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Sector wise gross value added (GVA) in Odisha: A statistical analysis

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Abstract
Gross value added(GVA) is an economic productivity metric that measures the contribution of a corporate subsidiary company, or municipality to an economy, producer, sector, or region.GVA is the output of the country less the intermediate consumption, which is the difference between gross output and net output. It is important because it is used to adjust GDP, which is key indicator of the state of a nation's total economy. The Odisha's economy is composed of mixture of economic activities related to 17 sectors i.e. Agriculture, Forestry, Fishing, Livestock, Mining and Quarrying, Manufacturing, Construction, Electricity, Gas, Water Supply & Other Utility Services, Transport by other means, Railway, Communication, Services related to Broadcasting Trade, Hotels and Restaurant, Financial services, Storage, Public Administration and Defence, and Other services. The present research study is a macro level attempt towards analyzing the regional variation in the growth of gross value added and comparing the sector wise contributions to the overall GVA of the state during the study period from 2011 to 2022. Pareto analysis which is a statistical technique in decision making will be used for the selection of a limited number of sectors i.e. Vital Few Sectors (VFS) that produce significant effect. It uses the Pareto principle(also known as the Juran's 80/20 rule) the idea that efforts may be focused on these VFS that contribute 80 percent of total state GVA so that the remaining Trivial many Sectors (TMS) having contribution to 20 percent can automatically be benefitted in terms of raising the GVA level. The degree of Inequality among the VFS sectors is measured by the computation of Gini concentration ratio or Gini Coefficient. By considering the degree of inequality among VFS sectors the policy implications can be formulated to overcome the inequality level. The Pareto analysis and Gini Coefficient describes the sector wise contribution to overall GVA of Odisha and also these estimates helps in drawing up suitable planning, programs and policy implementation. The broad policy objectives Thus, formulation of broad policy objectives is necessary for the under developed sectors i.e. Trivially Many Sectors (TMS) sectors. The best and appropriate development program can be formulated to remove inter sector wise disparities contributing to GVA.

Keywords: Gross value added (GVA), pareto analysis, vital few sector (VFS), trivial many sector (TMS), gini coefficient

Introduction
GDP is a very strong measure to gauge the economic health of a country and it reflects the sum total of the production of a country and as such comprises all purchases of goods and services produced by a country and services used by individuals, firms, foreigners and the governing bodies. It is used as an indicator by almost all the governments and economic decision-makers for planning and policy formulation. When government officials plan for the future, they consider the various economic sectors' contribution to the GDP. But, now the GDP of Indian economy and state economy is calculated in terms of GVA rather than considering GDP for better measurement of economy. The difference between GVA and GDP is that GVA is the value added to the product to enhance the various aspects of the product whereas GDP is the total amount of products produced in the country. GVA is the output of the country less the intermediate consumption, which is the difference between gross output and net output. GVA is important because it is used in the calculation of GDP, a key indicator of the state of a nation's total economy. It can also be used to see how much value is added (or loss) from a particular region, state, or province. At the national level, GVA is sometimes favored as a measure of total economic output and growth over GDP or (GNP). GVA is related to GDP

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through taxes on products and subsidies on products. It adds back subsidies that governments grant to certain sectors of the economy and subtracts taxes imposed on others. GDP is the internationally-accepted measure of overall economic growth in the country from consumer side where GVA provides sector-wise details of economic activity from the production side.

Odisha is one the fastest growing state economies in India. Odisha is a mainly agrarian economy with a GSDP value of Rs. 3.74 trillion at current prices. According to 2015-16 Economic Survey, Odisha's gross state domestic product (GSDP) was expected to grow at 7-8% in the 2014-15. Odisha has an agriculture-based economy which is in transition towards an industry and service-based economy. According to Dun and Bradstreet report, the GSDP is expected to grow at a rate of 8.1% during 2015-2020. Odisha is also one of the top FDI destinations in India. The sector wise contribution to GVA of Odisha Agriculture, Forestry, Fishing, Mining and Quarrying, Manufacturing, Construction, Electricity, Gas, Water Supply & Other Utility Services, Transport by other means, Railway, Communication, Services related to Broadcasting Trade, Hotels and Restaurant, Financial services, Storage, Real Estate, Ownership of Dwellings, Public Administration and Defence, and Other services.

Literature Review
The following is a brief review of related documents relating to the study of sector contributions to GDP to provide an adequate educational framework for the study.

Edward Knotek and Christian Garciga (2017) [1] made a GDP forecast on the basis of compiled data on national income. The authors generated the time-series models of GDP growth with proper explanatory variables. Such model predicted the growth of GDP in the period of analysis. Sandro Claudio Lera and Didier Sornette (2017) [2] predicted the economic growth rate scenario in USA. The authors identified the fluctuations in economic growth from one period to another and many factors are reasonable for economic growth rate fluctuation in USA in the period of analysis. Paul Armstrong-Taylor (2014) [3] examined the channels of GDP growth with reference to 14 developed countries during the period from 1980 to 2012. The author identified the factors promoting GDP growth in countries with large open banking system and trade deficits. Temel Taskin (2014) examined the factors determining the economic growth in Turkey with reference to 2006 to 2011. The author conducted the study on the basis of time series data relating to different regions in Turkey and identified inter regional variation in inclusive economic growth is different regions in Turkey over a period of time.

Rossitsa Rangelova (2010) [4] analyzed the trends in the development of GDP indicators in USA. The author identified the key indicators and their role in the determination of GDP and such type of indicators enable to make international comparison of GDP across the countries in the world. Nicolas Cachanosky (2009) [5] discussed the application of GDP as an indicator of economic development and pointed out the limitation of GDP indicator in studying the economic growth process across the countries. The authors suggested the value added approach towards explaining the macro economic performance of the countries. Barbara M. Fraumeni (2009) [6] made a new estimate of GDP in USA by adding the contributions of highway investment in GDP growth, high way capital input in GDP growth and high way gross output in GDP growth. Jacob Poke and Graeme Wells (2009) [7] predicted the GDP growth in Australia. The authors made use

of factor determining GDP growth and possible ways of forecasting GDP growth in Australia. The authors concluded that GDP growth rate depends on dynamic economic activities of the country along with structural changes. Rodney Edvinsson (2005) [8] analyzed the GDP per capita status in Sweden during the period 1720 to 1800. The author identified the annual changes in GDP on the basis of used indicators relating to official accounts of harvests, marriage rates, imports, price, rye and grains. The GDP growth was considerable in the 19th century and it became changed due to industrial revolution. Bert de Groot and Philip Hans Franses (2005) [9] measured the GDP growth in Dutch. The authors used appropriate statistics and indicators and estimated the GDP and identified the fluctuation in the growth of GDP in Dutch country in the period of analysis. Thomas Ziesemer (2005) [10] developed a growth model to explain the foreign debt and GDP ratio in Korea, Malaysia and Thailand during the period 1960 to 2000. The authors identified the inter country variation with respect to foreign debt GDP ratio, due to variation in their economic activities.

Ratan Kirti and Seema Prasad (2016) [11] estimated the impact of Foreign Direct Investment in India's GDP growth. The authors pointed out that increase in Foreign Direct Investment is positively associated with the growth of GDP in India during the post liberalization period. Pragyesh Nath Tripathi (2015) [14] made an estimation of Indian GDP growth during the period 1951 to 2012. The growth of GDP was higher during the reform period and it was lower during the pre reform period. The growth of GDP shows a positive trend and such trends accelerate the process of Indian economic growth. Rohin Anhal (2013) conducted a study on causality between energy consumption and GDP growth in India during the period 1970 to 2011. The result indicates that there is no causality between energy consumption and GDP growth during the period of analysis. Sivakumar Marimuthu (2013) [16] brings to attention that the share of agriculture in Indian GDP declined in recent years.

However, agriculture supports 60 per cent of the Indian population and many of the industries in Indian still depend on agriculture for their inputs as per the report by the author. The author argues the importance of gross domestic formation and gross domestic product and changes in agriculture in Indian economic development. Sofia Devi Shamurailatpam (2013) [17] conducted a study on casual relationship between export of goods and services and real GDP growth in India during the period 1990-1991 to 2011-2012. The authors identified the presence of bi-directional causality between GDP and export of the economy. Céline Guivarch and Sandrine Mathy (2012) [18] examined the energy GDP relation share in India. The author analyzed the government investment in energy sector and contribution of energy sector to the growth of Indian economy growth of agriculture and industrial production. Ranjan Kumar Dash and Purna Parida (2012) [19] examined the role of service sector in Indian GDP during the period 1996-1997 to 2010- 2011. The author identified the long term relationship among service exports service, imports and real exchange rate with respect to growth of Indian GDP during the period of analysis.

Rudra P. Pradhan and Tapan P. Bagchi (2012) [20] focused on casual relationship between government expenditure, GDP and exports during the period 1960 to 2010 with reference to Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The authors identified the bidirectional causality between exports and economic growth in India. Harish Mani, G. Bhalachandran and V. N. Pandit (2011) [21] argue that the

role of agriculture to the Indian GDP declined. However, agriculture plays a significant role in the overall economic prosperity of India. The authors identified the effects of agriculture investment on stable agriculture growth along with overall growth of the Indian economy. The authors made some policy implications towards enhancing the role of agriculture in the overall growth of agriculture sector in India. P. K. Mishra (2011) [22] compared the relationship between export performance and economic growth in India during the period 1970 to 2009. The authors identified the stationary of time service data in explaining the process of export growth and economic growth in India in the period of analysis. Indrani Chakraborty (2010) [23] analyzed economic growth in India during the post reform period consequent upon financial sector reforms. The author used the positive growth in real GDP by the effect of capital output ratio and human capacity growth and they have positive effects on economic growth in India. Tarlok Singh (2010) [24] identified the long term relationship between service sector growth and gross domestic product. The authors pointed out the relationship between service sector and non-service sector in explaining the growth of GDP. The author used appropriate statistical tools in explaining the GDP growth in India. Sajal Ghosh (2009) [25] made an analysis of link between electricity supply, employment and real GDP growth in India during the period 1970-71 to 2005-2006. The author notes that real GDP growth and electricity supply are the causative factors of high level employment generation in India. Thus, the author concluded that the prevention of wastage of electricity can increase economic growth in India. Alok Pandey and Annapurna Dixit (2008) [26] brought to attention that planned economy in India showed a mixed situation.

The GDP growth in India was 4 per cent during the period 1967- 1980 and it latter declined around 3.45 per cent per annum. After 1980's, the growth of agriculture sector increased along with mining, manufacturing and service sectors. The author concluded that the growth of GDP during the period 1950 to 1991 was quite discouraging, consequent of adoption of conservative economic policies. Alok Pandey (2008) [26-27] estimated the growth of Indian GDP along with growth of export during the period 1985-1986 to 2004- 2005. The author found that the growth of GDP and export trade was discouraging, necessitating the need for economic reforms. Rubina Verma (2006) [28] examined the growth of Indian GDP during the period 1970 to 1994. The author identified the high level productivity growth in service sector consequent upon implementation of economic reforms after 1990's. Rituparna Das (2006) [29] identified the relationship between impact of monetary policy on Indian output growth. The author argued that monetary policy is more effective and successful in USA than in India.

Alok Pandey (2006) [30] found the cointegration between export and gross domestic product during the period 1950-51 to 2001-02. The current year GDP has cointegrated with the export growth and the consecutive year GDP has no cointegration with export growth in India. Abhijit Sharma and Theodore Panagiotidis (2005) [31] 56 conducted a study on export growth and economic growth in India during the period 1971 to 2001. The authors identified the cointegration factors in export that lead economic growth in India. K. Chaitanya (2004) [32] reported the rapid process of economic growth during the post reform period, in India and it is expected to achieve growth rate over 8 per cent in the years to come as per the observation of the author.

The Comparative Cost Analysis of Irrigation Projects: A Case Study of Major, Medium, and Minor Irrigation Projects in Orissa is presented by Nayak, P.K. (2001) [33]. B. Rath and P.R. Jena (2003) [34] investigated the Post-Structural Reform Growth Pattern in Orissa and its implications for the state's future growth.

D.Chand and R.Gartia (2019) [35] presented a journal paper titled "Pareto Analysis on the Regional Development of Odisha" in which they discussed India's growth and development. "Regional inequality in agricultural growth in Orissa in the pre- and post-reform period," wrote Mamata Swain, Mrutyunjay Swain, and Deepak Kumar Das (2009) [36]

Objectives
The research focuses on the following objectives
1. To study the sector contribution to the Gross Value added (GVA) of Odisha at current prices.
2. To identify the Vital Few Sectors (VFS) and Trivial Many Sectors (TMS) out of all seventeen sectors by pareto curve analysis on the basis of Juran's 80/20 rule.
3. To study the degree of inequality among the VFS and suggest for policy implications.

Data and Methodology
Data: The data for the analysis of this paper is collected from various sources including Handbook of Statistics on Indian Economy, Central Statistics Office (CSO) statistical reports, National Sample Survey Organization(NSSO), and Economic Survey 2020-2022. The data is selected from the period 2011-2012 to 2020-2022 of 17 sectors contributing to total GVA of Odisha.

Methodology
This study aims to analyze the sector contribution and intellectual growth of the sectors of Odisha. The time series data re use to anlyse the structure of the overall sector wise contribution and growth of all sectors of Odisha. The paper works to examine the regional variability in the growth and sector contribution of Odisha of all sectors. Pareto's analytical approach to decision-making is based on the selection of a limited number of domains, namely VFS, which shows significant effect to total GVA so that the remaining 20% TMS can automatically benefitted by increasing GVA levels. The Pareto curve divides the all sectors into two major parts i.e. a small but important sectors that contribute to 80 percent of total GVA and are named as VFS and large number but not non-significant sectors elements that contribute to 20 percent of total GVA named as TMS. The Gini coefficient will be used to measure the degree of inequality and concentration level of all sectors. The Data analysis is done by using SPSS under DOS environment.

Analysis
Pareto Analysis of Juran's 80/20 rule: This decision-making study is based on the selection of only a few sectors, namely VFS, which has major influence of 80% on the total GVA of all sectors, while the remaining sectors, namely TMS, which contribute 20% to GVA, can be automatically benefited by raising GVA levels.

Pareto curve
The curve separates a few key sectors, which account for 80% of total GVA and are labelled VFS, from non-essential parts, which account for 20% of total GVA and are labelled TMS.

Gini Coefficient

The Gini Concentration ratio is used to measure the concentration level. It measures the inequality in the Odisha region regarding VFS to suggest policy outcomes.

$$GCR = \sum_{i=1}^{N-1} | X_{i+1}Y_i - X_iY_{i+1}|$$

Where X_i and Y_i are the cumulative proportion

Table 1: Gross Value Added (GVA) Of Odisha at Current Prices 2020-21

Economic Activities	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Agriculture	3090950	4387858	4531863	5239762	4645552	5617276	5615950	6534734	7757400	7196359
Forestry and logging	572223	619884	784937	864086	957598	1108049	1022004	1102513	1138884	1206627
Fishing and aquaculture	268365	335124	358168	453110	560391	699883	856198	949042	1087455	1081575
Mining and Quarrying	2648738	2666989	2868392	2703161	2862080	3292604	3467115	4126450	4209939	4002881
Manufacturing	4116404	4212453	5168498	4724215	4654610	6741508	8000596	8601940	8703040	7825778
Electricity, Gas water supply & other utility services	775701	937278	1044477	1008706	1218871	1318939	1313855	1422728	1467845	1369792
Construction	2059629	2074164	2314669	2393041	2370792	2609537	2973274	3298939	3326640	2969443
Trade & repair services	1838866	2218946	2533465	2782577	3082291	3240394	3665665	4106654	4386805	4004275
Hotels & restaurant	196989	217098	236155	247641	270300	297771	329945	367171	362094	164047
Communication	334737	371354	446868	537185	617741	639843	625238	684800	704370	76396
Livestock	538911	637320	729849	803496	880542	909690	1188323	1434752	1395832	1111523
Railways	179466	233719	266785	343229	395310	371338	407686	430401	466010	380730
Transport by other means	819369	940402	1039368	1149260	1223740	1469071	1687454	1548922	1677892	1546121
Storage	13967	15384	18233	18781	20245	22462	23279	26345	27563	26075
Financial services	796303	910354	962328	1065147	1184299	1148781	1395989	1526302	1723076	1886592
Public Administration services	863077	980808	1390657	1517496	1573618	1609037	1751531	1993959	2348486	2854941
Other services	1738239	1892760	1932774	2150766	2373548	2640051	3176499	3609298	4228354	4493111

Source: Economic Survey of Odisha, 2020-2021

In addition, for ease of data analysis and comparison, statistical metrics such as sector-wise mean, standard deviation, coefficient of variation (CV), Pareto curve, line graph, and bar graphs are used. The output results are presented as follows in Tables and Figures.

Table 2: Descriptive Statistics of Gross Value Added (GVA) of Odisha

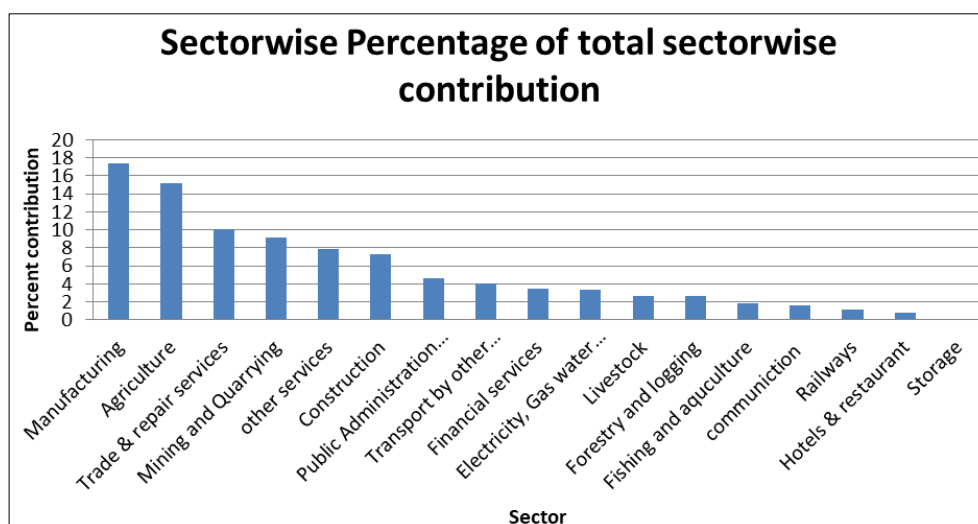| Sector	Sectoral contribution (in %)	Mean	Std. Deviation	Minimum	Maximum
Manufacturing	18.68387	6274904.2000	1887939.29254	4116404.00	8703040.00
Agriculture	16.26272	5461770.4000	1407607.20097	3090950.00	7757400.00
Trade & repair services	10.79267	3185993.8000	852539.90999	1838866.00	4386805.00
Mining and Quarrying	9.780776	3284834.9000	631563.66008	2648738.00	4209939.00
other services	8.407245	2823540.0000	1001634.49715	1738239.00	4493111.00
Construction	7.857805	2639012.8000	474048.80485	2059629.00	3326640.00
Public Administration services	5.027187	1688361.0000	597500.36726	863077.00	2854941.00
Transport by other means	4.403522	1310159.9000	316192.18773	819369.00	1687454.00
Financial services	3.751472	1259917.1000	361848.71954	796303.00	1886592.00
Electricity, Gas water supply & other utility services	3.536797	1187819.2000	232377.36561	775701.00	1467845.00
Livestock	2.867456	963023.8000	308776.10639	538911.00	1434752.00
Forestry and logging	2.791995	937680.5000	221062.56870	572223.00	1206627.00
Fishing and aquculture	1.979869	664931.10	313861.267	268365	1087455
communiction	1.709981	503853.2000	197872.28337	76396.00	704370.00
Railways	1.17336	347467.4000	92022.04621	179466.00	466010.00
Hotels & restaurant	0.910054	268921.1000	69343.96083	164047.00	367171.00
Storage	0.063224	21233.4000	4694.40528	13967.00	27563.00

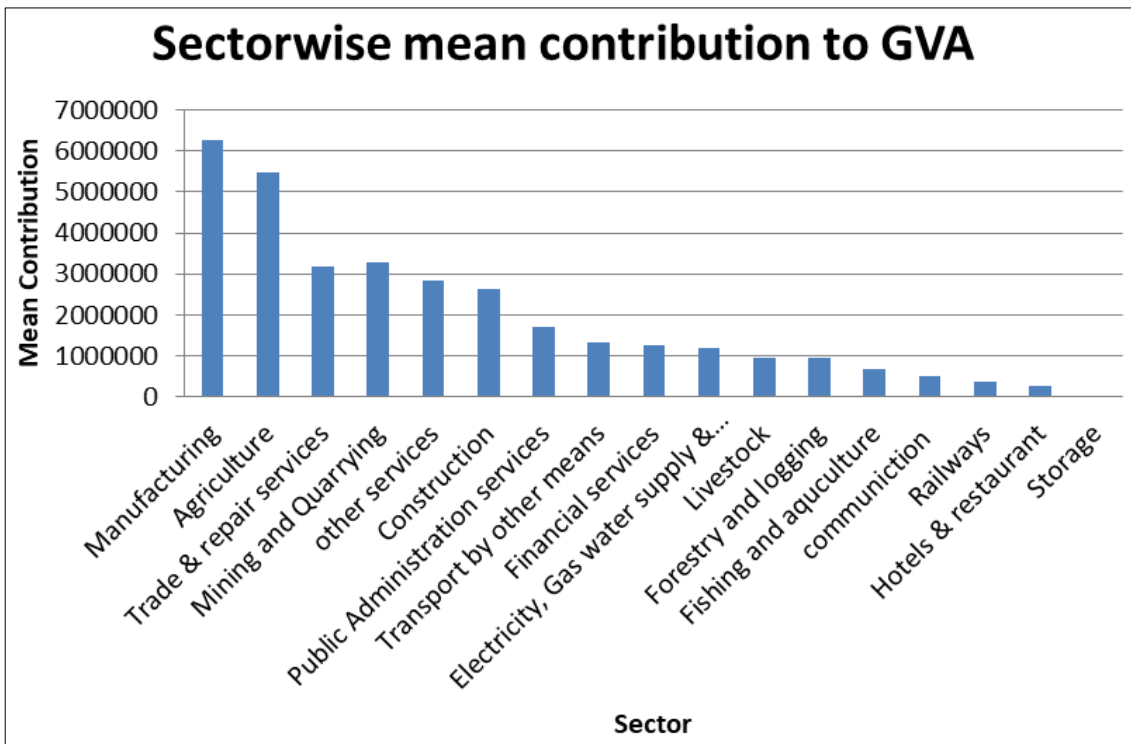**Fig 1:** Sector wise Percentage Contribution to GVA

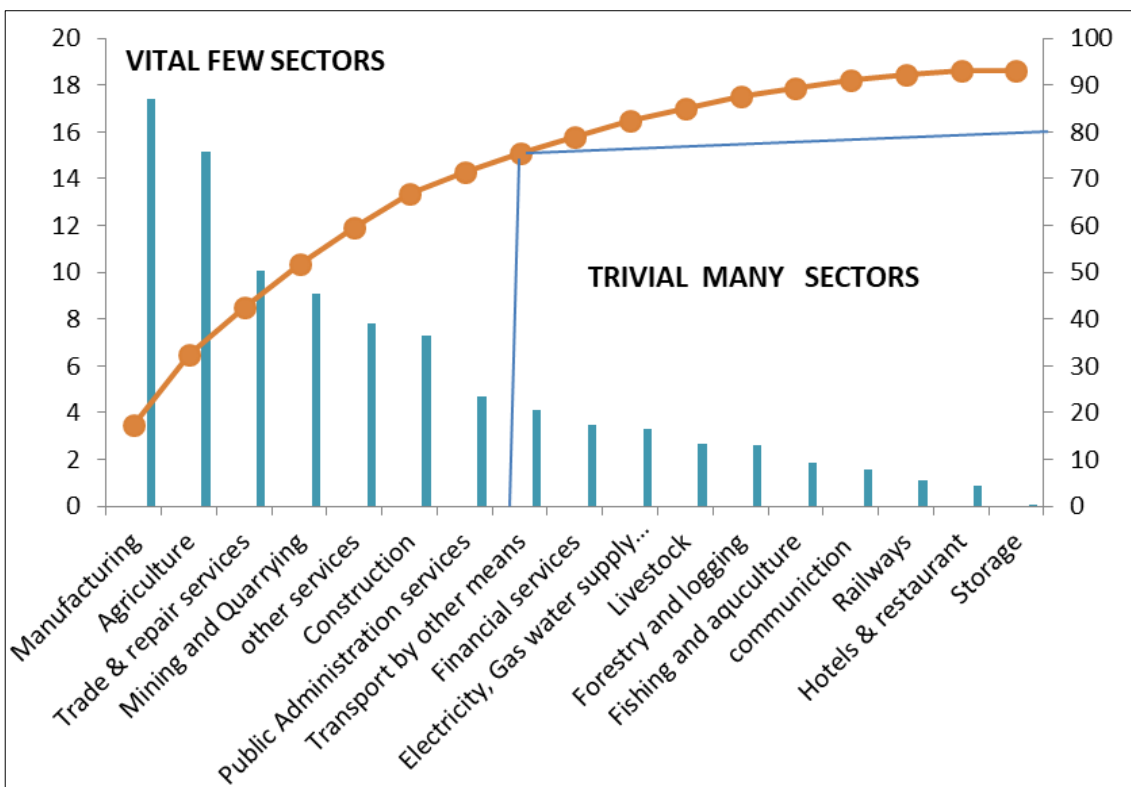**Fig 2:** Sector wise mean contribution to GVA

Fig 3: Pareto Curve for Gross Value added (GVA) of Odisha:

The Pareto Analysis (Figure 3) shows the sectorwise contribution to GDP of Odisha which distinguishes the whole sectors into two major section labeled as Vital Few Sectors (VFS) which contribute 80% to total GVA and Trivially Many Sectors (TMS) which contribute 20% to GVA can be automatically benefitted by increasing the GVA level. The figure 1 indicates that there are 7 VFS and 10 TMS sectors The VFS sectors which have significant effect of 80% are Manufacturing, Agriculture, Construction, Other Services, Trade & Repair Services, Mining & Quarrying and Public administration. The TMS sectors which have less contribution i.e. 20% to total GVA are Transport by other means, Financial Services, Communication, Fishing and aquaculture, Forestry & Logging, Electricity, Gas, Water Supply & Other utility services, Livestock, Railways, Storage.

Table 3: Gini Coefficient among Vital Few Sector (VFS)

Manufacturing	GC	Agriculture	GC	Trade & repair services	GC	Public Administration	GC	Mining and Quarrying	GC	Other services	GC
Agriculture	0.05072043	Trade & repair services	0.031232087	Public Administration	0.060672991	Mining and Quarrying	0.088435695	Other services	0.091545	Construction	0.102297
Trade & repair services	0.0314229	Public Administration	0.05727075	Mining and Quarrying	0.041729553	Other services	0.039520434	Construction	0.022237		
Public Administration	0.088609232	Mining and Quarrying	0.037713753	Other services	0.062533197	Construction	0.097923343				
Mining and Quarrying	0.05110532	Other services	0.067079069	Construction	0.051260266						
Other services	0.06558857	Construction	0.049547832								
Construction	0.0641348										

The Gini Coefficients among Vital Few Sectors is calculated and represented in the above (Table 3.1). The Gini Coefficient between Mining and Quarrying and Construction is lowest among all VFS sectors. This indicates that the degree of inequality is low as compared to other VFS sectors. The Other Services sector and Mining and Construction sector have highest Gini Coefficient which indicates that the degree of inequality is highest among all VFS sectors.
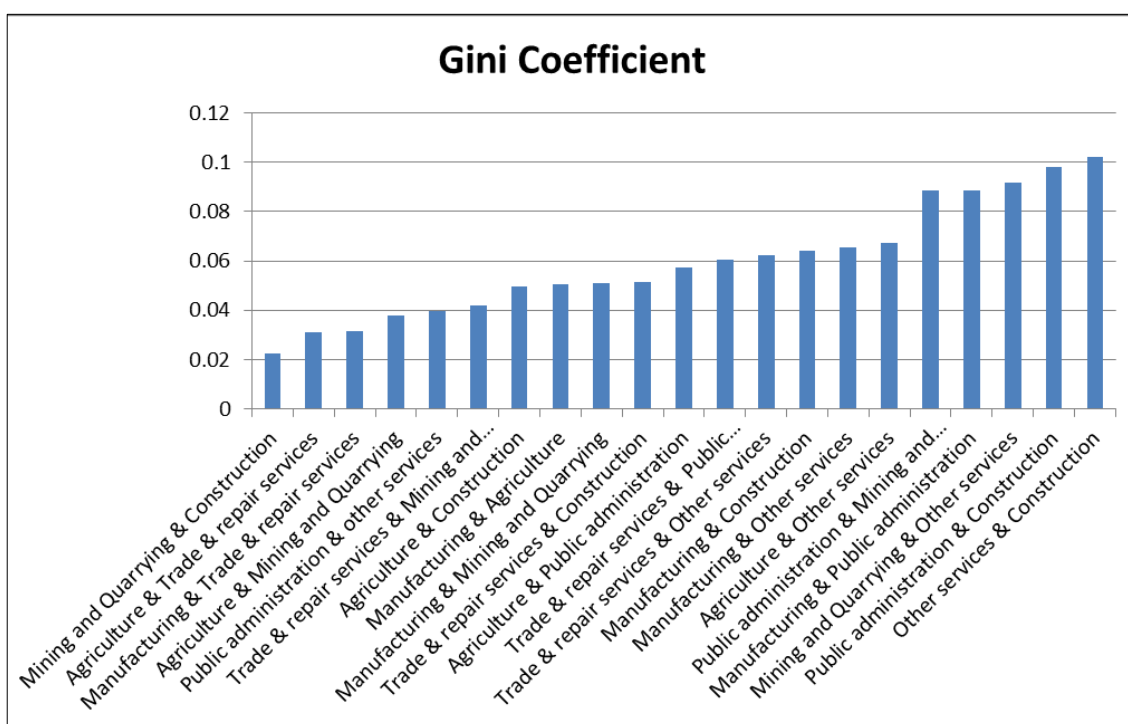

Fig 4: Gini Coefficient among Vital Few Sector (VFS):

The graph (Figure 4) shows the Gini Coefficients of all vital few sectors (VFS) which contribute 80% to the total GVA of Odisha. The degree of inequality is measured by computing Gini Coefficients of all VFS sectors. The highest degree of inequality is between other services and Construction sectors because its Gini Coefficient is high i.e. 0.102297. The Gini Coefficient of Mining & quarrying and Construction is 0.022237 which is the lowest among all. This indicates that the lowest degree of Inequality is Mining & quarrying and Construction. The VFS sectors which have high degree of inequality is kept in attention for policy suggestions. The policy measures should be created for the VFS sectors of higher degree of Inequality.

Conclusion

The State has not only to catch up with the national averages, but should also do better than that Odisha needs to grow at rates much higher than the national growth rates over a long period of time to catch up with the rest of India. Though regional, social and gender disparities have been narrowing down over time, regional, social and gender disparities still exist in the state. Therefore, there is a need to continue the ongoing drive for sustainable broad-based inclusive growth. The depressed regions and marginalized social classes, including women need greater attention. Engagement of the large sections of workforce, in particular, cultivators and agricultural labourers in the farm sector has contributed to under-employment low per capita incomes and high poverty among farm workers. The State Government has been implementing various anti-poverty programs including SGSY/NRLM, MGNREGS, IWMP and other programs for generation of wage employment. The State Government has been striving to improve the road connectivity in the State. Road construction improvement works are taken up on a massive scale through different programs, namely PMGSY, RIDF. Odisha is rich in minerals and their exploitation level has been increasing over the years. With vast mineral resources and abundant raw materials, the State has good

potential for industrialization. Modern applications of mining and qurrying is a helpful hand for the economic growth of Odisha. It suggests that levels of literacy, infant mortality rates, life expectancy at birth access to safe drinking water and income capture key dimensions of human development index of a region, community or society. The government and authorities are aware and appreciate the contribution of the real estate sector in the economic growth GVA of Odisha. The Odisha Government introduced a scheme to boost the trade hotel tourism sector by providing one month free tourist un till march 31,2022. Different measures should be emphasized to develop the other services sectors contributing to GVA of Odisha.

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