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Introduction

India and China are the only two billion plus countries in the World. The two countries account for more than 37 per cent of the World population (United Nations 2011). Around 1950 when India got freedom from a long and oppressive colonial rule (in 1947) and China became 'Red' (in 1949), the two countries had very similar population scenario - population of both the countries was in the very early stage of transition. Since then, the population transition path followed by China has been radically different from the population transition path followed by India. As a result of some very rapid transition since, China's population has now reached the post transition stage with a total fertility rate of 1.77 and an expectation of life at birth of 73 years so that the average annual population growth rate of the country is estimated to be less than 0.65 per cent per year during the period 2005-2010. By contrast, the total fertility rate in India still hovers around of 2.75 while the expectation of life at birth is just around 63.5 years resulting in an average annual population growth rate of more than 1.6 per cent during the period 2005-2010. Between 2005 and 2010, more almost 88 million people were estimated to have been added to India's population compared to less than 42 million in China. As a result of the different population transition path followed in the two countries, it is projected that the net addition to the population will be significantly more in India as compared to China in the years to come so that around the year 2030, India will become the most populous country in the world. At that time almost 18 per cent of the world population will be living in India and its population will still be increasing. China's population, on the other hand, is projected to start declining after 2030.

Implications of population transition have also been different in the two countries. The rapid transition in population in China had a significant impact on the economic growth. In a period of less than twenty years - between 1982 and 2000 - the gross domestic product per capita in China, adjusted for purchasing power parity, increased by more than four time - a record unmatched elsewhere in the world (Wang, Mason 2005) and the demographic dividend - the transition in the population characterized by reduction in fertility and mortality and associated changes in the age structure - accelerated China's economic growth by 2.3 per cent per year (Vermeer 2006). In India, comparatively, the demographic dividend has

remained comparatively small simply because the pace of population transition in the country has remained slow (Chaurasia, Gulati 2008).

In this paper, we compare the population transition path followed by China and India since 1950 to identify distinctive features of population transition in the two countries. The paper also explores factors and conditions behind the divergent path followed by the two countries after having very similar population scenario around the year 1950 and its implications for the future.

Population transition refers to the change in population stock (size, growth and composition) as the result of the change in the factors that affect the population stock (Schoen 2002). At the pre-transition stage, both birth rate and death rate are high with the result that the population age structure is young and increase in population is slow. With the onset of transition, first death rate and then birth rate starts decreasing so that the increase in population first accelerates and then slows down. Towards the end of the transition, both birth rate and death rate are very low and increase in population again becomes very slow but the age structure of the population gets older. Throughout this transition process, the size of the population increases, slowly in the beginning, rapidly in the middle, and again slowly at the end. The effect of transition on the growth in population depends upon two factors: 1) the gap between the crude birth rate and the crude death rate leading to an exceptional rate of natural increase and 2) length of the period in which the exceptional gap prevails (Vallin 2006). A synthetic index that characterises the pattern of population transition is the population multiplier (Chesnais 1979, 1986). This index is the number by which the population is multiplied when it moves from the pre-transition phase to the post-transition phase. There are two ways to calculate the population multiplier - theoretical and empirical. The theoretical approach involves approximation by means of either an analytical model (Keyfitz 1977) or through numerical simulation (Frejka 1973) whereas the empirical approach involves examination of recorded historical evidence complemented by long range population projections (Chesnais 1990).

During the process of transition, the age structure of the population changes significantly. In the pre-transitional stage, the population pyramid is typically triangular in shape. As transition proceeds, the population pyramid is progressively transformed to a rectangular and then to a trapezoidal shape and, in extreme scenario, to an inverted triangle. This

means that during the pre-transitional and post-transitional phase, the dependency ratio is high largely due to high young dependency in the pre-transitional phase and largely due to high old dependency in the post-transition stage.

The natural population growth rate along with crude birth rate and crude death rate are the indicators commonly used for measuring and monitoring population transition. However, the crude birth and death rates are conditioned by the age and sex structure of the population as not all population is exposed to the risk of birth and the risk of death varies by age. An alternative is to use cohort or period rates such as total fertility rate and expectation of life at birth but these indicators also have limitations as they do not take into account the age and sex structure of the population. Measuring and monitoring population transition, therefore requires that transition in both fertility and mortality as well as transition in the age structure effects on the crude birth rate and crude death rate are analysed.

The change in the population stock - size as well as structure - may also be influenced by the movement of the population - in or out migration. However, compared to the change in the population stock resulting from changes in the levels of fertility and mortality and associated age structure effects on the birth rate and the death rate, the change in the population stock resulting from migration is generally an insignificant proportion of the total population change.

The paper is organised as follows. The next section outlines the methodology while section three describes the data source. Section four presents the results of the analysis. Section five discusses key factors that influenced the transition path in China and India while the concluding section discusses future of population transition in the two countries.

Methodology

Fundamentally, population transition is the elaboration of the basic differential equation

$$\partial P/\partial t = mP \qquad (1)$$

where P is the population stock (size and structure of the population) and m is the force of transition (Schoen 2002). The force of transition may be an instantaneous rate or probability or risk of the change with respect to the demographic behaviour of interest. One special but useful feature of population transition is that it is logically closed. This means that the

change in the population stock over a given time period can be determined from the population stock at the beginning of the period and the demographic events that occur during the period under reference. The classical expression of this closure property is the well known balancing equation of population change

$$P(t) = P(0) + B(0,t) - D(0,t) + I(0,t) - O(0,t) \quad (2)$$

where t stands for time, B is the total number of births between time 0 and time t; D the total number of deaths; I total immigration and O total emigration during this time interval. If it is assumed that population is closed to migration or the net migration is either zero or very near to zero, then

$$P(t) - P(0) = B(0,t) - D(0,t). \quad (3)$$

Dividing both the sides by PY(0,t), the person years lived between time 0 and t, we get

$$r = b - d. \quad (4)$$

Here r is the (crude) rate of natural increase, b is the (crude) birth rate and d is the (crude) death rate. In the absence of migration, r serves as a useful indicator of population transition. When r=0, the birth rate is equal to the death rate and the population remains unchanged over time. Now

$$\nabla r = r_2 - r_1 = \nabla b - \nabla d = (b_2 - b_1) - (d_2 - d_1). \quad (5)$$

It is well known that both birth rate death rate are influenced by the age structure of the population in addition to prevailing levels of fertility and mortality. The analysis of population transition, therefore requires that the fertility and mortality effects are separated from the age structure effects on the birth and the death rate. If f denotes the age independent birth rate, then we can write

$$b = f * (b/f) \quad (6)$$

The ratio (b/f) represents the age structure effects on the birth rate. Similarly, if l denote the age independent death rate, then we can write

$$d = l * (d/l). \quad (7)$$

Substituting from (6) and (7) in (5) yields

$$\nabla r = \{(f_2*(b_2/f_2)) - (f_1*(b_1/f_1))\} - \{(l_2*(d_2/l_2)) - (l_1*(d_1/l_1))\}$$

or
$$\nabla r = \{(f_2*ab_2) - (f_1*ab_1)\} - \{(l_2*ad_2) - (l_1*ad_1)\} \quad (8)$$

where ab and ad denote the age structure effects on birth rate and death rate respectively. Now, following Kitagawa (1955), we get

$$(f_2* ab_2) - (f_1* ab_1) = (f_2 - f_1)*(ab_2 + ab_1)/2 + (f_2 + f_1)*(ab_2 - ab_1)/2 \quad (9)$$

and

$$(l_2 * ad_2) - (l_1 * ad_1) = (l_2 - l_1)*(ad_2 + ad_1)/2 + (l_2 + l_1)*(ad_2 - ad_1)/2 \quad (10)$$

Substituting from (9) and (10) in (8), we get the following decomposition of the change in the rate of natural increase:

$$\nabla r = \tfrac{1}{2}[\{(f_2 - f_1)*(ab_2 + ab_1)\} - \{(l_2 - l_1)*(ad_2 + ad_1)\} + \{(f_2 + f_1)*(ab_2 - ab_1)\} - \{(l_2 + l_1)*(ad_2 - ad_1)\}]$$
$$= (\nabla f - \nabla l) + (\nabla ab - \nabla ad) = \nabla i + \nabla a. \quad (11)$$

where $\nabla i = \nabla f - \nabla l$, and $\nabla a = \nabla ab - \nabla ad$. Here ∇i is the contribution of the net change in fertility and mortality (independent of age structure effects) to the change in the rate of natural increase. In other words, ∇i reflects the change in the intrinsic rate of population growth. Similarly, ∇a is the net change in the age structure effects on the crude birth rate and the crude death rate. Thus, equation (11) decomposes the change in the rate of natural increase into the change accountable to the change in the intrinsic rate of population growth and the change accountable to the change in the age structure effects. The age structure effects on the crude birth rate are attributed to the change in the proportion of females in the reproductive age group and their distribution within the reproductive life span as fertility of a woman varies by her age. Similarly, the age structure effects on the crude death rate are attributed to the proportion of population in different age groups as the risk of death varies by age. Changes in the age structure effects may induce a change in the crude birth rate and the crude death rate and hence in the rate of natural increase even if levels of fertility and mortality remain unchanged.

Application of equation (11) requires estimation of age independent birth rate f and age independent death rate l. Horiuchi (1991) has shown that the ratio (CBR/TFR) where CBR is the birth rate and TFR is the total fertility rate, is a measure of the age structure effects on the birth rate. Following Horiuchi, we define f as

$$f = w * (TFR/35)$$

where w is the proportion of females in the reproductive age group. Notice that f is a scalar multiple of TFR. As such, the ratio (b/f) measures the age structure effects on the birth rate. On the other hand, we measure the age independent death rate by the life table death rate.

Equation (11) addresses the controversial issue of which demographic indicator would be more efficient in analysing population transition. It decomposes the change in the rate of natural increase, ∇r into two

components, one determined by the change in the age independent birth rate, ∇f and age independent death rate, ∇l and the change in the age structure effects on the rate of natural increase. The change in f and l determines the change in the intrinsic rate of population growth ∇i. Thus equation (11) takes into consideration both the intrinsic rate of population growth and the age structure effects on the rate of natural increase and estimates, how much of the change in the rate of natural increase is the result of the change in the intrinsic rate of population growth and how much change is due to the change in the age structure effects.

Data Source

The analysis is based on the latest estimates of total population, birth rate, death rate, total fertility rate and expectation of life at birth prepared by the United Nations Population Division for India and China for different five-year periods since 1950 through 2010 (United Nations 2011). The Population Division of the United Nations has been preparing internationally comparable estimates and projections of the population of the world and its member countries and areas since 1950 to facilitate demographic comparisons across different regions and countries of the world. The estimates prepared by the United Nations represent a unique set of information about the size and structure of the population and key demographic indicators for the comparative analysis of population transition across countries. These estimates are based on a uniform set of assumptions and methodology.

Estimates of population and associated demographic indicators also prepared by individual countries which can also be used for analysing population transition. However, the problem in using these estimates and projections is that the estimation and projection exercise are generally based on different set of assumptions and methodology so that comparison based on such data leaves an error of varying magnitude in the comparison process. This error is avoided by the use of estimates and projections prepared by the United Nations. At the same time, a comparison of United Nations estimates with estimates prepared by individual countries suggest that there is a very close proximity between two estimates.

United Nations Population Division provides estimates of the rate of population growth only and not the rate of natural increase. Since the present analysis focusses on the rate of natural increase as the measure of

population transition, we have estimated the rate of natural increase in China and India from the estimated population and estimated average number of births and deaths per year provided by the United Nations. Our analysis suggests that the difference between the average annual rate of population growth and the average annual rate of natural increase in the two countries is very small. According to United Nations, there has been out migration from the two countries throughout the period under reference but the population moved out of both the countries constitute an insignificant proportion of the population of the two countries. This means that nearly all the population that has taken place in the two countries during the period under reference has been the result of the natural growth in population.

Results

Key indicators of population transition in China and India are compiled in table 1 and presented in figures 1 through 12. During the 55 years between 1950 and 2010, China's population increased by almost 791 million or by more than 2.4 times whereas India's population increased by almost 853 million or by almost 3.3 times the population in 1950. Population of China is now reaching the post transition stage with very low birth and death rates, below replacement fertility and an expectation of life at birth of almost 73 years. By contrast, India continues to stuck in the middle of the transition path with birth rate still around 23 and total fertility rate well above the replacement level. Progress in the mortality dimension of population transition has particularly been slow in India as compared to China. In China, the death rate fell sharply from around 22 during 1950-55 to less than 8 during 1970-75 and then to less than 7 by 2005-2010. Mortality decline in China has particularly been rapid during the 20 years between 1950-55 and 1970-75 when the expectation of life at birth improved by almost 20 years - at a rate of almost 1 year per year. By contrast, India still has a death rate of more than 8 per 1000 population. There was a gap of less than 7 years in the expectation of life at birth of China and India during 1950-55. This gap has now increased to almost 9 years. The expectation of life at birth in India increased by less than 13 years during this period - at a rate of around 0.6 years per year. The expectation of life at birth in India during 2005-2010 was lower than the expectation of life at birth that China achieved during 1970-75.

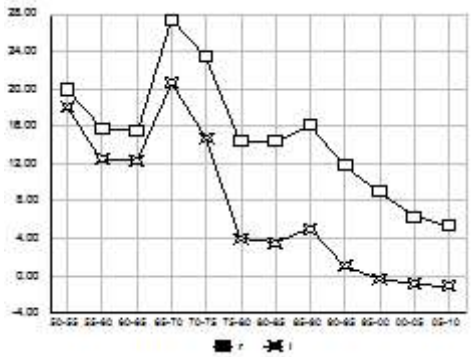
The same has been the case with transition in fertility. China achieved the replacement fertility sometimes during 1990-95 with most of the decline being confined to the period 1965-70 through 1975-80 when the total fertility rate decreased from almost 6 to less than 3 in just about 10 years. In India, the total fertility rate is still more than 2.7. The medium variant of population projections prepared by the United Nations suggest that there is little possibility that India would be able to achieve the replacement fertility before 2030. However, compared to China, India's fertility decline has been consistent. In China, fertility decline stagnated during 1955-70 and again during 1975-90. In India, the total fertility rate decreased consistently since 1950-55. The decrease in the total fertility rate has almost exactly followed a three-degree polynomial in time with R^2=0.999 which means that fertility decline in India was slow in the beginning, accelerated during the middle but has slowed down again in recent years, although both the acceleration and slowdown in the decrease in the total fertility rate has at best been marginal.

The age structure effects on the birth rate have tended to inflate the birth rate at a given level of age independent birth rate in both the countries throughout the period under reference. In China, these effects were marginal during the period 1950 through 1975 when the inflation in the birth rate resulting from age structure effects was less than 5 per cent of the age independent birth rate (f). However, these effects were more than 10 per cent during the period 1975 through 2000 and peaked during the period 1990-95 when the age structure effects inflated the age independent birth rate by almost 22 per cent. Since 1995-2000 the ratio (b/f) has decreased rapidly China and has become less than one for the first time during 2005-2010 which indicates that the age structure effects are now contributing to the transition in fertility in the country.

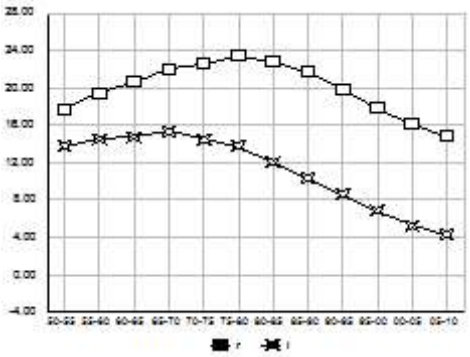
In India also, the ratio (b/f) has started decreasing after 1995-2000 but the decrease in the ratio is very slow so that during the period 2005-2010, the age structure effects inflated the birth rate in India by almost 16 per cent at the given level of age independent birth rate (f). Otherwise also, the ratio (b/f) has always been more than one in India throughout the period under reference and increased up to 1990-95. During the period 1985-95, these effects appear to have inflated the birth rate in the country by almost 18 per cent at the given level of age independent birth rate.

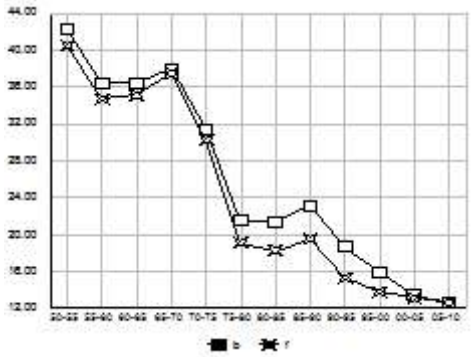
Figure 1: Population transition in China and India: 1950-2010

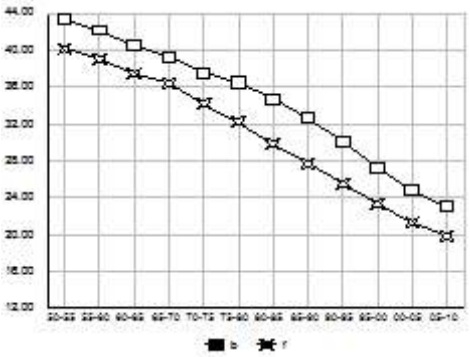
China

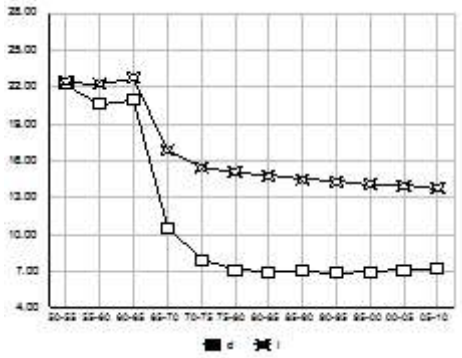


India









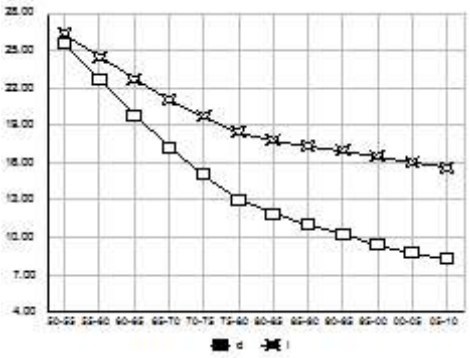
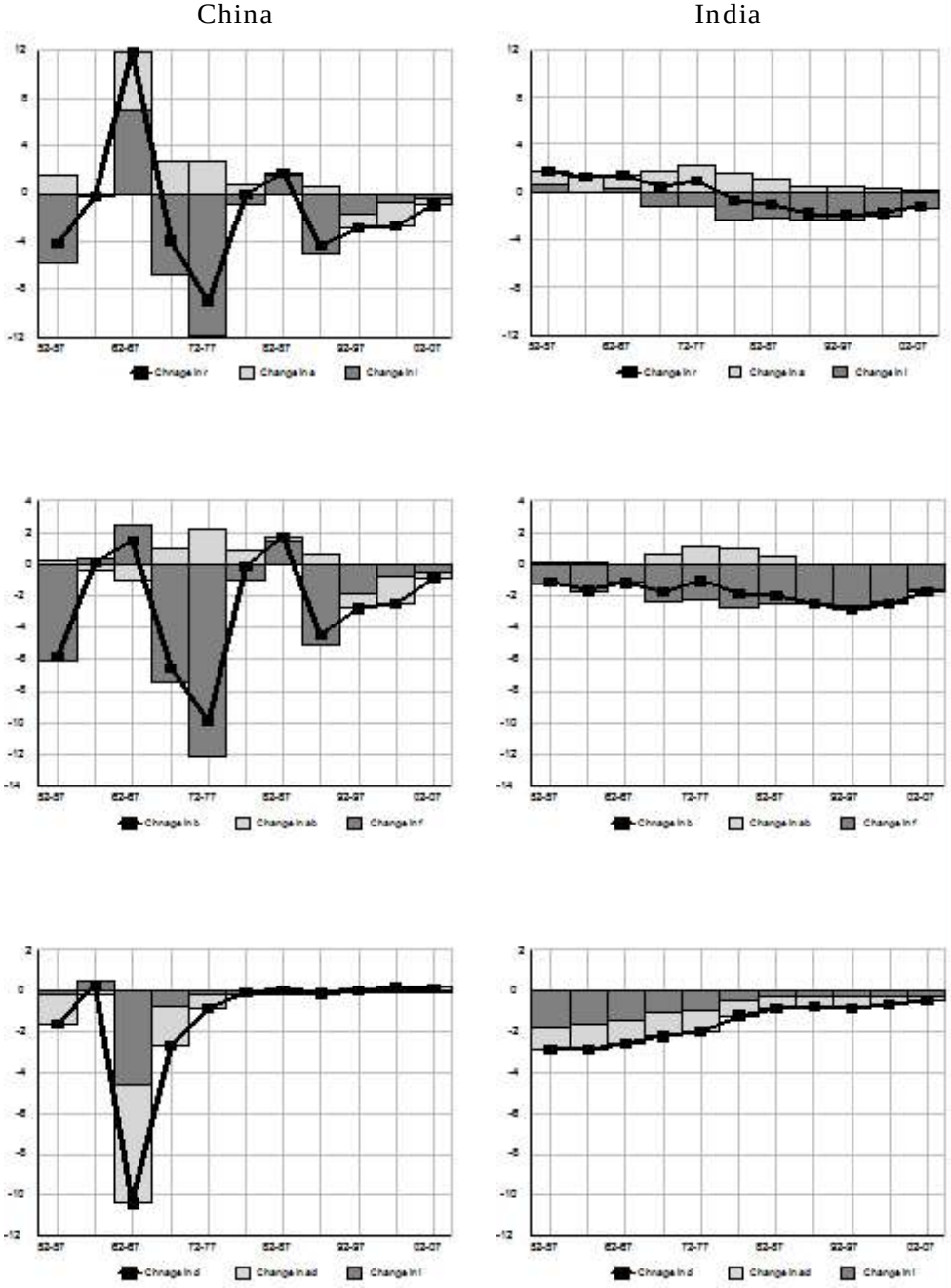


Figure 2: Decomposition of the change in *r*, *b*, and *d* in China and India



The age structure effects on the death rate have always been less than one in both the countries which indicates that the age structure of the population in the two countries always had a deflating effect on the prevailing level of the life table death rate. The transition in the age structure effects in the two countries has however been different. In China, the age structure effects accounted for less than 10 per cent deflation in the death rate at the prevailing level of life table death rate during the period 1950 through 1965. However, the ratio (d/l) decreased very sharply in the country during the period 1960-80 so that by 1975-80, the age structure effects in China deflated the death rate by almost 53 per cent from the prevailing level of the life table death rate. Since 1975-80, the ratio (d/l) has increased in China with the result, by the period 2005-10, the deflation in the death rate resulting from the age structure decreased to less than 48 per cent of the prevailing level of life table death rate. In India, on the other hand, the ratio (d/l) decreased throughout the period under reference and by the period 2005-10, these effects also accounted for about 47 per cent deflation in the death rate at the prevailing level of life table death rate in the country.

Table 2 decomposes the change in the rate of natural increase, r, into the change in the intrinsic rate of growth, i, and the change in the age structure effects, a in the two countries. In India, when i decreases, a increases so that the decrease in r is slower than the decrease in i. But when i increases, a also increases so that the increase in r is faster than the increase in i. In China also, a similar pattern prevailed during the period 1960-95. However, after 1995, the decrease in i has been associated with the decrease in a also so that the decrease in r has been faster than the decrease in i. Similar situation prevailed in China during the period 1955-65 also.

The decrease in the rate of natural increase, r, is determined by the decrease in the birth rate, b, and the decrease in the death rate, d. If the decrease in b is faster than the decrease in d, r decreases but if the decrease in b is slower than the decrease in d, r increases and if b and d decrease by the same amount, there is no decrease in r. In turn, the decrease in b depends upon the decrease in age independent birth rate, f, and the age structure effects on the birth rate, ab. Similarly, the decrease in d depends upon the decrease in l, the life table death rate and the decrease in ad, the age structure effects on death rate.

The decomposition of the change in b in the two countries suggests that before 1995, the age structure effects on the birth rate in general had tended to decelerate the change in b for in comparison to the change in f with a few exceptions. However, after 1995, the change in the age structure effects on the birth rate had tended to accelerate the decrease in the birth rate in comparison to the decrease in f. The exceptions to this general pattern are the period 1980-90 in China and the period 1965-75 in India. In India, the age structure effects on the birth rate accelerated the decrease in the birth rate for the prevailing decrease in the age independent birth rate. In China, on the other hand, the age structure effects on the birth rate contributed to accelerate the increase in the birth rate at the given level of the increase in the age independent birth rate.

As regards the transition in death rate, both the change in the life table death rate, l, and the change in the age structure effects on the death rate have contributed to the decrease in the death rate in India throughout the period under reference. However, the same has not been the case in China. During 1955-65, the change in the age structure effects on the death rate contributed to slowdown the increase in the death rate compared to the increase in the life table death rate. On the other hand, during the period 1975-90 and after 1995, the age structure effects on the death rate had depressed the decrease in the death rate compared to the decrease in the life table death rate.

Table 3 presents population transition in the two countries in terms of the change in the net addition to the population in different quinquennials. Unlike the transition in the rate of natural increase, the transition in the net addition to the population is also influenced by the size of the population. Because of the erratic transition in the rate of natural increase in China, the transition in the net addition to the population has also been erratic. The increase in r during 1960-1970 in China implies that the net addition to the country's population increased by a whopping more than 51 million - from around 53 million during 1955-60 to more than 104 million during 1965-70. Similarly, a rapid decrease in r between 1970 and 1980 implies that the net addition to the population was curtailed by almost 33 million during this period. After 1990, the net addition to the population of China has been decreasing in every quinquennials, although the decrease was quite substantial in the beginning but has reduced significantly in

recent years because of the near stagnation or even marginal increase in the intrinsic rate of population growth.

In India, despite a decrease in r after 1975-80, the net addition to the population continued to increase till 1990-95 when almost 91 million people were added to the population of the country. Since 1990, the net addition to the population of the country has started decreasing but the magnitude of the decrease in the net addition remains small. Between 1990-95 and 2005-10, the net addition to the population of the country decreased by just around 3 million. because of the large size effect on the net addition to the population. Moreover, the size effects to the net addition to the population of the country are still very substantial.

The foregoing analysis highlights the divergent population path followed by China and India during the second half of the last century despite having very similar population scenario around the year 1950. The implications of these divergent paths are obvious. Because of a rapid population transition unparalleled in world, China appears to have entered the post transition phase. On the other hand, because of slower than anticipated pace of transition, India is still stuck up in the middle of population transition. Although, the rate of natural increase has started decreasing in India country and the preliminary results of the 2011 population census suggest a decrease in the net addition to the population also for the first time (Chaurasia 2011), yet the current transition suggests that there is no possibility that India will be able to achieve the cherished goal of population stabilisation by the year 2045 as enshrined in the National Population Policy (Government of India 2000).

Discussion

Population transition, essentially, emanates from the process of social and economic development. The experience of the European countries suggests that as social and economic development advances, death rate declines which is followed, usually after a certain time lag, by the decline in the birth rate. As a result, the rate of natural increase first increases and then decreases with population transition. Moreover, the time lag between the decrease in the death rate and the decrease in the birth rate primarily determines the increase in the size of the population stock. This 'normal' process of transition can be accelerated through specific policies and programmes which are directed specifically to reducing the birth rate as

social and economic development processes automatically induce a decrease in the death rate. The effectiveness of these interventions determine the 'speed' of transition. If the pace of transition is is faster than the 'normal' pace of transition, population transition contributes to accelerate the social and economic development through what is termed as the demographic dividend. On the other hand, if the actual pace of transition is slower than the 'normal', population transition hampers social and economic progress. Although, it is difficult to ascertain the 'normal' pace of transition, yet accelerating the pace of population transition, in this framework, is deemed essential for hastening the pace of social and economic development. Specifically targeted interventions are therefore required to accelerate the 'speed' of population transition.

In line with the above argument, both China and India have made specific efforts to accelerate the population transition process right since 1950. Today, China can claim success of these efforts. By contrast, population transition in India has lagged behind. China has over-shot the expectations in terms of population transition whereas India has fallen short of these expectations. China's achievements have been termed as miraculous while India has often been referred for its failings.

One feature that distinguishes population transition in China from India is the impact of population and development policies on the population transition process. In China, this impact is very clearly visible whereas, in India, there is little sign of such an impact. Population transition in China has six distinct phases: 1) decrease in the rate of natural increase (1950-60); 2) period of stagnation (1955-65); 3) increase in the rate of natural increase (1960-70); 4) period of very rapid decrease (1965-80); 5) second period of stagnation (1975-90); 6) decrease in the rate of natural increase to very low levels (1990 on wards). These phases of population transition in China can broadly be related to six stages of population and development policy evolution: 1) first birth planning campaign (1956-58); 2) great leap forward (1958-61); 3) cultural revolution (1966-68); 4) third birth planning campaign (1971-79); 5) second marriage law and associated one child campaign (1979); and 6) localisation of birth control policy (1984). Although, only some of these policies influenced the population transition process positively, yet, the impact of population and development policies on the population transition process in China is very much evident.

On the other hand, the very smooth transition in the rate of natural increase in India suggests that population and development policies in India had little visible impact on the population transition process. This observation is surprising as the commitment to reducing fertility and curtailing population growth has explicitly been highlighted in all Five-year Development Plans that India had since independence. Similarly, there is no reflection of the impact of the population and health policies announced from time to time on the population transition process in the country. It appears that the divergent population transition path followed by China and India during the 60 years since 1950 is related to the sensitiveness of the population transition process to the population and development policies adopted in the two countries. In China, population transition process has been very highly sensitive to the population and development policies adopted. By contrast, the population transition process in India has hardly been influenced by the population and development policies of the government.

In table 4, we present a comparative perspective of the basic features of population and development policies and programmes designed to implement these policies in the two countries to understand why population transition in China has been sensitive to these policies as the present analysis reveals and why the population transition process in India has virtually remained unaffected by its population and development policies and programmes. This comparison includes the basic approach and orientation of population transition efforts adopted by the two countries as well as salient features of the programmes and activities designed and implemented to realise the policy goals and objectives. As may be seen from table 4, there are some common features of the implementation process in the two countries. At the same time, there are some important differences in the basic approach and processes adopted to realise population and development policy goals and objectives in the two countries.

Table 4 highlights the radical difference in the basic philosophy and the approach adopted for population transition in the two countries. The table also highlights fundamental weaknesses in the Indian approach towards population transition. It may be argued that Chinese approach suited to its typical cultural, social and political situation. The commitment of Chinese national leaders to health care and birth planning, their authority over all levels of the government through the cadre-based Party

and the lack of any significant opposition groups has provided a unique opportunity to programme managers in China to push the population agenda. China has been able to astutely link birth planning to the revolutionary restructuring of the Chinese society and social and economic institutions. China is also blessed with a unique social and cultural homogeneity as more than 90 per cent of its population belongs to only one, Han, community. By contrast, the baffling cultural, social and political diversity in India has always been a major population and development challenge. India does not have the cadre based political party system which has the dominating influence on the executive arm of the government as is the case in China. Also, the democratic franchising in India results in significant shifts in the political power structures at the national and state level at regular intervals which introduces a unique type of political inconsistency in all matters related to population and development. As a result of this political inconsistency, the task of translating population and development policies into programmes and activities that benefit people has been left at the discretion of the executive arm of the government with little community involvement. Population transition efforts in India have always been designed and implemented by the government for the government. Involvement of people and their democratically elected representatives has always been notional by design in these efforts.

Another important feature that distinguishes China from India is that China achieved signal success on the development front very early when the population of the country was in the pre-transition stage. China achieved very low levels of death rate, high life expectancy and nearly universal youth literacy (15-24 years) by the year 1970 that marks the beginning of population transition in the country. This means that the threshold of development necessary for population transition was in place in China when population transition started in the country. India, on the other hand, still continues to grapple with key development challenges that are critical for population transition, especially in the fields of health and education. During 1970-75, the death rate in India was nearly 2.5 time higher than that in China while there was a gap of almost 13 years in the expectation of life at birth of the two countries. Similarly, youth literacy rate in China was 83 per cent compared to only 46 per cent in India around 1970. Obviously, in India, development policies and programmes could not create

a conducive environment necessary for hastening the pace of population transition.

China and India have also differed in the approach adopted in the implementation of efforts to reduce the birth rate. Both the countries have followed the 'target' approach to achieve population transition goals but the targets allocating system in the two countries has been radically different. In China, the targets have been set in terms of the maximum permissible rate of natural increase in each province after taking into consideration such factors as level of social and economic development, past performance and ethnicity. The provincial government translates the target in terms of the rate of natural increase into birth quota for each county under its jurisdiction and this process is repeated down to the production team level where community birth planning takes place. Community birth planning determines which couple is permitted to have birth during the coming year after taking into consideration a host of local level factors. The entire exercise is highly participatory with Party workers at the grass roots level playing the dominant role.

In India, targets were used to be set in terms of the minimum number of new acceptors of different family planning methods to be recruited in a year to achieve the projected decline in the birth rate at the national level. These targets were then distributed across the constituent states and Union Territories of the country according to an agreed formula. The states and Union Territories, in turn, distributed these targets across the constituent districts on a proportionate basis according to the size of the population of the districts and the procedure is followed right up to the sub-health centre level, the lowest level service delivery institution of the public health and family welfare service delivery system. It is the responsibility of health workers posted at the sub-health centre to achieve these targets. In order to achieve these targets, health workers distributed condoms and oral pills, inserted intra-uterine device and motivated couples to under go sterilisation - male or female. The entire exercise used to be mechanical in nature and even the grass roots level worker who was responsible for achieving the targets was not involved in the target setting exercise. Moreover, little attention was paid to local conditions factors that may influence achievement of targets and the past performance. On the other hand, the support and cooperation of the people and their representatives is sought in the realisation of the targets set for recruiting new family

planning acceptors only. The community was no where involved in the process of setting up the targets which used to be an entirely bureaucratic exercise.

One of the implications of the target setting approach adopted in India is that any assessment of the impact of population transition efforts was possible only at the national level. Below the national level, the only indicator for measuring the performance of population transition efforts was the proportion of the targets achieved in terms of new acceptors of different family planning methods recruited in a year. A multi-dimensional framework or system of measuring the impact of population transition efforts, especially at the grass roots level, has always been missing in India. As such, local level planning for population transition has invariably been normative and payed little attention to local social, cultural, economic and political dimensions of population transition and the past performance population transition efforts.

The target-based approach of planning and implementing population transition efforts in both China and India has been subject to criticism by researchers. Responding to these criticism, Government of India abolished the system of allocating targets in 1996 and introduced the system of community needs assessment for planning for family planning service delivery. Under the new system, the onus of assessing the family planning needs of the community and meeting these needs was left entirely to the discretion of the grass roots level female health worker. She was supposed to visit each and every household in the area to assess the family planning needs. The system, however, failed miserably as fertility of married women in the country and in its most states stagnated and even increased during the period 1996-2003 (Chaurasia, 2011). Targets are now back again in the form of expected level of achievement (ELA).

In an attempt to reorganise population transition efforts, Government of India constituted the National Population Commission with the Prime Minister as its Chairman as recommended in the National Population Policy 2000. The Commission is mandated to review, monitor and give directions for the implementation of the National Population Policy, to promote inter-sectoral coordination and synergy between demographic, educational, environmental and developmental programme to hasten population transition. Unfortunately, the Commission was never allowed to function independently. Differences arose between the Commission and the

Ministry of Health and Family Welfare about roles, responsibilities and powers of the Commission. Ultimately, in 2004, the Commission was made a part of the Ministry jeopardising the very purpose for which it was constituted and largely remains on paper. The Commission could meet only three times since its constitution in the year 2000 which reflects the indifference to population related issues at the political level.

In the year 2005, Government of India launched the National Rural health Mission and the National Family Welfare (Planning) Programme which has been the mainstay of population transition efforts in the country for the last fifty years was merged into the Mission while the Department of Family Welfare in the Ministry of Health and Family Welfare which was responsible for the implementation of the National Family Planning Programme was merged with the Department of Health. With these administrative changes, there is now no dedicated department in the central government to plan and monitor population transition efforts. The National Rural Health Mission, on the other hand, aims at architectural corrections in the public health care delivery system. Family planning, under the Mission, is visualised in the context of the health needs of the people and not in the context of population transition as specified in the National Population Policy 2000 (Government of India, 2005).

Conclusions

Our analysis suggests that India lags behind China by at least 30-35 years in terms of population transition, despite the fact that the two countries were nearly at the same stage of transition around the year 1950. During the period 2000-05, China had a birth rate of around 13.9, a death rate of 6.6, a total fertility rate of less than 1.8 and an expectation of life at birth of 72 years. According to medium variant of the projections prepared by the United Nations, India is projected to achieve a birth rate of 13.6 and an expectation of life at birth of 72 years not before the period 2035-40 and a total fertility rate of 1.8 not before the period 2065-70. On the other hand, there is no possibility that India would be able to achieve the death rate that China achieved during the period 2000-05. The lowest death rate that India is projected to achieve is around 7.7 during the period 2020-25, after which the death rate will increase to almost 10 during the period 2045-50 as a result of the ageing of the population. After 2020-25, the decrease in the rate

of natural increase in India will primarily be the result of the increase in the death rate and not the decrease in the birth rate.

Implications of the slow population transition in India to future population growth are obvious. According to the medium variant of United Nations population projections, India's population is projected to increase from around 1225 million to almost 1692 million in the 40 years between 2010 and 2050. This means that India alone will be accounting for 467 million of around 2410 million or almost 20 per cent of the projected increase in the world population in the next 40 years. By way of comparison, China's population is projected to decrease by around 46 million during this period. Population projections prepared by the United Nations also suggest that India's population is most likely to increase up to the year 2062 when it will peak very close to 1719 million.

China has been an able to achieve signal successes in population transition by tailoring birth control efforts to local circumstances through: 1) mass mobilisation for the cause of population transition; 2) near universal availability of a broad range of family planning methods; and 3) sharing the responsibility for family planning and related health services between national and local governments. Population transition efforts in China were also backed by strong political commitment and the authority and hold of the Communist Party of China and their leaders on the executive at different tiers of administration. India, unfortunately, could not mobilise the community, ensure universal availability of family planning methods and evolve a responsibility sharing mechanism critical for the success of population transition efforts because of its inability to 1) mobilise the people for the cause of family planning; 2) ensure universal availability of family planning methods; and 3) decentralise the health and family welfare services delivery system. India has attempted to address issues related to population transition through bureaucratic channels without giving attention to India's diversity as a culture, as a society and as a polity. However, the bureaucratic system in India has not been able to evolve a model of population and development that incorporates India's diversity as a culture, as a society and as a polity.

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Table 1: Population scenario in China and India: 1950-2011.

Period	China						India					
	Population (million)	CBR (0/00)	CDR (0/00)	TFR	E(0) (Year)	Females 15-49 (%)	Population (million)	CBR (0/00)	CDR (0/00)	TFR	E(0) (Year)	Females 15-49 (%)
1950-55	578.905	42.172	22.236	6.107	44.582	22.53	388.734	43.299	25.539	5.903	37.913	23.55
1955-60	632.943	36.405	20.631	5.476	44.997	21.83	426.611	42.147	22.704	5.896	40.888	22.73
1960-65	684.419	36.469	20.959	5.607	43.964	21.98	471.547	40.476	19.845	5.822	44.093	22.22
1965-70	761.862	37.975	10.583	5.937	59.418	22.16	524.585	39.290	17.265	5.687	47.505	22.49
1970-75	865.096	31.422	7.949	4.765	64.572	22.22	586.338	37.558	15.044	5.264	50.769	22.83
1975-80	951.011	21.525	7.108	2.926	66.282	23.49	657.687	36.496	13.052	4.889	54.164	23.06
1980-85	1022.078	21.419	7.004	2.614	67.668	25.47	738.202	34.648	11.871	4.473	56.198	23.31
1985-90	1103.106	23.151	7.042	2.629	68.900	26.64	824.879	32.653	11.000	4.108	57.710	23.60
1990-95	1182.722	18.689	6.917	2.012	69.924	26.80	915.029	30.126	10.273	3.720	58.978	24.21
1995-2000	1245.633	15.905	6.945	1.800	70.832	27.01	1005.527	27.292	9.406	3.311	60.697	24.90
2000-05	1294.076	13.415	7.113	1.700	71.621	27.29	1094.643	24.810	8.720	2.960	62.466	25.37
2005-10	1332.318	12.545	7.197	1.640	72.711	27.12	1182.538	23.061	8.251	2.726	64.187	25.69

Source: United Nations (2011)

Table 2: Decomposition of the change in the natural population growth rate (per 1000) in China and India.

Period	r	i	∇r	Contribution of		∇b	Contribution of		∇d	Contribution of	
				∇i	∇a		∇f	∇ab		∇l	∇ad
						China					
1950-55	19.936	18.026									
1955-60	15.773	12.476	-4.162	-5.821	1.659	-5.767	-6.020	0.253	-1.605	-0.199	-1.406
1960-65	15.511	12.342	-0.263	-0.078	-0.185	0.065	0.405	-0.341	0.327	0.483	-0.156
1965-70	27.392	20.650	11.882	7.040	4.841	1.506	2.455	-0.949	-10.376	-4.586	-5.790
1970-75	23.473	14.722	-3.919	-6.698	2.779	-6.554	-7.465	0.912	-2.634	-0.767	-1.867
1975-80	14.418	4.002	-9.055	-11.856	2.801	-9.896	-12.052	2.156	-0.841	-0.197	-0.644
1980-85	14.415	3.492	-0.003	-0.796	0.793	-0.107	-0.942	0.835	-0.104	-0.146	0.042
1985-90	16.109	5.036	1.694	1.635	0.060	1.732	1.508	0.224	0.038	-0.127	0.165
1990-95	11.772	1.021	-4.337	-4.978	0.641	-4.462	-5.081	0.620	-0.124	-0.103	-0.021
1995-00	8.961	-0.325	-2.811	-1.726	-1.086	-2.784	-1.815	-0.969	0.027	-0.089	0.117
2000-05	6.302	-0.833	-2.659	-0.643	-2.015	-2.490	-0.721	-1.769	0.169	-0.078	0.247
2005-10	5.348	-1.081	-0.954	-0.352	-0.602	-0.870	-0.460	-0.410	0.084	-0.108	0.192

Period	r	i	∇r	Contribution of		∇b	Contribution of		∇d	Contribution of	
				∇i	∇a		∇f	∇ab		∇l	∇ad
						India					
1950-55	17.761	13.790									
1955-60	19.444	14.539	1.683	0.557	1.126	-1.152	-1.263	0.111	-2.835	-1.820	-1.015
1960-65	20.631	14.727	1.187	-0.116	1.303	-1.671	-1.719	0.048	-2.858	-1.603	-1.256
1965-70	22.025	15.323	1.394	0.264	1.130	-1.186	-1.117	-0.069	-2.580	-1.381	-1.199
1970-75	22.514	14.497	0.489	-1.302	1.791	-1.732	-2.374	0.642	-2.222	-1.072	-1.150
1975-80	23.444	13.763	0.930	-1.288	2.218	-1.062	-2.196	1.134	-1.991	-0.908	-1.084
1980-85	22.777	12.009	-0.667	-2.321	1.654	-1.848	-2.780	0.932	-1.181	-0.459	-0.722
1985-90	21.654	10.352	-1.123	-2.183	1.060	-1.995	-2.486	0.492	-0.871	-0.303	-0.568
1990-95	19.853	8.580	-1.801	-2.299	0.497	-2.527	-2.530	0.002	-0.726	-0.231	-0.495
1995-00	17.886	6.853	-1.966	-2.310	0.344	-2.834	-2.593	-0.241	-0.868	-0.283	-0.585
2000-05	16.091	5.301	-1.795	-2.096	0.301	-2.482	-2.357	-0.125	-0.686	-0.260	-0.426
2005-10	14.811	4.303	-1.280	-1.428	0.148	-1.749	-1.659	-0.090	-0.469	-0.231	-0.239

Source: Author's calculations

Table 3: Decomposition of the change in the net addition to the population in China and India: 1950-2010.

Period		Net addition (million)	Change in net addition (million)	Contribution of						
Start	End			Change in size (million)	∇i (million)	∇a (million)	∇f (million)	∇ab (million)	∇l (million)	∇ad (million)
						China				
1950	1955	57.704								
1955	1960	49.919	-7.786	4.824	-17.636	5.027	-18.238	0.767	-0.602	-4.260
1960	1965	53.079	3.160	4.026	18.916	-6.074	1.335	-1.122	1.591	-0.513
1965	1970	104.345	51.266	8.306	25.737	18.173	8.876	-3.431	-16.580	-20.935
1970	1975	101.531	-2.814	13.128	-55.881	-8.387	-30.365	3.708	-3.120	-7.595
1975	1980	68.558	-32.973	8.138	-23.416	0.099	-54.721	9.790	-0.893	-2.926
1980	1985	73.667	5.109	5.123	54.556	-9.905	-4.645	4.119	-0.720	0.208
1985	1990	88.852	15.186	6.183	12.913	-3.895	8.013	1.191	-0.673	0.875
1990	1995	69.615	-19.237	5.550	-37.792	3.323	-29.038	3.542	-0.588	-0.122
1995	2000	55.808	-13.807	3.261	19.748	-10.484	-11.018	-5.884	-0.543	0.708
2000	2005	40.775	-15.033	1.848	6.871	-5.901	-4.580	-11.231	-0.494	1.565
2005	2010	35.626	-5.149	1.114	1.914	9.281	-3.020	-2.693	-0.710	1.259

Period		Net addition (million)	Change in net addition (million)	Contribution of						
Start	End			Change in size (million)	∇i (million)	∇a (million)	∇f (million)	∇ab (million)	∇l (million)	∇ad (million)
						India				
1950	1955	34.521								
1955	1960	41.474	6.953	3.523	1.135	2.295	-2.575	0.227	-3.710	-2.069
1960	1965	48.642	7.168	4.502	-1.511	0.398	-3.860	0.107	-3.599	-2.819
1965	1970	57.770	9.128	5.656	0.946	-0.432	-2.781	-0.172	-3.438	-2.986
1970	1975	66.004	8.235	6.876	-4.350	1.837	-6.594	1.782	-2.977	-3.193
1975	1980	77.094	11.089	8.198	0.045	1.326	-6.829	3.527	-2.824	-3.370
1980	1985	84.071	6.977	9.304	-3.604	-1.968	-9.701	3.251	-1.602	-2.520
1985	1990	89.308	5.238	9.628	0.538	-2.323	-9.716	1.921	-1.186	-2.219
1990	1995	90.828	1.520	9.354	-0.503	-2.445	-11.004	0.010	-1.005	-2.154
1995	2000	89.925	-0.903	8.538	-0.056	-0.738	-12.449	-1.158	-1.357	-2.809
2000	2005	88.068	-1.857	7.570	1.124	-0.225	-12.373	-0.657	-1.366	-2.237
2005	2010	87.571	-0.497	6.790	3.803	-0.869	-9.443	-0.514	-1.313	-1.358

Source: Author's calculations

Table 4: A comparison of population transition efforts in China and India.

China	India
• Population transition efforts in China have always been focussed on reducing the rate of natural increase. This means that these efforts have taken into consideration both transition in the birth rate and the transition in the death rate.	• Population transition efforts in India have been focussed on reducing the birth rate only. Reduction of the death rate has never been the prerogative of population transition efforts in the country.
• The birth rate reduction efforts in China were launched when very low levels of death rate (mortality) was achieved.	• Efforts to reduce birth rate continue to be implemented in a high death rate (mortality) regime, particularly, high infant and child mortality.
• Organisation of the birth planning programme in China is unusual. Perhaps the most important feature of the organisational set up is that it allows local governments a voice in the implementation of birth planning policies.	• The National Family Planning Programme has always been a part of the Ministry of Health and Family Welfare with little involvement of local governments.
• Birth planning units in China have been established as independently functioning autonomous units throughout the administrative hierarchy right from the national to the village level.	• Family planning services delivery is only through health services delivery units. Family planning centres established in the early phase of the National Family Planning Programme were soon merged with health units.
• Implementation of the birth planning programme involves the Party, the executive, the health services	• Implementation of the National Family Planning Programme is the responsibility of the Department of

China	India
delivery unit and the birth planning unit.	Health and Family Welfare alone. It is virtually an executive function of the government with only a notional political involvement.
• The 'later (marriage)', 'longer (spacing between births)' and 'fewer (number of children)' strategy was adopted in China to reduce the birth rate. Reduction in death rate has not been a focus because the death rate was already very low when the birth rate reduction campaign was launched.	• For most of the time, India adopted the birth limitation strategy to reduce the birth rate. Moreover, the strategy paid little attention to the reduction in the death rate despite the fact that the death rate, especially, infant and child mortality rate were very high. Rather, it was argued that the promotion of family planning would being down infant and child mortality and hence the death rate.
• The focus of fertility reduction efforts in China has been on birth planning - late marriage, proper spacing between births and limiting the number of births.	• The focus of fertility reduction in India has been on limiting the number of births. Although, at the policy level, the need for delay in marriage and spacing between successive births has repeatedly been emphasised, yet, the implementation of the policy primarily focussed on birth limitation only.
• Targets for reducing the birth rate have been set in the form of the maximum number of births allowed.	• Targets for reducing birth rate have been in the form of the minimum number of new acceptors of different family planning methods to be recruited in a year to ensure projected decrease in the birth rate.

China	India
• Community birth planning has been the key for the implementation of the birth planning programme. Community birth planning ensured that every couple was given the birth planning target specific to the couple.	• The implementation was and continues to be based on the targets allocated to service providers only.
• Involvement of the Communist Party of China in programme implementation has contributed towards mobilising community for birth planning at all levels. In fact, the Party has dominated the process of setting up the priorities of population transition.	• Promotion of the use of family planning methods has always been and continues to be the responsibility of the public administration system, especially the public health care delivery system. The National Family (Welfare) Planning Programme has always been perceived by the people at large as a programme of the government for the government. Because of the bureaucratic orientation of the National Family Planning Programme, participation of political parties has always been notional in the implementation process.
• A system of sharing the responsibility of birth planning between national and local governments has been evolved and institutionalised.	• The National Family Planning Programme, the mainstay of population transition efforts continues to be a cent per cent centrally sponsored programme.
• The programme ensured universal, community-based availability of a broad range of family planning	• The availability of family planning methods is restricted to only those methods which are supported under the

China	India
methods.	official programme.
• The birth planning programme has been able to achieve very high levels of organisational efficiency.	• The organisational efficiency of the National Family Planning Programme remains abysmally poor.
• Performance monitoring of the birth planning programme has been based on 'late marriage rate' 'birth limitation rate' and 'planned birth rate'.	• Performance monitoring under the National Family Planning Programme has been based on the number of new acceptors of family planning methods recruited.
• Performance monitoring has been couple-based: number of couples who married late, number who have a planned birth, etc.	• Performance monitoring is provider-based: number of condoms and number of oral pill cycles distributed, number of IUD inserted, etc.
• The performance monitoring system permits assessment of programme impact at the grass roots level which is the basis of community birth planning.	• The performance monitoring system does not permit assessment of programme impact at the grass roots level, the interface with the people.