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Full Length Research Paper

Micro-spatial human resource reallocation model for rural agrarian sector, based on classical theories of regional growth: A case study of Paschim Medinipur, West Bengal, India

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Human resource is one of the important fundamental requirements for designing developmental planning for economy and society at both regional and national scales. Present day's social science does not confine itself within the consideration of the process of development as a cumulative process of enhancing the physical quality of life of inhabitants; rather it tries to chalk out the plans for possible best utilization of human resources along with the proper reallocation of it to assuage the problem from paucity of human resources at demand zones, mainly the urban centers as well as to release the pressure from surplus population at the neighbouring agrarian sectors. The intensive subsistence agro-based economy is characterized by the inelasticity of the products, minimum scope of profit and the presence of surplus agricultural labourers. Agriculture plays a vital role for the national economy, especially for developing countries like India. This economic sector is required to keep healthy. The existing allocation of human resources does not support the profitable economy, so the reallocation of this resource is necessary. Effort has been made to adopt a theoretical modeling on the classical theories of regional growth as decision support device for this aspect.

Keywords: Human Resource Reallocation, labour transfer, agrarian society, numerical modeling, socio-economic development

INTRODUCTION

Development implies change, and this 'change' should be directed towards rational social and economic transformation by which the welfare of the population a wider portion of the target area is ensured. Besides, the development in true sense would be achieved if each and every social and economic classes present at the target area witness similar rate of growth in reference with a selected span of time. A balanced development effort is always aspired; a differential unbalanced development and economic growth is potent enough to expose the contrast between upper and lower economic classes that would rather give birth to many social and economic problems. For the developing countries, it is the challenge to drive the development processes in a balanced format. One of the distinguishing characteristics of the developing nations is that the economy is predominated by agricultures and petty services. A great portion of the population indulge themselves in the primary economic sectors where the activities are labour-intensive, skill is hereditarily gained, innovative efforts are negligible, productivity is limited, per-head production and income is minimum and after all products are mostly income inelastic. 'The purpose of economic development is to increase the standard of living of the masses of people in low income groups. To attain this goal, national income must grow at a faster rate than the increase in population and the benefits of income growth must be distributed equitably' (Lefeber, 1963). The lower incoming and comparatively lower scale per capita gross domestic input (GDP) generating socio-economic sector requires to be nourished carefully for the purpose of steady increase of national income. One of the popular and well accepted concepts in solving the problems originated from this type of economic sector is the reallocation of human resources. Under this circumstances the surplus, inactive or below-used human resources of the agrarian economy

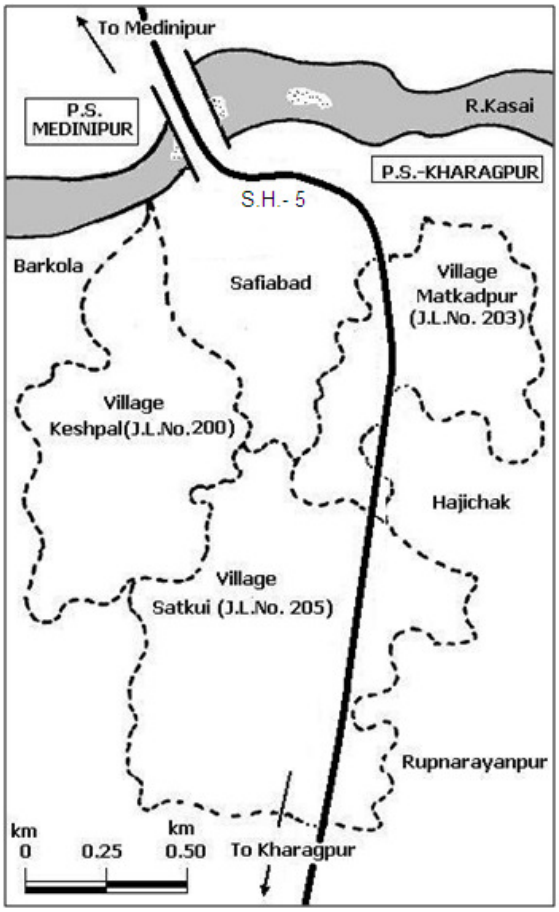


Figure 1. Outline map of the study area showing the location beside the state highway 5.

are required to be allocated properly.

Objectives of the study

The present study has been done to analyze and interpret the following:

1. To interpret the present occupational characteristics of the agro-based economic sector and analyze the dynamism of the population's participation in different fields of occupation.
2. To study the interrelationship between different occupations and human decision making processes on accepting an occupation in respect to contemporary socio economic perspectives.
3. To find the congested and minimum profitable occupational sectors within the agrarian economy and the status of the job fields.
4. To select the nearest and accessible fields of non-agricultural job opportunities and prepare a theoretical model that would support the decision making on proper reallocation of human resources.

The study area

Three agriculture based villages, Keshpal (J.L. No. 200), Matkadpur (J.L. No. 203) and Satkui (J.L. No. 205) of Kharagpur Police Station, Paschim Medinipur district, West Bengal are selected as the area for the present study. The three villages are situated besides the state highway (S.H.-5) joining the two towns at the opposite direction of these villages, Medinipur at North and Kharagpur at South (Figure 1). These villages have the economy, dependent to agriculture and accommodate a great numbers of cultivators, agricultural labourers job holders allied with the agricultural activities. Besides the two urban places, Medinipur and Kharagpur show a high demands for labourers in non-agricultural sectors.

METHODOLOGY

The present study is based on the secondary database mostly along with some information that has been collected through casual discussion with the inhabitants of the study area. Secondary data are collected from the Census of India, 2001, published from the Office of the Directorate of Census, Government of India; District Statistical Handbook, published by Bureau of Applied Economics and Statistics, Government of West Bengal; West Bengal Human Development Report, published by Government of West Bengal; West Bengal State Domestic Production Report, published by Ministry of Information and Broadcasting, Government of West Bengal; different research articles published in journals, magazines, newspaper report, etc.

The classical theories of development economics and concepts of development geography, concerned with the present study have been analyzed and the database has been utilized to apply these concepts at the study area. Statistical techniques, relevant to social sciences are applied. The linear programming and numerical analysis, especially the transportation algorithms have been used to construct a decision support device for human resource reallocation.

RESULTS AND DISCUSSION

Agricultural process, itself plays a vital role in providing the food security to the urban inhabitants. So, the agricultural processes are to be nourished in a careful way but it should be ensured that the whole system is being channelized towards a profitable direction. The occupational structure of the study area would reveal the fact that a great portion of the inhabitants of the three villages are directly or marginally related with the process.

The data regarding the occupation profile of the study area from three consecutive census years is capable to express the trend of temporal change of the share of population at different field of jobs (Figure 2). All the occupations at a particular place are mutually interrelated, that is, the change of the volume of population at a particular field would proceed to influence another fields and this has also been reflected through Table 1. For the convenience of interpretation, the rate of decadal change

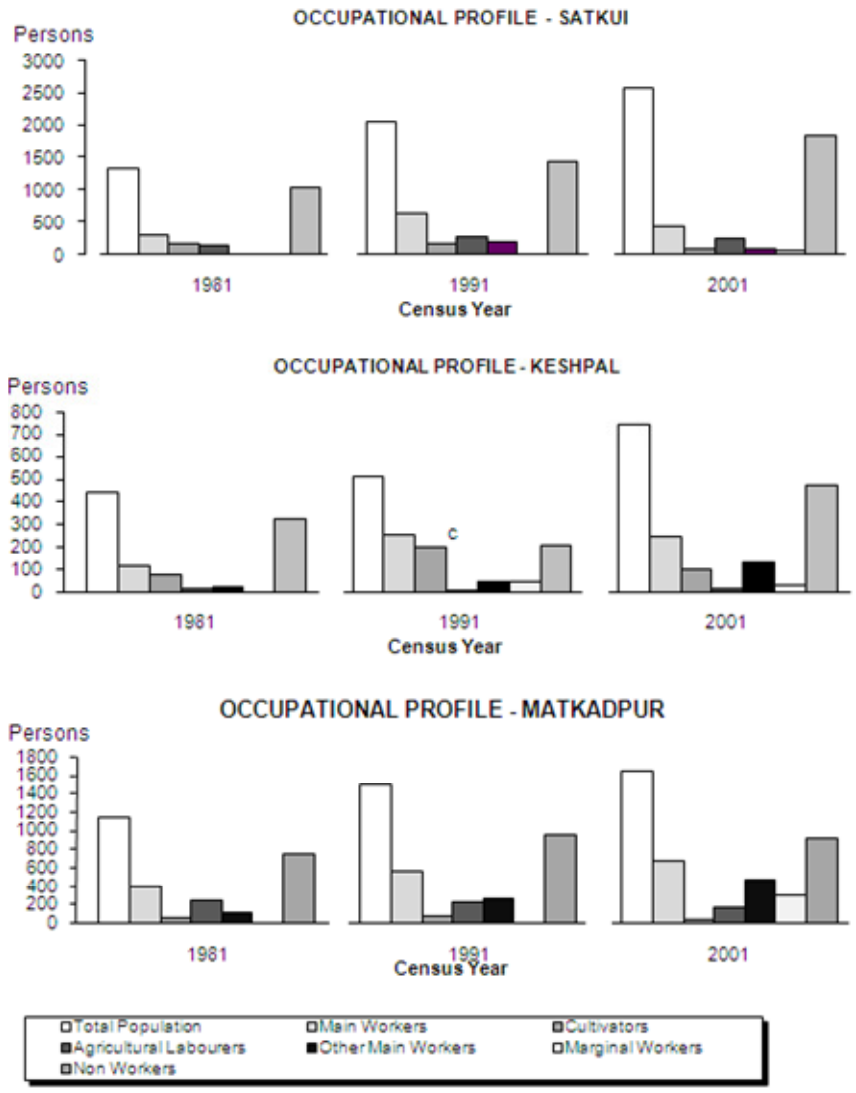


Figure 2. The occupational profile of three villages of the study area.

of the number of members in each occupational field has been calculated Table 2.

A glimpse over the columns of Table 2 indicates that the change of population under any occupational sector may typically affects the change of population under one or more occupational sector. Hence, these interrelationships of the change of the number of members in different occupational spheres with time require to be examined. For the purpose of assessing the strength of the relationship between the decadal changes of population share of different occupational sector the correlation matrix was prepared (Table 3).

The most significant relationship found from correlation coefficient matrixes is that the growth of the number of agricultural labourers is in strong positive correlation (Figure 3) with the growth of the population of the study area. Besides, the matrix is also exposing the fact that there is a rapid growth of non-working population with the increase of total population in the villages under study. The cultivators occupy a great share within the total numbers of main workers for all the three villages. The inhabitants of the villages who do not posses agricultural land prefer to work as agricultural labourers, because the agro base economy provides better security of getting the job throughout the year than that of the marginal kind of occupations. The villages are situated at the floodplain of river Kasai and the fertile soil of the region encourages a profitable agricultural process throughout the year. All these circumstances set the mind of the inhabitants in such a way that they decide either to join as agricultural labourers or to accept other jobs Related to agriculture and allied activities or to remain as non-working population (actually the pseudo unemployed) but not to be included within the marginal working group (trend is

Table 1. The occupational structure of the study area (1981, 1991 and 2001).

Name of village	Total population			Main workers			Cultivators			Agricultural labourers			Other main workers			Marginal workers			Non-workers		
	1981	1991	2001	1981	1991	2001	1981	1991	2001	1981	1991	2001	1981	1991	2001	1981	1991	2001	1981	1991	2001
Keshpal	443	512	743	117	258	245	78	203	101	16	10	12	23	45	132	0	46	28	326	208	470
Matkadpur	1151	1508	1643	401	555	683	47	79	46	246	216	164	108	260	473	4	0	308	746	953	912
Satkui	1326	2048	2568	302	637	423	167	159	89	120	266	230	15	212	104	0	1	48	1024	1446	1837

Table 2. Temporal dynamism in the share of population by different fields of occupation.

Year	Village	Decadal change of population (%)	Decadal change of Main Workers (%)	Decadal change of Cultivators (%)	Decadal change of Agricultural Labourers (%)	Decadal change of Main Workers (%)	Decadal change of Marginal Workers (%)	Decadal change of Non-working population (%)
I	II	III	IV	V	VI	VII	VIII	IX
	Keshpal	15.576	120.513	160.256	- 37.500	95.652	...	- 36.196
1981 to 1991	Matkadpur	31.017	38.404	68.085	- 12.195	140.741	...	27.748
	Satkui	54.449	110.927	- 4.790	- 54.887	1313.333	...	41.211
	Keshpal	45.117	- 5.039	- 50.246	20.000	65.909	- 39.130	125.962
1991 to 2001	Matkadpur	8.952	23.063	- 41.772	- 24.074	81.923	...	- 4.302
	Satkui	25.391	- 33.595	- 44.025	- 13.534	- 50.944	4700.000	27.040
	Keshpal	33.861	54.701	14.744	- 12.500	236.957	...	44.172
1981 to 2001	Matkadpur	21.373	35.162	- 1.064	- 16. 667	168.981	38.000	22.252
	Satkui	46.833	20.033	- 23.353	45.833	296.667	...	79.395

Table 3. Correlation coefficient matrix.

	Decadal change of population (%)	Decadal change of Main Workers (%)	Decadal change of Cultivators (%)	Decadal change of Agricultural Labourers (%)	Decadal change of Main Workers (%)	Decadal change of Marginal Workers (%)	Decadal change of Non-working population (%)
Decadal change of population (%)	1						
Decadal change of main workers (%)	0.56409	1					
Decadal change of cultivators (%)	- 0.29994	0.71569	1				
Decadal change of agricultural labourers (%)	0.92034	0.02933	- 0.44713	1			
Decadal change of main workers (%)	0.63596	0.58901	- 0.04445	0.70218	1		
Decadal change of marginal workers (%)	- 0.94325	- 0.08219	0.44417	- 0.96718	- 0.21425	1	
Decadal change of non-working population (%)	0.75787	- 0.47640	- 0.61689	0.67852	0.08919	- 0.97575	1

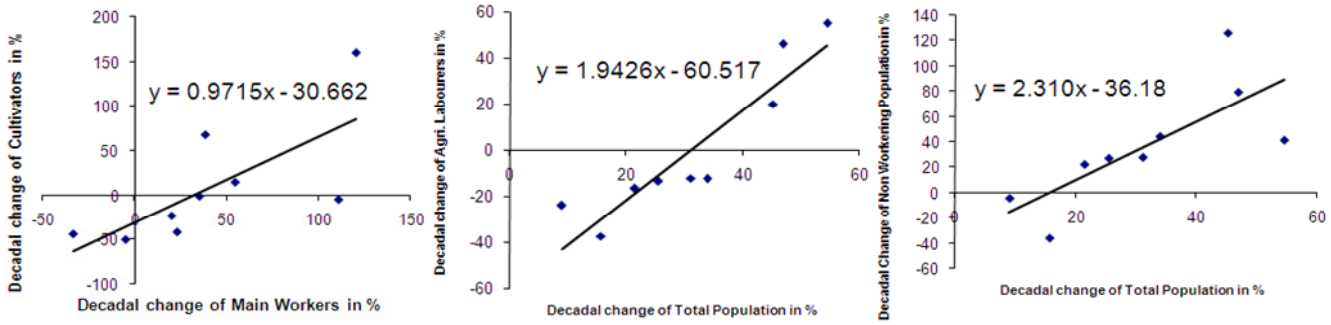


Figure 3. Significant positive relationship found from correlation co-efficient matrix.

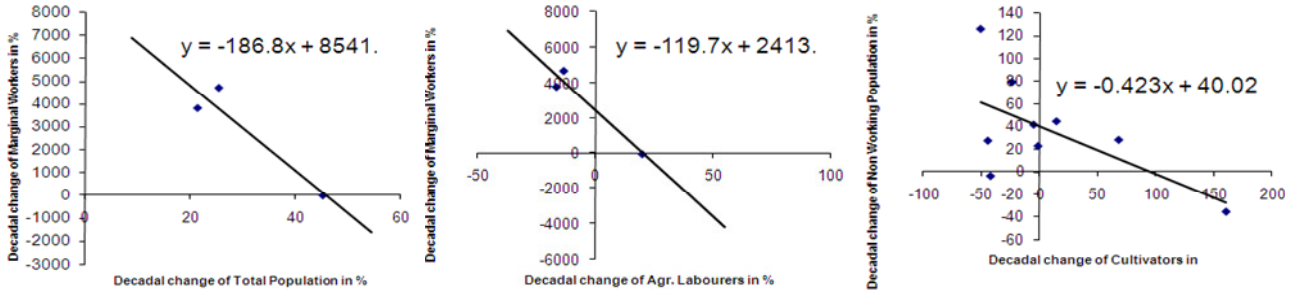


Figure 4. Significant negative relationship found from correlation co-efficient matrix.

shown in Figure 4). The labour intensive subsistence agricultural economy is gasping with the high volume of surplus agricultural labourers.

The Lewis-Fei-Ranis (Lewis, 1958; Fei and Ranis, 1961) model of economic development tried to explain transfer of labours and re-allocation of resources from one sector to another. The labour surplus theory given by them still forms a fundamental concept in this concern. This theory conceives the internal functions within a traditional subsistence agricultural sector. In this sector, with the increasing sufficiency in food, population tends to increase and that leads to gradual overcrowding at the rural agricultural fields of occupation. As a result, per capita food production gradually declines due to the natural constraints in the productivity and spatial limitation of the land. As a result, the marginal pro-ductivity of labours in this sector declines ultimately falling to zero, that is, if a labourer is removed from his job in agriculture, the production does not declines, that is, his contribution in the production system was zero.

The existence of such excess labours signifies disguised unemployment. It can be identified by the more rapid growth of non-working population volume than that of the total population volume.

Accordingly,

$$(P_{T2} - P_{T1}) / t_1 < (P_{N2} - P_{N1}) / t_2$$

where P_{Ti} is the total population, P_{Ni} is non-working population, t_i is the time;

or

$(P_{T2} - P_{T1}) / t_1 < (x_2 \times P_{T2} - x_1 \times P_{T1}) / t_2$ [Expressing non working population as the fraction of the total population];

or

$$P_{T1} / P_{T2} < (x_2 - 1) / (x_1 - 1) \qquad [\text{If } t_1 = t_2] \ldots\ldots (1)$$

The growth profile of the population of the study area reflects it clearly. If the growth rate is expressed for the spans of 1981 to 2001, then all the villages show the higher decadal growth of non-working population than that of the growth of the total population and this differential growth of two sectors is extreme for the village of Satkui where the decadal change of total population is around +46.833%, but the change of non-working population is around +79.395%.

Arthur Lewis (1958) in his celebrated paper 'Economic Development with Unlimited Supplies of Labour' argued that the marginal product of labour may be zero or negative in an economy that is still at a low level of development and experiencing a rapid ratio of population growth (mentioned by Thrillwall, 2006). One of the distinguishing features of agriculture is that it is an activity that is subject to diminishing returns owing to the fixity of the supply of land. If there is rapid population growth and labour has little employment opportunity other than the

land, a stage may be reached where the land cannot provide further workers a minimum salary. Under this circumstance the labours would require to commute to nearby centres of non-agricultural activities where they would be paid considerably higher wage. But this cost of labour would be considered cheaper to the employers of manufacturing and service sectors. The lower the cost of labour, the faster the rate of expansion of manufacturing or service sectors, but this depends on the rate at which the agricultural sector is releasing labour.

Agricultural sector is a source of saving and capital accumulation. Harrod's model of economic growth expresses two basic assumptions: Firstly, the saving of a community in period t is a constant proportion (s) of the income received during that period and secondly, the desired investment (I) during period t is a constant proportion (g) of the amount by which the income during period t exceeds that of the previous period (t-1).

Accordingly,

$$St = s.Yt \quad (2)$$

$$It = g(Yt - Yt\text{-}1) \quad (3)$$

National income (Y_t) in period t is taken as the summation of consumption (C_t) and investment (I_t) in that period.

Hence,

$$Y_t = C_t + I_t \quad (4)$$

In the Keynesian system, ex-post saving is equal to ex-post investment, that is, actual saving equals actual (or realized) investment. Therefore, from Equation 2, it can be said that the realized investment in period t equals to sY_t. Equation 3 gives the desired investment for period t. For the purpose of equilibrium, it is necessary that the realized investment is equal to the desired investment.

Accordingly,

$$sY_t = g(Y_t - Y_{t\text{-}1}) \quad (5)$$

This can be written as:

$$(Y_t - Y_{t\text{-}1}) / Y_t = s / g \quad (6)$$

This rate of growth of income is given the name 'warranted rate of growth of income' by Harrod (1939).

Since both s and g are constant, Equation 6 requires that income must continue to increase at a constant rate. For the traditional agricultural fields, the income per capita is seen to decline gradually; but for the wider cause of strengthening regional as well as national economy, the per- head income required to be increased. Considering the aforementioned theories, a numerical model of human resource reallocation can be constructed.

The population profile of the study area is examinedand it is assumed that the members of agricultural labour sector and marginal worker sector have to be traced on finding non-agricultural jobs, firstly that would possibly create a demand of labourers for agricultural sector and it would be satisfied by the presently non-working or disguising unemployed population. The two nearest urban areas, that is Medinipur and Kharagpur would be the initial centre of absorption of the commuting labours. To evaluate the possible sharing of these labours, the principle of 'gravitational analysis' was utilized. The potential population who would create the demand for service is assumed by subtracting total numbers of similar kind of labourers available within the population from the total population figure to diminish the effect of repulsion.

$$\text{Potential population } P_P = P_T - (P_A + P_M) \quad (7)$$

where P_T is the total population, P_A is the agricultural labourers and P_M is the marginal workers potential (see Table 4) at different centres to attract the commuting labours is calculated by the following formula (Chand and Puri, 1983):

$$\text{Potential at centre j } (Pi,j) = K[Mj/dij^2] \quad (8)$$

where Mj is the population at centre j,dij is the distance between centre i and j and K is the constant (Table 5).

Distribution of the commutable population towards different destination has been done proportional with the potential of the absorbing centres and the matrix has been prepared for linear programming transportation analysis. The general form of a transport matrix (following Chakravorty and Ghosh, 1999; Mukherjee, 2004) as used for the present analysis is given subsequently. There are m origins O_i, I = 1, 2,....., m. It is assumed that at each origin there are a_i numbers of commutable labourers. There are also n destinations Dj, j=1,2,....,n. Each destination demands bj numbers of labourers. A destination's demand can be satisfied by multiple sources and an origin's labourers can be shared by different destinations (Figure 5). In order for this problem to have feasible solution, the total supply from the origins must be equal to the total demand at the destinations and it is assumed that:

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j \quad (9)$$

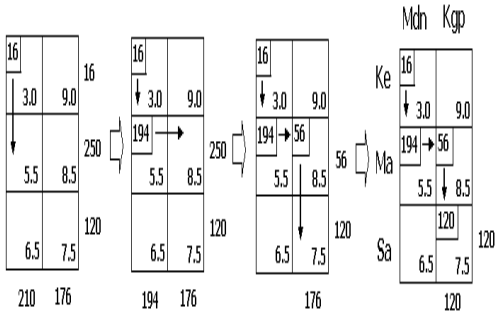
The distance to be crossed to reach the destination Dj from the origin Oi is given by cij. The minimum distance through road and water (river) is expressed by (R) and (W) Respectively.

All the quantities are positive as negative figure have no physical meaning (Figure 6). For the purpose of getting initial basic feasible solution, the North West Corner algorithm of transportation matrixanalysis of L.P.P. is applied as follows:

Table 4. Measuring the potential population at different centres.

Year	Village/Town	Total population (P_T)	Agricultural labourers (P_A)	Marginal workers (P_M)	P_A+ P_M	Potential population P_P= P_T-(P_A+ P_M)
I	II	III	IV	V	VI	VII
1981	Keshpal (Ke)	443	16	0	16	427
	Matkadpur (Ma)	1151	246	4	250	901
	Satkui (Sa)	1326	120	0	120	1206
1991	Keshpal (Ke)	512	10	46	56	456
	Matkadpur (Ma)	1508	216	0	216	1292
	Satkui (Sa)	2048	266	1	267	1781
2001	Keshpal (Ke)	743	12	28	40	703
	Matkadpur (Ma)	1643	164	308	472	1171
	Satkui (Sa)	2568	230	48	278	2290
1981	Medinipur (Mdn)	86118	891	332	1223	84895
	Kharagpur (Kgp)	150475	1749	1429	3178	147297
1991	Medinipur (Mdn)	125498	1155	550	1705	123793
	Kharagpur (Kgp)	177989	1366	576	1942	176047
2001	Medinipur (Mdn)	149769	164	3922	4086	145683
	Kharagpur (Kgp)	188761	343	5595	5938	182823

For the matrix of the year 1981:



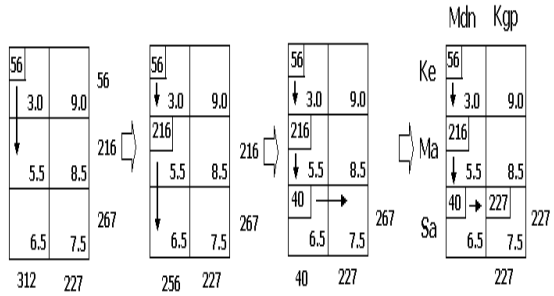
Hence, the initial basic solution would be

x_{11} = 16; x_{21} = 194; x_{22} = 56; x_{32} = 120

and the correspond-ding total distance to be traveled for which the transport cost to be paid by the commuters would not be add with saving:

d_{T1} = (16 × 3.0) + (194 × 5.5) + (56 × 8.5) + (120 × 7.5) = 2497 km/day

For the matrix of the year 1991:



Hence, the initial basic solution would be x_{11} = 56, x_{21} = 216, x_{31} = 40, x_{32} = 227 and the

Table 5. Calculation of potential at different centres.

Year	i	j	Potential population at j (Mj)	Distance between i and j (km) (dij)	Potential at Centre j $P_{i,j} = K[Mj/dij^2]$
I	II	III	IV	V	VI
1981	Keshpal (Ke)	Medinipur (Mdn)	84895	3.0	9432.778
	Keshpal (Ke)	Kharagpur (Kgp)	147297	9.0	1818.481
	Matkadpur (Ma)	Medinipur (Mdn)	84895	5.5	2806.446
	Matkadpur (Ma)	Kharagpur (Kgp)	147297	8.5	2038.713
	Satkui (Sa)	Medinipur (Mdn)	84895	6.5	2009.349
	Satkui (Sa)	Kharagpur (Kgp)	147297	7.5	2618.613
1991	Keshpal (Ke)	Medinipur (Mdn)	123793	3.0	13754.778
	Keshpal (Ke)	Kharagpur (Kgp)	176047	9.0	2173.419
	Matkadpur (Ma)	Medinipur (Mdn)	123793	5.5	4092.331
	Matkadpur (Ma)	Kharagpur (Kgp)	176047	8.5	2436.637
	Satkui (Sa)	Medinipur (Mdn)	123793	6.5	2930.012
	Satkui (Sa)	Kharagpur (Kgp)	176047	7.5	3129.724
2001	Keshpal (Ke)	Medinipur (Mdn)	145683	3.0	16187.000
	Keshpal (Ke)	Kharagpur (Kgp)	182823	9.0	2257.074
	Matkadpur (Ma)	Medinipur (Mdn)	145683	5.5	4815.960
	Matkadpur (Ma)	Kharagpur (Kgp)	182823	8.5	2530.422
	Satkui (Sa)	Medinipur (Mdn)	145683	6.5	3448.118
	Satkui (Sa)	Kharagpur (Kgp)	182823	7.5	3250.187

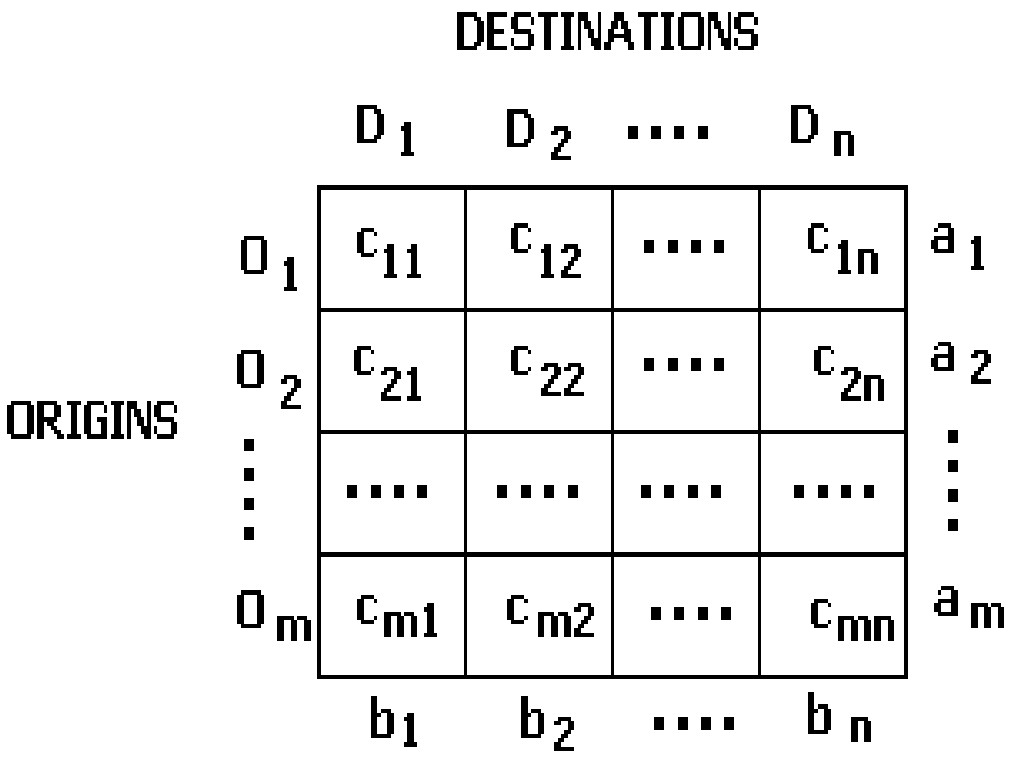


Figure 5. General structure of the allocation matrix to be used for linear programming analysis.

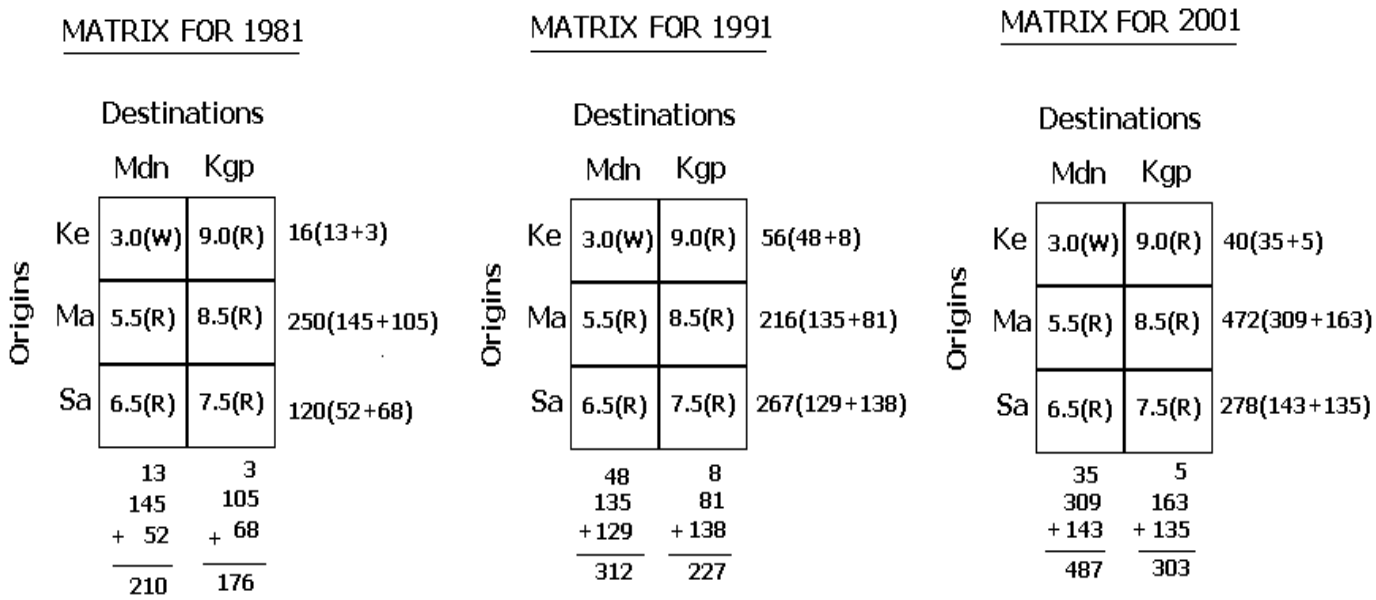
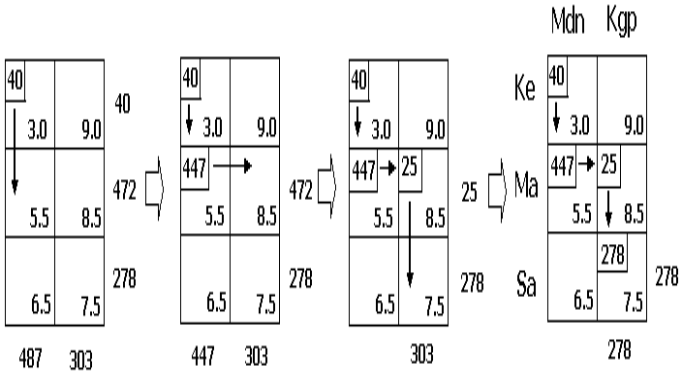


Figure 6. Distribution of the commutable population towards different destination.

corresponding total distance to be traveled for which the transport cost to be paid by the commuters would not be add with saving:

d_{T2} = (56 × 3.0) + (216 × 5.5) + (40 × 6.5) + (227 × 7.5) = 3318.5 km/day

For the matrix of the year 2001:



Hence, the initial basic solution would be x_{11} = 40, x_{21} = 447, distance to be traveled for which the transport cost to be x_{22} = 25, x_{32} = 278 and the corresponding total paid by the commuters would not be add with saving:

d_{T3} = (40 × 3.0) + (447 × 5.5) + (25 × 8.5) + (278 × 7.5) = 4876 km/day.

The aforementioned analysis indicates the fact that for the labourers of the village of Keshpal Medinipur town is the most profitable destination where they would reach by expensing least transport cost. The ferry service across the river Kasai provides the cheaper mode of transport to enter Medinipur municipal area. The labourers of village Satkui can profitably commute to Kharagpur town for accepting non-agricultural occupation. The large population size of Kharagpur town is capable to create a high and diversified demand of services. Besides, Kharagpur is the most important railway junction in this region that creates additional demand of high volume of labour force. The automobile servicing centres, small scale industries, hotels and transport sectors are also the places of absorption of large numbers of workers. The village of Matkadpur shows both the towns as profitable destinations. Though, the analysis traced more on Medinipur but there are some facts to be considered. The potentiality of a centre is evaluated by the help of population and distance only. But the availability of job, diversity of population at destination, economic specialty of the Kharagpur town evokes the idea that the peoples of this village should prefer Kharagpur by considering these realities.

The actualization of the human resource reallocation is harder a job to be performed for the population of the study area and the basic challenges come from:

1. Educationally backwardness;
2. The deficiencies in skill;
3. The gap between the skill and techniques known to rural commuters and that required at urban areas to get a satisfactory job;
4. Internal competition within the urban area itself;
5. The psychological stress of leaving the traditional jobs;
6. Lack of enthusiasms among rural marginal and non-working population to accept new category of jobs;
7. Political influences, non-cooperation by urban worker's

organizations, etc;
8. Lack of proper policy neither by local governments nor by states.

The effort of enhancing the level of skill and efficiency of rural youths through proper training may be effective in satisfying the urban needs with the help of rural man-power potentiality. The level of education in rural areas required to be raised which may be helpful in channelizing the rural youths towards the non-agricultural jobs and can be effective in accumulating wage from non-agricultural sectors of the urban or semi-urban areas to increase the per capita income figure of rural sectors. The discussion with the rural inhabitants reveals the fact that the non-cooperation or passive hindrance from the unions or organizations of the urban sectors is often found as the factor of discouragement for the rural inhabitants of the study area. The local level efforts, patroned by the local governments or reputed public organizations may be helpful in assuaging this particular problem. It is the fact, that a single numerical model is not capable to consider each and every aspects of the complex real world and above all the complexity of decision making process of human being, but it may work as a decision support device; depending on which rational decision can be provided after a scientific justification of the actual circumstances.

Conclusions

The socio-economic development of rural agrarian sector of India deserves the enhancement of income generation per capita; and in the context of the present scenario, it may not be possible without proper reallocation of less-utilized and pseudo human resources of the agro-based rural areas through enabling a part of the rural inhabitants in generating income from non-agricultural secondary or tertiary economic sector of neighbouring urban centres. The aforesaid numerical model may be utilized as a decision support device for reallocating the existing distribution of human resources and can successfully be applied in the case of three villages of Paschim Medinipur districts that lie between two urban centres, that is Midnapore and Kharagpur town. In micro-level planning, this algorithm may be effectively used and a range of rural and urban centres may be taken into consideration, as this model is flexible in terms of the number of ‘origin’ and ‘destination’ centres of allocable human resources. The numerical model may also be effectively used by including extra parameters that have effects on the absorption of the commutable human resources and influence on the potentiality of an urban centre, and the calculation of the potential of a centre may be re-defined as per requirement. The model targets in maximization of income and minimization of irresistible expenditure like conveyance cost at the rural sector that mutually results into increasing the volume of saving as well as more investment in health care and educational attainment, skill development, etc. This may automatically strengthen the circumstance that would be compatible for steady socio-economic development of the particular area. The present rural development policies and schemes in India are mostly built on the principle of strengthening weaker or backward section of rural population through providing material or financial intensives. This may not show an enthusiastic result for a long term of development of economy and society in true sense. The rural development plans required to be motivated towards generating quality human resources and rational allocation of existing human resources to ensure the possible best utilization of it, targeting the development to be launched as an auto-run process. In this respect, the numerical models of human resource reallocation may play a vital role in the decision making of the planners and policy makers, contributing to the relevant field.

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