Tribal of Odisha and their Contributions to Science and Technology (S&T)

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Abstract: About 68 million people of the state of India are members of Scheduled Tribes and one of the most studied tribal religions is that of Odisha(Census 2011). This paper highlights about the tribes of Odisha and theircontribution in the field of science & Technology nowadays. Many scientific studies are going on, on Tribal Community as on date. The extent of collaboration on tribal can't be easily determined by traditional methods of survey and observations. A lot of papers has been published regarding the contribution of the tribal people as well as about the tribal community of Odisha in science & technology but all these documentations was in unorganized manner till date as all these publications are contributed by various authors in various languages on various issues with different domain. These scientific documentation on tribal community needs an organized well-defined data for future and further studies of researchers.
Keywords: Odisha Tribal, Tribal Surnames,Tribal Contribution, Science & Technology

I. INTRODUCTION

Tribal population has been found in almost all parts of India and Odisha claims to be the second largest leading tribal state in the country. The Adivasi (aborigins), Vanabasis(forest dwellers), and Girijanas(mountain dwellers) represents an impressive 22.13% population of Odisha comprising 62 major tribes and 233minor tribes.Odisha has 62 distincttribal groups, making it the largest collection of tribal people in a single state in thecountry. Each of these tribal group have their own indigenous customs and they have their own system of culture, traditions, religious practices, inheritance of property, marriage system, healthcarepractices and magico-religious practices. Earlier the tribal communities havebeen categorized as hunter-gatherer-nomads, hunter-gatherer and shiftingcultivators, simple artisans, settled agriculturists, industrial and urban unskilled andsemi-skilled workers, etc. But now tribal community have been showing their capabilities in every field especially in the field of Science & Technology (S&T). The overall literacy rate of the STs has increased from 22.31 per cent to37.37 percent. The Work Participation Rate (WPR) of the ST population is also increasing day by day in field of S&T. Basically, the aim of this paper is to highlight the contribution of tribal community in research publications in the field of science & Technology and to create a digitized platform based on bibliography study of S&T publications by the tribal community.

a. Tribal and it's categorization in Odisha

As per 2011 Census, the Scheduled Tribe (ST) population of the State of Orissa is 9,590,756. Of this, 8,994,967 are in rural areas and 595,789 in urban areas. This constitutes 22.8 percent of the total population of the State and 9.7 per cent of the total tribal population of the country. The state holds 3rd and 11th rank among the States/UTs in terms of ST population and the proportion of ST population to total population of the State respectively. The highest number of Scheduled Tribes has been recorded in Mayurbhanj (1,479,576) and the lowest in Puri (6,129). The State has a total of sixty-two (62) Scheduled Tribes.

Table 1. shows district wise distribution of ST population that Malkangiri district has the highest proportion and Puri has the lowest proportion as per 2001 Census. Since, there is not much change in size distribution in Census 2011, it is worth to know the population distribution of ST in Odisha as per available data of 2001 Census.

Table no 1: District wise distribution of ST population of Odisha.

District	Population Size (in %)
Malkangiri	57.4%
Mayurbhanj	56.6%
Rayagada	55.8%
Nabarangapur	55%
Puri	0.3%

Out of sixty-two (62) STs, Khond is the most populous tribe with a population of 1,395,643 constituting 17.1 percent of the total ST population. Gond is the second largest tribe, having a number of 782,104. having 9.6 per cent share in the total ST population. Six other tribes namely, Santal, Kolha, Munda, Saora, Shabar and Bhottada along with Khond and Gond constitute 64.2 per cent of the total ST population of the State. Bhumij, Bhuiya, Oraon, Paroja and Kisan having a population ranging from 248,144 to 321,592. [3,4,5] Together, they form 18.1 per cent. Five STs, namely, Bhumia, Binjhal, Koya etc. having population in the range of 103,537 to 196,846 constitute 9 per cent of total ST population. Remaining forty four (44) tribes along with the generic tribes constitute the residual 8.8 per cent of total ST population of the State. Five tribes namely Chenchu, Mankidi, Desua Bhumij, Ghara, Tharua are very small groups having less than 500 population. .

Table no 2: Categorization of tribes and its population

Tribes Category (Out of 62)	Population size (in %)
Khond	17.1
Gond	9.6
Santal, Kolha, Munda, Saora, Shabar & Bhottada	46.2
Bhumij, Bhuiya, Oraon, Paroja & Kisan	18.1
Chenchu, Mankidi, Desua Bhumij, Ghara	0.2
Remaining 44 tribes	8.8

Table no 3: District wise distribution of the individual ST

Individual ST	District
Khond	Kandhamal, Nayagarh, Boudh & Rayagada
Gond	Nabarangpur, Nuapada
Santal & Kolha	Mayurbhanj
Munda, Saora, Shabar & Bhottada	Sundargarh, Bargarh, Gajapati & Nabarangpur

District wise distribution of the individual STTable 3. shows that Khond have the highest proportion (93.3 per cent) in Kandhamal district, followed by Nayagarh (76.9 per cent), Baudh(76.4 per cent), and Rayagada (71.1 per cent) districts. Gond have the highest concentration in Nabarangapur districts followed by Nuapada district whereas Santal and Kolha are primarily concentrated in Mayurbhanj district. Other four STs, Munda, Saora, Shabar and Bhottada are primarily concentrated in Sundargarh, Bargarh, Gajapati and Nabarangapur districts respectively. The overall sex ratio of the ST population in Orissa is 1003. It shows the preponderance of females and is higher than the national average (978) for all STs. At individual tribe level, except Santal, all the major tribes of the state have over all sex ratio higher than that of the national average. [1-4].

b. Literacy Rate in Odisha

Odisha has a low literacy rate. According to 2011 census over all literacy rate of the country is 74.04 per cent whereas, for Orissa is 72.9 percent. The literacy rate of scheduled Tribes in Odisha is a cause for concern but nowadays the literacy rate among Scheduled Tribes, which was 37.37 percent in 2001, increased to 52.24per cent in 2011. The literacy rate was 72.9 percent in 2011, showing an overall improvement in the education level of the tribal's too. Male literacy has increased from 51.5per cent to 63.70 per cent during 2001-2011. The gap between the literacy rate of the total population and the ST population is 20.66 per cent. Female literacy continues to be an area of concern despite notable achievement during last decade. ST female literacy increased from 23.36 per cent to 41.20 percent during 2001-2011. ST female literacy is lower by approximately 22.8 percents point as compared to overall female literacy of the general population. Literacy rates have increased over the years due various programs targeted at it by the ministry as well as voluntary and nongovernmental organization, but there still exists a huge hiatus between the general and ST population literacy rates. It has been seen that in case of both general and tribal population the male literacy rate is higher in

comparison to female literacy rate. ST male literacy rate has increased 12.20 % from 1991 to 2011 where as ST female literacy has increased 17.84 % in the same period [5-7]. Among the major tribes, Gond has the highest percentage of literates (47 %) followed by Saora, Santal, Munda, Shabar (35.4 per cent) etc. Gond has also registered the highest female literacy. Bhottada have the lowest percentage offemale literates, preceded by Kolha and Khond.

II. SURNAMES OF TRIBAL IN ODISHA
According to the Order, 1950 as amended by Modification Order, 1956, Amendment Act, 1976 and the Scheduled Castes and Scheduled Tribes Order (Amendment) Act 2002 No. of Ministry of Law &Justice republished by Law Department, Govt. of Orissa., the list of Scheduled Tribes surnames of tribal in Odisha are listed below:

1. Bagata, Bhakta
2. Baiga
3. Banjara, Banjari
4. Bathudi, Bathuri
5. Bhottada, Dhotada, Bhotra, Bhatra, Bhattara, Bhotora, Bhatara
6. Bhuiya, Bhuyan
7. Bhumia
8. Bhumij, Teli Bhumij, Haladipokhria Bhumij, HaladiPokharia Bhumija, Desi Bhumij, Desia, Bhumij, Tamaria Bhumij
9. Bhunjia
10. Binjhal, Binjhwar
11. Binjhia, Binjhoa
12. Birhor
13. Bondo Poraja, Bonda Paroja, Banda Paroja
14. Chenchu
15. Dal
16. Desua Bhumij
17. Dharua, Dhuruba, Dhuruva
18. Didayi, Didai Paroja, Didai
19. Gadaba, Bodo Gadaba, Gutob Gadaba, Kapu Gadaba, Ollara Gadaba, Parenga Gadaba,   Sano Gadaba
20. Gandia
21. Ghara
22. Gond, Gondo, Rajgond, Maria Gond, Dhur Gond
23. Ho
24. Holva
25. Jatapu
26. Juang
27. Kandha Gauda
28. Kawar, Kanwar
29. Kharia, Kharian, Berga Kharia, Dhelki Kharia, Dudh Kharia, Erenga Kharia, Munda, Kharia, Oraon Kharia, Khandia, Pahari Kharia
30. Kharwar
31. Khond, Kond, Kandha, Nanguli Kandha, Sitha Kandha, Kondh, Kui, Buda Kondh, Bura,Kandha, Desia Kandha, Dungaria Kondh, Kutia Kandha, Kandha Gauda, Muli Kondh, Malua Kondh, Pengo Kandha, Raja Kondh, Raj Kondh
32. Kisan, Nagesar, Nagesia
33. Kol
34. Kolah Loharas, Kol Loharas
35. Kolha
36. Koli, Malhar
37. Kondadora
38. Kora, Khaira, Khayara
39. Korua
40. Kotia
41. Koya, Gumba Koya, Koitur Koya, Kamar Koya, Musara Koya
42. Kulis
43. Lodha, Nodh, Nodha, Lodh

44. Madia
45. Mahali
46. Mankidi
47. Mankirdia, Mankria, Mankidi
48. Matya, Matia
49. Mirdhas, Kuda, Koda
50. Munda, Munda Lohara, Munda Mahalis, Nagabanshi Munda, Oriya Munda
51. Mundari
52. Omanatya, Omanatyo, Amanatya
53. Oraon, Dhangar, Uran
54. Parenga
55. Paroja, Parja, Bodo Paroja, Barong Jhodia Paroja, Chhelia Paroja, Jhodia Paroja, Konda, Paroja, Paraja, Ponga Paroja, Sodia Paroja, Sano Paroja, Solia Paroja.
56. Pentia
57. Rajuar
58. Santal
59. Saora, Savar, Saura, Sahara, Arsi Saora, Based Saora, Bhima Saora, Bhimma Saora, Chumura Saora, Jara Savar, Jadu Saora, Jati Saora, Juari Saora, Kampu Saora, Kamp, Soura, Kapo Saora, Kindal Saora, Kumbi Kancher Saora, Kalapithia Saora, Kirat Saora, Lanjia Saora, Lamba Lanjia Saora, Luara Saora, Luar Saora, Laria Savar, Malia Saora, Malla Saora, Uriya Saora, Raika Saora, Sudda Saora, Sarda Saora, Tankala Saora, Patro Saora, Vesu Saora.
60. Shabar, Lodha.

a. Interpretation and analysis

Out of the 62 Scheduled Tribes, the State has declared 13 tribal communities as Primitive Tribal Groups. These thirteen communities are: 1 .Bonda Paraja, 2. Chuktia Bhunjia, 3. Didayi, 4. Dongaria Kondha, 5. Juang, 6. Hill Kharia (also knov/n as7. Mankiridia, 8. Birhor), 9, Kutia Kondh, 10. Lanjia Saora, ll.Lodha, 12. Paudi Bhuiyan and 13. Saora. Each of these tribal communities is rich in social institutions, socio-cultural profile and ethnic identity as revealed from their life styles.

1. BIRHOR: Birhors are mainly distributed in the districts of Sambalpur, Sundargarh, Balasore, Cuttack and Ganjam. The meaning of the term Birhor in their language is Bir (forest) and Hor (men) i.e. men of the forest.
2. BONDO: The Bondo are only found in Odisha State. They are the speakers of the 'Kemo language which belongs to the Austro-Asiatic language family. There are three subgroups: the Bondo highlanders, Lower Bondo and the Gadaba-Bondo group. The Bondo villages are found in hilltops and hill slopes, as well, and their economic life centres on cultivation, both shifting and settled.
3. CHUKTIA BHUNJIA: The Chuktia Bhunjici are members of the Bhunjia tribal groups, concentrated in the Sonabera plateau of Kalahandi (old) district, which is located at an altitude of approximately 3,000 feet above the sea level. High and undulating hill ranges, streams and dense forest distinguish the area.
4. DIDAYI: The Didayi is an ethnic group that occupies the area of the Konda Kamberu hill ranges and the Machhkund River. Their habitat constitutes riverine plains, undulating plateau and rugged mountainous terrain.
5. DONGRIA KANDHA: The Dongria Kandha, members of the Kandha tribe of Odisha, are found in the Niyamgiri hill ranges ofthe Eastern Ghats and particularly in the Rayagada and Koraput districts. Dongria Kandhcts speak a language, called the kuvi, which is of Dravidian linguistic ancestry.
6. JUANG: The Juang are found only in Odisha State, concentrated in the districts of Keonjhar and Dhenkanal. The Gonasika, which is situated in Keonihar district, is the principal seat of the tribe. The Gonasika area constitutes sedentary landscape with hills, slopes, ridges, and valleys. The vegetative cover in the area ranges from barren to thin forest, within a sub-tropical monsoon climate.
7. KHARIA:The PaharUHill Kharia, members of Kharia tribe, are considered the most 'backward' insofar as their economic status is concerned. The Hill Kharias are the autochthonous inhabitants of the Similipal hill ranges of Mayurbhanj district.
8. KUTIA KANDHA: The Kulia Kandha is a sub-section of the Kandha tribal group of Odisha and they are mainly concentrated in Belghar area of the Balliguda subdivision in Phulbani district. Their habitat is located in the northeastern fringe of the Eastern Ghats and contains hills, rivers and streams.
9. LODHA: the Lodhas are concentrated in two areas, namely Morada and Suliapada in the Sadar subdivision of Mayurbhanj district. They are originally a Mundari speaking tribe. Their economy is subsistence-oriented and depends upon the collection of minor forest produce, wage-earning and

agricultural labour. The Lodha social organization is characterized by patrilineal and totemistic clans, and most of the families are nuclear.

10. PAUDI BHUYAN : The Bhuyan is one of the major tribes of Odisha. They are found in the districts of Keonjhar, Sundargarh, Mayurbhanj and Sambalpur and are chiefly concentrated in the Bhuyan pirha of Keonjhar district and Bonai subdivision of Sundargarh district.
11. SAORA: The Saora is one of the major tribes of Odisha and they speak a language, Saora, which can be classified under the Austro-Asiatic language family. They are found in almost all districts of the State, but are chiefly concentrated in Gajapati and Rayagada districts.

b.Derivation of tribal surnames

Recent MP and MLA election (2019) from different reserved ST areas in Odisha state has been studied to collect authentic surnames. The surnames of the tribal are as follows:

Baka, Bhoi, Biswal, Dian, Dishari, Ekka, Gamango, Gond, Hembram, Jani, Kanhar, Khuntia, Laguri, Madhei, Madhi, Majhi, Marandi, Muduli, Munda, Murmu, Naik, Nayak, Oram, Padhi, Pangi, Pradhani, Randhari, Saraka, Soren, Tete and Tudu.

From the literatures study from the references as available in different authentic sources, the entire surnames are listed below:

Baka, Banda Paroja, Barong Jhodia Paroja, Bhimma Saora, Bhoi, Biswal, Bodo Gadaba, Bodo Paroja, Buda Kondh, Chhelia Paroja, Chumura Saora, Dehury, Desia Kandha, Dian, Dishari, Dongaria Kondh, Ekka, Gadaba, Gamango, Gond, Gumba Koya, Gutob Gadaba, Hembram, Jadu Saora, Jani, Janie, Jara Savar, Jati Saora, Jhankar, Jharania Kondh, Jhodia Paroja, Juari Saora, Kaiapithia Saora, Kamar Koya, Kampa Soura, Kampu Saora, Kandha, Kanhar, Kapo Saora, Kapu Gadaba, Khond, Khuntia, Kindal Saora, Kirat Saora, Kisan, Koitur Koya, Kol, Kond, Konda, Konhar, Koya, Kui, Kumbi Saora, Kutia Kandha, Laguri, Lamba, Lanjia Saora, Laria Savar, Lodh, Luar Saora, Madhei, Madhi, Mahalodh, Majhi, Majhi, Malia Saora, Mallick, Malua Kondh, Marandi, Muduli, Muli Kondh, Munda, Murmu, Musara Koya, Nagesar, Nagesia, Naik, Nanguli Kandha, Nayak, Ollara Gadaba, Oram, Padhi, Pangi, Paraja, Parenga Gadaba, Parja, Paroja, Pengo Kandha, Ponga Paroja, Pradhani, Raj Khond, Raja Kondh, Randhari, Sabar, Sano Gadaba, Sano Paroja, Saora, Saraka, Shabar, Sitha Kandha Kondh, Sodia Paroja, Solia Paroja, Soren, Tete, Tudu

III. RESEARCH METHODOLOGY

In order to do statistical analysis based on the scientific contribution by tribalcommunity of Odisha,the methodology has been adapted to collect data from different sources and then develop a web enabled database. Data has been collected from both primary and secondary sources such as Web-ofScience, SCOPUS, Google Scholar, Indian Science Abstracts and online literatures available at IndianJournals.com etc. Around 17,756 bibliographical details of references were collected from 09 resources to throw some lights to S&T contribution of tribal of Odisha. After mapping with tribal authors from the total collections, there are 935 articles contributed on S&T by the tribal of Odisha. The total percentage of share is 05.27 only. The total tribal constitutes 22.1 percent of the total population of the State and 9.7 per cent of the total tribal population of the country. Hence, the S&T contribution of tribal of Odisha is not significant as compared to their population in the state. The above references are collected based on different Bibliometrics parameters. The parameters are listed below:

1. Publication Source (Title, Vol., Issue, Year, Pages, Language etc.)
2. Title of the article
3. Authors with their affiliations
4. Subject Keywords
5. Abstract
6. Cross References, if any

IV. DATA ANALYSIS AND INTERPRETATION

Sharing in S&T contribution

There are 17,756 bibliographical details of articles or references collected from 09 resources to throw some lights to S&T contribution of tribal of Odisha. After mapping with tribal authors from the total collections, there are 935 articles contributed on S&T by the tribal of Odisha. The total percentage of share is 05.27 only. The total tribal constitutes 22.1 percent of the total population of the State and 9.7 per cent of the total tribal population of the country. Hence, the S&T contribution of tribal of Odisha is not significant as compared to their population in the state.

Table no 4: Collection of data from different sources

Source	Total Articles	Contribution by Tribal	Share %
WOS	741	52	7.02
NRRI AR	89	6	6.74
SCOPUS	12030	802	6.67
NISER AR	90	6	6.67
CIFA AR	157	8	5.10
IIT AR	85	3	3.53
IJ.COM	1073	35	3.26
OUAT AR	518	11	2.12
ISA	2973	12	0.40
Total	17756	935	5.27

The maximum S&T articles of 802 are collected from SCOPUS. 85.78 % which representing 802 articles references are collected from SCOPUS to analyzing S&T contribution of tribal of Odisha. SCOPUS is the major database on which the study is based to analyze S&T contribution of the tribal in the state.
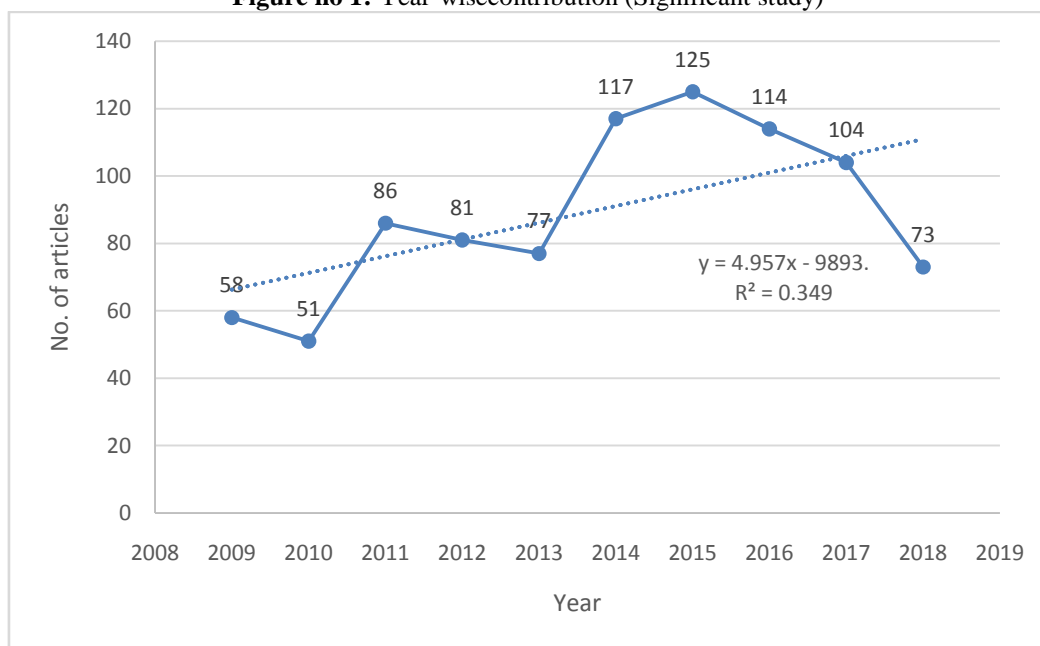
Year-wise Contribution of Tribal

Table no 5: Year-wise S&T contribution by the tribal of Odisha

Year	No. of Articles
Before 2008	9
2008	40
2009	58
2010	51
2011	86
2012	81
2013	77
2014	117
2015	125
2016	114
2017	104
2018	73
Total	935

Publication data for the year 2009 to 20018 (10 Years) is studied to know the trends. However, some data are shown against the year 2008 and also 'Before 2008'. It looks these 02 years data collection are not studied under the year-wise contribution. Although the year 2015 is the most significant for S&T publications, publishing 125 articles by the tribal, but not remarkable changes in the total publications per year during 2014, 2016 and 2017. Tribal of Odisha has started their significant contribution from the year 2014 and continued as positive trend in S&T contribution in Odisha.

Figure no 1: Year-wisecontribution (Significant study)

The publication pattern of the tribal is to follow a positive pattern (growth) during the study period. The linear equation is also shown in Fig 1 as above. The calculated value of R2 is 0.3492. It is showing slow trend during the years.

Authorship Pattern followed by the tribal of Odisha

The tribal of Odisha has followed similar patterned which similar to earlier studies done by many researchers. Triple authorship is the most preferred pattern for all scientific publishers in primary sources. The upward trend is used to noticed from single authorship to triple authorship and downward trends from quadruple authorship onwards. However, there is a specific trend for the study observed in Triple, Quadruple and Quintuple authorship's pattern. The tribal of Odisha are very much preferable for these patterns. There are also some unusual patterns followed in this study which observed in the category of 'Decuple & more'. The trends of last ten categories are in the following authorship patterns:
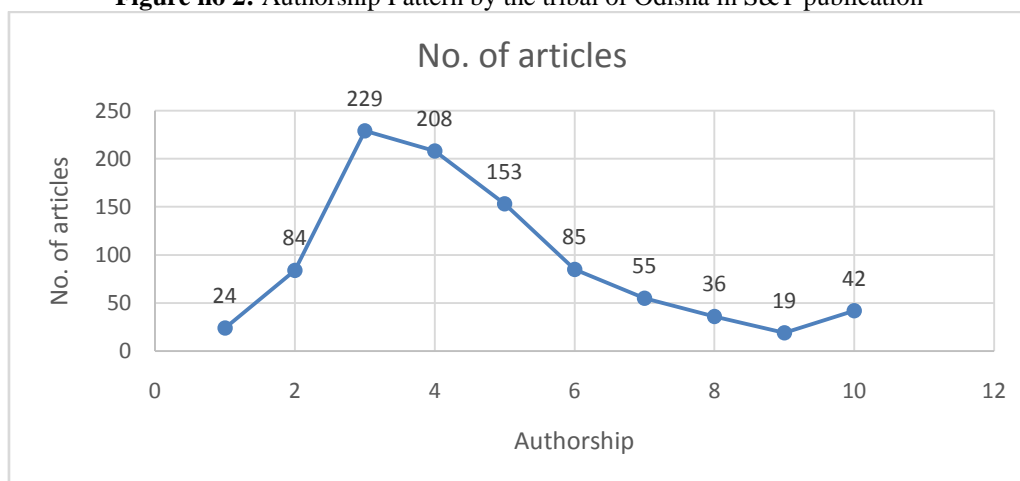
*15, 15, 16, 16, 16, 18, 21, 31, 52 & 86 '**Authorship Patterns**'*

Higher author patterns are observed in the area of 'Biological Sciences' in particular to 'Agriculture Science'.

Table no 6: Authorship Pattern by the tribal of Odisha

Authorship Category	No. of articles
Single	24
Double	84
Triple	229
Quadruple	208
Quintuple	153
Sextuple	85
Septuple	55
Octuple	36
Nonuple	19
Decuple & more	42
Total	935

Figure no 2: Authorship Pattern by the tribal of Odisha in S&T publication

The tribal of Odisha is followed a '**Pyramid Publication Pattern**' as shown in Fig 3.

Author's Productivity Study

From the study it is noticed that there are 227 authors have published 935 S&T articles in different primary journals. The table as shown below, the top 25 authors have published 469 articles sharing more than 50% of the total publications. The tribal author B. Majhi has published 79 S&T articles and occupied Rank 1 in the top productive list.

Table no 7: Top 25 Productive Tribal Authors

Author's Name	No. of Articles	Rank
Majhi B	79	1
Mallick S.	47	2
Mallick P.	32	3
Naik B.	29	4
Kundu C.N.	24	5
Dehuri S.	18	6
Naik S.K.	18	7
Kundu S.	16	8
Mallik A.	16	9
Besra L.	15	10
Naik S.	15	11
Nath I	14	12
Nath R.K.	14	13
Bhuyan P.	13	14
Majhi D.	13	15
Mallick B.	13	16
Kundu A. K.	12	17
Kundu D.K.	11	18
Majhi S.K	11	19
Mallick P.K.	11	20
Bhoi B	10	21
Kundu M	10	22
Nath G.	10	23
Dehury B.	9	24
Dehury S.	9	25

The entire rank between the tribal authors are distributed as given in Table 5. Out of 227 authors, 106 authors have contributed 106 articles.

Table no 8: Rank between the tribal authors

No. of Authors	No. of Articles	Rank
1	79	1
1	47	2
1	32	3
1	29	4
1	24	5
2	36	6
2	32	7
2	30	8
2	28	9
3	39	10
1	12	11
3	33	12
3	30	13
8	72	14
5	40	15
5	35	16
8	48	17
5	25	18
16	64	19
17	51	20
34	68	21
106	106	22
227		

The team were able to cover up almost all the resources and validation of data relating to analysis of different Bibliometrics parameters has been done but it was noticed during preliminary survey that there is no direct field or parameter to select tribal communitycontributing to S&T. The limitations that the team has faced, the author's surnames are common with other communities and creating confusion with the collected data to select the authors under tribal community. Hence, to authenticate the data, a questionnaire has been designed to collect the data from the listed authors from the collected literature as well as from the different scientific institutions of Odisha, if anything left during literature search from secondary sources.

V. DATA COLLECTION OF S&T LITERATURE OF ODISHA:

From the study it is noticed that there are 227 authors have published 935 S&T articles in different primary journals. The table as shown below, the top 25 authors have published 469 articles sharing more than 50% of the total publications. The tribal author B. Majhi has published 79 S&T articles and occupied Rank 1 in the top productive list.

VI. CONCLUSION

A survey has been done on the list of publications and journals, e-sources, list of magazines and media sources based on activities done tribal community of Odisha: renowned persons working in the field of Science & Technology in order to collect valuable documents of tribal community.Data was collected from different institutes based on different areas of science & technology. It has been noticed that the tribal people has contributed a lot in different research activities in various field of science & technology at different journals, books, publications, magazines, websites and newspapers etc and through this data base has beencreated for documentation of valuable documents by tribal people with the help of the oracle soft ware . It has increased the visibility and productivity of tribal scientists which impacts on organization of research and communication specially working in the field of science &technology. Awareness has been created about tribal community of Odisha working in Science area.The documents have been preserved on works done by tribal culture in a systematic manner that can be utilized in future.

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