Population age structure and sustainable development in Odisha, India

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Abstract

The present paper analyses the changing age structure and its interface with the demographic and economic situation in Odisha, a socio-economically poor state of India which has experienced an impressive decline in fertility in the recent past. Based on demographic data from the census of India, the sample registration system, and the national family health survey, the study observes that the declining trends of fertility and mortality have resulted in a decline in the percentage of the child population and an increase in the percentage of working age as well as the aged population in Odisha. Regional variation in age structure is conspicuous, yet the overall trends of population age structure have provided both opportunities and challenges for achieving sustainable development goals in the state. On the one hand, a proper arrangement to provide quality education starting from the primary level, quality health services, and decent jobs will help in realising the demographic dividend and on the other; there is a need for having proper social safety mechanisms for the aged people in place to facilitate healthy ageing in the state.

Keywords: *Age structure, fertility, mortality, demographic dividend, ageing, sustainable development.*

Introduction

Population age structure is dynamic and the nature of changes is context-specific. Fertility, mortality and migration are the three interrelated and inter-dependent determining factors of the age structure. It gives an idea about the demographic and socio-economic history of a population over a period of about a century. A change in age-structure is inevitable consequent to a change in fertility, mortality and life expectancy. Similarly, the ongoing and future change in age structure will have both positive and adverse effects on socio-economic development. The United Nations 2030 Agenda recognizes the importance of age structure for sustainable development too (United Nations, 2015). During the 50th session of the United Nations Commission on population and development held in 2017, many governments and institutions issued statements reinforcing the importance of demography for development (United Nations, 2017). The age structure can have a significant impact on countries' stability, governance, economic development and individual well-being (Madsen, 2010). A study in India, Indonesia and Thailand highlights that although the rapid change in fertility in these countries will not lead to the shrinking of the labour force, a rapid increase in old dependency will have serious

impacts on economic development (Ram, 2002). Bloom (2011) sees opening up new economic opportunities as a consequence of the demographic change in India. Joe et al. (2015) highlight that a smooth pace of fertility decline has delayed India's prospects for an early demographic dividend. Needless to say, that changing age structure presents both formidable challenges and windows of opportunities for economic development.

The failure to account for and adapt to changes in age structure can lead to economic and social catastrophes in years to come. Developing countries with growing populations of young people must find ways to provide education and job opportunities to young masses to harness their potential contribution to sustainable development. India has started experiencing a shift in the age structure, moving from the youthful populations associated with the relatively high levels of fertility and mortality of the past, towards the older populations associated with the lower levels of fertility and mortality in recent times. This shift would lead to an increasing share of working ages (15-59 or 15-65). During 1911-1961, the share of working ages in the total population fluctuated between 54 to 60 percent (Rao, 1964). During 1961 and 2011, the share of the working-age population increased from 54.4 percent to 60.3 percent. Projected figures show that the share of the working ages would rise for some time reaching a peak of 65 percent for the 15-59 year age group (and nearly 70 percent for the 15-64 year group) before beginning to decline (United Nations, 2011). Given the diversities in economic and social structures, the nature of change in age structure and

its impact on socio-economic development would vary across states.

Accounting for 3.7 percent of the total population of the country, Odisha is one of the poorest states of India. As per the latest, National Sample Survey Organisation estimates, 32.6 percent of Odisha's population was living below the poverty line against the national average of 21.2 percent in 2011-12 (Government of India, 2013). According to the 2011 census, the female literacy rate in Odisha (64.4 %) is well below the national aggregate figure (74 %). A scenario of low birth rate along with low death rate but high childhood mortality and poor economic conditions remains a matter of concern (Das, 2018). This paper discusses the changing age structure, variations in it across districts and regions, and its association with economic performance in the state of Odisha.

Data Base and Methodology

The study is based on information available in the census of India. Data on vital statistics and life expectancy from the National Family Health Survey (NFHS) and the Sample Registration System (SRS) were also used. The 2014-15 economic survey report of Odisha forms the basis of economic data. Table 1 provides the definition/measurement of indicators used in this study.

Age structure is the proportion of a population in different age classes. The age structures of different populations are usually compared in terms of three broad age groups which identify persons in the working-age (15-59 years), children under the working-age (0-14 years) and aged people (60 + years). Changing age structure is shown by population pyramids. The coefficient of correlation is used to find out the degree

Table 1: List of Indicators and their Measurements.

Indicators	Definition/Measurement
Crude Birth Rate (CBR)	Number of live births per 1000 mid-year population in a given geographical area during a given year.
Total Fertility Rate	Number of children who would be born per woman if she were to pass through the childbearing years bearing children according to a current schedule of age-specific fertility rates.
Crude Death Rate (CDR)	Number of deaths per 1000 mid-year population in a given geographical area during a given year.
Infant Mortality rate (IMR)	Number of deaths of infants under one year per 1000 live births in a given year.
Maternal Mortality Ratio (MMR)	Annual number of female deaths per one lakh live births from any cause related to or aggravated by the pregnancy or its management.
Life expectancy at Birth	Average number of years that a newly born baby is expected to survive at current mortality rates
Dependency Ratio	Population in 0 to 14 and 60+ to the population aged 15 to 59, expressed in percentage.
Index of Ageing	Population aged 60+ per 100 children (0-14 age group).

and extent of correlation between various indicators of age structure and per capita Net District Domestic Product (NDDP) in Odisha at the district level.

Population Size, fertility, and Mortality

During the first half of the 20th century 4.3 million people were added to Odisha's population (Table 2). This period is marked by fluctuations in the decadal growth rate of the population. During the second half of the 20th century 22.1 million people were added. According to the 2011 census, the population size of Odisha was 41.9 million. The highest decadal growth rate (25.05 %) was recorded during 1961–1971 and since then the growth rate has been declining. There was a significant decline in the growth rate of the population during 2001–2011, from 16.25 percent to 13.97 percent. The rate of population growth in Odisha has been lower than the national figure since 1971. The slowing down in the pace of population growth can largely be attributed to a decrease in natural increase,

Table 2: Population Growth in Odisha (1901-2011)

Year	Population	Change	Decadal Variation (%)
1901	10,302,917	-	-
1911	11,378,875	1,075,958	10.44
1921	11,158,586	- 220,289	- 1.94
1931	12,491,056	1332,470	11.94
1941	13,767,988	1,276,932	10.22
1951	14,645,946	877,958	6.38
1961	17,548,846	2,902,900	19.82
1971	21,944,615	4,395,769	25.05
1981	26,370,271	4,425,656	20.17
1991	31,569,736	5,289,465	20.06
2001	36,804,660	5,144,924	16.25
2011	41,947,358	5,142,698	13.97

Source: India, Registrar General of India (2011). Census of India 2011

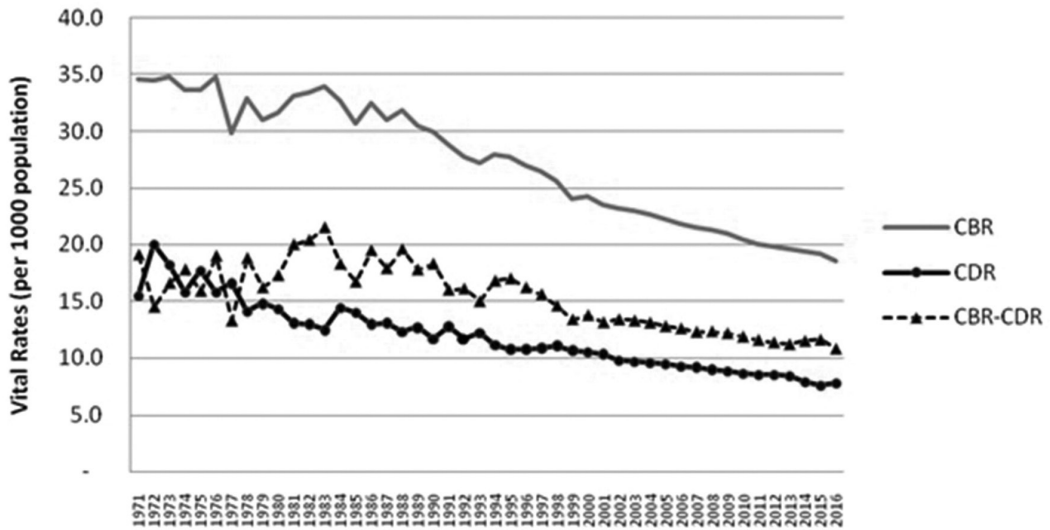which is measured in terms of the difference between CBR and CDR.

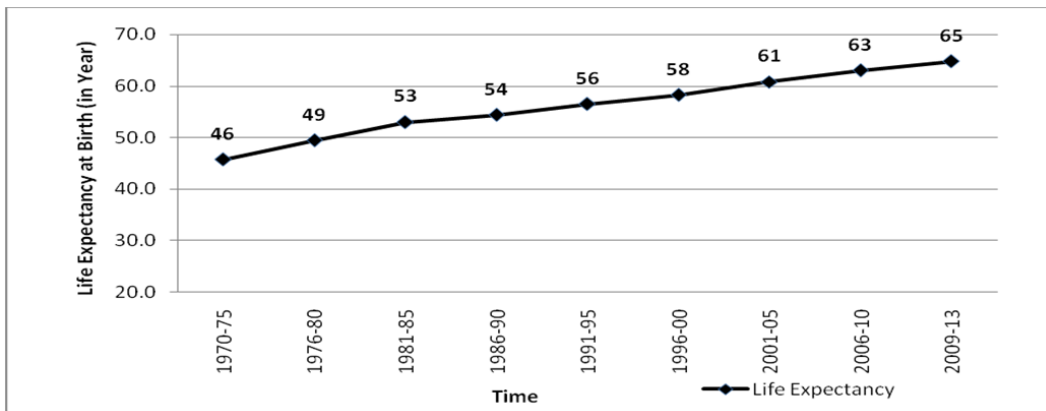Fig 1: Demographic Trends in Odisha, 1971-2016.

Fig 2: Life Expectancy at Birth in Odisha

According to the Sample Registration System (SRS) estimates the CBR declined significantly from 34.6 in 1971 to 18.6 in 2016 in Odisha. Similarly, the TFR declined from 4.7 in 1971 to 2.0 in 2016. The national figure for CBR declined from 36.9 in 1971 to 20.4 in 2016 and the TFR declined from 5.2 in 1971 to 2.3 during the same period. There has been a rapid fall in CBR in Odisha since the early 1980s. The state has achieved the replacement level of fertility (TFR 2.1) in 2012. The pace of decline in fertility in Odisha however has been slightly slower than the average decline in the country

Table 3: Percentage distribution of population in broad age group in Odisha by regions, 2011

Region	Child Population (%)	Population in the working ages (%)	Aged Population (%)	Age Not Stated (%)	Total
Southern	32.30	58.50	8.86	0.34	100
Coastal	26.01	63.39	10.34	0.26	100
Northern	28.78	61.86	9.10	0.26	100
All Odisha	28.8	61.5	9.5	0.3	100
India	30.8	60.3	8.6	0.3	100

Source: Calculated from 2011 census

(Behuria and Das, 2016; Das, 2018) though, the fertility rate continues to be lower in Odisha vis a vis the national average. Fig 1 shows the steady decline in natural growth (CBR-CDR) in the 1970s and 1980s and a much faster rate of decline since the 1990s. The CBR-CDR gap in Odisha too declined from 20.0 in 1981 to 10.8 in 2016. This has happened due to the higher rate of decline in CBR relative to the CDR during the same time. Certainly, the population growth pattern clearly corresponds to the rate of decline in natural growth.

IMR has sharply declined from 127 in 1971 to 34 in 2016 in Odisha with a consequent improvement in life expectancy at birth from 46 during 1970-75 to 65 in 2009-2013 (Das, 2018, Fig 2). Reduction in IMR, declining natural increase, and the rise in life expectancy re-shaped the age structure of the population in the state.

Changing Age Structure

Population pyramids (Fig 3 and fig 3a) for Odisha reveal a substantial decline in the child population in 0-4, 5-9 and 10-14 age group during 2001-2011 indicating a recent fertility decline leading to an increase in the working-age population. As per the 2011 census, 28.8 percent of the population is dependent with 61.5 percent working and 9.5 percent the old age population (Table 3). Thus, Odisha has marched ahead of the national average in terms of demographic transition. During 2001 and 2011 the young dependency declined while old-age dependency surged from 8.3 to 9.5 percent and the working-age population increased from 58.4 to 61.5 percent. Declining fertility and increasing life expectancy are clearly reflected in the population pyramid indicating also the onset of the early ageing process in the state. There are significant inter-district and inter-regional variation in the process though (Appendix 1, Table 3).

Table 3 presents regional[1] variation in the age structure of Odisha. The proportion of the child population is the highest in the

[1]National Sample Survey Organisation (NSSO) divides Odisha into three natural divisions; Southern (includes Kandhamal, Baudh, Subarnapur, Ganjam, Gajapati, Nuapada, Kalahandi, Rayagada, Nabarangpur, Koraput and Malkanagiri district); Northern (includes Bargarh, Jharsuguda, Sambalpur, Debgarh, Sundargarh, Kendujhar, Mayurbhanj, Dhenkanal, Angul, and Balangir district) and Coastal (includes Balaswar, Bhadrak, Kendrapara, Jagatshingpur, Cuttack, Jajapur, Nayagarh, Khorda, and Puri district).

southern region followed by the northern and the coastal while the reverse is true for the aged and working-age population (Table 3). The apex of the pyramid is broader for the coastal region, followed by the northern and the southern regions (Fig 4, 5 and 6). The order gets reversed in the case of the base of the pyramid.

The bulge in the middle of the pyramid is more visible in the coastal region. This regional difference in age composition corresponds to the levels and trends of fertility decline. Coastal Odisha has experienced a rapid pace of fertility decline compared to the other regions (Behuria and Das, 2016).
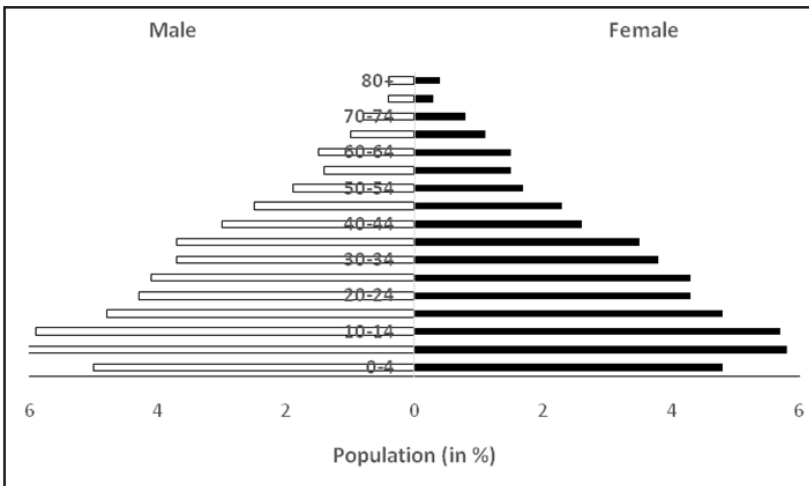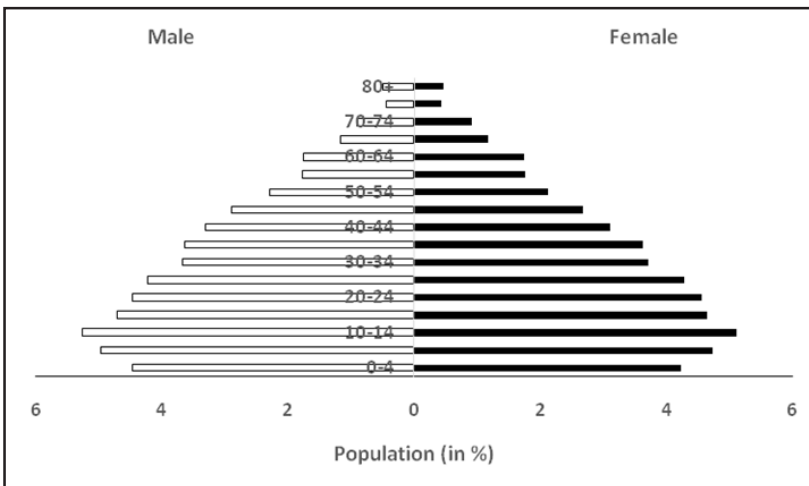

Fig 3: Population Pyramid in Odisha, 2001

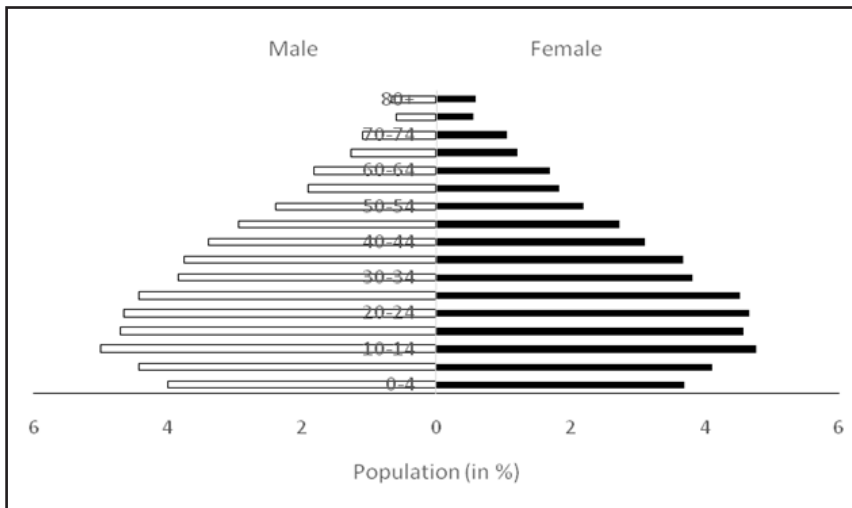Fig 3a: Population Pyramid in Odisha, 2011

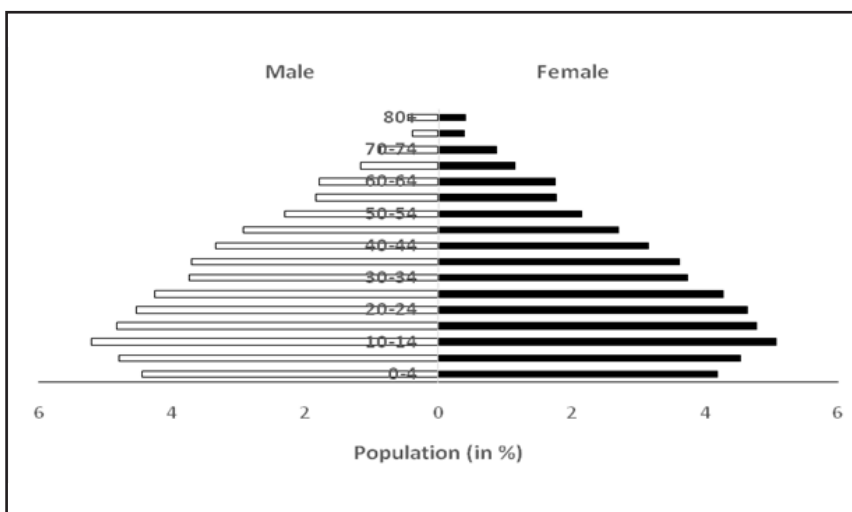Fig 4: Population pyramid of the coastal region of Odisha, 2011

Fig 5: Population pyramid of the northern region of Odisha, 2011

Economic Implications

Reduction in fertility in the recent past has resulted in an increase in the share of the population in working age and aged population while the share of the dependant young population has declined. If these trends continue, the state will have both economic challenges and opportunities.

Dependency

A comparison with the situation at the national level reveals a lower total dependency and child dependency ratio in
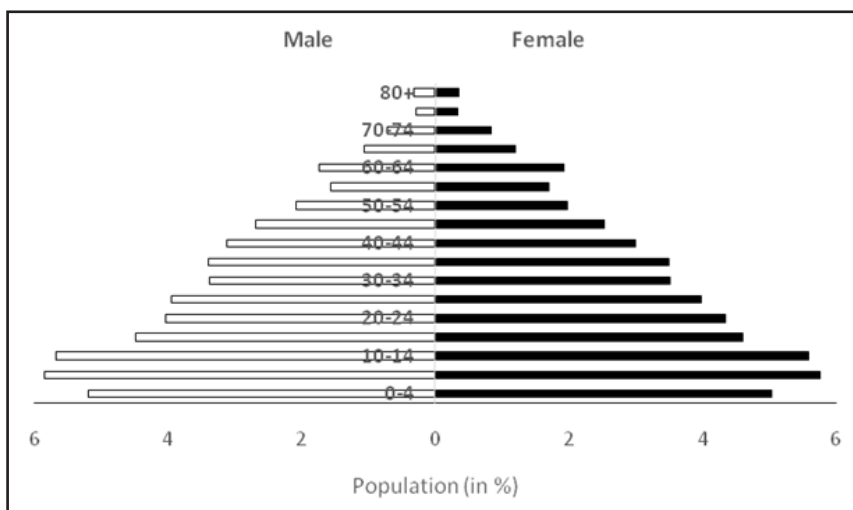
Fig 6: Population pyramid of the southern region of Odisha, 2011

Odisha. Old-age dependency ratio also lower in Odisha. According to the 2011 census, the total, child and the old dependency ratio for India were 65.2, 51.0 and 14.2 percent respectively. The corresponding figures for Odisha are 62.3, 46.8 and 15.5 percent. Figure 7 shows that the dependency ratio had declined from 2001 to 2011 in Odisha, though old age dependency had marginally increased. Significantly, dependency as a whole declined from 70.9 percent to 62.3 percent driven by a steep drop in the young age dependency ratio (Das, 2018).

At the sub-regional level, there is an important variation with much higher dependency in the southern region, followed by the northern and the coastal region (Table 4). The pattern is identical for child dependency but reverses for old-age dependency. The degree of inter-district variations (Figures 8-10) in all indicators, however, is not large as coefficient variation is low (18.5 %, 11.9 % and 13.0 for the child, old and overall dependency). The extent of variation is higher in the case of child dependency compared to old-age dependency. Broad district level patterns show that child dependency is higher in southern districts while these districts have lower old dependency (Figures 8-10). It should be noted that the district level pattern

Table 4: Regional variations in dependency ratio in Odisha, 2011

Region	Child dependency ratio	Old dependency ratio	Total dependency ratio
Southern	55.2	15.1	70.4
Coastal	41.0	16.3	57.3
Northern	46.5	14.7	61.2
All	46.8	15.5	62.3

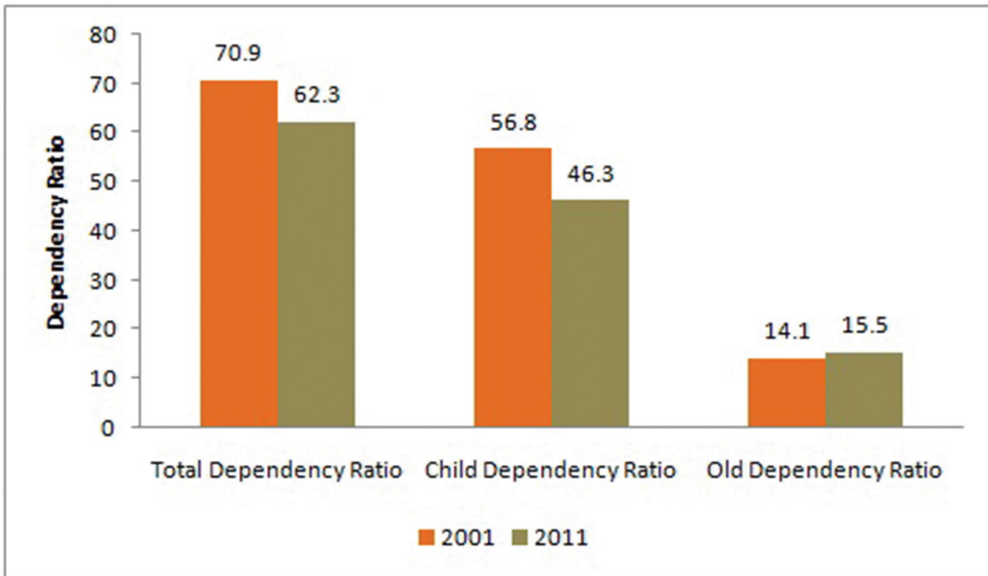*Source: Calculated from Census of India, 2011*

Fig 7: Dependency ratio in Odisha, 2001 – 2011
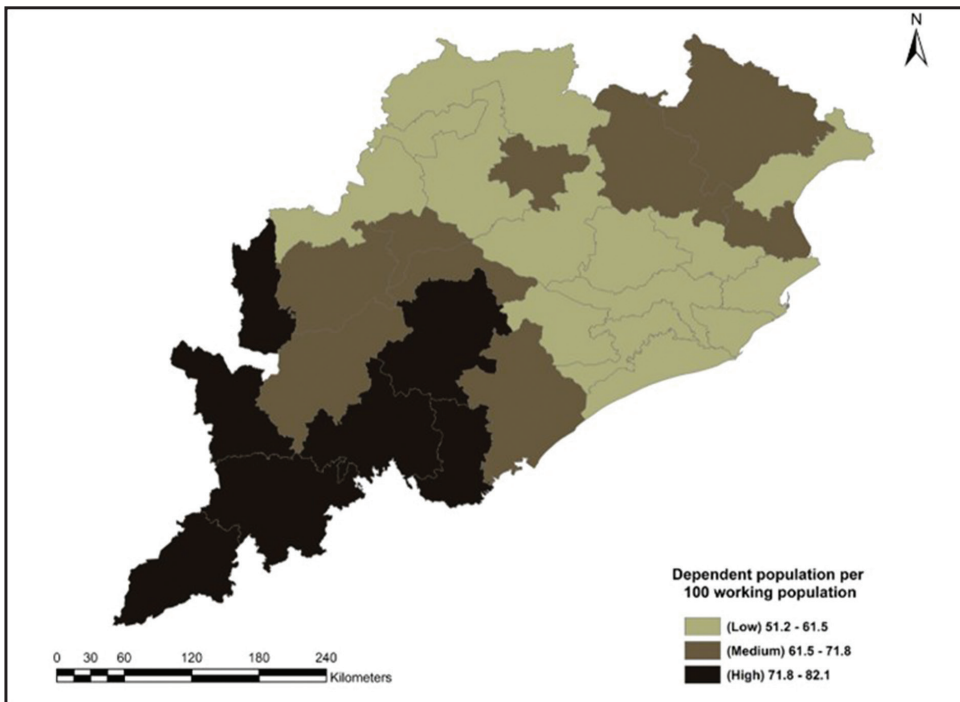

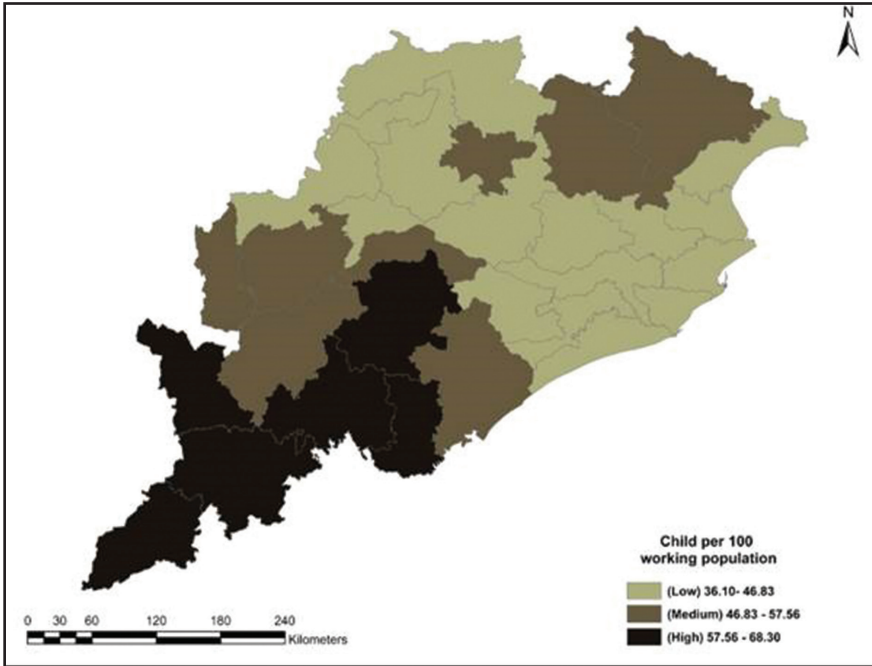Fig 8: Distribution of districts by dependency ratio in Odisha, 2011

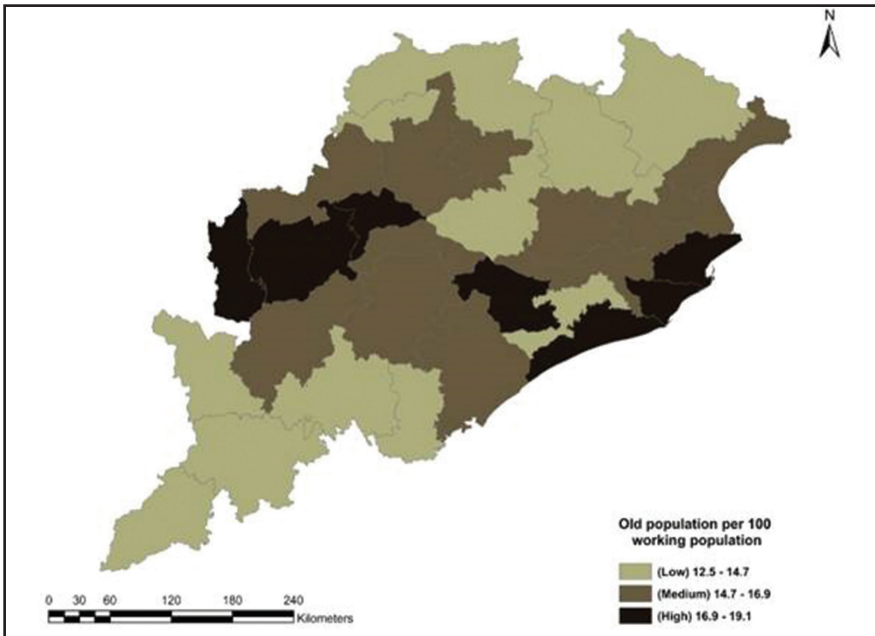Fig 9: Distribution of districts by child dependency ratio in Odisha, 2011

Fig 10: Distribution of districts by old dependency ratio in Odisha, 2011

of dependency ratio closely corresponds to that of fertility: dependency ratio is higher where fertility is higher (r=0.956).

Discussion

Population Ageing

The demographic changes as discussed in the previous sections have implications for ageing. Appendix 2 shows that the index of ageing in the state has increased from 25 in 2001 to 33 in 2011 with the coastal region ageing faster (Ageing index- 40) during 2001 and 2011 revealing that the ageing process has already set in all parts of the state, though with a different pace. However, inter-district variation in ageing has changed little with the coefficient of correlation (r= 0.987) between the index of ageing for 2001 and that of 2011 continuing to be strong and statistically significant.

Demographic Dividend

The demographic dividend is defined as the benefits which can be reaped from the age structure of a population. Particularly, benefits can be reaped when there is a large stock of productive workers in the population with low old-age dependency. With more people in the labour force and fewer children to support, a country is said to be having a window of opportunities for economic growth. This can be materialised if the right investments and policies are made in the health, education, and employment sectors. The rising share of working-age population in Odisha caused largely by rapid fertility decline in the recent past means the economy of the state has the potential to grow. Significantly, the working-age population in the total population of Odisha has increased from 58.4 to 61.5 percent from 2001-2011. This trend is expected to continue for some time.

Age Structure and Economic development

Age structure plays a significant role in output per capita. An attempt is made here to find the degree of association between the per capita Net District Domestic Product (NDDP) and economic indicators of age structure.
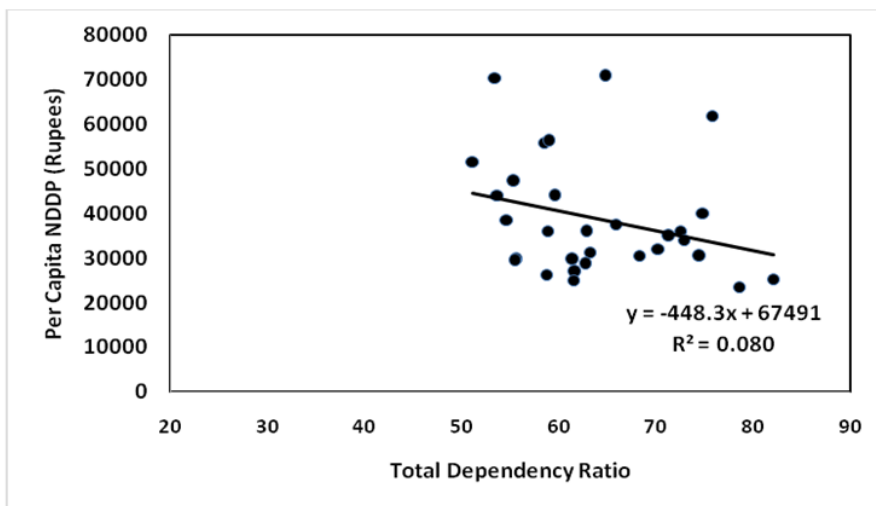

Fig 11: Relationship between Dependency Ratio and Per Capita NDDP in Odisha, 2011
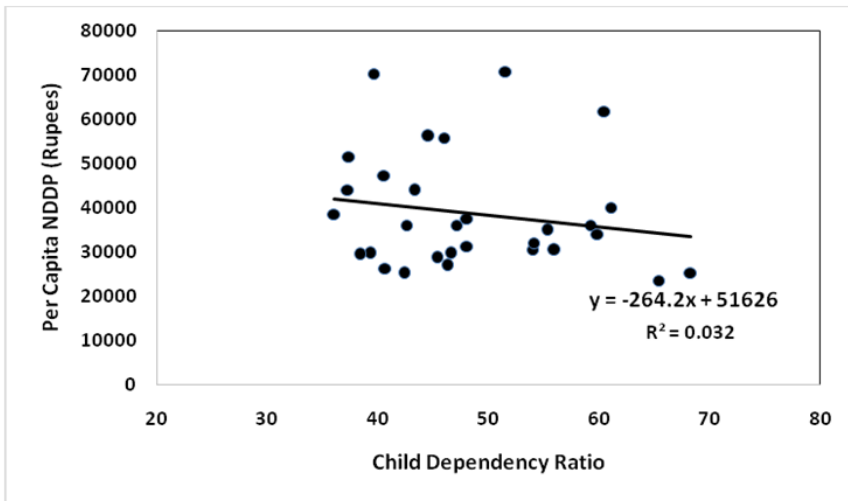
Fig 12: Relationship between child dependency ratio and per capita NDDP in Odisha, 2011
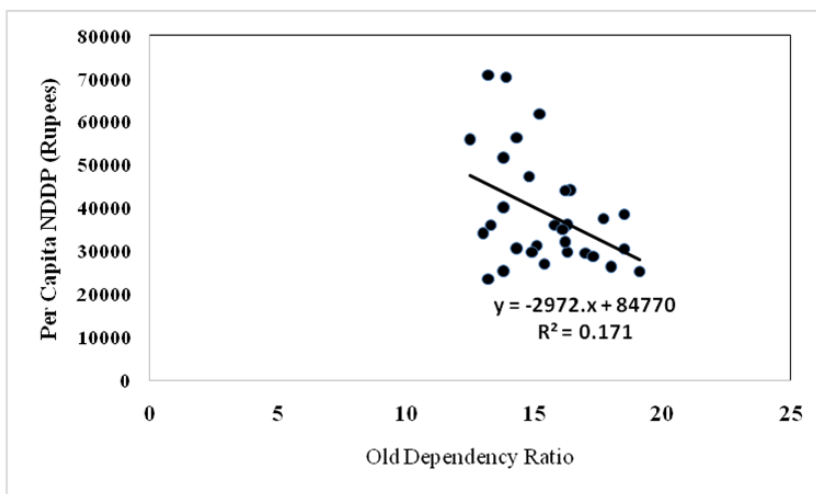
Fig 13: Relationship between old dependency ratio and per capita NDDP in Odisha, 2011

Fig 11 shows a statistically insignificant negative relationship (r = -0.282) between the dependency ratio and per capita NDDP. Similar in nature and somehow weaker relationship (r = -0.178) is observed in the case of child dependency (fig 12). On the other hand, the relationship between the old dependency ratio and per capita NDDP (r = -0.413) is moderately negative but statistically significant at the 5% level (fig. 13). There is a positive correlation between the percentage of working age population and per capita NDDP in the state; yet not statistically significant. This indicates that a higher percentage of the population of working-age does not necessarily lead to higher economic growth. Rather, demographic dividend can be harnessed if people in the productive age

group are educated, skilled and if they have access to job opportunities.

Education, Employment and Health Needs

Only seven percent of the population aged 15+ has higher education according to the 2011 census (Table 5). The figures for rural and urban areas are 4.2 percent and 19.3 percent respectively. The male-female gap to the disadvantage of the female population was also glaring irrespective of place of residence.

Table 5: Percentage of the population (15+) with a higher education degree in Odisha, 2011

Place of Residence	All	Male	Female
Total	7	9	4.7
Rural	4.2	5.9	2.6
Urban	19.3	23.1	15.2

Source: Calculated from the census of India, 2011

According to the 2011 census, the proportion of technically educated persons is abysmally low in the state. People with higher education in engineering and technology, medicine, and agriculture and allied sciences comprise 11.7 percent, 0.2 percent and 0.1 percent respectively of the total people with higher education. In contrast, the figures for the graduate degree other than a technical degree and the postgraduate degree other than a technical degree are 66 percent and 16.5 percent respectively. Hence the very low level of access to higher education and very poor coverage of job oriented technical education are the important features of the state of higher education in Odisha.

The creation of decent employment opportunities is yet another important desired step in harnessing the demographic dividend. Changes in the unemployment rate and the sectoral composition of the workforce give an idea about the economic progress of a region. National Sample Survey Organisation provides estimates based on 'usual activity status' of individuals and 'the unemployment rate derived from 'usual principal status' is sometimes called "chronic unemployment" as the persons coming under this category remained unemployed for a major part of the period for which they were available' (Government of Odisha, 2018: 26). The unemployment rate in Odisha has declined from 5.9 percent in 2012-13 to 3.8 percent in 2015-16. The aggregate figure for India in 2015-16 was 3.7 percent too. The corresponding figures for urban and rural Odisha were 4.4 percent and 3.7 percent respectively. This indicates that the unemployment rate in the state is not very high. However, the agricultural sector continues to absorb more than 62 percent of the total workforce in the unorganized sector, even though the share of state's agriculture in gross state domestic product has declined to less than 20 percent. This leads to disguised employment in the form of lower-income and productivity of labour in rural Odisha. Similarly, the rising share of marginal workers in the total workforce from 33 percent in 2001 to 39 percent in 2011 is a cause of worry.

The transition of workers out of the agricultural sector to non-agricultural sectors is taking place at a snail's pace. In 1971, only 20 percent of the workforce of Odisha was engaged in non-agricultural activities; increased to 38 percent in 2011 registering an increase of 18 percentage points during 1971-2011 (calculation based on a census of India data). Further, there has been a decline in

Table 6: Prevalence of different health issues in the age group of 15-49 years, 2015-16

Health Indicators (persons per 1,00,000 usual residents)	Male	Female
Diabetes	2913	1525
Asthma	2233	2502
Goitre or any other thyroid disorder	287	1245
Any heart disease	1001	1125
Cancer	199	59
TB*	453	226

Note: *includes all age group
Source: IIPS and ICF (2017), National Family Health Survey-4 (2015-16), Odisha Report.

employment in the organised sector from 7.95 lakh in 2013 to 5.03 lakh in 2015. Between 2004 and 2015, the compound annual growth rate of employment in the public sector fell by 2.1 percent but there was an increase of 1.4 percent in the private sector in the State (Government of Odisha, 2018). Of course, the private sectors demand technologically skilled workers and Odisha's performance in producing a skilled workforce has been less than satisfactory.

According to NFHS 4 data, around 20 percent of men and 26 percent of women in the age group of 15-49 had low BMI in 2015-16 (IIPS and ICF, 2017). The corresponding figures for anaemia were 28 percent and 51 percent for men and women in the same age group. The same survey depicts a poor state of children's health in the state. The health issues (Table 6) related to Asthma, Tuberculosis and goitre are quite common. On the other hand, cancer, heart problems and diabetes will pose a real challenge to the per head productivity. With the poor state of higher education, employment and health, Odisha are unlikely to harness the dividend from its youthful population. However, there is a huge scope for achieving better economic development indicators by utilising and managing the youth.

Conclusion

The declining trends of fertility and mortality have brought about significant changes to the population age structure of Odisha. The share of children's population has declined, and that of the population in the working ages and old age group has increased. Caused by fertility decline and improvement in life expectancy, the onset of ageing will certainly increase the burden of supporting the aged population. In fact, the overall dependency ratio in the state has taken a declining trend and thereby providing the opportunity to harness the demographic dividend. However, the sheer increase in the share of the population of working age is not enough to reap the benefit of demographic changes. The extent to which Odisha can capitalise on this depends on how educated, skilled and healthy its population is, and how well its workers can be employed. The state of education, health and employment in the state is far from satisfactory. The added cause of worry is regional variations in demographic compositions and resultant implications on the society and economy.

The southern region of Odisha with a higher fertility level exerts a higher burden of providing a decent quality of life to children. Coastal Odisha has performed well in the demographic front, followed by the northern region of the state. As the ageing process has already started in the state, particularly in the coastal part, there is an urgent need for social safety mechanisms for aged people in place. The concerted effort to evolve a proper arrangement to provide quality education starting from the primary level, quality health services, and decent jobs will help in realising the demographic dividend. Further, there is a need to strengthen ongoing government schemes of skill development meant for youths to equip them according to the demand of the job market which is key to harnessing the demographic dividend. The United Nations sustainable development goals in many ways have a close connection with the demographic structure. In the absence of a set of well thought out strategy to manage the challenges and opportunities emerging out of changing demographic structure, Odisha is unlikely to ensure overall progress by 2030.

Acknowledgement

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Appendix 1: Percentage distribution of population in broad age group in districts of Odisha, 2011

Districts	% of Child Population	% of Adult Population	% of Old Population	% of Age Not Stated	Total Population
Bargarh	25.2	64.2	10.5	0.1	1,481,255
Jharsuguda	25.7	65.0	9.0	0.2	579,505
Sambalpur	26.1	64.2	9.5	0.2	1,041,099
Debagarh	29.4	61.1	9.2	0.2	312,520
Sundargarh	28.9	62.9	7.8	0.3	2,093,437
Kendughar	31.2	60.4	8.0	0.4	1,801,733
Mayurbhanj	32.0	59.3	8.4	0.2	2,519,738
Baleshwar	28.8	61.8	9.2	0.2	2,320,529
Bhadrak	28.6	61.7	9.5	0.2	1,506,337
Kendrapara	23.3	64.5	12.0	0.3	1,440,361
Jagatsinghpur	23.3	64.5	12.0	0.3	1,136,971
Cuttack	24.2	64.8	10.6	0.3	2,624,470
Jajapur	27.1	62.5	10.2	0.3	1,827,192
Dhenkanal	26.7	62.8	10.2	0.2	1,192,811
Anugul	28.0	62.7	9.0	0.3	1,273,821
Nayagarh	26.2	61.8	11.8	0.2	962,789
Khorda	24.6	65.9	9.0	0.3	2,251,673
Puri	24.7	64.2	10.9	0.3	1,698,730
Ganjam	28.8	61.2	9.6	0.3	3,529,031
Gajapati	34.1	57.6	7.7	0.6	577,817
Khandhamal	34.4	56.8	8.7	0.2	733,110
Baudh	32.2	58.2	9.4	0.2	441,162
Subarnapur	27.8	61.3	10.6	0.2	610,183
Balangir	29.0	60.1	10.7	0.2	1,648,997
Nuapada	32.0	57.2	10.6	0.2	610,382
Kalahandi	31.7	58.5	9.5	0.3	1,576,869
Rayagada	34.5	57.6	7.5	0.4	967,911
Nabarangapur	36.4	55.7	7.3	0.5	1,220,946
Koraput	34.8	57.0	7.9	0.4	1,379,647
Malkangiri	37.4	54.8	7.6	0.3	613,192
Odisha	28.8	61.5	9.5	0.3	41,974,218
India	30.8	60.3	8.6	0.3	1,210,193,422

Source: Census of India, 2011

Appendix 2: District wise variations in the pace of ageing in Odisha, 2001and 2011

Districts	Index of Ageing, 2001	Index of Ageing, 2011
Odisha	25	33
Bargarh	32	42
Jharsuguda	26	35
Sambalpur	27	36
Debagarh	24	31
Sundargarh	20	27
Kendujhar	19	26
Mayurbhang	20	26
Baleshwar	23	32
Bhadrak	25	33
Kendrapara	34	44
Jagatsinghpur	37	51
Cuttack	33	44
Jajapur	27	37
Dhenkanal	27	38
Anugul	22	32
Nayagarh	33	45
Khorda	27	37
Puri	33	44
Ganjam	25	33
Gajapati	17	22
Kandhamal	17	25
Baudh	23	29
Subarnapur	27	38
Balangir	29	37
Nuapada	26	33
Kalahandi	24	30
Rayagada	16	22
Nabarangapur	16	20
Koraput	16	23
Malkangiri	15	20

Source: Calculated based on Census of India, 2001 and 2011