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Economic Contribution Of Cattail (Typha Domingensis): A Source Of Alternative Livelihood Option In Flood Prone Bengal Plains, India.

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ABSTRACT

Wetland is very significant for their services especially high biological productivity of several ecosystem goods that are potential for economically viable livelihood options. The measurement of economic value of biodiversity is a fundamental step towards its conservation. The present research was undertaken to estimate the productivity, use pattern, economic valuation (through detailed value chain analysis) and monetary contribution to the local economy by Typha domingensis. This species is almost abundant in the water logged areas in lower gangetic plain of West Bengal. Lower gangetic plain is mostly having flood prone areas which often not conductive for cultivable cash crops. To overcome this situation, proper utilization of Typha domingensis,is an alternative livelihood options.

Keywords: Cattail (Typha domingensis), Value chain analysis, Economic value, Lower Gangetic area, Alternative livelihood.

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INTRODUCTION

Human civilization had been intricately associated with diversified life forms from the early period to modern dates using the biological resources for their daily life support. The early human colonization was mostly developed either in the forest fringe areas for easy access to forest goods or along the riverine or other wetland system for using water sources in cultivation of crops, capturing aquatic resources and transportation as well. Thus traditional societies of developing countries extensively depend on a natural resource based system for getting essential needs like vegetables, fruits, meats, medicine, thatching materials etc. Among all the ecosystems, wetland is very significant for the services especially high biological productivity of several ecosystem goods that are potential for economically viable livelihood options. Thus a considerable number of wetland species are highly valued for food, fuel, fodder, vegetables, pulses, oils, waste water treatments, fertilizer, paper-pulp etc. [1]. Besides providing the major conventional resources of cash crop such as Paddy, Jute, Fish, Prawns etc, wetland biodiversity also contributes the major tangible values of wetlands [2].

The measurement of economic value of biodiversity is a fundamental step towards its conservation [3], particularly assigning the monetary values since it allows the benefits associated with biodiversity to be directly compared with economic value of alternative resource use option [4]. In India, wetland flora such as water chesnut (Trapa nataus var bispinosa), Shola (Aeschynomene aspara), Makhna (Euryale ferox) Lotus (Nelumbo nucifera) have significant contribution in rural socio-economy through a market system [5],[2]. In Indian Sundarban, only 3 sedges of Cyperus spp. (C. malaccensis, C.compressus and C.iria) were found to be contributed 9.927% of the total annual economic income of a family and surprisingly their production per hector in the salt water inundated agricultural fields and wet lands after 'Aila' (Typhoon) was 5-8 times higher than paddy [6]. Wetland plants also provide source of income to local people of Northern Africa through preparing and selling the household items, various utensils and craft products to customers including tourists [7], [8]. People of Amrach and Santie villages in Kemissie are involved in mattress making from Typha latifolia and Cyperus species from Chefa wetland and the average net income from mattress was 928 and 227 for Amrach and Santie respectively besides using these in dry seasons as fodder, thatching materials and other social rituals. Apart from the direct economically benefit, cattail population reduces excess nutrients in aquatic systems, sequester atmospheric carbon dioxide, and displace greenhouse gas emissions contributing multiple environmental and economic co-benefits, such as incentives for wetland restoration and habitat improvement [9]. But large numbers of wetland goods which have significant monetary contribution to the traditional society are mostly ignored to properly assess their economic valuation. On the other hand, several wetland resources are not well marketed, through an imperfect market system [10]. Therefore, the ecosystem people are not getting the actual economic benefit from resources.

Now-a-days, the advancement in economic valuation does express benefits of wetland resources in a much better way through quantification and monetary expression. In several wetlands, which are mostly in low lying inundation with marshy lands are primarily devoid of any cultivation practice for cash crop. Such wetlands generally harbour some populations of emergent macrophytes and amongst these Typha domingensis is very significant to the traditional local people for livelihoods in the low lying areas of lower Bengal. Productivity (about 150 quintal/ha/yr) and economic benefits from cattail in lower Bengal through selling mattress (Rs- 5000/ha/yr) and rain shed (Rs- 9000/ha/yr) is very significant (Ghosh, 2005) but there is ahead to assess the contribution of that species to different socio economic level (e.g. cultivator, mat maker or primary and secondary intermediaters) which is essential for the value chain analysis for complete economic valuation.

Cattail is distributed throughout southern Canada and the eastern United States, Mexico, New Zealand and Australia, Japan, Nepal, India and many other countries over the world. In India cultivation of cattail is maximum in lower Gangeatic plains, particularly in West Bengal mostly in Howrah and Nodia district.

The present research was undertaken with objectives to estimate the productivity, use pattern, economic valuation (through detailed value chain analysis) and monetary contribution of Typha domingensis to the local economy.

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STUDY AREA

Lower gangeatic plain includes the Kishanganj tehsil of Purnea district in Bihar, the 78% of West Bengal (excluding the Purulia district and the mountainous parts of Darjeeling district) and most parts of Bangladesh are the potential habitat of Typha spp. In West Bengal, it includes mostly the districts Howrah, South-24-pargana, north-24-pargana and Hooghly. The annual rainfall of those areas is 1302-1607mm and very high relative humidity. Poor drainage system results water logged condition during monsoon. The temperature of those areas throughout the year is 34° (approx.). Out of these districts "Howrah" came from the word "Hawor" means "Low land" including lowlying areas. As most of the land mass of Howrah (at 22° 35′ 24″ N, 88° 18′ 36″ E) remained water logged in most of the months and thus two sites namely Uttarpirpur and Banibon of Uluberia were selected for the present study where most of villagers of those two villages generate their economy through cultivation of Typha domingensis accessing a common market (Banibon bazaar).

METHOD

Two villages viz. Uttarpirpur and Banibon were selected as most of the inhabitant of these villages were directly or indirectly linked to the cultivation/propagation of Typha domingensis for their major economy generation. A total of 40 families involved in cattail cultivation from two villages, each having equal numbers, were surveyed for getting information such as main income source, local name of the species used as raw material for the preparation of "chhoi" (mat), cultivated/collection areas including the availability of wild raw materials in river/canal bank or any low land of common property [if available then the % of collection out of the annual harvest of the family (both collection and cultivation)], season of harvest (annual/biannual), fertilizer cost (if used, amount and cost chemical fertilizer and bio fertilizer), amount of collection/ harvest per family per season, production per acre (fresh and dry weight), used plant part etc. through arranged group discussion [11] conducted twice with local people (mostly of the Muslim community) of the two selected villages. The labour cost was calculated through the analysis of circulated and duly filled questionnaires set always with the participatory observation containing number of mean days involved for manual deweeding and harvesting (including binding, carrying to the storing places [12]. Questionnaires was developed in local language and distributed among villagers of each villages (25-30 cattail cultivators) of which 70-75% duly filled questionnaires were returned back on which the cost-benefit analysis were made (to the cultivator level). Cost of transport to the Chhoi making market from the storing place of the villagers was noted through personal meeting with the farmers.

The local markets (Banibon bazaar, Nimdighi bus stop) where the maximum portion of the bioresource was brought to sell from the adjacent villages such as (Uttarpirpur and Banibon) by the farmers, were visited in one week interval. At first, 15 groups of mat makers from the market were selected for a group discussion and subsequently a set of questionnaires in local language were distributed to the mat-makers. 80±2% filled questionnaires were retuned back. The questions include purchase price of the raw material to the chhoi market; production cost of "chhoi" and value added services (VAS) e.g. oil and thread etc; cost involve on preparing chhoi (man days) from the resources per unit area; transport cost in respect to distance and ultimate selling price to the user groups for various purpose. The data obtained from the filled up questionnaires of both groups (farmers and mat makers) were computed and analyzed to get the cost-benefit of both the groups.

RESULTS

Potentiality of Cattail market

From the two studied villages, it was observed that only 8%±2 of the villagers possessed their own land and the rest had very little or no cultivable land. Out of these 8%, 30-35% villagers had huge cattail cultivable land and some of the lands were not under their ownership but permitted by the owners for cultivation on a lease basis (for a certain periods of years). 60-65% of the poor villagers (under Below Poverty Line) used to work as field labourer for daily cash income. Among the villagers, 93±2% were directly associated with the cattail cultivation.

It was come to know from the discussion with mat maker groups that the chhoi (mat) prepared from Typha domingensis had various uses at different levels. Locally it was transported to various areas of districts Hoogly, East& West Midnapur, Burdwan and Howrah as thatching material for temporary site shelter of labourer worked in brick Klein set along nearby bank of the river Ganga. Otherwise maximum production of chhoi were transported to some distant states of India like Punjab, Haryana, UP, Maharashtra, Odisha where these were used as anti desiccation packaging materials for long transport of vegetables and fruits etc. Here in this level the ultimate market price at consumer level was dependent on the location of market and distance of transport which was obviously higher than the local markets. It was interestingly to note that the price of the chhoi reached its peak during local festivals (Durga puja or local fairs) when these materials were used to prepare different attractive handcrafts and other decorative items of 'Theme puja pandels' (Decoration of festival place based on a theme). Here the cost of chhoi was mainly influenced by effort of skilled labour and their demands in that period.

Outline of raw material production

Production and quality are important criteria for any biological component to be an economically viable resource. Thus, quality and productivity of resources may also classify it into several types. On the basis of productivity and quality (size and softness of the leaf) of Typha domingensis, 3 types were found to be grown and marketed depending upon annual precipitation and nature of elevation of land for better water storage capacity.

Types are Type-I: Good Quality- Typha domingensis growing in the field mostly with maximum level of year-long inundation. Type-II: Medium Quality- Typha domingensis growing in the field in moderate inundation. Type-III: Low Quality-Typha domingensis growing in the field with very poor inundation, sometimes even in dried condition.

The production of Typha domingensis in the study area was 82.5quintal/acre/year. 90% of raw material were cultivated /propagated in private farming land and remaining 10% were accessed as common property resource from vested wetlands (public property) such as bank of rivers, canals and other flood plain regions. The cultivation process of Typha domingensis was being performed with a one-time plantation of some of its underground rhizomatous parts and after harvesting, regeneration continued in successive years. Unlike recent mode of paddy cultivation chemical/biological pesticides and herbicides were not required. But manual deweeding in few months interval was in practice for getting better yield.

Harvesting was made once in a year with a requirement of 80±2 man days per year for cutting, binding in the field and carrying to the store house of semi skilled labourers. The total labour cost for preparation of raw materials in marketable form (in bundles), estimated to be Rs-19036/acre/year. (Table 1) The selling price of raw material from farmer level to mat maker's level was Rs-42520±146.46/acre production for both Type-I and Type-II and Rs- 22432±126.42/acre production for Type-III. (Table 2)

Table 1: Production cost of raw resource of Typha domingensis at farmer level

Sampling site	Production cost of raw bioresource/acre (Rs.)				
	Mean labour cost	Mean Processing cost	Mean binding cost	Mean caring cost	Chemical/Bio fertilizer
S.S.-1	11400±849	1200±0.00	2600±0.00	1945±643.46	0.00
S.S.-2	11400±460	1205±21.21	2565±106.07	1980±700.03	0.00
S.S.-3	11400±990	1205±21.21	2545±63.64	2000±707.10	0.00
S.S.-4	11400±795	1272.5±3.54	2457.5±229.81	2040.5±774.28	0.00
S.S.-5	11400±636	1235±56.57	2375±247.49	2045±770.74	0.00
S.S.-6	11400±371	1200±0.00	2692.5±144.96	1989±705.69	0.00
S.S.-7	11400±556	1250±0.00	2561.5±96.87	1995.5±686.60	0.00

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Table 2: Selling price of raw resource of Typha domingensis

Sampling site	Raw resource selling price to the mat makers (Rs./Acre)		
	Grade- I	Grade-II	Grade-III
S.S.-1	42500±0.00	42500±0.00	22387.5±159.09
S.S.-2	42403±4.00	42403±3.353	22287.5±17.677
S.S.-3	42375±106.0	42375±106.06	22450±70.71
S.S.-4	42650±112.0	42650±112.13	22345±134.35
S.S.-5	42500±141	42500±141.42	22470±42.426
S.S.-6	42550±71.00	45050±3606	22600±112.132
S.S.-7	42663±265.0	42663±265.16	22490±14.142
S.S.-8	42520±52.00	42520±52.325	22432±33.234

Preparation of Final Product and Marketing

Raw materials in bundle forms were either collected from different villages or directly from the cultivation/regeneration field by mat makers. In that case, cost of transport was implied on the mat maker groups and it was Rs- 3455.44±846.76/km/raw material produced per acre. For transporting of raw materials produced per acre from Uttarpirpur and Banibon villages to the Banibon bazaar, Nimdighi bus stop market was Rs 3455.44± 846.76/km. (Fig. 1)

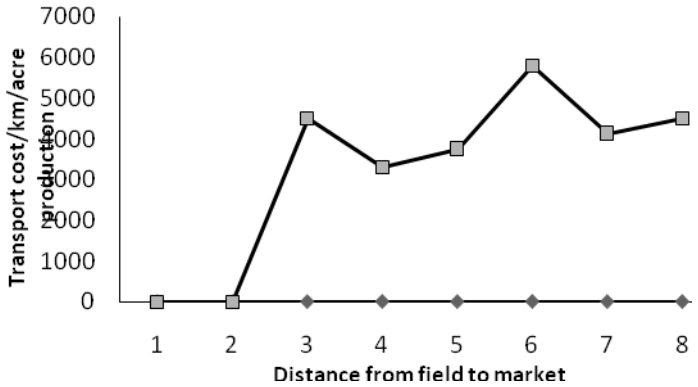

Fig 1: Transport cost of raw material with the distance

Three types of mat with different size were prepared from these raw materials based on their quality and length. The choice of mat makers to prepare different types of mats depends on market demand. From per acre yield of raw material of Typha domingensis, a total of 1350± 150 large size chhoi, 1864.28± 310.53 medium size chhoi, 2678.57± 317.35 small size chhoi could be prepared. Though tightly stitched mats had higher market value, these needs more quantity of raw materials with labour cost as well as value added services like thread (used as stitching material) and oil (for lubrication of needle during the time of stitching). The finished product of these three types of mat were then rolled and stacked separately for sale. To prepare best quality thatching material from the raw materials per acre, the labour cost and value added services were calculated Rs. 36454±481.89 and 3750±391.92 respectively. But it was lower in case of thatching materials of medium size (Rs 44481±574.32as labour cost, 2284±113.92as VAS) and small size (27412±448.47as labour cost, 2542±198.28as VAS). (Table- 3)

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Table 3: Making cost/Production cost Rs. of thatching material (Chhoi)

Sampling site	Labour Cost (Rs.)			VAS (Rs.)		
	Grade- I	Grade-II	Grade-III	Grade- I	Grade-II	Grade-III
S.S.-1	36246±347.89	43787.5±830.85	27228.5±323.14	3603.5±4.949	2190.5±127.98	2318±248.90
S.S.-2	37055±629.32	44825±247	27244.5±345.77	3569.5±98.28	2412±123.74	2559±83.43
S.S.-3	36250±353.55	44700±424.26	27333±236.17	3583±24.04	2266.5±23.33	2573.5±178.89
S.S.-4	36000±0.00	44100±1272.79	27850±494.97	3600±0.00	2175±106.06	2421±394.06
S.S.-5	36975±742.46	44741.5±153.44	27750±1060.66	3675±106.06	2250±70.71	2775±106.06
S.S.-6	36205±289.91	44805.5±275.06	27161±227.68	3550±70.71	2404±164.04	2511±114.55
S.S.-7	36468±26.16	44365.5±13.43	27337.5±477.29	3600±0.00	2290±14.14	2615±120.20

Transport cost of saleable product of thatching material to the consumer market is depended on the distance and mode of transport and also directly proportional to the distance travelled. (Fig-2)

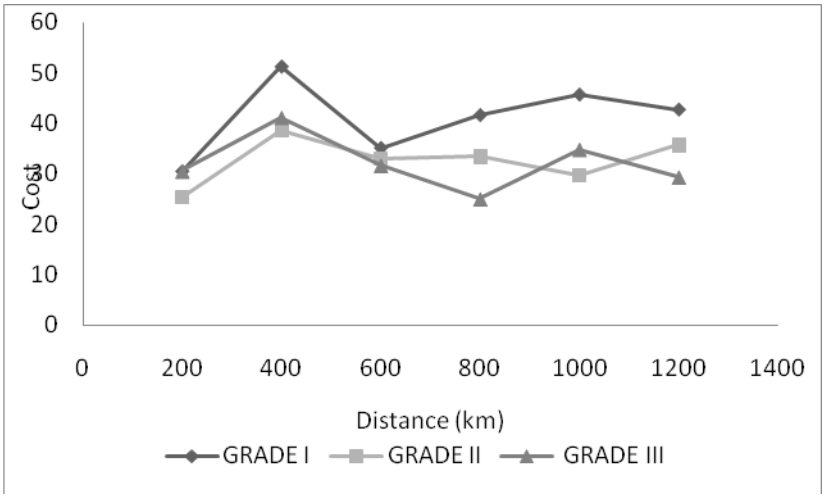

Fig 2: Transport cost of three different Qualities of that thatching material

It was noted that the transport of saleable thatching materials is not involved to hire any vehicles for sale purposes, rather transporting through running goods vehicles and other public transport, if space for accommodating the saleable good was available. Transport cost was also directly related to the weight and size of the thatching materials to be transported. In this respect the transport cost of large sizedthatching materials prepared from per acre product of GRADE-I raw materials required Rs- 44.328922±5.38/km, whereas medium and small sized mat prepared from one acre product of GRADE-II and GRADE-III raw materials required 33.526711±3.18/km and Rs 33.059176±3.48/km respectively.

Except occasional cases 90-95% of chhoi prepared from Typha domingensis was used as anti-desication material for long distance transport of vegetables. In such cases, the ultimate selling price of chhoi prepared from one acre product of raw materials was Rs- 157663±783.64, 135413±738.7987315±527.39for Grade I, Grade-II and Grade-III respectively. (Table 4)

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Table 4: Transport cost and Ultimate selling price of thatching material.

	Transport cost			Ultimate selling price to the consumers level		
SU	**Grade- I**	**Grade-II**	**Grade-III**	**Grade- I**	**Grade-II**	**Grade-III**
1	30.48	25.41	30.49	157800	135000	87000
2	51.29	38.47	41.04	157500	135000	87000
3	35.13	32.93	31.62	158400	135000	87500
4	41.66	33.33	25	158250	135000	86950
5	45.73	29.73	34.76	157500	136500	88350
6	42.75	35.65	29.3	157200	135000	86400
7	50.3	35.25	36.23	158625	136500	87750
8	46.52	35.45	32.75	157950	135397	86912
9	48.41	35.35	34.49	157950	134175	86328
10	46	35.42	33.19	157300	136500	87823
11	43	33.69	32.89	158400	134709	87500
12	45.46	34.56	33.04	155250	136500	87750
13	45.73	29.73	34.76	157200	135539	87448
14	45.03	32.66	33.56	158120	135674	87527
15	45.5	35.25	32.72	157500	134709	87500
Mean	44.32±5.38	33.52±3.18	33.05±3.48	157663±783.64	135413±738.79	87315±527.39

Economic contribution of Typha domingensis

It was estimated that the mean net economic revenue of Rs-18881.25±313.37/year/acre generated from Typha domingensis by the raw material producer groups (farmer) and Rs- 52111±522.97/acre/year by the mat makers groups (Fig. 3). Thus, 66.6% of the profit generated from Typha domingensis was flowed to mat maker groups where as 43.5% to the farmers. The mean value of (monetary value of the bioresource) Typha domingensis was calculated through the sum of the mean net profit of farmers and the mean net profit of mat makers. Thus in the present context the mean economic value of Typha domingensis at the present area was estimated to be Rs-70992.7±513.24/acre/year. (Table 5)

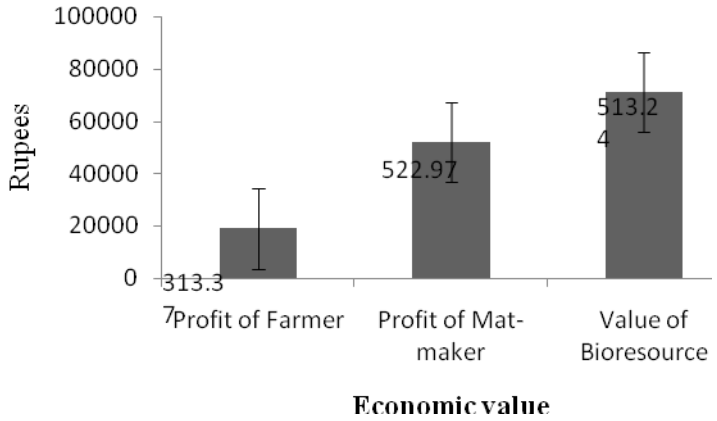

Fig 3: Economic value of Typha domingensis

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Table 5: Economic value of bioresource (per acre)

SU	MEAN PROFIT OF FARMERS(Rs)	PROFIT OF MAT MAKERS(Rs)	MEAN OF VALUE OF BIORESOURCE (per Acer)
1	18621.67±110.78	52389.08±473.69	71010.74±181.45
2	19104.5±62.93	51364.55±89.96	70470.05±76.44
3	18606.84±547.06	52421.92±290.05	71028.76±418.56
4	18850.17±2665.10	52169.68±518.36	71019.85±126.13
5	18843.34±11.78	52476.43±11.89	71319.77±0.053
6	18889.34±168.76	51649.35±450.17	70538.68±309.47
7	18890.9±216.69	52496.59±664.08	71387.49±440.39

The comparison of the net economic contribution of Typha domingensis with most commonly cultivated Paddy (Oryza sativa- the most common crop of the lower gangetic plain) of both High Yielding Varieties (HYVs) and Traditional Varieties (TRVs) shows that there is a three time increase of monetary contribution of Typha domingensis (Rs 70992.7±513.24) than Paddy (HYVs:Rs- 7500± 476.09/acre/year and TRVs: Rs- 3040± 251.39/acre/year. (Fig-4)

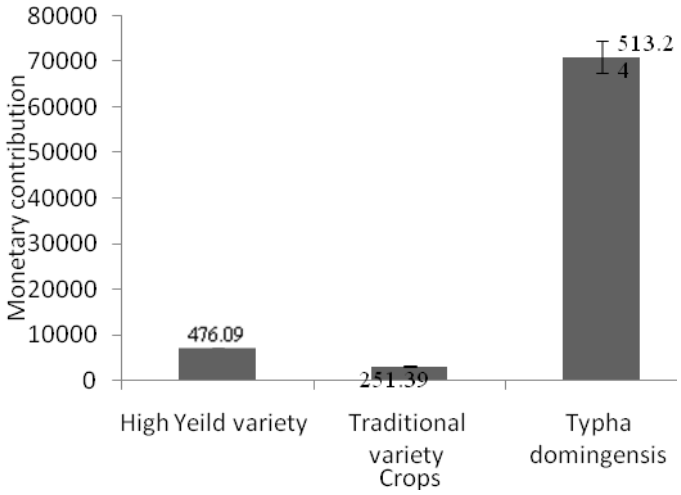

Fig 4: The comparison of the net economic contribution of Typha domingensis with most commonly cultivated Paddy

DISCUSSION

Typha domingensis, growing either wild or semi-wild conditions, seldom implies any production cost. This species is almost abundant in the water logged areas in lower gangetic plains of West Bengal. It generally grows in the lands of submergence in most of the period of the year and unsuitable for other crop production such as paddy. Moreover, low lands of lower gangetic plain is mostly having flood prone areas which often noconducing for cultivable cash crops. To overcome this adverse water logged situation and consequently proper land utilization the use of Typha domingensis, as represented in the present study may be adapted for alternative livelihood option from which cash income may be ensured through 'Chhoi' preparation having the potentiality of contributing considerable percentage of annual income of the people of that areas.

It was estimated from the present study that the economic worth generated from Typha domingensis is three times higher than the benefit gained through the cultivation of Oryza sativa (both in case of High yielding variety and traditional rice variety). It is because a large amount of production cost is needed for production of paddy such as Fertilizer (chemical and bio fertilizer), Pesticides / herbicides, labour cost in different level of cultivation (during the time of land preparation, sowing, spreading of fertilizer, deweeding, harvesting etc), cost of irrigation etc. Where as in case of Typha domingensis , except lobour cost during the

time of raw material preparation and harvesting and preparation of finished product for sale including stitching materials and transport (from field to market and market to consumer), no other costly Value added service are to be required to prepare the 'Chhoi'. Though the comparison does not imply any suggestion of substitution, as the paddy is the staple crop and indispensable for rural livelihood but the 'Chhoi' is not. Here the comparison used only to represent the potentiality of the cattail (Typha domingensis) to be an alternative livelihood option during the adverse period in those low land flood prone areas.

This study also reveals that this species presently as a whole contributes Rs-18881.25±313.37/acre/year to the farmer level and Rs- 52111±522.97/acre/year to the mat maker level. An unequal sharing of benefits gained from this species was observed in the present study. It was estimated that 60% of benefit gained from the commercialization of Typha domingensis was mobilized to the mat maker whereas only 40% to the raw material producer group (farmer). This result indicates that the Typha domingensis in local market operates in an imperfect market system. Generally, wild or semi-wild of forest resources are state controlled subject. The pricing mechanism differs between states which largely influenced the resource value at farm gate.

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