure, winnowing trays (winnowing food grains), round-basket for winnowing of parched paddy colloquially called *mudhi* and *khai*, small-baskets with a handle for the offering of fruits and flowers to deities during different festivals, hand fans and many others as depicted in **Figure 3k-o** and **4a-j**. The present result substantiates the findings of Patel (2005), Singh (2008), Teron & Borthakur (2012), Darabant et al. (2016), Maulana et al. (2017), Sharma et al. (2018) and Nongkynrih et al. (2019). In our study, leaves were widely used as fodder for domestic animals. Bhandari et al. (2015) and Bhardwaj et al. (2018) opined that the leaves of *Bambusa vulgaris* can be exploited as forage, to reduce fodder scarcity and feed ruminants and meet their nutritional requirements. In the present investigation, bamboo was used for the preparation of various types of fishing devices (**Figure 4k-o**). The present result corroborates the findings of Niyonkuru & Lalèyè (2010) and Nath et al. (2015). In addition to fishing crafts and gears, bamboo was also used for the traditional fish drying process (**Figure 5a-b**). The utilization of bamboo for the fish drying process is also reported elsewhere (Sharma et al., 2013; Jhakar 2020).

The flute, a bamboo-made musical instrument is widely used in the study area (**Figure 5c**). The use of bamboo for preparing folk musical instruments is also reported (Patel, 2005; Cottingham, 2014; Kang et al., 2017; Liana et al., 2017). Additionally, another bamboo-made musical instrument locally called *kendara* was also used by a particular group of people in the district (**Figure 5d**). It was observed that dry leaves, dead and distorted culms in the clump, and branches were used as fuel for cooking. Previous studies suggest that bamboo can provide an alternative renewable energy source for cooking (Singh, 2008; Lucas, 2013; Hossain et al., 2015). The current investigation recorded the utilization of bamboo for various traditional socio-religious purposes, for instance, in the Raja festival, preparation of cottage for Jangnya, Hindu marriage rituals and Dola Purnima (**Figure 5e-h**). The present result draws support from the studies of Deb (2015). It is noteworthy to mention that in Hindu religious beliefs and socio-cultural practices, in the villages in India as well as in the Bhadrak district, a dead body is placed on a bier made of bamboo poles and carried on the shoulders of close male relatives to the funeral ground. In the current study, the young shoot (branch) was used as a tooth stick. The present result is similar to the findings of Vasishth et al. (2008) and Hounnankpon et al. (2017). During the study, it was revealed that both males and females were engaged in the production of bamboo items. It is noteworthy to mention that males exclusively engaged in harvesting and splitting of bamboo which needs more physical

labour, expertise, skill and tenacity. Females assist in all possible stages of handicraft making. Currently, bamboo handicraft art has suffered setback due to modernization that has brought in plastic, aluminum and iron ore products which are used to assist in various household chores. It is however noteworthy to comment that traditional bamboo handicraft art has survived and is still relevant to people's needs, in spite of modernization. The study revealed that most of the products were sold for Rs (Rupee). 20-100 and artisans earn a meager Rs. 200-300 per day as return due to lack of proper exposure, sponsorship and marketing of their products. Moreover, it provides livelihood to rural people in remote areas and also aids in women empowerment as most of the grassroot artisans are women. The present result is in agreement with Nath & Das (2008), Nath et al. (2009) and Lobovikov et al. (2012). In the studied area, bamboo is helping i.e., facilitate poverty mitigation and elimination among poor people (Rao et al., 1987; Lobovikov et al., 2009). The evidence is higher contribution of bamboo to the household economy in poorer households (Hogarth et al., 2013). Another important aspect of this indigenous craft is that illiterate artisans involved in craft making are in the unorganized rural sector and have no cooperative society for proper marketing and are also not aware of the laws concerning modern trade and commerce to protect their designs and technologies. This has resulted in their traditional knowledge, skills and practices in crafting such items with intricate designs and novelty now becoming vulnerable. Eventhough there are some training programmes on-going to train rural artisans in bamboo craft by the Central as well as State governments (Odisha Bamboo Development Agency and Directorate of Handicrafts & Cottage Industries, Odisha) in Odisha, due to lack of awareness, the artisans are unable to access such facilities to modernize their bamboo handicraft techniques.

Conclusion

Woody bamboo grass is observed to be invaluable for a specific community -- those who have age-old expertise in processing and utilizing different parts of this plant to produce various household articles. This has resulted in the plant providing livelihood to these people. However, it is a matter of concern that many local men go to urban areas to make more income, leaving women at home to look after the children and to do housework. It is suggested that bamboo is an excellent pro-poor resource, especially in remote areas with limited off-farm income opportunities. Proper training with modern technology, financial assistance to develop infrastructure, as well as proper marketing of products will boost earning opportunities among rural people of the said district. In the aspect of women empowerment in the bamboo sector, the government should

take necessary steps for the improvement of weaving skills among women. We envision that the development of traditional handicrafts can be combined well with poverty alleviation in the context of a government-targeted poverty alleviation programme.

Table 1. List of respondents, their gender and age, parts of bamboo used and traditional bamboo products manufactured by bamboo artisans in Bhadrak district, Odisha.

Respondent	Gender	Age	Use of plants	Bamboo Product for household use
Respondent 1	Female	75	Shoot	Fishing devices.
Respondent 2	Female	62	Shoot	Winnows, round winnows.
Respondent 3	Female	59	Shoot & branch	Small basket, small basket with handle.
Respondent 4	Female	48	Shoot & branch	Small round and flattened baskets.
Respondent 5	Female	57	Shoot & branch	Small round and flattened baskets.
Respondent 6	Male	80	Shoot & branch	Big basket, medium basket.
Respondent 7	Male	77	Shoot & branch	Big basket, medium basket.
Respondent 8	Male	64	Shoot & branch	Big basket, medium basket.
Respondent 9	Male	60	Shoot & branch	Big basket, medium basket.
Respondent 10	Male	71	Shoot & branch	Big basket, medium basket.
Respondent 11	Female	59	Shoot & branch	Medium basket, small medium basket.
Respondent 12	Female	35	Shoot	Food grain storage basket.
Respondent 13	Female	41	Shoot	Food grain storage basket.
Respondent 14	Female	58	Shoot & branch	Food grain storage basket.
Respondent 15	Male	45	Shoot & branch	Fishing devices, big basket.
Respondent 16	Male	72	Shoot & branch	Fishing devices, big basket, medium basket.
Respondent 17	Male	35	Shoot & branch	Fishing devices, medium basket.
Respondent 18	Male	41	Shoot & branch	Fishing devices, big basket.
Respondent 19	Male	65	Shoot & branch	Fishing devices, big basket, medium basket.
Respondent 20	Female	73	Shoot & branch	Round winnows, medium basket.
Respondent 21	Male	78	Shoot & branch	Big basket, medium basket, small basket.
Respondent 22	Male	71	Shoot & branch	Round winnows, big basket, medium basket.
Respondent 23	Male	64	Shoot & branch	Big basket, medium basket, small basket.
Respondent 24	Male	61	Shoot & branch	Big basket, medium basket, small basket.
Respondent 25	Male	56	Shoot & branch	Fishing devices, medium basket.
Respondent 26	Female	57	Shoot & branch	Small basket with handle, small round and flattened baskets.
Respondent 27	Female	37	Shoot & branch	Small basket with handle, small round and flattened baskets.
Respondent 28	Female	39	Shoot & branch	Small basket with handle, small round and flattened baskets.
Respondent 29	Female	46	Shoot & branch	Small basket with handle, small round and flattened baskets.
Respondent 30	Female	61	Shoot & branch	Small basket with handle, small round and flattened baskets.
Respondent 31	Female	73	Shoot & branch	Small basket with handle, small round and flattened baskets.
Respondent 32	Male	67	Shoot	Mat

Respondent 33	Male	47	Shoot	Mat
Respondent 34	Male	39	Shoot	Mat
Respondent 35	Male	42	Shoot & branch	Mat
Respondent 36	Male	64	Shoot & branch	Big basket, medium basket, small basket
Respondent 37	Male	70	Shoot & branch	Big basket, medium basket, small basket
Respondent 38	Male	56	Shoot & branch	Big basket, medium basket, small basket
Respondent 39	Male	70	Shoot	Mat
Respondent 40	Male	39	Shoot	Mat
Respondent 41	Male	47	Shoot	Mat
Respondent 42	Male	50	Shoot	Mat
Respondent 43	Female	48	Shoot & branch	Round winnows, small basket with handle.
Respondent 44	Female	67	Shoot & branch	Round winnows, small basket with handle.
Respondent 45	Female	36	Shoot & branch	Round winnows, small basket with handle.
Respondent 46	Female	43	Shoot & branch	Round winnows, small basket with handle.
Respondent 47	Female	59	Shoot & branch	Round winnows, small basket with handle.
Respondent 48	Male	60	Shoot & branch	Big basket, medium basket.
Respondent 49	Male	65	Shoot & branch	Big basket, medium basket.
Respondent 50	Male	43	Shoot & branch	Food grain storage basket.
Respondent 51	Male	49	Shoot & branch	Small round and flattened baskets.
Respondent 52	Male	50	Shoot	Winnows, round winnows.
Respondent 53	Male	53	Shoot & branch	Big basket, medium basket, small basket
Respondent 54	Female	69	Shoot & branch	Small basket with handle.
Respondent 55	Male	47	Shoot	Food grain storage basket
Respondent 56	Male	40	Shoot & branch	Small round and flattened baskets
Respondent 57	Male	76	Shoot	Mat
Respondent 58	Male	65	Shoot	Mat
Respondent 59	Male	53	Shoot	Mat
Respondent 60	Male	51	Shoot	Mat
Respondent 61	Male	48	Shoot	Mat
Respondent 62	Male	41	Shoot	Mat
Respondent 63	Male	64	Shoot	Mat
Respondent 64	Female	67	Shoot	Hand fan, food grain storage basket
Respondent 65	Female	50	Shoot	Hand fan, food grain storage basket
Respondent 66	Female	49	Shoot	Hand fan, small basket with handle.
Respondent 67	Female	54	Shoot	Hand fan, small basket with handle.
Respondent 68	Female	66	Shoot	Hand fan, small basket with handle.
Respondent 69	Male	63	Shoot & branch	Hat, big basket,
Respondent 70	Male	70	Shoot & branch	Big basket, medium basket, small basket.
Respondent 71	Male	61	Shoot & branch	Big basket, medium basket, small basket.

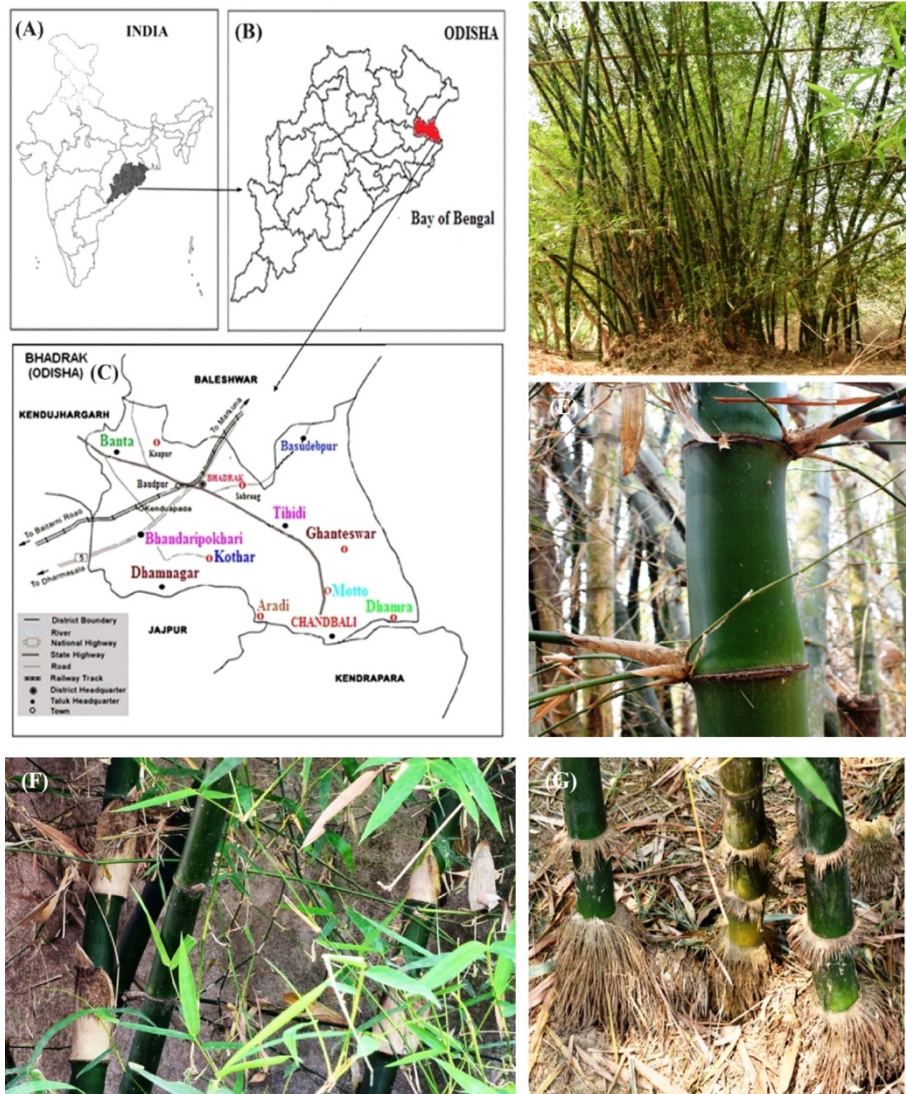


Figure 1. A. Location of Odisha state in the eastern region of India B. Map of Odisha state showing Bhadrak district and C. Study area showing different blocks of the Bhadrak district D. Clumps of *Bambusa vulgaris* Schrad ex Wendl E. Bamboo shoot showing node, internode and branch F. Culm sheath and leaves of *Bambusa vulgaris* G. Roots of *Bambusa vulgaris*.

Table 2. Multifarious uses of bamboo in Bhadrak district, Odisha.

Use category	Local name	Specific uses
Construction for human shelter		Bamboo pole and splitting culms are used for construction of houses.
Sealing of house		Bamboo pole is used for sealing of house.
Poultry and cattle shelter		Bamboo pole and splitting culms used for poultry and cattle shelter.
Shed building (market, and other sales places)		Bamboo pole and splitting culms are used for shed building (market, and other sales places).
Construction in the field to observe crop		Bamboo pole and splitting culms is used for construction in the field to observe crops.
Foot bridge construction		Bamboo poles are used for foot bridge construction.
Bamboo pole Scaffolding		Bamboo poles are used for scaffolding.
Household goods-construction (stool, bench, shelf)		Strips of bamboo are used for house hold articles.
Bamboo pole		Carrying gods and goddess in various religious festivals such as Dola Purnima.
Bamboo pole		Used in Raja festival (June 13- June 15).
Fishing devices		To capture fish from pond, river, and rice fields.
Fish drying		Bamboo poles and strips are used for fish drying.
Ladder	Sidi	Used for climbing.
Bamboo bier		For transporting dead bodies to cremation ground.
Piece of bamboo		For mixing and stirring of paddy.
Hand fans	Binchana	Used rural and urban areas in summer season particularly during halt of electricity supply.
Solid lathis	Thenga	Used by the police.
Gate	Phataka	Main gate for the house.
Winnows	Kula	Winnowing of rice and other grains
Round winnows	Dala	Winnowing of parched paddy colloquially called 'mudhi' and 'khai'.
Big basket	Tola	For keeping hen.
Big basket	Jhanka	Fodder collection, carrying manure.
Medium basket	Tokei	For filtering rice water from cooked rice and collection of agricultural crops.
Medium round basket	Jhudi	For carrying manure and soil.
Small round basket	Chaluni	For sorting rice, wheat.
Small basket	Chota pachhia	For sowing rice in the field, keeping kitchen items as vegetables, collection of flower.
Small basket with handle		Used for carrying puja materials for deities.
Food grain storage basket	Bada tokei	For storage of food grain.
Small round and flattened baskets	Chota dala	Religious rites/worship.

Hat	Topi	Used as cap.
Mats	Chatei	Used in wall of rooms and protection to roadside plants.
Packing material		Used as packing material during transportation of goods.
Balance	Taraju	Used for weighing.
Walking sticks	Chhadi	Used by old age people for walking.
Bullock cart	Baladagadi	Used as part of bullock cart.
Small stick	Danga	To handle the cattle during ploughing and during driving of bullock cart.
Broom	Chanchuni	For collection of animal dung.
Mouth traps	Munha bandha	Mouth traps for ploughing animals (ox).
Ceremonial temporary construction	Mancha	Used to prepare pandals in ceremonies, for instance, Durga puja, marriage ceremony, meetings.
Hoardings		For information to public.
Boat	Danga	Used as pole in boat.
Rickshaw		Hoarding of rickshaw.
Agarbatii	Dhupakathi	Incense sticks.
Ice-cream		Ice-cream sticks.
Fencing	Bada	Fencing of home and farmland to protect the sapling from other animals.
Sealing of road		To block the road and contentment zone during Covid-19 pandemic.
Flag pole	Pataka Khunta	Flagpole for flags and cultural emblems
Musical instruments	Badyajantra	Flute.
Glass		Container for drinking.
Cup		Tea cup.
Pond protection		Fish pond protection.
Support for plants	Mancha	Stand and cover for creepers plants.
Firewood		Used for cooking.
Tooth stick	Danta kathi	Used as tooth brush.
Fodder	Pasukhadya	Fodder for domestic animals.



Figure 2. a. New shoot of *Bambusa vulgaris* Schrad ex Wendl b. bamboo used as structure base in mud house c. used as roofing material d-e. used in livestock shelter and poultry farm f. traditional bamboo foot bridge g. used in scaffolding h. stair case used during construction i. used for winnowing of sand j-k bamboo strip and basket used for transportation of fishes, fodder, manure, and rice-seedling l. used for protection to crop field m. used for protection of home garden n. support to creeper plants and o. walking stick.



Figure 3. a. Bamboo used for protection to plants in afforestation programme along roadside b. a ladder c. used in crackers d. incense sticks e. used as stick in umbrella f. used as packing material g. used for watering rice field h. bamboo pole (locally called *kata* used as device to start and halt the passenger boat i. and j. interview with artisan at work k-o. various handicraft product of baskets.



Figure 4. a. Bamboo handicraft product used for keeping vegetables b. round device generally utilized for carrying manure and other material used in construction work. c. Winnowing tray d. round winnowing tray e. *puja dala* with a handle f. flat *puja dala* usually used by the shop-keeper to sell *bhoga* to customers during various festivals g. hand fan h. Japanese fan i. round basket usually used by fisher man to keep fresh catch j. tea cup k-o. bamboo made fishing devices used by the fisher folk.



Figure 5. a-b. Bamboo used in fish drying process c. Bamboo made flute d. A musical instrument locally called *kendara* e. Bamboo made swing used in Raja festival f. Bamboo made open cottage used for Jangnya g. used in marriage ceremony h. used in carrying gods and goddess during Dola purnima.

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